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Part 10424: Device Specialization — Sleep Apnoea Breathing Therapy Equipment (SABTE)

Informatique de santé — Communication entre dispositifs de santé personnels

Partie 10424: Spécialisation de dispositif — Équipement de thérapie respiratoire de l'apnée du sommeil (SABTE)

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Abstract: Within the context of the ISO/IEEE 11073 family of standards for device communication, a normative definition of the communication between sleep apnoea breathing therapy equipment (SABTE) devices (agents) and managers (e.g., cell phones, personal computers, personal health appliances, set top boxes), in a manner that enables plug-and-play interoperability, is established in this standard. It leverages appropriate portions of existing standards including ISO/IEEE 11073 terminology, information models, application profile standards, and transport standards. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for SABTE. In this context, SABTE is defined as a device that is intended to alleviate the symptoms of a patient who suffers from sleep apnoea by delivering a therapeutic breathing pressure to the patient. SABTE is primarily used in the home health-care environment by a lay operator without direct professional supervision.

Keywords: IEEE 11073-10424™, medical device communication, personal health devices, sleep apnoea breathing therapy equipment (SABTE)

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Introduction

This introduction is not part of IEEE Std 11073-10424-2014, Health informatics—Personal Health Device Communication—Part 10424: Device Specialization—Sleep Apnoea Breathing Therapy Equipment (SABTE).

ISO/IEEE 11073 standards enable communication between medical devices and external computer systems. Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between sleep apnoea breathing therapy equipment (SABTE) devices (agents) and managers (e.g., cell phones, personal computers, personal health appliances, set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards including ISO/IEEE 11073 terminology, information models, application profile standards, and transport standards. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for SABTE. In this context, SABTE is defined as a device that is intended to alleviate the symptoms of a patient who suffers from sleep apnoea by delivering a therapeutic breathing pressure to the patient. SABTE is primarily used in the home health-care environment by a lay operator without direct professional supervision.

Contents

Health informatics—Personal health device communication

Part 10424: Device Specialization—Sleep Apnoea Breathing Therapy Equipment (SABTE)

1. Overview

1.1 Scope

Within the context of the ISO/IEEE 11073 family of standards for device communication, this standard establishes a normative definition of the communication between sleep apnoea breathing therapy equipment and managers (e.g., cell phones, personal computers, personal health appliances, set top boxes) in a manner that enables plug-and-play interoperability. It leverages appropriate portions of existing standards including ISO/IEEE 11073 terminology, information models, application profile standards, and transport standards. It specifies the use of specific term codes, formats, and behaviors in telehealth environments restricting optionality in base frameworks in favor of interoperability. This standard defines a common core of communication functionality for sleep apnoea breathing therapy equipment. In this context, sleep apnoea breathing therapy equipment are defined as devices that are intended to alleviate the symptoms of a patient who suffers from sleep apnoea by delivering a therapeutic breathing pressure to the patient. Sleep apnoea breathing therapy equipment are primarily used in the home health-care environment by a lay operator without direct professional supervision.

1.2 Purpose

This standard addresses a need for an openly defined, independent standard for controlling information exchange to and from personal health devices (agents) and managers (e.g., cell phones, personal computers, personal health appliances, and set top boxes). Interoperability is key to growing the potential market for these devices and to enabling people to be better informed participants in the management of their health.

1.1 Context

See IEEE Std 11073-20601a™-2010 for an overview of the environment within which this standard is written.[1]

This standard defines the device specialization for the SABTE, being a specific agent type, and it provides a description of the device concepts, its capabilities, and its implementation according to this standard.

This standard is based on IEEE Std 11073-20601a-2010, which in turn draws information from both ISO/IEEE 11073-10201:2004 [B9] and ISO/IEEE 11073-20101:2004 [B10].[2] The medical device encoding rules (MDERs) used within this standard are fully described in IEEE Std 11073-20601a-2010.

This standard reproduces relevant portions of the nomenclature found in ISO/IEEE 11073-10101:2004 [B8] and adds new nomenclature codes for the purposes of this standard. Between this standard and IEEE Std 11073-20601a-2010, all required nomenclature codes for implementation are documented.

NOTE 1—IEEE Std 11073-20601a-2010 is an amendment to ISO/IEEE 11073-20601:2010. It contains new material and corrections and does not copy the content of ISO/IEEE 11073-20601:2010. Throughout this standard, a reference to IEEE Std 11073-20601a-2010 refers to the document that is obtained after applying this new material and corrections to ISO/IEEE 11073-20601:2010.[3]

NOTE 2—In this standard, ISO/IEEE 11073-104zz is used to refer to the collection of device specialization standards that utilize IEEE Std 11073-20601a-2010, where zz can be any number from 01 to 99, inclusive.

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ISO/IEEE 11073-20601:2010, Health informatics—Personal health device communication—Part 20601: Application profile—Optimized Exchange Protocol.[4]

IEEE Std 11073-20601a™-2010, Health informatics—Personal health device communication—Part 20601: Application profile—Optimized Exchange Protocol—Amendment 1.[5, 6]

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3. Definitions, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause.[7]

agent: A node that collects and transmits personal health data to an associated manager.

airflow: Volume of air per minute that flows through the SABTE system, tubing, connectors, etc.

apnoea: An abnormal pattern of breathing characterized by a strong reduction of airflow compared to baseline.

apnoea hypopnoea index (AHI): An index of sleep apnoea severity that denotes the average number of apnoea and hypopnoea events per hour.

Cheyne-Stokes respiration (CSR): An abnormal pattern of breathing characterized by progressively deeper and sometimes faster breathing, followed by a gradual decrease that results in an apnoea.

class: In object-oriented modeling, it describes the attributes, methods, and events that objects instantiated from the class utilize.

compliance: A patient's adherence to a recommended course of treatment.

device: A term used to refer to a physical apparatus implementing either an agent or a manager role.

efficacy: Indicates the capacity for beneficial change (or therapeutic effect) of treatment with SABTE.

handle: An unsigned 16-bit number that is locally unique and identifies one of the object instances within an agent.

hypopnoea: An abnormal pattern of breathing characterized by a moderate reduction of airflow compared to baseline associated with an oxygen desaturation.

I:E ratio: Ratio between duration of the inspiration to the duration of the expiration during a breath cycle.

leakage: Volume of air lost per minute by unintentional and intentional leakage in SABTE system, tubing, connectors, etc.

manager: A node receiving data from one or more agent systems. Some examples of managers include a cellular phone, health appliance, set top box, or computer system.

object: In object-oriented modeling, a particular instantiation of a class. The instantiation realizes attributes, methods, and events from the class.

obj-handle: *See:* **handle.**

personal health device (PHD): A device used in personal health applications.

[7] *IEEE Standards Dictionary Online* subscription is available at: http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

personal telehealth device: *See:* **personal health device.**

therapy pressure: Breathing system pressure delivered by the SABTE.

tidal volume: Volume of air moved into or out of a patient's lung during breathing.

3.2 Acronyms and abbreviations

AcSV	anti-cyclic servo ventilation
AHI	apnoea hypopnoea index
APAP	automatic positive airway pressure
APDU	application protocol data unit
ASN.1	Abstract Syntax Notation One
BiLevel PAP S	bi-level positive airway pressure spontaneous breathing
BiLevel PAP ST	bi-level positive airway pressure spontaneous-timed breathing
BiLevel PAP T	bi-level positive airway pressure timed breathing
BPAP	bi-level positive airway pressure
cAHI	central apnoea hypopnoea index
CPAP	continuous positive airway pressure
CSR	Cheyne-Stokes respiration
DIM	domain information model
EPAP	expiratory positive airway pressure
EUI-64	extended unique identifier (64 bits)
ICS	implementation conformance statements
IPAP	inspiratory positive airway pressure
MDC	medical device communication
MDER	medical device encoding rule
MDS	medical device system
MOC	managed object class
oAHI	obstructive apnoea hypopnoea index
OID	object identifier
OSA	obstructive sleep apnoea
P	pressure
P50	50th percentile
P90	90th percentile
P95	95th percentile
PAP	positive airway pressure
PDU	protocol data unit

PHD	personal health device
RR	respiratory rate
RT-SA	real-time sample array
SABTE	Sleep Apnoea Breathing Therapy Equipment
SATD	Sleep Apnoea Therapy Device
uAHI	unclassified apnoea hypopnoea index
VMO	virtual medical object
VMS	virtual medical system

4. Introduction to ISO/IEEE 11073 personal health devices standards

4.1 General

This standard and the remainder of the series of ISO/IEEE 11073 personal health device (PHD) standards fit in the larger context of the ISO/IEEE 11073 series of standards. The full suite of standards enables agents to interconnect and interoperate with managers and with computerized health-care information systems. See IEEE Std 11073-20601a-2010 for a description of the guiding principles for this series of ISO/IEEE 11073 PHD standards.

IEEE Std 11073-20601a-2010 supports the modeling and implementation of an extensive set of PHDs. This standard defines aspects of the SABTE device. It describes all aspects necessary to implement the application layer services and data exchange protocol between an ISO/IEEE 11073 PHD SABTE agent and a manager. This standard defines a subset of the objects and functionality contained in IEEE Std 11073-20601a-2010 and extends and adds definitions where appropriate. All new definitions are given in Annex B in Abstract Syntax Notation One (ASN.1). Nomenclature codes referenced in this standard, which are not defined in IEEE Std 11073-20601a-2010, are normatively defined in Annex C.

4.2 Introduction to ISO/IEEE 11073-20601 modeling constructs

4.2.1 General

The ISO/IEEE 11073 series of standards, and in particular IEEE Std 11073-20601a-2010, is based on an object-oriented systems management paradigm. The overall system model is divided into three principal components: the domain information model (DIM), the service model, and the communication model. See IEEE Std 11073-20601a-2010 for a detailed description of the modeling constructs.

4.2.2 Domain information model

The DIM is a hierarchical model that describes an agent as a set of objects. These objects and their attributes represent the elements that control behavior and report on the status of the agent and data that an agent can communicate to a manager. Communication between the agent and the manager is defined by the application protocol in IEEE Std 11073-20601a-2010.

4.2.3 Service model

The service model defines the conceptual mechanisms for the data exchange services. Such services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. The messages defined in IEEE Std 11073-20601a-2010 can coexist with messages defined in other standard application profiles defined in the ISO/IEEE 11073 series of standards.

4.2.4 Communication model

In general, the communication model supports the topology of one or more agents communicating over logical point-to-point connections to a single manager. For each logical point-to-point connection, the dynamic system behavior is defined by a connection state machine as specified in IEEE Std 11073-20601a-2010.

4.2.5 Implementing the models

An agent implementing this standard shall implement all mandatory elements of the information, service, and communication models as well as all conditional elements where the condition is met. The agent should implement the recommended elements, and it may implement any combination of the optional elements. A manager implementing this standard shall utilize at least one of the mandatory, conditional, recommended, or optional elements. In this context, “utilize” means to use the element as part of the primary function of the manager device. For example, a manager whose primary function is to display data would need to display a piece of data in the element in order to utilize it.

4.3 Compliance with other standards

Devices that comply with this standard may also be required to comply with other domain- and device-specific standards that supersede the requirements of this standard with respect to issues including safety, reliability, and risk management. A user of this standard is expected to be familiar with all other such standards that apply and to comply with any higher specifications thus imposed. Typically, medical devices will comply with the IEC 60601-1:2007 [B2] base standards with respect to electrical and mechanical safety and any device-specific standard as might be defined in the IEC 60601-2 [B3] and ISO/IEC 80601-2 [B7] series of standards. Software aspects may apply through standards such as IEC 62304:2006/ EN 62304:2006 [B4].

Devices that comply with this standard implement higher layers of network software and utilize lower layers as appropriate to the application. The requirements on performance of such applications and conformance are defined elsewhere and are outside the scope of this standard. Moreover, the use of any medical equipment is subject to risk assessment and risk management appropriate to the application. Some relevant examples are ISO 14971:2007 [B6] and IEC 80001-1:2010 [B5]. The requirements of such risk assessment and risk management and conformance are outside the scope of this standard.

The definitions of sleep and associated events are based on the AASM Manual Version 2.0 [B1].

5. SABTE device concepts and modalities

5.1 General

This clause presents the general concepts of sleep apnoea breathing therapy equipment (SABTE). In the context of PHDs in the ISO/IEEE 11073 family of standards, SABTE is intended to alleviate the symptoms of patients who suffer from sleep apnoea by delivering a therapeutic breathing pressure to the patient. Sleep apnoea is the clinically significant intermittent absences of normal respiration occurring during sleep indicated by apnoea and hypopnoea events.

An apnoea (also known as *apnea* and *apnœa*) event is defined according to the AASM Manual [B1] as a reduction of airflow of ≥90% compared to baseline during ≥10 s (see Figure 1). It can be caused by obstruction of the upper airway, resulting in *obstructive sleep apnoea* (OSA), or by a failure of the brain to initiate a breath, called *central sleep apnoea* (CSA), and is typically associated with heart failure patients. Fairly common are mixed apnoea, which consists of central and obstructive components. Often, co-morbidities are present in patients with OSA, which can contribute to their earlier onset including hypertension, heart failure, and diabetes if left untreated. It can cause and worsen other medical conditions, including hypertension, heart failure, and diabetes.

An hypopnoea (also known as *hypopnea* and *hypopnœa*) event is defined according to the AASM Manual [B1] as a reduction of airflow ≥30% compared to baseline during ≥10 s and associated with an oxygen desaturation of ≥3% from pre-event baseline (see Figure 1). Hypopnoeas are less severe than apnoeas (which is a more complete loss of airflow). It can likewise result in a decreased amount of air movement into the lungs and can cause oxygen levels in the blood to drop. Like apnoeas, hypopnoeas come in the three varieties: obstucive, central, or mixed. But it is more commonly due to partial obstruction of the upper airway.

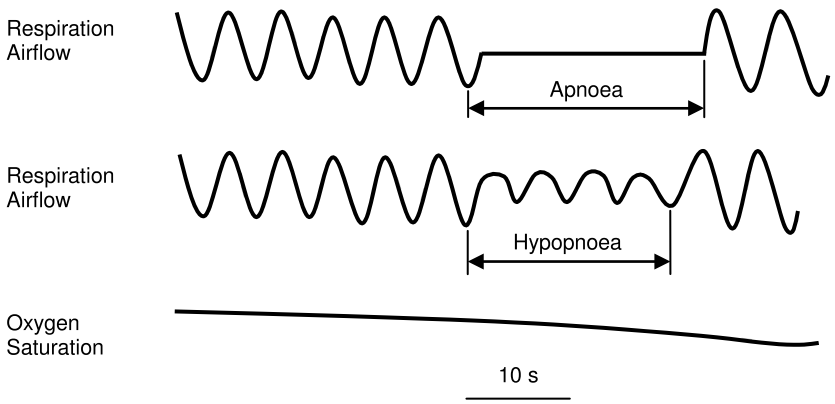

Figure 1—Apnoea and hyponea event

Cheyne-Stokes respiration (CSR) is defined according to the AASM Manual [B1] as a cyclic crescendo and decrescendo change in the breathing amplitude with duration of at least at least 10 consecutive minutes (see Figure 2). The pattern repeats usually with each cycle taking 30 s to 2 min.

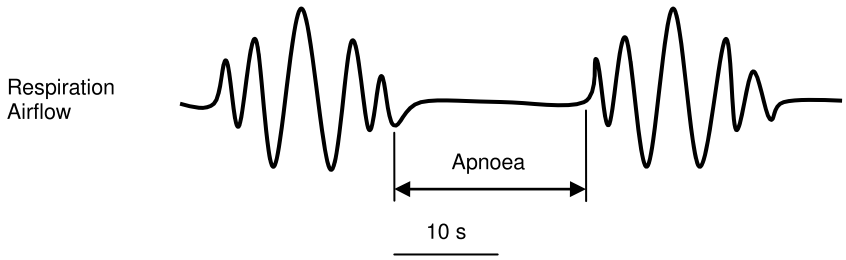

Figure 2—Cheyne-Stokes respiration

Dependent on severity of the sleep apnoea, different device types are used to treat the absences of normal respiration during sleep. This standard supports three types of sleep apnoea therapy devices (SATD) as follows:

— Continuous positive airway pressure (CPAP) device: The most common SATD used for obstructive sleep apnoea treatment is a CPAP device. This type of device is commonly used for people who are suffering from moderate or severe sleep apnoea. In general, this device uses a special mask that is customized to fit over a person's nose. It works by gently blowing air into the entry and passage of air into the airways. Through this action, air is pressed against the airway wall. At the same time, pressure of air is also set so it would be just enough to stop and prevent blockage and narrowing of airways during sleep.

— Auto-CPAP (APAP) device: For a CPAP device this therapy pressure is adjusted by a health-care professional normally in a sleep laboratory during the first nights and afterwards fixed. An Auto-CPAP device automatically adjusts the therapy pressure while the patient is sleeping to his current needs between limits given by the health-care professional.

— Bi-level positive airway pressure (BiLevel PAP) device: This device is commonly used for those unable to be adapted to using CPAP and Auto-CPAP, or for central sleep apnoea sufferers who need assistance for a weak breathing pattern. It provides more pressure during the inhalation phase, less during the exhalation phase. There are three sub-modes of BiLevel PAP: spontaneous breathing "S," timed breathing "T," and spontaneous-timed breathing "ST."

— Auto-Bi-level positive airway pressure (Auto-BiLevel PAP) device: Like the Auto-CPAP this type of SATD automatically adjusts the BiLevel PAP settings to the patient needs within given limits of a health-care professional.

— Anti-cyclic Servo Ventilation (AcSV) device: AcSV mode of therapy has been introduced to attempt to manage complex sleep apnoea and CSR.

Typically more complex devices support also the therapy modes of lower class devices. For example a BiLevel PAP device could also support the therapy modes Auto-CPAP and CPAP, whereas an Auto-CPAP device also supports the therapy mode CPAP. The combination of a SATD, mask, tube, and different accessories are called *sleep apnoea breathing therapy equipment* (SABTE) as shown in Figure 3.

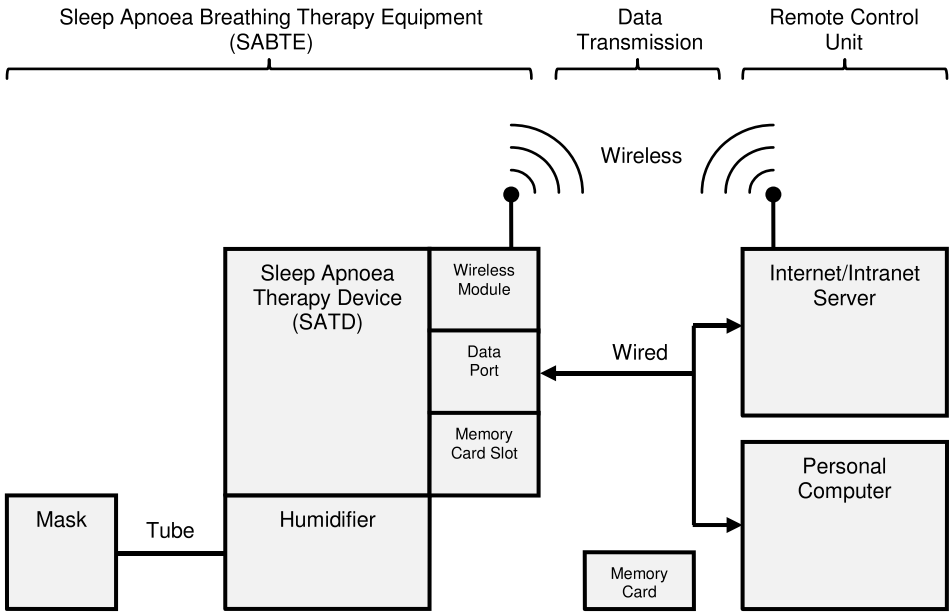

Figure 3—SABTE Interfaces

SABTE provide, detect, and store data for device handling and later analysis by health-care professionals, health-care service providers, payers, and patients. This standard supports reading out of the following:

- Device identification: Information identifying the device.
- Compliance monitoring: Accumulated data provided as a set of information on an off-line basis providing evidence of patient compliance with the sleep apnoea therapy.
- Efficacy monitoring: In addition to compliance monitoring data, providing parameters related to the effectiveness of the treatment.
- Service monitoring: Indicators relating to preventative and corrective maintenance of the device and its accessories.
- Device settings: Configuration of the SATD behavior and usage.
- Therapy settings: Configuration of the different therapy modes provided by SATD.

The data of compliance and efficacy monitoring is only generated during a therapy session (i.e., SATD is in device mode = therapy). A therapy session starts typically in the evening when the patient gets into bed and stops in the morning when the patient leaves the bed. During a therapy session the SATD might detect if a patient is using the device (e.g., via breathing patterns in the respiration airflow). If a SATD could not detect real patient usage then usage session is equal therapy session. Epochs and events according to the efficacy annotations could only occur during usage sessions. The difference between epochs and events are that epochs may overlap with events and epochs of other types (i.e., snoring or CSR epochs); events may overlap with epochs but not with other events (i.e., hypopnoea or apnoea events). Figure 4 provides an illustration of sessions, epochs, events, and their annotations.

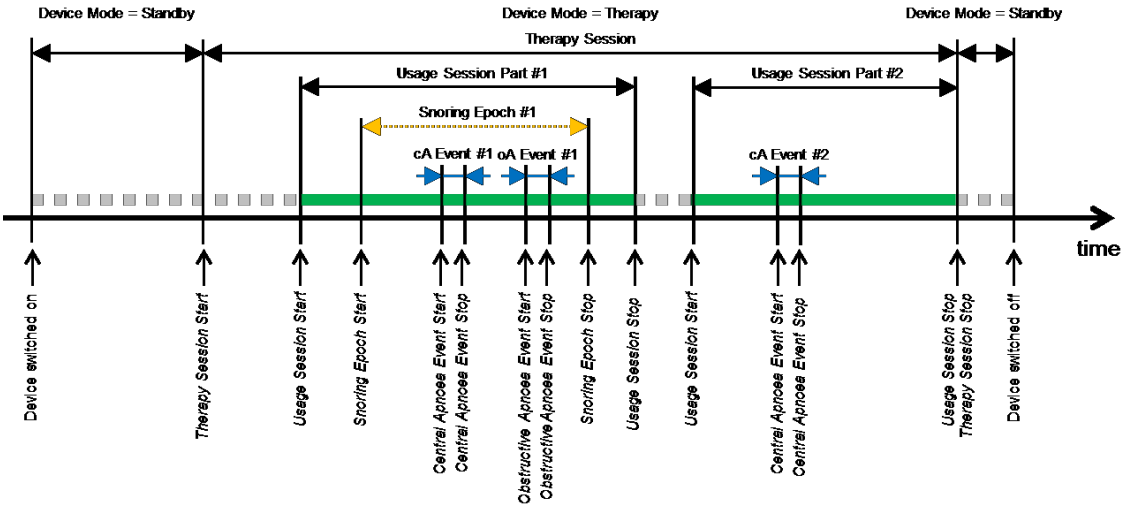

Figure 4—Sessions, epochs, events, and annotations

SABTE devices are used in different locations and by different users. There are three typical scenarios for the data transfer between a SABTE (i.e., agent) and a remote control unit (i.e., manager) as follows:

— In a non health-care environment (e.g., patient home) stored data is automatically transferred (e.g., once a day, week, month) via an attached remote control unit (e.g., mobile station with cellular network connection or modem with land line connection) to Internet server. Normally the data transfer happens after device usage and no user interaction is necessary.

— In a health-care office (e.g., service provider or physician office) stored data is requested by a remote control unit (e.g., personal computer, tablet). The remote control unit is controlled by health-care service provider or professional. Normally the data transfer happens during (e.g., mask fitting) or after (e.g., therapy control) device usage and the user selects the data to be transferred.

— In a clinic environment (e.g., sleep laboratory) current data is automatically transferred (e.g., as data stream) to a remote control unit (e.g., via Intranet server to a personal computer in a control room). The remote control unit is controlled by health-care professional. Normally the user only selects when the data transmission should be started or stopped.

This standard is not applicable to home health-care environment ventilators, ventilatory support equipment, emergency and transport ventilators, anesthetic ventilators, high-frequency jet ventilators, critical care ventilators, or high-frequency oscillatory ventilators.

5.2 Compliance monitoring

This clause describes the accumulated data as a set of information providing evidence of patient compliance (also known as *adherence*, *capacitance*, or *concordance*) with the sleep apnoea therapy.

5.2.1 Duration of patient use

The “duration of patient use” (also known as *compliance*) is the time period where SABTE was providing therapy to the patient (i.e., was used by the patient) during a usage session measured in minutes. It could be three distinct duration values, as follows:

— With attached humidifier
— Without attached humidifier
— Total duration

5.2.2 Compliance annotations

The “compliance annotations” indicate by time stamps the start and stop of a therapy session, usage session, and undetermined session.

5.3 Efficacy monitoring

In addition to the compliance monitoring data, this clause describes parameters related to the effectiveness of the treatment.

5.3.1 Apnoea hypopnoea index (AHI)

The *apnoea hypopnoea index* (AHI) is the total number of all apnoea and hypopnoea events occurring during a usage session divided by the hours of sleep.

Apnoea and hypopnoea events could be classified as obstructive, central or mixed based on the pattern of respiratory effort. If an event could not be classified it is named unclassified.

Based on this definition the *central apnoea hypopnoea index* (cAHI) is the total number of all central apnoea and central hypopnoea events occurring during a usage session divided by the hours of sleep. The *obstructive apnoea hypopnoea index* (oAHI) counts all mixed and obstructive events. All unclassified apnoea and hypopnoea events are summarized in the *unclassified apnoea hypopnoea index* (uAHI).

For further details see AASM Manual, Version 2.0 [B1].

5.3.2 Therapy pressure

“Therapy pressure” is the pressure delivered by the SABTE at the patient interface (e.g., mask) measured in hPa. It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90 and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

The percentile therapy pressure is the pressure at which the patient was supplied that percent of time at or below. For instance, if the data show a 90 percentile therapy pressure (P90) of 11 hPa, it means that 90% of the time the patient was using the SABTE the patient was receiving a breathing system of 11 hPa or less.

5.3.3 Therapy pressure waveform

There are applications where it is desired to visualize the sequence of samples related to the time-varying therapy pressure as a waveform. It could be distinct in target therapy pressure (i.e., what is the aim of the therapy algorithm) and the current therapy pressure (i.e., what is physically possible, for example, because of high leakage). The unit of “therapy pressure waveform” is hPa. The waveform is typically used to display a curve.

5.3.4 Leakage

The “leakage” (also known as *leak*) is the volume of air lost per minute by unintentional and intentional leakage in SABTE system, tubing, connectors, etc. measured in L/min. Intentional leakage is that leak normally due to the use of a vented mask. Unintentional leakage is that due to other circumstances such as poor mask fit or similar issues. It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90 and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

The percentile leakage is the air escaping that percent of time at or below. For instance, if the data show a 90 percentile leakage (P90) of 5 L/min, it means that 90 percent of the time the leakage was of 5 L/min or less.

5.3.5 Leakage waveform

There are applications where it is desired to visualize the sequence of samples related to the time-varying leakage as a waveform. The unit of the “leakage waveform” is L/min. The waveform is typically used to display a curve.

5.3.6 Airflow waveform

There are applications where it is desired to visualize the sequence of samples related to the time-varying airflow (also known as *airway flow wave*) as a waveform. It could be distinct in total device airflow (i.e., respiration airflow, purge flow and leakage), device airflow without purge flow (i.e., respiration airflow and leakage) and the respiration airflow. The unit of the “airflow waveform” is L/min. The waveform is typically used to display a curve.

5.3.7 Respiratory rate

The “respiratory rate” (RR, also known as *ventilation rate, respiration rate, breathing rate, breathing frequency,* and *respiratory frequency*) is the number of breaths a patient takes during one minute measured in breaths per minute (bpm). It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90 and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

5.3.8 Tidal volume

The “tidal volume” (VT, also known as *respiratory tidal volume*) is the volume of air moved into or out of a patient’s lung during breathing measured in ml. It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90, and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

5.3.9 Respiratory minute volume

The “respiratory minute volume” (RMV or $\dot{V}$, also known as *minute ventilation* and *expired minute volume*) is the volume of air inhaled or exhaled from a patient’s lung per minute measured in L/min. It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90, and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

5.3.10 I:E ratio

The “I:E ratio” (TI/TE, Ti/T, or TiT) is the ratio between duration of the inspiration to the duration of the expiration during a breath cycle measured in percentage. In normal spontaneous breathing, the expiratory time is about twice as long as the inspiratory time. This gives an I:E ratio of 1:2 and is read “one to two.” But the value is stored and transmitted as 50%. It could be the instantaneous value or a statistical parameter of a usage session (i.e., minimum, maximum, arithmetic mean, P50, P90, and P95).

The instantaneous value is often fluctuating and is therefore filtered (e.g., moving average) reducing higher frequency content for the purpose to display a number.

5.3.11 Snoring duration

The “snoring duration” is the time period where snoring occurs during a usage session measured in minutes. It is the total sum of all soring periods during a therapy session.

5.3.12 CSR duration

The “CSR duration” is the time period where CSR occurs during a usage session measured in minutes. It is the total sum of all CSR periods during a therapy session.

5.3.13 Efficacy annotations

The “efficacy annotations” indicates by time stamps the start and stop of an artifact breathing epoch, spontaneous breathing epoch, timed breathing epoch, snoring epoch, CSR epoch, undetermined epoch, flow limitation event, unclassified hypopnoea event, obstructive hypopnoea event, central hypopnoea event, unclassified apnoea event, obstructive apnoea event, mixed apnoea event, central apnoea event, and undetermined event during a usage session.

5.4 Service monitoring

This subclause describes indicators relating to preventative and corrective maintenance of the device and its accessories.

5.4.1 Duration of flow generation

The “duration of flow generation” (also known as *operating hours counter*) is the time period where the SABTE was powered on and was providing airflow measured in minutes. It is the sum of duration of all operating periods (e.g., therapy, mask fitting, and drying periods) during the lifetime of the flow generator.

5.4.2 PHD DM status

The “PHD DM status” allows generic notification handling for PHDs. It indicates by time stamps the raising of info, warning, error, service, and undetermined messages.

5.5 Device settings

This subclause describes the configuration of the SATD behavior and usage.

5.5.1 Device mode set

The “device mode set” is the current active setting of the SABTE device state. It is a selection out of the following:

— Standby
— Therapy
— Mask fitting
— Drying
— Exporting
— Undetermined

The mode “standby” means that the SATD is powered on, the flow generation is off, and the SATD is ready to use. The mode “therapy” means that the flow generation of the SATD is on and the SABTE is providing therapy to a patient. The mode “mask fitting” is a special device mode that is used to check if the mask position is O.K. and the leakage is in a normal range. The mode “drying” is a special device mode that is used to dry the breathing system part like turbine and tube. The mode “exporting” is a special device mode for devices that are not capable of exporting data during other modes. It is used to indicate that the SATD is currently busy with storing data for example on a memory card or is transmitting data via wire or wireless. If the current device mode could not be detected or is not supported by this standard, the mode “undetermined” is used.

5.6 Therapy settings

This subclause describes the configuration of the different therapy modes provided by SATD.

5.6.1 Therapy mode set

The “therapy mode set” is the current active setting of the SABTE therapy state. It is a selection out of the following:

— CPAP
— Auto-CPAP
— BiLevel PAP S
— BiLevel PAP T
— BiLevel PAP ST
— Auto-BiLevel PAP S
— Auto-BiLevel PAP T
— Auto-BiLevel PAP ST
— AcSV
— Undetermined

The mode “CPAP” stands for Continuous Positive Airway Pressure, which means fixed therapy pressure during a therapy session. In the mode “Auto-CPAP” (also known as *APAP*) the therapy pressure is a fixed therapy pressure level but the level will be automatically adapted during a therapy session to the patient needs. The mode “BiLevel PAP” (also known as *BPAP* or *Bi-Level*) means that the therapy pressure is switched between two levels. There are three sub-modes of BiLevel PAP: spontaneous breathing “S,” timed breathing “T,” and spontaneous-timed breathing “ST.” In addition, Auto-BiLevel PAP automatically adapt the therapy pressure levels during a therapy session to the patient needs. The mode “AcSV” (also known as *Anti-cyclic Servo Ventilation* or *Adaptive Servo Ventilation*) is a form of closed-loop mechanical ventilation, pressure preset, and volume or flow cycled. If the current therapy mode could not be detected or is not supported by this standard, the mode “undetermined” is used.

Therapy modes apply when the “device mode set” is “therapy” (see 5.6.5, 5.6.8, and 5.6.9).

5.6.2 Humidifier level set

“Humidifier level set” is a comfort feature of a SATD. If a humidifier is attached and filled with water, it allows increasing the humidity of the breathing air.

The “humidifier level set” is the current active setting of the SABTE humidifier level set as a percentage of the maximum possible setting. It could be one or more settings of the following:

— Humidifier relative stage (e.g., heater power)
— Humidifier relative air output temperature
— Humidifier relative humidity

A value of 0% means minimal possible humidifier level (i.e., disabled, relative stage of 0% = “off,” relative temperature of 0% = 0 °C, relative humidity of 0 %). A value of 100% means maximal possible humidifier level (i.e., automatically adjusted, relative stage of 100% = “maximum,” theoretically relative temperature of 100% = 100 °C, theoretically relative humidity of 100%).

5.6.3 Autostart/-stop set

“Autostart/-stop set” is a comfort feature of a SATD. It allows starting the therapy without pushing a button only via breathing into the mask.

The “Autostart/-stop set” is the current active setting of the SABTE autostart and autostop feature. It is a selection out of the following:

— Autostart off and autostop off

— Autostart off and autostop on

— Autostart on and autostop off

— Autostart on and autostop on

“Autostart on” means that if the “device mode set” is “standby” and a patient starts using the SABTE, the SATD detects it and automatically switches into device mode “therapy.” “Autostop on” means that if the “device mode set” is “therapy” and the patient stops using the SABTE, the SATD automatically switches into device mode “standby.” “Autostart off” or “autostop off” mean that this feature is disabled.

5.6.4 Ramp settings

“Ramp” is a comfort feature on a SATD. The ramp function increases the pressure gradually until it reaches the prescribed therapy pressure.

5.6.4.1 Ramp start pressure set

The “ramp start pressure set” is the therapy pressure at the start of the sleep ramp set in hPa.

This setting is normally used in combination with “ramp duration set” (see 5.6.4.2).

5.6.4.2 Ramp duration set

The “ramp duration set” is the length of the sleep ramp set in minutes. A value of 0 min means that the sleep ramp is disabled.

This setting is normally used in combination with “ramp start pressure set” (see 5.6.4).

5.6.5 Pressure adaption settings

“Pressure adaption” is a comfort feature of a SATD. It reduces the pressure during expiration used as exhalation relief.

5.6.5.1 Pressure adaption level set

The “pressure adaption level set” (also known as *pressure reduction level*) is the current active setting of the pressure adaption during expiration and/or inspiration set as a percentage of the maximum setting. A value of 0% means minimal possible pressure adaption level (e.g., disabled), whereas a value of 100% means maximal possible pressure reduction (e.g., automatically adjusted).

This setting is normally used in combination with “pressure adaption freeze set” (see 5.6.5.2).

5.6.5.2 Pressure adaption freeze set

The “pressure adaption freeze set” is the current active setting of the pressure adaption freeze feature. It is a selection between “on” or “off.” A value “off” means that the patient could change the setting of the “pressure adaption level” setting. A value “on” means that only a health-care professional could change the setting of the “pressure adaption level.”

This setting is normally used in combination with “pressure adaption level set” (see 5.6.5.1).

5.6.6 Inspiration pressure rise set

The “inspiration pressure rise set” (P Rise) is the current active setting of the pressure rise during inspiration set as a percentage of the maximum setting. A value of 0% means minimal possible inspiration pressure rise (e.g., disabled), whereas a value of 100% means maximal possible inspiration pressure rise (e.g., automatically adjusted).

5.6.7 CPAP settings

The “CPAP settings” contain the setting of “P CPAP Set.”

Typically in CPAP mode also the comfort features “humidifier level set,” “autostart/-stop set,” “ramp start pressure set,” “ramp duration set,” “pressure adaption level set” and “pressure adaption freeze set” are available.

5.6.7.1 P CPAP Set

The “P CPAP Set” is the target therapy pressure during a therapy session set in hPa.

5.6.8 Auto-CPAP settings

The “auto-CPAP settings” contain the setting of “Pmin APAP Set,” “Pmax APAP Set,” and “inspiration pressure rise set.” These are atomic settings that mean that only all values together have a useful meaning.

Typically in Auto-CPAP mode also the comfort features “humidifier level set,” “autostart/-stop set,” “ramp start pressure set,” “ramp duration set,” “pressure adaption level set,” and “pressure adaption freeze set” are available.

5.6.8.1 Pmin APAP set

The “Pmin APAP set” is the lower bound of the target therapy pressure during a therapy session set in hPa.

5.6.8.2 Pmax APAP set

The “Pmax APAP set” is the upper bound of the target therapy pressure during a therapy session set in hPa.

5.6.9 BiLevel PAP S / T / ST settings

The “BiLevel PAP settings” contain the setting of “P IPAP set,” “P EPAP set,” “respiratory rate set,” “I:E ratio set,” “trigger sensitivity set” and “inspiration pressure rise set.” These are atomic settings, which means that only all values together have a useful meaning.

Typically in BiLevel PAP S / T / ST mode also the comfort features “humidifier level set,” “auto-start/-stop set,” “ramp start pressure set” and “ramp duration set” are available.

5.6.9.1 P IPAP set

The “P IPAP set” is the target inspiration therapy pressure during a breath cycle set in hPa.

5.6.9.2 P EPAP set

The “P EPAP set” is the target expiration therapy pressure during a breath cycle set in hPa.

5.6.9.3 Respiratory rate set

The “respiratory rate set” (RR set) is the target breathing frequency during a therapy session set in breaths per minute (bpm) (see 5.3.7).

5.6.9.4 I:E ratio set

The “I:E ratio set” is the target ratio between duration of the inspiration to the duration of the expiration during a breath cycle set in percentage (see 5.3.10).

5.6.9.5 Trigger sensitivity set

The “trigger sensitivity set” is the target inspiratory and expiratory trigger sensitivity set in percentage of the maximum setting. A value of 0% means minimal possible trigger sensitivity (e.g., disabled), whereas a value of 100% means maximal possible trigger sensitivity (e.g., automatically adjusted).

6. Sleep apnoea breathing therapy equipment domain information model

6.1 Overview

This clause describes the domain information model of the sleep apnoea breathing therapy equipment (SABTE).

6.2 Class extensions

In this standard, no class extensions are defined with respect to IEEE Std 11073-20601a-2010.

6.3 Object instance diagram

The object instance diagram of the SABTE domain information model, defined for the purposes of this standard, is shown in Figure 5.

The objects of the DIM, as shown in Figure 5, are described in 6.5 through 6.10. This includes the medical device system (MDS) object (6.5), the numeric objects (6.6), the RT-SA objects (6.7), the enumeration objects (6.8), the PM-store objects (6.9), and the scanner objects (6.10). Subclause 6.11 specifies the rules for extending the SABTE information model beyond elements as described in this standard. Each subclause that describes an object of the SABTE contains the following information:

— The nomenclature code used to identify the class of the object. One example where this code is used is the configuration event, where the object class is reported for each object. This allows the manager to determine whether the class of the object being specified is a numeric, real-time sample array, enumeration, scanner, or PM-store class.

— The attributes of the object. Each object has attributes that represent and convey information on the physical device and its data sources. Each object has a Handle attribute that identifies the object instance within an agent. Attribute values are accessed and modified using methods such as GET and SET. Attribute types are defined using ASN.1. The ASN.1 definitions for new attribute types specific to this standard are in Annex B, and the ASN.1 definitions for existing attribute types referenced in this standard are in IEEE Std 11073-20601a-2010.

— The methods available on the object.

— The potential events generated by the object. The data are sent to the manager using events.

— The available services such as getting or setting attributes.

The attributes for each class are defined in tables that specify the name of the attribute, its value, and its qualifier. The qualifiers mean: M—Attribute is mandatory, C—Attribute is conditional and depends on the condition stated in the Remark or Value column (if IEEE Std 11073-20601a-2010 is referenced, then it contains the conditions), R—Attribute is recommended, NR—Attribute is not recommended, and O—Attribute is optional. Mandatory attributes shall be implemented by an agent. Conditional attributes shall be implemented if the condition applies and may be implemented otherwise. Recommended attributes should be implemented by the agent. Not recommended attributes should not be implemented by the agent. Optional attributes may be implemented by the agent. For attributes with qualifiers set to R or NR, underlying requirements stated in the Remark and Value column in IEEE Std 11073-20601a-2010 shall be followed.

The attributes can be either *static*, meaning that they shall remain unchanged after the configuration is agreed upon, or *dynamic*, meaning that the attribute may change at some point after configuration.

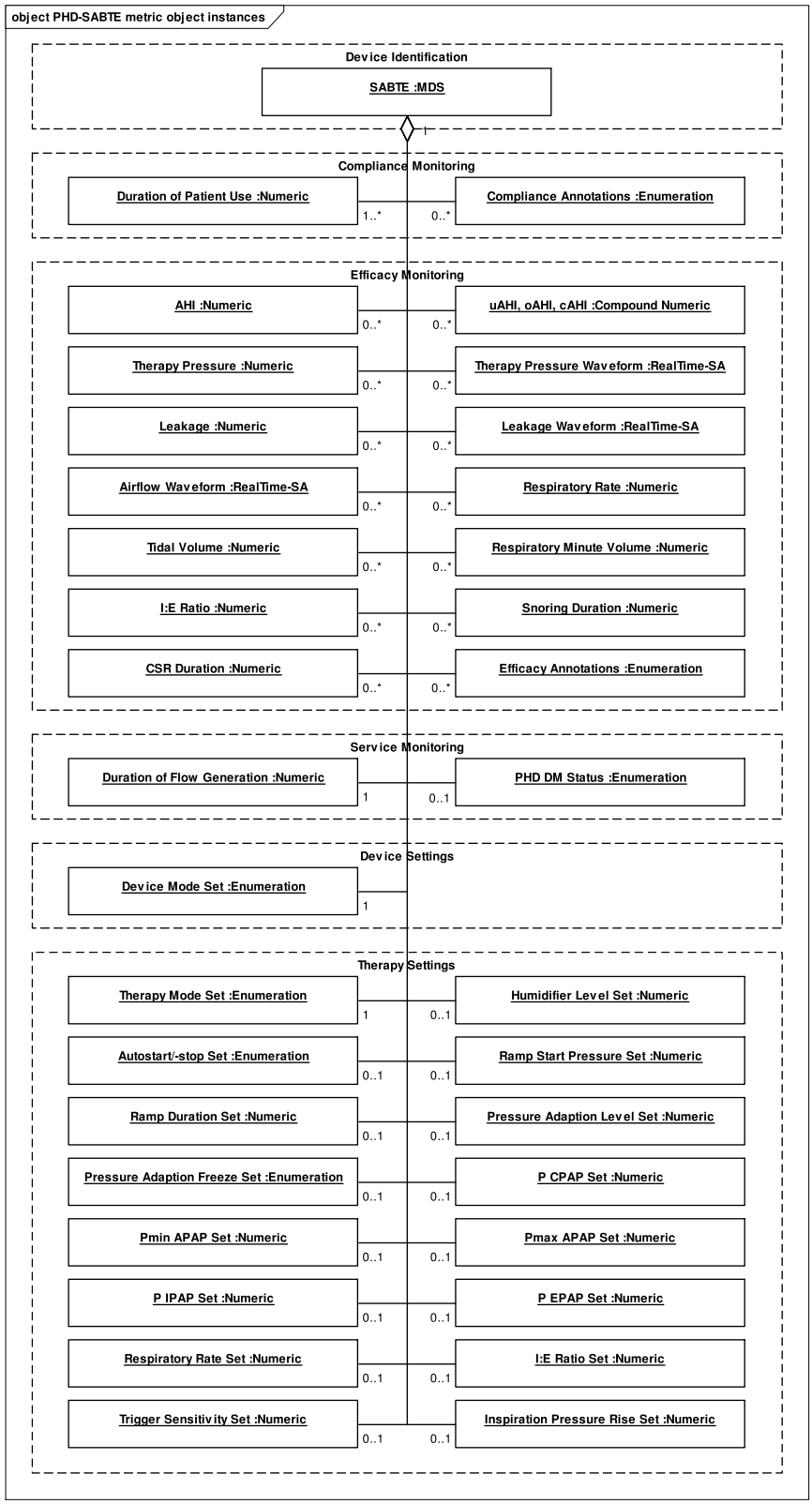

Figure 5—SABTE—domain information model

6.4 Types of configuration

6.4.1 General

As specified in IEEE Std 11073-20601a-2010, there are two styles of configuration available. Subclauses 6.4.2 and 6.4.3 briefly introduce standard and extended configurations.

6.4.2 Standard configuration

Standard configurations are defined in the IEEE 11073-104zz specializations (such as this standard) and are assigned a well-known identifier (Dev-Configuration-Id). The usage of a standard configuration is negotiated at association time between the agent and the manager. If the manager recognizes and selects to operate using the configuration, then the agent can send measurements immediately. If the manager does not recognize the configuration, the agent provides the configuration prior to transmitting measurement information.

One standard configuration is defined in this standard. The standard configuration 2400 (0x0960) contains the SABTE objects “duration of patient use (total)” (see 6.7.2), “duration of flow generation” (6.7.13), “device mode set” (see 6.9.5), and “therapy mode set” (see 6.9.6).

6.4.3 Extended configuration

In extended configurations, the agent’s configuration is not predefined in a standard. The agent determines the objects, attributes, and values that will be used in a configuration and assigns a configuration identifier. When the agent associates with a manager, an acceptable configuration is negotiated. Typically, the manager does not recognize the agent’s configuration on the first connection, so the manager responds that the agent needs to send its configuration information as a configuration event report. If, however, the manager recognizes the configuration, either because it was preloaded in some way or the agent had previously associated with the manager, then the manager responds that the configuration is known and no further configuration information needs to be sent.

6.5 Profile

6.5.1 General

A profile further constrains the objects, services, and communication model of a specialization. By profiling the device specialization, the standard provides more guidance on the specific mandatory objects that shall be implemented, the objects that are optional, and the objects that are not required. This standard defines three profiles: the CPAP profile (see 6.5.2), the Auto-CPAP profile (see 6.5.3), and the BiLevel PAP profile (see 6.5.4). A SABTE device may implement one or more of these three profiles.

6.5.2 CPAP profile

The metric object instance diagram of the CPAP profile domain information model is shown in Figure 6. A SABTE device implementing the CPAP profile shall implement in addition to the standard configuration objects (see 6.4) the object “P CPAP set.” The objects “Pmin APAP set,” “Pmax APAP set,” “P IPAP set,” “P EPAP set,” “respiratory rate set,” “I:E ratio set,” “trigger sensitivity set,” and “inspiration pressure rise set” are not required. The nomenclature code to identify the CPAP profile is MDC_DEV_SUB_SPEC_PROFILE_CPAP. For the CPAP profile, currently no standard configuration is defined.

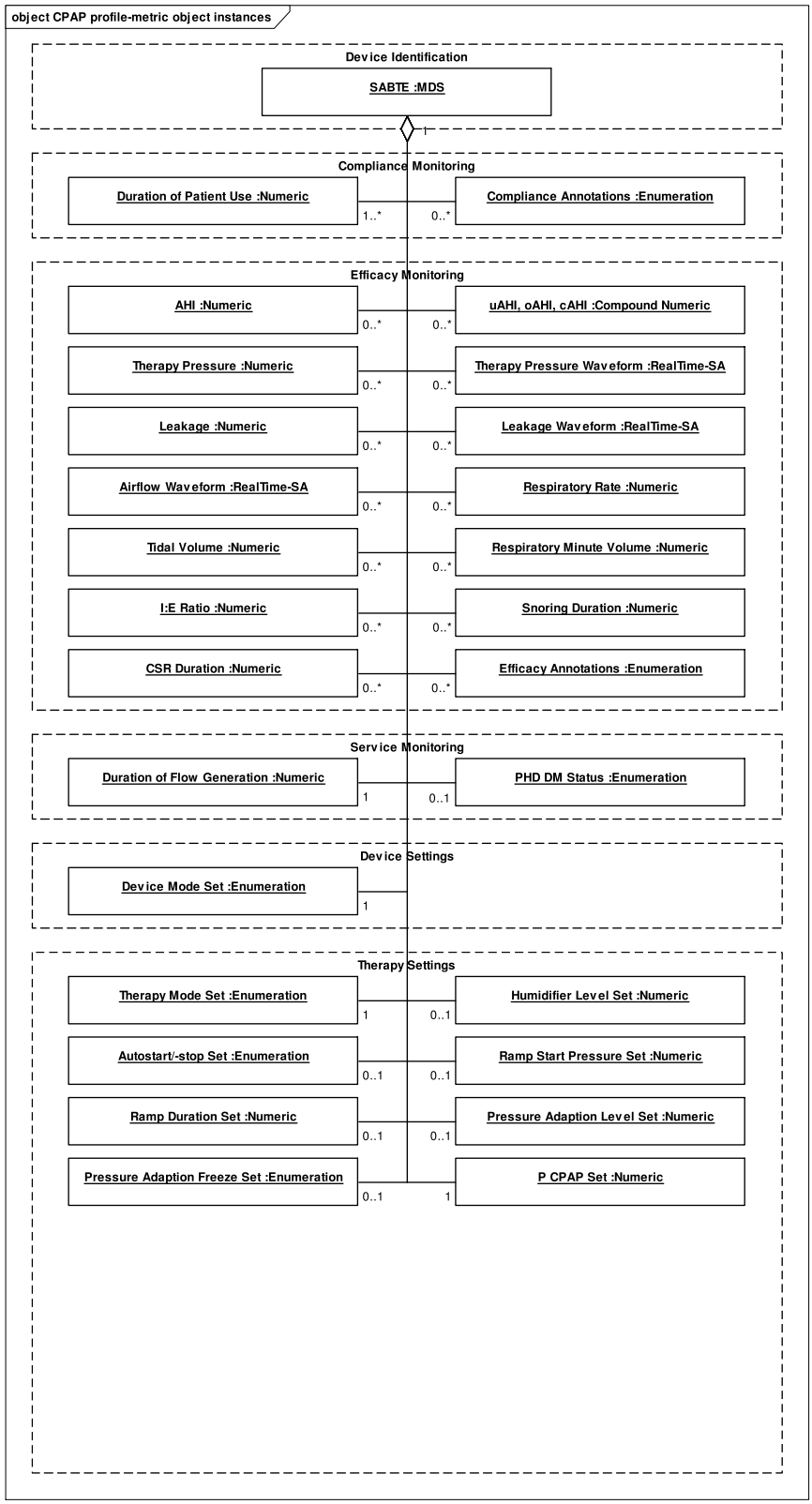

Figure 6—CPAP profile—metric objects

6.5.3 Auto-CPAP profile

The metric object instance diagram of the Auto-CPAP profile domain information model is shown in Figure 7. A SABTE device implementing the Auto-CPAP profile shall implement in addition to the standard configuration objects (see 6.4) the objects “Pmin APAP set” and “Pmax APAP set.” The objects “P CPAP set,” “P IPAP set,” “P EPAP set,” “respiratory rate set,” “I:E ratio set,” and “trigger sensitivity set” are not required. The nomenclature code to identify the Auto-CPAP profile is MDC_DEV_SUB_SPEC_PROFILE_CPAP_AUTO. For the Auto-CPAP profile, currently no standard configuration is defined.

6.5.4 BiLevel PAP profile

The metric object instance diagram of the BiLevel PAP profile domain information model is shown in Figure 8. A SABTE device implementing the BiLevel PAP profile shall implement in addition to the standard configuration objects (see 6.4) the objects “P IPAP set” and “P EPAP set.” The objects “pressure adaption level set,” “pressure adaption freeze set,” “P CPAP set,” “Pmin APAP set,” and “Pmax APAP Set” are not required. The nomenclature code to identify the BiLevel PAP profile is MDC_DEV_SUB_SPEC_PROFILE_BPAP. For the BiLevel PAP profile, currently no standard configuration is defined.

6.6 Medical device system object

6.6.1 MDS object attributes

Table 1 summarizes the attributes of the SABTE MDS object. The nomenclature code to identify the MDS class is MDC_MOC_VMS_MDS_SIMP.

Table 1—MDS object attributes

Attribute name	Value	Qual.
Handle	0	M
System-Type	Attribute not present. See IEEE Std 11073-20601a-2010.	C
System-Type-Spec-List	{MDC_DEV_SPEC_PROFILE_SABTE, 1} and Profile value: {MDC_DEV_SUB_SPEC_PROFILE_CPAP, 1}, {MDC_DEV_SUB_SPEC_PROFILE_CPAP_AUTO, 1} or {MDC_DEV_SUB_SPEC_PROFILE_BPAP, 1}	M
System-Model	{“Manufacturer,” “Model”}.	M
System-Id	Extended unique identifier (64-bits) (EUI-64) See IEEE Std 11073-20601a-2010.	M
Dev-Configuration-Id	Standard config: 0x0960 (2400) Extended configs: 0x4000-0x7FFF.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Production-Specification	See IEEE Std 11073-20601a-2010.	M
Mds-Time-Info	See IEEE Std 11073-20601a-2010.	C
Date-and-Time	See IEEE Std 11073-20601a-2010.	C
Base-Offset-Time	See IEEE Std 11073-20601a-2010.	R

Table 1—MDS object attributes *(continued)*

Attribute name	Value	Qual.
Relative-Time	See IEEE Std 11073-20601a-2010.	C
HiRes-Relative-Time	See IEEE Std 11073-20601a-2010.	C
Date-and-Time-Adjustment	See IEEE Std 11073-20601a-2010.	C
Power-Status	See IEEE Std 11073-20601a-2010.	O
Battery-Level	See IEEE Std 11073-20601a-2010.	O
Remaining-Battery-Time	See IEEE Std 11073-20601a-2010.	O
Reg-Cert-Data-List	See IEEE Std 11073-20601a-2010.	O
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

In the response to a Get MDS Object command, only implemented attributes and their corresponding values are returned.

See IEEE Std 11073-20601a-2010 for descriptive explanations of the individual attributes as well as for information on attribute ID and attribute type.

If an agent implements multiple IEEE 11073-104zz specializations, System-Type-Spec-List is a list of type/version pairs, each referencing the respective device specialization and version of that specialization. For a SABTE agent, a specialization value of MDC_DEV_SPEC_PROFILE_SABTE shall be included in the System-Type-Spec-List attribute as shown in Table 1. Additionally, the value(s) for the supported profile(s) shall be included in the System-Type-Spec-List attribute. The profile value for a SABTE agent supporting the CPAP profile shall be set to MDC_DEV_SUB_SPEC_PROFILE_CPAP. The profile value for a SABTE agent supporting the Auto-CPAP profile shall be set to MDC_DEV_SUB_SPEC_PROFILE_CPAP_AUTO. The profile value for a SABTE agent supporting the BiLevel PAP profile shall be set to MDC_DEV_SUB_SPEC_PROFILE_BPAP.

The Dev-Configuration-Id attribute holds a locally unique 16-bit identifier that identifies the device configuration. For a SABTE agent with extended configuration, this identifier is chosen in the range of extended-config-start to extended-config-end (see IEEE Std 11073-20601a-2010) as shown in Table 1.

The agent sends the Dev-Configuration-Id during the Associating state (see 8.3) to identify its configuration for the duration of the association. If the manager already holds the configuration information relating to the Dev-Configuration-Id, it recognizes the Dev-Configuration-Id and the Configuring state (see 8.4) is skipped, and the agent and manager then enter the Operating state. If the manager does not recognize the Dev-Configuration-Id, the agent and manager enter the Configuring state.

Agents following this device specialization shall include a component to the Production-Specification attribute with the spec-type field set to serial-number and the prod-spec field set to the serial number of the device. Furthermore they shall include a component to the Production-Specification MDS-object attribute with the spec-type field set to fw-revision and the prod-spec field set to the firmware identifier of the device (see ISO/IEC 80601-2-70 [B7]).

SABTE should use Base-Offset-Time to handle daylight saving time and time-zone traveling.

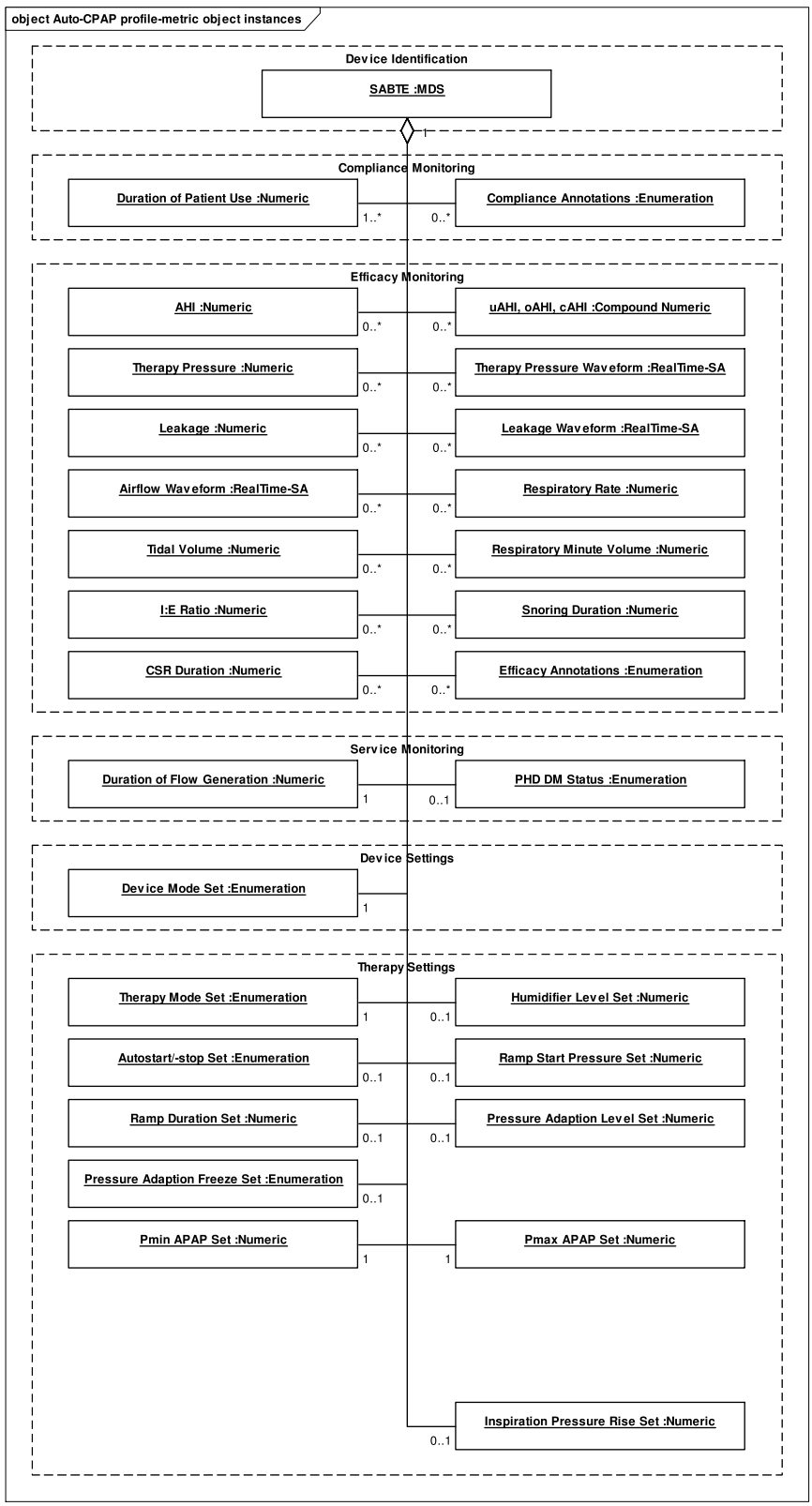

Figure 7—Auto-CPAP profile—metric objects

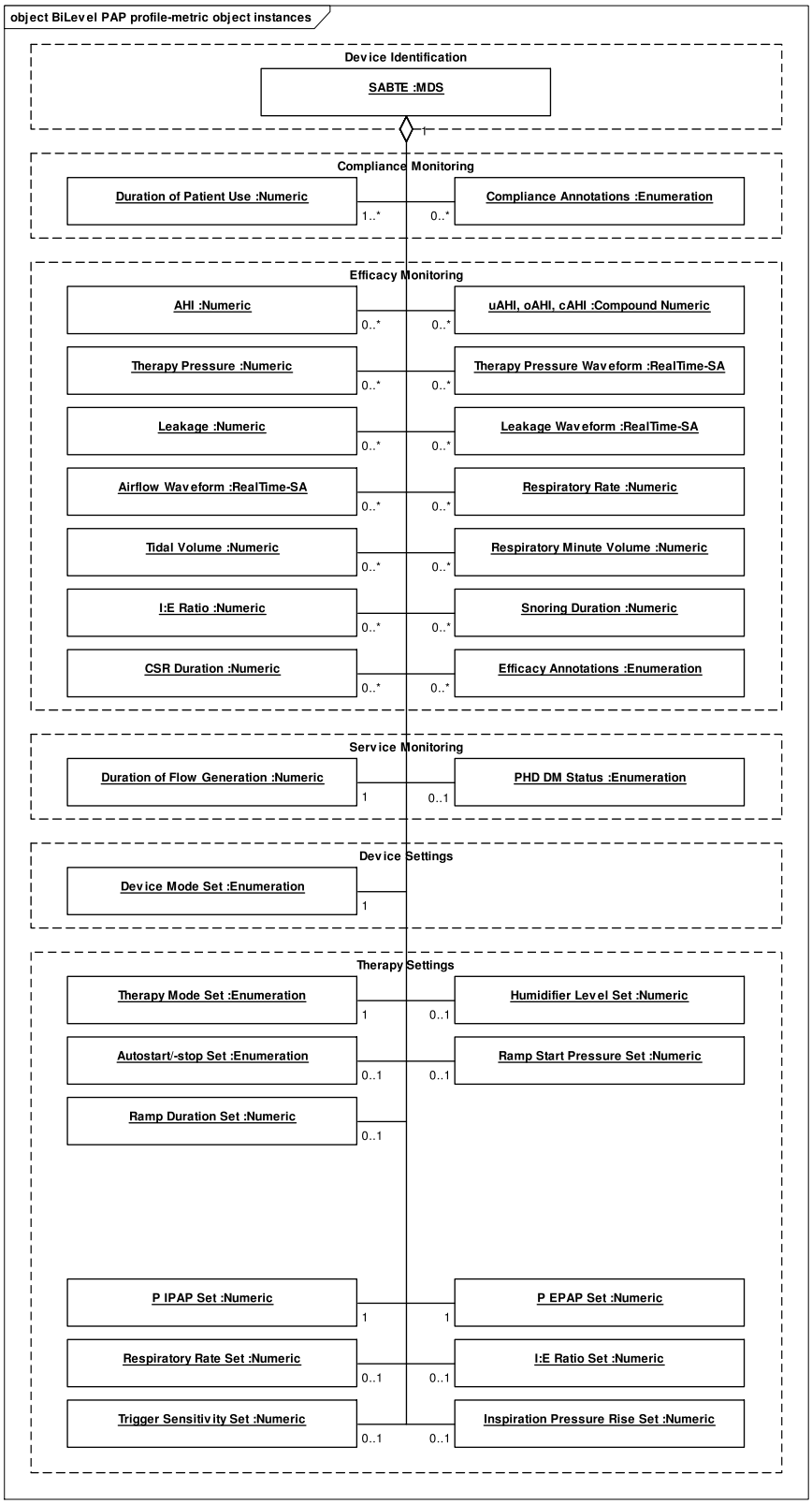

Figure 8—BiLevel PAP profile—metric objects

6.6.2 MDS object methods

Table 2 defines the methods (actions) of the MDS object. These methods are invoked using the Action service. In Table 2, the Subservice type name column defines the name of the method; the Mode column defines whether the method is invoked as an unconfirmed action (i.e., roiv-cmip-action from IEEE Std 11073-20601a-2010) or a confirmed action (i.e., roiv-cmip-confirmed-action); the Subservice type (action-type) column defines the nomenclature code to use in the action-type field of an action request and response (see IEEE Std 11073-20601a-2010); the Parameters (action-info-args) column defines the associated ASN.1 data structure (see IEEE Std 11073-20601a-2010 for ASN.1 definitions) to use in the action message for the action-info-args field of the request; and the Results (action-info-args) column defines the structure to use in the action-info-args of the response.

Table 2—MDS object methods

Service	Subservice type name	Mode	Subservice type (action-type)	Parameters (action-info-args)	Results (action-info-args)
ACTION	MDS-Data-Request	Confirmed	MDC_ACT_DATA_ REQUEST	DataRequest	DataResponse
	Set-Time	Confirmed	MDC_ACT_SET_TIME	SetTimeInvoke	—
	Set-Base-Offset-Time	Confirmed	MDC_ACT_SET_BO_ TIME	SetBOTimeInvoke	—

— **MDS-Data-Request:**
This method allows the manager system to enable or disable measurement data transmission from the agent (see IEEE Std 11073-20601a-2010).

— **Set-Time:**
This method allows the manager to set a real-time clock in the agent with the absolute time. The agent indicates whether the Set-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601a-2010).

— **Set-Base-Offset-Time:**
This method allows the manager system to set a real-time clock (RTC) with a base time and the offset in minutes to local time. The agent indicates whether the Set-Base-Offset-Time command is valid using the mds-time-capab-set-clock bit in the Mds-Time-Info attribute (see IEEE Std 11073-20601a-2010).

If the agent supports the Absolute-Time-Stamp attribute, the method Set-Time shall be implemented. If the agent supports the Base-Offset-Time-Stamp attribute, the method Set-Base-Offset-Time shall be implemented.

Agents following only this device specialization and no others may send event reports either by using agent-initiated or manager-initiated measurement data transmission. During the association procedure (see 8.3), data-req-mode-capab shall be set to the appropriate value for the event report style. As a result, the manager shall assume that if the SABTE agent supports any of the MDS-Data-Request features, then it may use them to access the object value only if the object's Metric-Spec-Small attribute has its acc-manager-initiated bit set (see IEEE Std 11073-20601-2008 for additional information).

6.6.3 MDS object events

Table 3 defines the events that can be sent by the SABTE MDS object.

Table 3—SABTE MDS object events

Service	Subservice type name	Mode	Subservice type (event-type)	Parameters (event-info)	Results (event-reply-info)
EVENT REPORT	MDS-Configuration-Event	Confirmed	MDC_NOTI_CONFIG	ConfigReport	ConfigReport Rsp
	MDS-Dynamic-Data-Update-Var	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_VAR	ScanReportInfoVar	—
	MDS-Dynamic-Data-Update-Fixed	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
	MDS-Dynamic-Data-Update-MP-Var	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—
	MDS-Dynamic-Data-Update-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—

— **MDS-Configuration-Event:**
This event is sent by the SABTE agent during the configuring procedure if the manager does not already know the SABTE agent's configuration from past associations or because the manager has not been implemented to recognize the configuration according to the SABTE device specialization. The event provides static information about the supported measurement capabilities of the SABTE agent.

— **MDS-Dynamic-Data-Update-Var:**
This event provides dynamic measurement data from the SABTE agent numeric and enumeration object(s). These data are reported using a generic attribute list variable format. The event is sent as an unsolicited message by the agent (i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-Fixed:**
This event provides dynamic measurement data from the SABTE agent numeric and enumeration object(s). These data are reported in the fixed format defined by the Attribute-Value-Map attribute of the object. The event is sent as an unsolicited message by the agent (i.e., an agent-initiated measurement data transmission). See 8.5.3 for more information on unsolicited event reporting.

— **MDS-Dynamic-Data-Update-MP-Var:**
This is the same as MDS-Dynamic-Data-Update-Var but allows inclusion of data from multiple people.

— **MDS-Dynamic-Data-Update-MP-Fixed:**
This is the same as MDS-Dynamic-Data-Update-Fixed but allows inclusion of data from multiple people.

In general SABTE is only used by one patient so that MDS-Dynamic-Data-Update-MP-Var and MDS-Dynamic-Data-Update-MP-Fixed is typically not implemented in a SABTE agent.

NOTE—IEEE Std 11073-20601a-2010 requires that managers support all of the MDS object events listed previously.

6.6.4 Other MDS services

6.6.4.1 GET service

A SABTE agent shall support the GET service, which is provided by the MDS object to retrieve the values of all implemented MDS object attributes. The GET service can be invoked as soon as the SABTE agent receives the Association Response and moves to the Associated state, including the Operating and Configuring substates.

The manager may request the MDS object attributes of the SABTE agent, in which case, the manager shall send the "Remote Operation Invoke | Get" message (see roiv-cmip-get in IEEE Std 11073-20601a-2010) with the reserved MDS handle value of 0. The SABTE agent shall report its MDS object attributes to the manager using the "Remote Operation Response | Get" message (see rors-cmip-get in IEEE Std 11073-20601a-2010). See Table 4 for a summary of the GET service including some message fields.

Table 4—SABTE MDS object GET service

Service	Subservice type name	Mode	Subservice type	Parameters	Results
GET	<na>	<implied confirmed>	<na>	GetArgumentSimple = (obj-handle = 0), attribute-id-list <*optional*>	GetResultSimple = (obj-handle = 0), attribute-list

See 8.5.2 for details on the procedure for getting the MDS object attributes.

6.6.4.2 SET service

The SABTE specialization does not require an implementation to support the MDS object SET service.

6.7 Numeric objects

6.7.1 General

The SABTE DIM (see Figure 5) contains numeric and compound numeric objects that represent aspects of the sleep therapy compliance, efficacy, and settings. The nomenclature code to identify the numeric or compound numeric class is MDC_MOC_VMO_METRIC_NU. Table 5 shows the attributes that are common to all the numeric types of the SABTE agent.

Table 5—Common SABTE numeric and compound numeric object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	Defined in each respective table.	M
Type	Defined in each respective table.	M	Defined in each respective table.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	Defined in each respective table.	M	Defined in each respective table.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	O	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	O
Measurement-Status	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Id	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Id-List	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Unit-Code	Defined in each respective table.	M	Defined in each respective table.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	Defined in each respective table.	M
Source-Handle-Reference	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Label-String	See IEEE Std 11073-20601a-2010.	O	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Base-Offset-Time-Stamp	See IEEE Std 11073-20601a-2010.	R	If fixed format is used and the standard configuration is unchanged, this attribute is mandatory; otherwise, the conditions from IEEE Std 11073-20601a-2010 apply.	R
Relative-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
HiRes-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C

Table 5—Common SABTE numeric and compound numeric object attributes *(continued)*

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.		Value
Compound-Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Compound-Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Compound-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Accuracy	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

Subclauses 6.7.2 through 6.7.21 describe the numeric objects that are defined for use in the SABTE. Each object represents a specific aspect of the sleep therapy compliance, efficacy, and settings, and its class is denoted by the Type attribute. The description of each numeric object defines the data or events it produces, the possible states, and where appropriate, its behavior. The respective tables define the numeric values generated by the agent in response to a change in state.

Sometimes, the interpretation of one attribute value in an object depends on other attribute values in the same object. For example, Unit-Code and Unit-LabelString provide context for the observed values. Whenever a contextual attribute changes, the agent shall report these changes to the manager using an MDS object event (see 6.5.3) prior to reporting any of the dependent values.

The numeric and compound numeric object does not support any methods, events, or other services.

See IEEE Std 11073-20601a-2010 for descriptive explanations on the individual attributes as well as for information on attribute ID and attribute type.

6.7.2 Duration of patient use

Table 6 summarizes the attributes of the duration of patient use numeric object. The duration of patient use numeric object shall be supported by a SABTE agent.

Table 6—Duration of patient use numeric object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	1	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_USAGE_TOTAL} or {MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_USAGE_W_HUM} or {MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_USAGE_WO_HUM}	M	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_USAGE_TOTAL}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_MIN	M	MDC_DIM_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	MDC_ATTR_NU_VAL_OBS_BASIC, then MDC_ATTR_TIME_STAMP_BO.	M
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R	If fixed format is used and the standard configuration is unchanged, this attribute is mandatory; otherwise, the conditions from IEEE Std 11073-20601a-2010 apply.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

For a SABTE agent with standard configuration, the AttrValMap structure (see IEEE Std 11073-20601a-2010) of the Attribute-Value-Map attribute shall contain the attribute ID and attribute length information of the Basic-Nu-Observed-Value and Base-Offset-Time-Stamp attribute in the same order as indicated in Table 6.

The Type attribute is used to distinguish the modality of particular duration of patient use between total duration with and without attached humidifier (i.e., MDC_SABTE_TIME_PD_USAGE_TOTAL), only the duration with attached humidifier (i.e., MDC_SABTE_TIME_PD_USAGE_W_HUM), or only the duration without attached humidifier (i.e., MDC_SABTE_TIME_PD_USAGE_WO_HUM).

6.7.3 Apnoea hypopnoea index (AHI)

Table 7 summarizes the attributes of the AHI numeric object. The AHI numeric object may be supported by a SABTE agent.

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular AHI between total AHI (i.e., MDC_SABTE_AHI_TOTAL), uAHI (i.e., MDC_SABTE_AHI_UNCLASS), oAHI (i.e., MDC_SABTE_AHI_OBSTRUC), or cAHI (i.e., MDC_SABTE_AHI_CENT).

Table 7—AHI numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_AHI_TOTAL} or {MDC_PART_PHD_DM, MDC_SABTE_AHI_UNCLASS} or {MDC_PART_PHD_DM, MDC_SABTE_AHI_OBSTRUC} or {MDC_PART_PHD_DM, MDC_SABTE_AHI_CENT}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-calculation.	M
Unit-Code	MDC_DIM_EVT_PER_HR	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

6.7.4 Compound apnoea hypopnoea index

Table 8 summarizes the attributes of the compound numeric object that reports uAHI, oAHI, and cAHI values. The AHI compound numeric object may be supported by a SABTE agent.

Table 8—Apnoea hypopnoea index compound numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_AHI}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-calculation.	M
Metric-Id-List	MDC_SABTE_AHI_UNCLASS, then MDC_SABTE_AHI_OBSTRUC, then MDC_SABTE_AHI_CENTRAL	M
Unit-Code	MDC_DIM_EVT_PER_HR	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	NR
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	NR
Compound-Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R
Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	NR

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

If an agent does not support a classification the corresponding value shall be reported as the special value Not a Number (NaN).

6.7.5 Therapy Pressure

Table 9 summarizes the attributes of the therapy pressure numeric object. The therapy pressure numeric object may be supported by a SABTE agent.

Table 9—Therapy pressure numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_P50} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_P90} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular therapy pressure between instantaneous value (i.e., MDC_SABTE_PRESS_INSTANT), minimum of a usage session (i.e., MDC_SABTE_PRESS_MIN), maximum of a usage session (i.e., MDC_SABTE_PRESS_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_PRESS_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_PRESS_P50), 90th percentile of a usage session (i.e., MDC_SABTE_PRESS_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_PRESS_P95).

6.7.6 Leakage

Table 10 summarizes the attributes of the leakage numeric object. The leakage numeric object may be supported by a SABTE agent.

Table 10—Leakage numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM MDC_SABTE_VOL_LEAK_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_P50} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_P90} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_L_PER_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular leakage between instantaneous value (i.e., MDC_SABTE_VOL_LEAK_INSTANT), minimum of a usage session (i.e., MDC_SABTE_VOL_LEAK_MIN), maximum of a usage session (i.e., MDC_SABTE_VOL_LEAK_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_VOL_LEAK_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_VOL_LEAK_P50), 90th percentile of a usage session (i.e., MDC_SABTE_VOL_LEAK_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_VOL_LEAK_P95).

6.7.7 Respiratory rate

Table 11 summarizes the attributes of the respiratory rate numeric object. The respiratory rate numeric object may be supported by a SABTE agent.

Table 11—Respiratory rate numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_P50} or {MDC_PART_PHD_DM, MDC_SABTE_RATE_P90} or {MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_RESP_PER_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular respiratory rate between instantaneous value (i.e., MDC_SABTE_RESP_RATE_INSTANT), minimum of a usage session (i.e., MDC_SABTE_RESP_RATE_MIN), maximum of a usage session (i.e., MDC_SABTE_RESP_RATE_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_RESP_RATE_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_RESP_RATE_P50), 90th percentile of a usage session (i.e., MDC_SABTE_RESP_RATE_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_RESP_RATE_P95).

6.7.8 Tidal volume

Table 12 summarizes the attributes of the tidal volume numeric object. The tidal volume numeric object may be supported by a SABTE agent.

Table 12—Tidal volume numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_P50} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_P90} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_TIDAL_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_MILLI_L	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular tidal volume between instantaneous value (i.e., MDC_SABTE_VOL_TIDAL_INSTANT), minimum of a usage session (i.e., MDC_SABTE_VOL_TIDAL_MIN), maximum of a usage session (i.e., MDC_SABTE_VOL_TIDAL_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_VOL_TIDAL_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_VOL_TIDAL_P50), 90th percentile of a usage session (i.e., MDC_SABTE_VOL_TIDAL_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_VOL_TIDAL_P95).

6.7.9 Respiratory minute volume

Table 13 summarizes the attributes of the respiratory minute volume numeric object. The respiratory minute volume numeric object may be supported by a SABTE agent.

Table 13—Respiratory minute volume numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_P50} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_P90} or {MDC_PART_PHD_DM, MDC_SABTE_VOL_MINUTE_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_L_PER_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular respiratory minute volume between instantaneous value (i.e., MDC_SABTE_VOL_MINUTE_INSTANT), minimum of a usage session (i.e., MDC_SABTE_VOL_MINUTE_MIN), maximum of a usage session (i.e., MDC_SABTE_VOL_MINUTE_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_VOL_MINUTE_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_VOL_MINUTE_P50), 90th percentile of a usage session (i.e., MDC_SABTE_VOL_MINUTE_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_VOL_MINUTE_P95).

6.7.10 I:E ratio

Table 14 summarizes the attributes of the I:E ratio numeric object. The I:E ratio numeric object may be supported by a SABTE agent.

Table 14—I:E ratio duration numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_INSTANT} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_MIN} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_MAX} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_MEAN} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_P50} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_P90} or {MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_P95}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-calculation.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular I:E ratio between instantaneous value (i.e., MDC_SABTE_RATIO_IE_INSTANT), minimum of a usage session (i.e., MDC_SABTE_RATIO_IE_MIN), maximum of a usage session (i.e., MDC_SABTE_RATIO_IE_MAX), arithmetic mean of a usage session (i.e., MDC_SABTE_RATIO_IE_MEAN), 50th percentile of a usage session (i.e., MDC_SABTE_RATIO_IE_P50), 90th percentile of a usage session (i.e., MDC_SABTE_RATIO_IE_P90), or 95th percentile of a usage session (i.e., MDC_SABTE_RATIO_IE_P95).

6.7.11 Snoring duration

Table 15 summarizes the attributes of the snoring duration numeric object. The snoring duration numeric object may be supported by a SABTE agent.

Table 15—Snoring duration numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_SNORING_TOTAL}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-calculation.	M
Unit-Code	MDC_DIM_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.12 CSR duration

Table 16 summarizes the attributes of the CSR duration numeric object. The CSR duration numeric object may be supported by a SABTE agent.

Table 16—CSR duration numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_CSR_TOTAL}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-calculation.	M
Unit-Code	MDC_DIM_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.13 Duration of flow generation

Table 17 summarizes the attributes of the duration of flow generation numeric object. The duration of flow generation numeric object shall be supported by a SABTE agent.

Table 17—Duration of flow generation numeric object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	2	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_FLOW_GEN_TOTAL}	M	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_FLOW_GEN_TOTAL}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Unit-Code	MDC_DIM_MIN	M	MDC_DIM_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	MDC_ATTR_NU_VAL_OBS_SIMP, then MDC_ATTR_TIME_STAMP_BO.	M
Simple-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R	If fixed format is used and the standard configuration is unchanged, this attribute is mandatory; otherwise, the conditions from IEEE Std 11073-20601a-2010 apply.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

For a SABTE agent with standard configuration, the AttrValMap structure (see IEEE Std 11073-20601a-2010) of the Attribute-Value-Map attribute shall contain the attribute ID and attribute length information of the Simple-Nu-Observed-Value and Base-Offset-Time-Stamp attribute in the same order as indicated in Table 17.

6.7.14 Humidifier level set

Table 18 summarizes the attributes of humidifier level set numeric object. The humidifier level set numeric object may be supported by a SABTE agent.

Table 18—Humidifier level set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_LVL_HUMID_STAGE_SET} or {MDC_PART_PHD_DM, MDC_SABTE_LVL_HUMID_TEMP_SET} or {MDC_PART_PHD_DM, MDC_SABTE_LVL_HUMID_HUM_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of humidifier level settings between humidifier relative stage (i.e., MDC_SABTE_LVL_HUMID_STAGE_SET), humidifier relative air output temperature (i.e., MDC_SABTE_LVL_HUMID_TEMP_SET), or humidifier relative humidity (i.e., MDC_SABTE_LVL_HUMID_HUM_SET).

As humidifier level value shall be used 0% for the minimal possible humidifier level (i.e., disabled, relative stage of 0% = “off,” relative temperature of 0% = 0 °C, relative humidity of 0 %). As value shall be used 100% for maximal possible humidifier level (i.e., relative stage of 100% = “maximum,” theoretically relative temperature of 100% = 100 °C, theoretically relative humidity of 100 %).

6.7.15 Ramp start pressure set

Table 19 summarizes the attributes of ramp start pressure set numeric object. The ramp start pressure set numeric object may be supported by a SABTE agent.

Table 19—Ramp start pressure set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_RAMP_START_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.16 Ramp duration set

Table 20 summarizes the attributes of ramp duration set numeric object. The ramp duration set numeric object may be supported by a SABTE agent.

Table 20—Ramp duration set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_TIME_PD_RAMP_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

As ramp duration value shall be used 0 min if the sleep ramp is disabled.

6.7.17 Pressure adaption level set

Table 21 summarizes the attributes of pressure adaption level set numeric object. The pressure adaption level set numeric object may be supported by a SABTE agent.

Table 21—Pressure adaption level set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_LVL_ADAPT_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

As pressure adaption level value shall be used 0% for the minimal possible pressure adaption (e.g., disabled). As value shall be used 100% for maximal possible pressure adaption (e.g., automatically adjusted).

6.7.18 P CPAP set

Table 22 summarizes the attributes of the P CPAP set numeric object. The P CPAP set numeric object may be supported by a SABTE agent.

Table 22—P CPAP set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_CPAP_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.19 Pmin APAP set

Table 23 summarizes the attributes of the Pmin APAP set numeric object. The Pmin APAP set numeric object may be supported by a SABTE agent.

Table 23—Pmin APAP set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_CPAP_AUTO_MIN_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.20 Pmax APAP set

Table 24 summarizes the attributes of the Pmax APAP set numeric object. The Pmax APAP set numeric object may be supported by a SABTE agent.

Table 24—Pmax APAP set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_CPAP_AUTO_MAX_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.21 P IPAP Set

Table 25 summarizes the attributes of the P IPAP set numeric object. The P IPAP set numeric object may be supported by a SABTE agent.

Table 25—P IPAP set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_IPAP_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.22 P EPAP set

Table 26 summarizes the attributes of the P EPAP set numeric object. The P EPAP set numeric object may be supported by a SABTE agent.

Table 26—P EPAP set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS_EPAP_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.23 Respiratory rate set

Table 27 summarizes the attributes of the respiratory rate set numeric object. The respiratory rate set numeric object may be supported by a SABTE agent.

Table 27—Respiratory rate set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_RESP_RATE_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_RESP_PER_MIN	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.24 I:E ratio set

Table 28 summarizes the attributes of the I:E ratio set numeric object. The I:E ratio set numeric object may be supported by a SABTE agent.

Table 28—I:E ratio set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_RATIO_IE_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.7.25 Trigger sensitivity set

Table 29 summarizes the attributes of the trigger sensitivity set numeric object. The trigger sensitivity set numeric object may be supported by a SABTE agent.

Table 29—Trigger sensitivity set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_LVL_TRIG_SENS_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

As trigger sensitivity value shall be used 0% for the minimal possible trigger sensitivity (e.g., disabled). As value shall be used 100% for maximal possible trigger sensitivity (e.g., automatically adjusted).

6.7.26 Inspiration pressure rise set

Table 30 summarizes the attributes of the inspiration pressure rise set numeric object. The inspiration pressure rise set numeric object may be supported by a SABTE agent.

Table 30—Inspiration pressure rise set numeric object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_LVL_INSP_PRESS_RISE_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Unit-Code	MDC_DIM_PERCENT	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Basic-Nu-Observed-Value	See IEEE Std 11073-20601a-2010.	R

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

As inspiration pressure rise value shall be used 0% for the minimal possible inspiration pressure rise (e.g., disabled). As value shall be used 100% for maximal possible inspiration pressure rise (e.g., automatically adjusted).

6.8 Real-time sample array objects

6.8.1 General

The SABTE DIM for metric objects (see Figure 5) contains two RT-SA objects for therapy pressure and airflow waveform data. The nomenclature code to identify the RT-SA class is MDC_MOC_VMO_METRIC_SA_RT. Table 31 shows the attributes that are common to all the real-time sample array types of the SABTE agent.

Subclauses 6.8.2 through 6.8.4 describe the possible uses of the SABTE real-time sample array object. Each use is an instance of the real-time sample array class with a particular Type value. The interpretation of associated values is dependent on the Type value. The description of each real-time sample array object defines all the possible states and, where appropriate, its behavior. The respective tables define the events generated by the agent in response to a change in state.

The real-time sample array data shall be made available only through a PM-store or scanner object. Therefore only the mss-acc-agent-initiated bit in the Metric-Spec-Small attribute shall be set (see Table 31).

The real-time sample array object does not support any methods, events, or other services.

See IEEE Std 11073-20601a-2010 for descriptive explanations on the individual attributes as well as information on attribute ID and attribute type.

Table 31—Common SABTE real-time sample array object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	Defined in each respective table.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	mss-acc-agent-initiated	M
Measurement-Status	See IEEE Std 11073-20601a-2010.	R
Metric-Id	See IEEE Std 11073-20601a-2010.	NR
Metric-Id-List	See IEEE Std 11073-20601a-2010.	NR
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	NR
Unit-Code	Defined in each respective table.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Source-Handle-Reference	See IEEE Std 11073-20601a-2010.	NR
Label-String	See IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See IEEE Std 11073-20601a-2010.	C
Base-Offset-Time-Stamp	See IEEE Std 11073-20601a-2010.	R
Relative-Time-Stamp	See IEEE Std 11073-20601a-2010.	C
HiRes-Time-Stamp	See IEEE Std 11073-20601a-2010.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR
Sample-Period	See IEEE Std 11073-20601a-2010.	M
Simple-Sa-Observed-Value	See IEEE Std 11073-20601a-2010.	M
Scale-and-Range-Specification	See IEEE Std 11073-20601a-2010.	M
Sa-Specification	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

6.8.2 Therapy pressure waveform

Therapy pressure waveforms are transmitted as a series of samples with each waveform represented as a separate object. Table 32 summarizes the attributes of the therapy pressure waveform RT-SA object. The therapy pressure waveform RT-SA object may be supported by a SABTE agent.

Table 32—Therapy pressure waveform RT-SA object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PRESS} or {MDC_PART_PHD_DM, MDC_SABTE_PRESS_TARGET}	M
Unit-Code	MDC_DIM_HECTO_PASCAL	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of therapy pressure waveform between current therapy pressure (i.e., MDC_SABTE_PRESS) or target therapy pressure (i.e., MDC_SABTE_PRESS_TARGET).

6.8.3 Leakage waveform

Leakage waveforms are transmitted as a series of samples with each waveform represented as a separate object. Table 33 summarizes the attributes of the leakage waveform RT-SA object. The leakage waveform RT-SA object may be supported by a SABTE agent.

Table 33—Leakage waveform RT-SA object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_VOL_LEAK}	M
Unit-Code	MDC_DIM_L_PER_MIN	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

6.8.4 Airflow waveform

Airflow waveforms are transmitted as a series of samples with each waveform represented as a separate object. Table 34 summarizes the attributes of the airflow waveform RT-SA object. The airflow waveform RT-SA object may be supported by a SABTE agent.

Table 34—Airflow waveform RT-SA object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_FLOW_TOTAL} or {MDC_PART_PHD_DM, MDC_SABTE_FLOW_WO_PURGE} or {MDC_PART_PHD_DM, MDC_SABTE_FLOW_RESP}	M
Unit-Code	MDC_DIM_L_PER_MIN	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The Type attribute is used to distinguish the modality of particular airflow waveform between total device airflow (i.e., MDC_SABTE_FLOW_TOTAL), device airflow without purge flow (i.e., MDC_SABTE_FLOW_WO_PURGE), or respiration airflow (i.e., MDC_SABTE_FLOW_RESP).

6.9 Enumeration objects

6.9.1 General

SABTE uses a number of enumeration objects to represent information and events that are related to sleep therapy and its measurement. The nomenclature code to identify the enumeration class is MDC_MOC_VMO_METRIC_ENUM. The attribute structure shown in Table 35 is common to all enumeration types.

Table 35—Common SABTE enumeration object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	Defined in each respective table.	M
Type	Defined in each respective table.	M	Defined in each respective table.	M
Supplemental-Types	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Spec-Small	Defined in each respective table.	M	Defined in each respective table.	M
Metric-Structure-Small	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Measurement-Status	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Id	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Id-List	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Metric-Id-Partition	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Unit-Code	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	Defined in each respective table.	M
Source-Handle-Reference	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR
Label-String	See IEEE Std 11073-20601a-2010.	O	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	O
Unit-LabelString	See IEEE Std 11073-20601a-2010.	O	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	O
Absolute-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Base-Offset-Time-Stamp	See IEEE Std 11073-20601a-2010.	R	If fixed format is used and the standard configuration is unchanged, this attribute is mandatory; otherwise, the conditions from IEEE Std 11073-20601a-2010 apply.	R
Relative-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
HiRes-Time-Stamp	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Measure-Active-Period	See IEEE Std 11073-20601a-2010.	NR	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	NR

Table 35—Common SABTE enumeration object attributes *(continued)*

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.		Value
Enum-Observed-Value-Simple-OID	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Simple-Bit-Str	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Basic-Bit-Str	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Simple-Str	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Partition	See IEEE Std 11073-20601a-2010.	C	Attribute not initially present. If present follow IEEE Std 11073-20601a-2010.	C

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

Subclauses 6.9.2 through 6.9.8 describe the possible uses of the SABTE enumeration object. Each use is an instance of the enumeration class with a particular Type value. The interpretation of associated values is dependent on the Type value. The description of each enumeration object defines all the possible states and, where appropriate, its behavior. The respective tables define the events generated by the agent in response to a change in state.

Because the SABTE enumeration objects are essentially event flags, the Unit-Code attribute is not appropriate. Similarly, the Source-Handle-Reference is inappropriate as these objects monitor the status of the therapy or the equipment.

The enumeration object does not support any methods, events, or other services.

See IEEE Std 11073-20601a-2010 for descriptive explanations on the individual attributes as well as information on attribute ID and attribute type.

6.9.2 Compliance annotations

Table 36 summarizes the attributes of the compliance annotations enumeration object. The compliance annotations enumeration object may be supported by a SABTE agent.

Table 36—Compliance annotations enumeration object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PATT_COMPLIANCE_CLS}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Basic-Bit-Str	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

Compliance annotations are realized by the setting of the appropriate bit in the Enum-Observed-Value-Basic-Bit-Str as defined in Table 37. If a manager supports this object, it shall be able to interpret the entire set of presented conditions. An agent is not required to implement all the features specified in Table 37. Anytime the status changes for any monitored condition, the agent shall report the status of all the monitored conditions.

The detection of the condition change may take time. In case there is a delay in detecting the start or stop of a condition, then the event shall be reported with a time stamp that is the time of the occurrence of the respective event, rather than the time that the event is reported.

If an acceptable, existing bit is not available, sabte-annotation-session-undetermined-start/stop shall be used.

A manager shall interpret these bits only within the context of this attribute and only within this device specialization, as other specializations may use corresponding terms for different purposes.

Table 37—Mapping of compliance annotations to object Bit-Str attribute

Compliance Annotations	SABTEComplianceAnnotations mnemonic
Start of undetermined session detected.	sabte-annotation-session-undetermined-start
Stop of undetermined session detected.	sabte-annotation-session-undetermined-stop
Start of therapy session detected.	sabte-annotation-session-therapy-start
Stop of therapy session detected.	sabte-annotation-session-therapy-stop
Start of usage session detected.	sabte-annotation-session-usage-start
Stop of usage session detected.	sabte-annotation-session-usage-stop

The specific bit mappings of SABTEComplianceAnnotations are defined in Annex B.

6.9.3 Efficacy annotations

Table 38 summarizes the attributes of the efficacy annotations enumeration object. The efficacy annotations enumeration object may be supported by a SABTE agent.

Table 38—Efficacy annotations enumeration object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_PATT_EFFICACY_CLS}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-msmt-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Simple-Bit-Str	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

Efficacy annotations are realized by the setting of the appropriate bit in the Enum-Observed-Value-Simple-Bit-Str as defined in Table 39. If a manager supports this object, it shall be able to interpret the entire set of presented conditions. An agent is not required to implement all the features specified in Table 39. Anytime the status changes for any monitored condition, the agent shall report the status of all the monitored conditions.

The detection of the condition change may take time. In case there is a delay in detecting the start or stop of a condition, then the event shall be reported with a time stamp that is the time of the occurrence of the respective event, rather than the time that the event is reported.

If an acceptable, existing bit is not available, sabte-annotation-session-undetermined-start/stop shall be used.

A manager shall interpret these bits only within the context of this attribute and only within this device specialization, as other specializations may use corresponding terms for different purposes.

Table 39—Mapping of efficacy annotations to object Bit-Str attribute

Efficacy annotations	SABTEEfficacyannotations mnemonic
Start of undetermined epoch detected.	sabte-annotation-epoch-undetermined-start
Stop of undetermined epoch detected.	sabte-annotation-epoch-undetermined-stop
Start of artifact breathing epoch detected.	sabte-annotation-epoch-breathing-artifact-start
Stop of artifact breathing epoch detected.	sabte-annotation-epoch-breathing-artifact-stop
Start of spontaneous breathing epoch detected.	sabte-annotation-epoch-breathing-spontaneous-start
Stop of spontaneous breathing epoch detected.	sabte-annotation-epoch-breathing-spontaneous-stop
Start of timed breathing epoch detected.	sabte-annotation-epoch-breathing-timed-start
Stop of timed breathing epoch detected.	sabte-annotation-epoch-breathing-timed-stop
Start of snoring epoch detected.	sabte-annotation-epoch-snoring-start
Stop of snoring epoch detected.	sabte-annotation-epoch-snoring-stop
Start of CSR epoch detected.	sabte-annotation-epoch-csr-start
Stop of CSR epoch detected.	sabte-annotation-epoch-csr-stop

Table 39—Mapping of efficacy annotations to object Bit-Str attribute *(continued)*

Efficacy annotations	SABTEEfficacyannotations mnemonic
Start of undetermined event detected.	sabte-annotation-event-undetermined-start
Stop of undetermined event detected.	sabte-annotation-event-undetermined-stop
Start of flow limitation event detected.	sabte-annotation-event-flow-limitation-start
Stop of flow limitation event detected.	sabte-annotation-event-flow-limitation-stop
Start of unclassified hypopnoea event detected.	sabte-annotation-event-hypopnoea-unclassified-start
Stop of unclassified hypopnoea event detected.	sabte-annotation-event-hypopnoea-unclassified-stop
Start of obstructive hypopnoea event detected.	sabte-annotation-event-hypopnoea-obstructive-start
Stop of obstructive hypopnoea event detected.	sabte-annotation-event-hypopnoea-obstructive-stop
Start of central hypopnoea event detected.	sabte-annotation-event-hypopnoea-central-start
Stop of central hypopnoea event detected.	sabte-annotation-event-hypopnoea-central-stop
Start of unclassified apnoea event detected.	sabte-annotation-event-apnoea-unclassified-start
Stop of unclassified apnoea event detected.	sabte-annotation-event-apnoea-unclassified-stop
Start of obstructive apnoea event detected.	sabte-annotation-event-apnoea-obstructive-start
Stop of obstructive apnoea event detected.	sabte-annotation-event-apnoea-obstructive-stop
Start of mixed apnoea events detected.	sabte-annotation-event-apnoea-mixed-start
Stop of mixed apnoea events detected.	sabte-annotation-event-apnoea-mixed-stop
Start of central apnoea event detected.	sabte-annotation-event-apnoea-central-start
Stop of central apnoea event detected.	sabte-annotation-event-apnoea-central-stop

The specific bit mappings of SABTEEfficacyAnnotations are defined in Annex B.

6.9.4 PHD DM status

Table 40 summarizes the attributes of the PHD DM status enumeration object. The PHD DM status enumeration object may be supported by a SABTE agent.

Table 40—PHD DM status enumeration object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_PHD_DM_DEV_STAT}	M
Metric-Spec-Small	mss-avail-intermittent, mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Simple-Bit-Str	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

The explicit expression of the existence of annunciations is realized by the setting of the appropriate bit in the Enum-Observed-Value-Simple-Bit-Str as defined in Table 41. If a manager supports this object, it shall be able to interpret the entire set of presented conditions. An agent is not required to implement all the features specified in Table 41. Anytime the status changes for any monitored condition, the agent shall report the status of all the monitored conditions.

The detection of the condition change may take time. In case there is a delay in detecting the start or stop of a condition, then the event shall be reported with a time stamp that is the time of the occurrence of the respective event, rather than the time that the event is reported.

If an acceptable, existing bit is not available, device-status-undetermined shall be used. A manager shall interpret these bits only within the context of this attribute and only within this device specialization, as other specializations may use corresponding terms for different purposes.

Table 41—Mapping of PHD DM status to object Bit-Str attribute

PHD DM status condition	PHDDMStat mnemonic
Agent reports that an undetermined or not supported condition occurred.	device-status-undetermined
Agent reports that a reset has occurred.	device-status-reset
Agent reports that a general fault occurred.	device-status-error
Agent reports that a mechanical fault occurred.	device-status-error-mechanical
Agent reports that an electronic fault occurred.	device-status-error-electronic
Agent reports that a software error occurred.	device-status-error-software
Agent reports that a battery fault occurred.	device-status-error-battery
Agent reports that a general service is required.	device-status-service
Agent reports that a time synchronization is required.	device-status-service-time-sync-required
Agent reports that a calibration is required.	device-status-service-calibration-required
Agent reports that a component replenishment is required.	device-status-service-replenishment-required
Agent reports that battery power is low.	device-status-battery-low
Agent reports that battery is depleted.	device-status-battery-depleted
Agent reports that battery has been replaced.	device-status-battery-replaced
Agent reports that battery is interrupted.	device-status-battery-interrupted

The specific bit mappings of PHDDMStat are defined in Annex B.

6.9.5 Device mode set

Table 42 summarizes the attributes of the device mode set enumeration object. The device mode set enumeration object shall be supported by a SABTE agent.

Table 42—Device mode set enumeration object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	3	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_MODE_DEV_SET}	M	{MDC_PART_PHD_DM, MDC_SABTE_MODE_DEV_SET }	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	MDC_ATTR_ENUM_OBS_VAL_SIMP_OID, then MDC_ATTR_TIME_STAMP_BO.	M
Enum-Observed-Value-Simple-OID	See following text.	M	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

For a SABTE agent with standard configuration, the AttrValMap structure (see IEEE Std 11073-20601a-2010) of the Attribute-Value-Map attribute shall contain the attribute ID and attribute length information of the Enum-Observed-Value-Simple-OID and Base-Offset-Time-Stamp attribute in the same order as indicated in Table 42.

The codes for the Enum-Observed-Value-Simple-OID shall be one of the codes defined in Table 43. If a SABTE device is using a device mode that is not listed, then a private (vendor specified) nomenclature code shall be used (0xF000 – 0xFFFF).

Table 43—Nomenclature codes for device mode

Description/definition	Reference ID	Code
Device mode “Undetermined”.	MDC_SABTE_MODE_DEV_UNDETERMINED	22269
Device mode “Standby” active.	MDC_SABTE_MODE_DEV_STANDBY	22270
Device mode “Therapy” active.	MDC_SABTE_MODE_DEV_THERAPY	22271
Device mode “Mask Fitting” active.	MDC_SABTE_MODE_DEV_MASK_FITTING	22272
Device mode “Drying” active.	MDC_SABTE_MODE_DEV_DRYING	22273
Device mode “Exporting” active.	MDC_SABTE_MODE_DEV_EXPORTING	22274

6.9.6 Therapy mode set

Table 44 summarizes the attributes of the therapy mode set enumeration object. The therapy mode set enumeration object shall be supported by a SABTE agent.

Table 44—Therapy mode set enumeration object attributes

Attribute name	Extended configuration		Standard configurations (Dev-Configuration-Id = 0x0960)	
	Value	Qual.	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M	4	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_MODE_THERAPY_SET}	M	{MDC_PART_PHD_DM, MDC_SABTE_MODE_THERAPY_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C	MDC_ATTR_ENUM_OBS_VAL_SIMP_OID, then MDC_ATTR_TIME_STAMP_BO.	M
Enum-Observed-Value-Simple-OID	See following text.	M	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

For a SABTE agent with standard configuration, the AttrValMap structure (see IEEE Std 11073-20601a-2010) of the Attribute-Value-Map attribute shall contain the attribute ID and attribute length information of the Enum-Observed-Value-Simple-OID and Base-Offset-Time-Stamp attribute in the same order as indicated in Table 44.

The codes for the Enum-Observed-Value-Simple-OID shall be one of the codes defined in Table 45. If a SABTE device is using a therapy mode that is not listed, than a private (vendor specified) nomenclature code shall be used (0xF000 – 0xFFFF).

Table 45—Nomenclature codes for therapy mode

Description/definition	Reference ID	Code
Therapy mode “Undetermined”.	MDC_SABTE_MODE_THERAPY_UNDETERMINED	22281
Therapy mode “CPAP” active.	MDC_SABTE_MODE_THERAPY_CPAP	22282
Therapy mode “Auto-CPAP” active.	MDC_SABTE_MODE_THERAPY_CPAP_AUTO	22283
Therapy mode “BiLevel PAP S” active.	MDC_SABTE_MODE_THERAPY_BPAP_S	22284
Therapy mode “BiLevel PAP T” active.	MDC_SABTE_MODE_THERAPY_BPAP_T	22285
Therapy mode “BiLevel PAP ST” active.	MDC_SABTE_MODE_THERAPY_BPAP_ST	22286
Therapy mode “Auto-BiLevel PAP S” active.	MDC_SABTE_MODE_THERAPY_BPAP_S_AUTO	22287
Therapy mode “Auto-BiLevel PAP T” active.	MDC_SABTE_MODE_THERAPY_BPAP_T_AUTO	22288
Therapy mode “Auto-BiLevel PAP ST” active.	MDC_SABTE_MODE_THERAPY_BPAP_ST_AUTO	22289
Therapy mode “AcSV” active.	MDC_SABTE_MODE_THERAPY_ACSV	22290

6.9.7 Autostart/-stop set

Table 46 summarizes the attributes of the autostart/-stop set enumeration object. The autostart/-stop set enumeration object may be supported by a SABTE agent.

Table 46—Autostart/-stop set enumeration object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_MODE_AUTOSTARTSTOP_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Basic-Bit-Str	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

This object is instantiated only in extended configurations. A manager should support the interpretation of this object to enable reporting of these occurrences. An agent should support this object to transmit these occurrences.

The current active autostart/-stop is expressed by the setting of the appropriate bit in the Enum-Observed-Value-Basic-Bit-Str as defined in Table 47. If a manager supports the interpretation of this object, it shall be able to interpret the entire set of presented conditions. An agent is not required to implement all the features specified in Table 47. Anytime the status changes for any monitored condition, the agent shall report on all monitored conditions. A manager shall interpret these bits only within the context of this attribute and only within this device specialization, as other specializations may use corresponding terms for different purposes.

Table 47—Mapping of Autostart/-stop to object Bit-Str attribute

Autostart/-stop	SABTEAutoStartStop mnemonic
Autostart enabled.	sabte-autostart-on
Autostop enabled.	sabte-autostop-on

The specific bit mappings of SABTEAutoStartStop are defined in Annex B.

6.9.8 Pressure adaption freeze set

Table 48 summarizes the attributes of the pressure adaption freeze set enumeration object. The pressure adaption freeze set enumeration object may be supported by a SABTE agent.

Table 48—Pressure adaption freeze set enumeration object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Type	{MDC_PART_PHD_DM, MDC_SABTE_MODE_ADAPT_FREEZE_SET}	M
Metric-Spec-Small	mss-avail-stored-data, mss-upd-aperiodic, mss-acc-manager-initiated, mss-acc-agent-initiated, mss-cat-setting.	M
Attribute-Value-Map	See IEEE Std 11073-20601a-2010.	C
Enum-Observed-Value-Simple-OID	See following text.	M

NOTE—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

This object is instantiated only in extended configurations. A manager should support the interpretation of this object to enable reporting of these occurrences. An agent should support this object to transmit these occurrences.

The codes for the Enum-Observed-Value-Simple-OID shall be one of the codes defined in Table 49.

Table 49—Nomenclature codes for pressure adaption freeze

Description/definition	Reference ID	Code
Pressure adaption freeze disabled.	MDC_SABTE_MODE_ADAPT_FREEZE_OFF	22261
Pressure adaption freeze enabled.	MDC_SABTE_MODE_ADAPT_FREEZE_ON	22262

6.10 PM-store objects

6.10.1 General

In the context of PHDs, SABTE agents are portable or mobile devices. As stated in 5.1, SABTE agents may be used at a time when away from a network and manager/agent associations cannot be established. It is also common that a given set of measurements made by SABTE may need to be uploaded to more than one manager, for example, in the home and at a medical facility.

In order to be suitable for a wide range of devices with different extents of complexity and feature sets, this standard supports agent-initiated transmission of temporally stored data and transmission of streaming data by use of scanner objects as well as manager-initiated transmission of data recorded in PM-stores. Any configuration not including a PM-store object shall utilize agent-initiated event reports or scanner objects to transmit the measurements or observations. The use of temporarily stored data as defined in IEEE Std 11073-20601a-2010 is most useful for small numbers of measurements and is subject to automatic deletion during upload.

Alternatively, any configuration with a PM-store for longer term storage shall disable agent-initiated transmission as well as the use of scanner objects and support manager-initiated transmission of data recorded in PM-stores. The data held in PM-store objects may be deleted by user actions via the manager or user interface on the device, and the capacity is limited only by the agent's storage capabilities.

NOTE—PM-store objects are not part of the standard configurations defined in this standard.

6.10.2 Persistent store model

The wide range of potential combinations of data layouts makes it impractical to provide a specification for a single normative persistent store data model. As such, a SABTE agent has considerable latitude in selecting the format and set of data elements to transmit. If a SABTE agent supports this function, the framework in the following subclause should be followed. The intent of this approach is to provide a "file system description" of the data layout, as opposed to a "file format specification." In other words, following the guides provided in this standard should enable an implementer to store and retrieve the data within this model, but the specifics for determining the specific nature of the data layout and the subsequent visualization, mining, or other managing of the retrieved data is outside the scope of this standard.

SABTE stores data in a number of different ways, depending on the particular needs of the acquisition. The information model for the persistent store hierarchy is shown in Figure 9. As an example and pattern, Figure 10 illustrates the relationship between the various objects for a PM-store implementation. The PM-stores and PM-segments could group data in different ways. So each day could have an extra PM-store used to collect all PM-segments for that day and make it possible to transmit only the data set for a selected date. Or only one PM-store could be used, which means that to get the data set for a certain date the agent must transmit all PM-segments or must support the segm-id-list, and/or abs-time-range/bo-time-range choice in the SegmSelection action-info-args of the Get-Segment-Info method. A PM-segment could contain all varieties of data within one therapy session (e.g., Therapy Session Statistic), or multiple PM-segments could be created, whereby each one contains the measurements of one object for that same therapy session (e.g., Therapy Session Compliance Annotation). However, the hierarchy of the PM-store, PM-segment, entry, and elements should take the form seen in Figure 9.

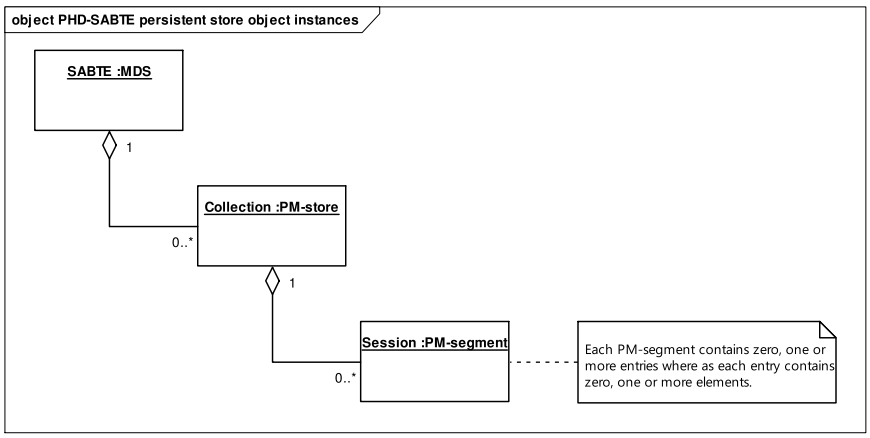

Figure 9—SABTE—persistent metric store model

The example in Figure 10 illustrates a PM-store realization that could store data sets up to 90 days. Each data set contains 6 or more PM-segments and each PM-segment contains 0, 1, or more entries. Beside the "Day Collection Statistic," each PM-segment stores data from a distinct contiguous therapy session. Figure 10 shows PM-segment entries that store aperiodic (e.g., Therapy Session Compliance Annotation) and periodic (e.g., Therapy Session Low Resolution Waveform) only one data element. There are also PM-segment entries that store aperiodic (e.g., Therapy Session Statistic) and periodic (e.g., Therapy Session High Resolution Waveform) two or more data elements. Since each entry contains the set of consistently ordered data sampled at a single point in time, one could place time-stamp information in the SegEntryHdr, indicating the occurrence of each reading. If the samples are taken at fixed intervals, then the start time and sampling interval should be stored in the PM-segment attributes MDC_ATTR_TIME_START_SEG/ MDC_ATTR_TIME_START_SEG_BO and MDC_ATTR_TIME_PD_SAMP, and the SegmEntryHdr may be left empty, whereas if the samples are not taken at fixed intervals, the time stamp of each sample must be stored in each SegmEntryHdr.

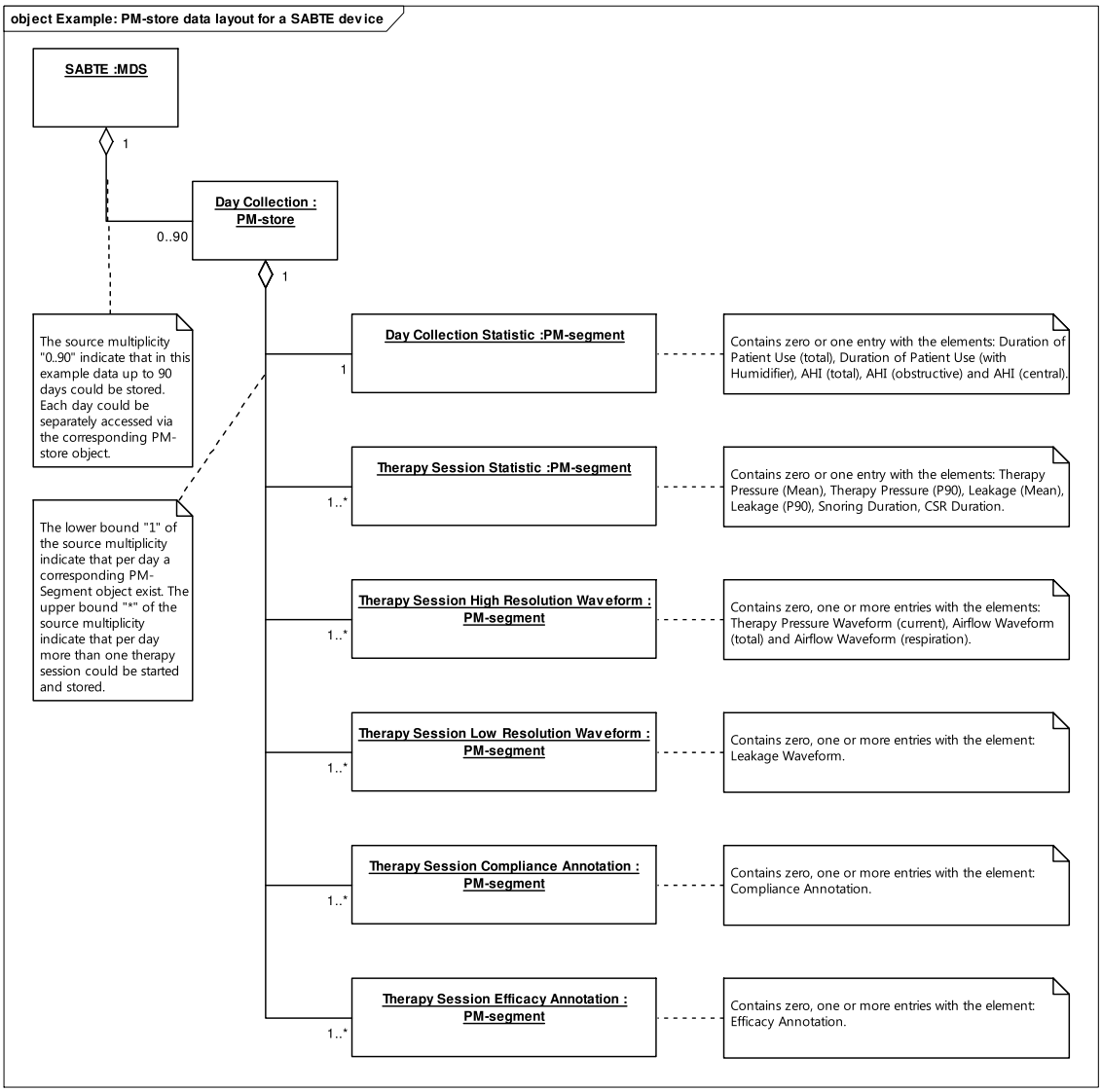

Figure 10—Example: PM-store data layout for a SABTE device

6.10.3 PM-store object attributes

Table 50 shows the attributes of the PM-store object. The nomenclature code to identify the PM-store class is MDC_MOC_VMO_PMSTORE.

Table 50—PM-store object attributes

Attribute name	Extended configuration	
	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
PM-Store-Capab	See IEEE Std 11073-20601a-2010.	M
Store-Sample-Algorithm	See IEEE Std 11073-20601a-2010.	M
Store-Capacity-Count	See IEEE Std 11073-20601a-2010.	O
Store-Usage-Count	See IEEE Std 11073-20601a-2010.	O
Operational-State	See IEEE Std 11073-20601a-2010.	M
PM-Store-Label	See IEEE Std 11073-20601a-2010.	O
Sample-Period	See IEEE Std 11073-20601a-2010.	C
Number-Of-Segments	See IEEE Std 11073-20601a-2010.	M
Clear-Timeout	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

If the measurements are periodic and the Sample-Period is not defined in each of the components' PM-Segment object attributes, the Sample-Period shall be defined in the PM-Store attribute. If the Sample-Period is defined in both the PM-Store and in the PM-Segment(s), the PM-Segment attribute value shall take precedence.

NOTE 3—If all Sample-Periods are the same in all PM-segments, it is advised defining this attribute in the PM-store to reduce the SegmentInfoList payload size.

Periodic measurements shall be aligned such that the first measurement is at the same time as the starting time stamp. This need is expressed to align events in case two associated PM-segments have widely varying sample periods.

6.10.4 PM-store object methods

Table 51 defines the methods of the PM-store objects.

Table 51—SABTE PM-store object methods

Service	Subservice type name	Mode	Subservice type (action-type)	Parameters (action-info-args)	Results (action-info-args)
ACTION	Clear-Segments	Confirmed	MDC_ACT_SEG_CLR	SegmSelection	—
	Get-Segment-Info	Confirmed	MDC_ACT_SEG_GET_INFO	SegmSelection	SegmentInfoList
	Trig-Segment-Data-Xfer	Confirmed	MDC_ACT_SEG_TRIG_XFER	TrigSegmDataXferReq	TrigSegmDataXferRsp

— **Clear-Segments:**
This method allows the manager to delete all data entries stored in a PM-segment object.

— **Get-Segment-Info:**
This method allows the manager to retrieve the PM-segment attributes.

— **Trig-Segment-Data-Xfer:**
This method allows the manager to initiate the transfer of the data entries stored in the PM-segment object.

Refer to IEEE Std 11073-20601a-2010 for details.

6.10.5 PM-store object events

Table 52 defines the events sent by the PM-store objects.

Table 52—SABTE PM-store object events

Service	Subservice type name	Mode	Subservice type (event-type)	Parameters (event-info)	Results (event-reply-info)
EVENT REPORT	Segment-Data-Event	Confirmed	MDC_NOTI_SEGMENT_DATA	SegmentDataEvent	SegmentDataResult

— **Segment-Data-Event:**
This event allows the agent to send the data entries stored in the PM-segment object. This event is triggered by the manager using the Trig-Segment-Data-Xfer action.

Refer to IEEE Std 11073-20601a-2010 for details.

6.10.6 PM-store object services

6.10.6.1 GET service

The GET service shall be provided by an agent implementing one or more PM-store objects. This service shall be available only while the agent is in the Operating state.

Refer to IEEE Std 11073-20601a-2010 for details.

6.10.6.2 SET service

There are currently no SET services defined for PM-store objects in this standard.

6.10.7 PM-segment objects

Table 53 shows the attributes of the PM-segment object contained in the PM-store object managing the stored measurements. The nomenclature code to identify the PM-segment class is MDC_MOC_PM_SEGMENT.

Table 53—PM-Segment object attributes

Attribute name	Extended configuration	
	Value	Qual.
Instance Number	See IEEE Std 11073-20601a-2010.	M
PM-Segment-Entry-Map	See IEEE Std 11073-20601a-2010.	M
PM-Seg-Person-Id	See IEEE Std 11073-20601a-2010.	C
Operational-State	See IEEE Std 11073-20601a-2010.	M
Sample-Period	See IEEE Std 11073-20601a-2010.	C
Segment-Label	See IEEE Std 11073-20601a-2010.	O
Segment-Start-Abs-Time	See IEEE Std 11073-20601a-2010.	C
Segment-End-Abs-Time	See IEEE Std 11073-20601a-2010.	C
Date-and-Time-Adjustment	See IEEE Std 11073-20601a-2010.	C
Segment-Start-BO-Time	See IEEE Std 11073-20601a-2010.	R
Segment-End-BO-Time	See IEEE Std 11073-20601a-2010.	R
Segment-Usage-Count	See IEEE Std 11073-20601a-2010.	O
Segment-Statistics	See IEEE Std 11073-20601a-2010.	O
Fixed-Segment-Data	Specified by vendor.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transfer-Timeout	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

The Fixed-Segment-Data attribute serves as the container of the stored measurements. The exact data format or data type of this attribute is vendor-specific.

In cases where a measurement is not available at the required time, then the value for a numeric measurement represented by the (S)FLOAT-type data type shall use the special NaN (not a number) value to indicate an unavailable value.

6.11 Scanner objects

6.11.1 General

The scanner object class is a powerful construct that enables efficient grouping of several attribute value changes from one or more metric objects into a single event report in a more efficient way than can be done by using MDS events. A scanner implementation is either episodic or periodic. It is also helpful in conveying the continuous nature of annunciations expressed within enumeration objects, as the scanner object can periodically dispatch scan event reports dedicated to a particular part of status recording when the period reported in the Reporting-Interval attribute expires. The information model for the scanner

hierarchy is shown in Figure 11, containing two optional scanner objects. PeriCfgScanner objects are used to send reports containing periodic data. EpiCfgScanner objects are used to send reports containing episodic data, that is, data not having a fixed period between each data value.

NOTE—Periodic or episodic configurable scanners objects are not part of the standard configurations defined in this standard.

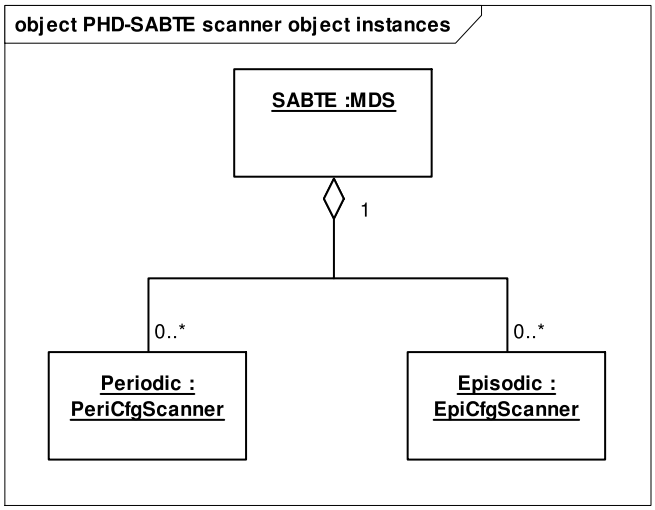

Figure 11—SABTE—scanner model

Figure 12 illustrates an example collection of data that would be periodically transmitted as an associated block of information from a periodic configurable scanner. This construct enables the packaging of data as an associated set of measurements.

Scan report 1	Base-Offset Time	Therapy Pressure	Respiration Rate	Efficacy Annotations	…
Scan report 2	Base-Offset Time	Therapy Pressure	Respiration Rate	Efficacy Annotations	…
Scan report 3	Base-Offset Time	Therapy Pressure	Respiration Rate	Efficacy Annotations	…
⋮		⋮			⋮

Figure 12—Example: Periodic configurable scanner data layout for a SABTE device

Because IEEE Std 11073-20601a-2010 requires the manager to support grouped-format event reports, a manager must support the interpretation of this object class if the agent transmits data using periodic scanner object. Otherwise, if the agent presents the bulk of its data with scanner objects, the manager cannot receive the data presented by such an agent.

6.11.2 Periodic configurable scanner attributes

Table 54 shows the attributes applicable to the periodic configurable scanner object. The nomenclature code to identify the periodic configurable scanner class is MDC_MOC_SCAN_CFG_PERI.

Table 54—Periodic configurable scanner object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Operational-State	See IEEE Std 11073-20601a-2010.	M
Scan-Handle-List	See IEEE Std 11073-20601a-2010.	C
Scan-Handle-Attr-Val-Map	See IEEE Std 11073-20601a-2010.	C
Confirm-Mode	See IEEE Std 11073-20601a-2010.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transmit-Window	See IEEE Std 11073-20601a-2010.	O
Reporting-Interval	See IEEE Std 11073-20601a-2010.	M

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

With regard to the Confirm-Mode attribute, an agent may support either or both confirmed or unconfirmed scan reports; the manager shall support both confirmed and unconfirmed scan reports.

A single periodic configurable scanner object may be employed by a SABTE device in order to reduce the data transmissions between the agent and the manager.

The events in Table 55 define the events sent by the periodic configurable scanner object of the SABTE agent.

Table 55—Periodic configurable scanner object events

Event	Mode	Event type	Event info parameter	Event-reply-info
Buf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_VAR	ScanReportInfoVar	—
Buf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
Buf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—
Buf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—
Buf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—
Buf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—

Agents that implement a periodic configurable scanner shall support the SET service for the Operational-State attribute in Table 54.

6.11.3 Episodic configurable scanner attributes

Table 56 shows the attributes applicable to the episodic configurable scanner object. The nomenclature code to identify the episodic configurable scanner class is MDC_ MOC_SCAN_CFG_EPI.

Table 56—Episodic configurable scanner object attributes

Attribute name	Value	Qual.
Handle	See IEEE Std 11073-20601a-2010.	M
Operational-State	See IEEE Std 11073-20601a-2010.	M
Scan-Handle_list	See IEEE Std 11073-20601a-2010.	C
Scan-Handle-Attr-Val-Map	See IEEE Std 11073-20601a-2010.	C
Confirm-Mode	See IEEE Std 11073-20601a-2010.	M
Confirm-Timeout	See IEEE Std 11073-20601a-2010.	O
Transmit-Window	See IEEE Std 11073-20601a-2010.	O
Min-Reporting-Interval	See IEEE Std 11073-20601a-2010.	O

NOTE 1—See IEEE Std 11073-20601a-2010 for information on whether an attribute is static or dynamic.

NOTE 2—See 6.3 for a description of the qualifiers.

With regard to the Confirm-Mode attribute, an agent may support either or both confirmed or unconfirmed scan reports; the manager shall support both confirmed and unconfirmed scan reports.

The events in Table 57 define the events sent by the episodic configurable scanner object of the SABTE agent.

Table 57—Episodic configurable scanner object events

Event	Mode	Event type	Event info parameter	Event-reply-info
Unbuf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_VAR	ScanReportInfoVar	—
Unbuf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—
Unbuf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—
Unbuf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—
Unbuf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—
Unbuf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—

Agents that implement an episodic configurable scanner shall support the SET service for the Operational-State attribute in Table 56.

6.12 Class extension objects

In this standard, no class extension objects are defined with respect to IEEE Std 11073-20601a-2010.

6.13 SABTE information model extensibility rules

The SABTE domain information model of this standard may be extended by including elements defined in IEEE Std 11073-20601a-2010 as well as vendor-specific elements. Any object or attribute extensions implemented should follow the guidelines of this standard as closely as possible.

A SABTE agent having a configuration with extensions beyond the standard configuration, as specified in this standard, shall use a configuration ID in the range of IDs reserved for extended configurations (see IEEE Std 11073-20601a-2010).

7. SABTE service model

7.1 General

The service model defines the conceptual mechanisms for data exchange services. These services are mapped to messages that are exchanged between the agent and the manager. Protocol messages within the ISO/IEEE 11073 series of standards are defined in ASN.1. See IEEE Std 11073-20601a-2010 for a detailed description of the PHD service model. Subclauses 7.2 and 7.3 define the specifics of object access and event reporting services for a SABTE agent according to this standard.

7.2 Object access services

The object access services of IEEE Std 11073-20601a-2010 are used to access the objects defined in the domain information model of the SABTE.

The following generic object access services are supported by a SABTE agent according to this standard:

— GET service: used by the manager to retrieve the values of the agent MDS object attributes and the agent PM-Store object attributes. The list of SABTE attributes is given for the MDS object in 6.6.1 and for the PM-Store object in 6.10.3.

— SET service: used by the manager to set the values of the agent object attributes. For a SABTE agent according to this standard, the Operational-State attributes in Table 54 and Table 56 of the periodic configurable scanner and the episodic configurable scanner objects are the only settable attributes.

— Event report service: used by the agent to send configuration reports and measurement data to the manager. The list of event reports for the SABTE device specialization is given for the MDS object in 6.5.3, for the PM-store object in 6.10.5, for the scanner objects in 6.11.2 and 6.11.3.

— Action service: used by the manager to invoke actions (or methods) supported by the agent. The list of MDS objects actions is given in 6.6.2 and the PM-store object actions is given in 6.10.4.

Table 58 summarizes the object access services described in this standard.

Table 58—SABTE MDS object access services

Service	Subservice type name	Mode	Subservice type	Parameters	Result	Remarks
GET	<na>	<implied Confirmed>	<na>	GetArgumentSimple = (obj-handle = 0), attribute-id-list <*optional*>	GetResultSimple = (obj-handle = 0), attribute-list	Allows the manager to retrieve the value of attributes of the MDS object in the agent.
	<na>	<implied Confirmed>	<na>	GetArgumentSimple = (obj-handle = *handle of PM-store object*), attribute-id-list <*optional*>	GetResultSimple = (obj-handle = *handle of PM-store object*), attribute-list	Allows the manager to retrieve the values of attributes of a PM-store object in the agent.
SET	<na>	Confirmed or unconfirmed	<na>	SetArgumentSimple = (obj-handle = *handle of scanner object*)	SetResultSimple = (obj-handle = *handle of scanner object*)	Allows the manager to initiate and end data retrieval via a scanner object of the agent.
EVENT REPORT	MDS-Configuration-Event	Confirmed	MDC_NOTI_CONFIG	ConfigReport	ConfigReportRsp	Configuration Report to inform manager of the configuration of the agent.
	MDS-Dynamic-Data-Update-Var	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_VAR	ScanReportInfoVar	—	Data Report to provide dynamic data to manager for some or all of the agent's objects in variable format.
	MDS-Dynamic-Data-Update-Fixed	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	Data Report to provide dynamic data to manager for some or all of the agent's objects in fixed format.
	MDS-Dynamic-Data-Update-MP-Var	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—	This is the same as MDS-Dynamic-Data-Update-Var but allows inclusion of data from multiple people.
	MDS-Dynamic-Data-Update-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	This is the same as MDS-Dynamic-Data-Update-Fixed but allows inclusion of data from multiple people.
	Segment-Data-Event	Confirmed	MDC_NOTI_SEGMENT_DATA	SegmentDataEvent	SegmentDataResult	PM-store object event to provide data stored in the Fixed-Segment-Data of a PM-segment from the agent to the manager.
	Unbuf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_VAR	ScanReportInfoVar	—	Episodic configurable scanner event to provide sets of attribute value changes about any objects and attributes that the scanner monitors.
	Unbuf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	This is the same as Unbuf-Scan-Report-Fixed but with fixed message format for each object.

Table 58—SABTE MDS object access services *(continued)*

Service	Subservice type name	Mode	Subservice type	Parameters	Result	Remarks
	Unbuf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—	This is the same as Unbuf-Scan-Report-Fixed but with grouped message format.
	Unbuf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—	This is the same as Unbuf-Scan-Report-Var but allows inclusion of data from multiple persons.
	Unbuf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	This is the same as Unbuf-Scan-Report-Fixed but allows inclusion of data from multiple persons.
	Unbuf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_UNBUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—	This is the same as Unbuf-Scan-Report-Grouped but allows inclusion of data from multiple persons.
	Buf-Scan-Report-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_VAR	ScanReportInfoVar	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-Var but with data buffered over the reporting interval.
	Buf-Scan-Report-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_FIXED	ScanReportInfoFixed	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-Fixed but with data buffered over the reporting interval.
	Buf-Scan-Report-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_GROUPED	ScanReportInfoGrouped	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-Grouped but with data buffered over the reporting interval.
	Buf-Scan-Report-MP-Var	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_VAR	ScanReportInfoMPVar	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-MP-Var but with data buffered over the reporting interval.
	Buf-Scan-Report-MP-Fixed	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_FIXED	ScanReportInfoMPFixed	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-MP-Fixed, but with data buffered over the reporting interval.
	Buf-Scan-Report-MP-Grouped	Confirmed or unconfirmed	MDC_NOTI_BUF_SCAN_REPORT_MP_GROUPED	ScanReportInfoMPGrouped	—	Periodic configurable scanner event equivalent with Unbuf-Scan-Report-MP-Grouped, but with data buffered over the reporting interval.

Table 58—SABTE MDS object access services *(continued)*

Service	Subservice type name	Mode	Subservice type	Parameters	Result	Remarks
ACTION	MDS-Data-Request	Confirmed	MDC_ACT_DATA_REQUEST	DataRequest	DataResponse	Allows the manager to enable or disable measurement data transmission from the agent.
	Set-Time	Confirmed	MDC_ACT_SET_TIME	SetTimeInvoke	—	Manager method to invoke the agent to set time in absolute time format to requested value.
	Set-Base-Offset-Time	Confirmed	MDC_ACT_SET_BO_TIME	SetBOTimeInvoke	—	Manager method to invoke the agent to set time in base offset time format to requested value.
	Clear-Segments	Confirmed	MDC_ACT_SEG_CLR	SegmSelection	—	Allows the manager to delete data stored in selected PM-segments in the agent.
	Get-Segment-Info	Confirmed	MDC_ACT_SEG_GET_INFO	SegmSelection	SegmentInfoList	Allows the manager to retrieve the value of PM-segment attributes of one or more PM-segments in the agent.
	Trig-Segment-Data-Xfer	Confirmed	MDC_ACT_SEG_TRIG_XFER	TrigSegmDataXferReq	TrigSegmDataXferRsp	Allows the manager to start the transfer of the Fixed-Segment-Data attribute of a PM-segment in the agent.

7.3 Object access event report services

The event report service (see Table 23) is used by the agent to report its information (e.g., measurements). Event reports in this standard are a property of the MDS object (see Table 3), the PM-Store object (see Table 52), and Scanner objects (see Table 55 and Table 57). The event reports used in this standard are defined in IEEE Std 11073-20601a-2010.

The following conditions apply for a SABTE agent according to this standard:

— Event reports transmitting measurement data may be used either in confirmed or unconfirmed mode.

— Some agent implementations support agent-initiated mode only through MDS object emission. These implementations should take care to not send any relatively high-bandwidth measurements such as waveform data in this manner.

— Some agent implementations support agent-initiated mode only through the use of periodic or episodic configurable scanner objects. The manager is in control of scanner object data transfer by setting the Operational-State attribute of the appropriate scanner object.

— Manager-initiated mode may be supported for measurement data transmission.

— Persistently stored metric mode may be supported for measurement data transmission.

A SABTE agent, which is designed to operate in an environment where data may be collected from multiple people, may use one of the multi-person event report styles to transmit all the data from each person in a single event. But typically this functionality is not required for SABTE so that the agent may use only the single-person event report styles, which have reduced overhead.

A manager shall support both single-person and multiple-person event reports. A SABTE agent may support either one or both single-person and multiple-person event reports. The formats for single- and multiple-person reports are described in IEEE Std 11073-20601a-2010.

8. SABTE communication model

8.1 Overview

This clause describes the general communication model and procedures of the SABTE agent as defined in IEEE Std 11073-20601a-2010. Therefore, the respective parts of IEEE Std 11073-20601a-2010 are not reproduced; rather the specific choices and restrictions with respect to optional elements (e.g., objects, attributes, and actions) and specific extensions (e.g., nomenclature terms) are specified.

For an illustrative overview of the various message transactions during a typical measurement session, see the sequence diagram for the example use case in Annex D and the corresponding protocol data unit (PDU) examples in Annex E.

8.2 Communications characteristics

In this subclause, limits on the size of an application protocol data unit (APDU) transmitted or to be received by a SABTE agent are defined. Small limits allow for simple implementations in terms of low cost and complexity.

A SABTE agent implementing only this device specialization shall not transmit any APDU larger than N_{tx} and shall be capable of receiving any APDU up to a size of N_{rx}. For this standard, N_{tx} shall be 64 512 octets and N_{rx} shall be 8 192 octets.

For a SABTE agent implementing functions from other device specializations, an upper bound estimation of the APDU sizes brings the following: An agent shall not transmit any APDU larger than the sum of N_{tx} of all the device specializations implemented and shall be capable of receiving any APDU up to the sum of N_{rx} of all the device specializations implemented. If these numbers are higher than the maximum size determined in IEEE Std 11073-20601a-2010, the latter shall be applied.

In case the APDU size limit does not allow for the inclusion of a certain amount of multiple pending measurements at the agent, they shall be sent using multiple event reports. See 8.5.3 for the maximum number of measurements allowed for inclusion in a single event report.

8.3 Association procedure

8.3.1 General

Unless otherwise stated, the association procedure for an agent and manager according to this standard shall be pursued as specified in IEEE Std 11073-20601a-2010.

8.3.2 Agent procedure—association request

In the association request sent by the agent to the manager:

— The version of the association procedure used by the agent shall be set to assoc-version1 (i.e., *assoc-version* = 0x80000000).

— The DataProtoList structure element of the data protocol identifier shall be set to data-proto-id-20601 (i.e., *data-proto-id* = 0x5079).

— The *data-proto-info* field shall contain a PhdAssociationInformation structure that shall contain the following parameter values:

1) The agent shall support protocol-version2. Support for any other version may be indicated by setting additional bits. When protocols higher than protocol-version2 are used, the agent shall continue to use only features as specified in this standard. When protocols lower than protocol-version2 are used, the agent shall use only features in that protocol.

2) At least the MDERs shall be supported (i.e., *encoding-rules* = 0x8000).

3) The version of the nomenclature used shall be set to nom-version1 (i.e., *nomenclature-version* = 0x80000000).

4) The field *functional-units* may have the test association bits set but shall not have any other bits set.

5) The field *system-type* shall be set to sys-type-agent (i.e., *system-type* = 0x00800000).

6) The *system-id* field shall be set to the value of the System-Id attribute of the MDS object of the agent. The manager may use this field to determine the identity of the SABTE with which it is associating and, optionally, to implement a simple access restriction policy.

7) The *dev-config-id* field shall be set to the value of the Dev-Configuration-Id attribute of the MDS object of the agent.

8) If the agent supports only the SABTE specialization, then the field indicating the data request modes (*data-req-mode-capab*) supported by the SABTE agent shall be set based on the communication capabilities of the agent.

   If the agent supports agent-initiated measurement transfer, then data-req-mode-capab shall have the *data-req-supp-init-agent* bit set. The *data-req-init-manager-count* shall be set to zero, and *data-req-init-agent-count* shall be set to 1.

   If the agent supports manager-initiated measurement transfer, then *data-req-mode-capab* shall have the *data-req-supp-stop*, *data-req-supp-scope-handle*, *data-req-supp-mode-single-rsp* and *data-req-supp-mode-time-no-limit* bits appropriately set. The *data-req-init-manager-count* shall be set to the maximum number of concurrent manager-initiated flows supported by the agent, and *data-req-init-agent-count* shall be set to 0 or 1.

8.3.3 Manager procedure—association response

In the association response message sent by the manager:

— The *result* field shall be set to an appropriate response from those defined in IEEE Std 11073-20601a-2010. For example, if all other conditions of the association protocol are satisfied, *accepted* is returned when the manager recognizes the *dev-config-id* of the agent and *accepted-unknown-config* otherwise.

— In the DataProtoList structure element, the data protocol identifier shall be set to data-proto-id-20601 (i.e., *data-proto-id* = 0x5079).

— The *data-proto-info* field shall be filled in with a PhdAssociationInformation structure that shall contain the following parameter values:

1) A manager following this specialization shall support *protocol-version2*. A manager may support additional higher protocol versions and select them if offered by an agent.
2) The manager shall respond with a single selected encoding rule that is supported by both agent and manager. The manager shall support at least the MDERs.
3) The version of the nomenclature used shall be set to nom-version1 (i.e., *nomenclature-version* = 0x80000000).
4) The field *functional-units* shall have all bits reset except for those relating to a test association.
5) The field *system-type* shall be set to sys-type-manager (i.e., *system-type* = 0x80000000).
6) The *system-id* field shall contain the unique system ID of the manager device, which shall be a valid EUI-64 type identifier.
7) The field *dev-config-id* shall be manager-config-response (0).
8) The field *data-req-mode-capab* shall be 0.
9) If the agent supports only the SABTE specialization, *data-req-init-agent-count* shall be set to 0 and *data-req-init-manager-count* shall be set to 0.

8.4 Configuring procedure

8.4.1 General

The agent enters the Configuring state if it receives an association response of accepted-unknown-config. In this case, the configuration procedure as specified in IEEE Std 11073-20601a-2010 shall be followed. Subclause 8.4.2 specifies the configuration notification and response messages for a SABTE agent with standard configuration ID 2400 (0x0960). Normally, a manager would already know the standard configuration. However, for the purposes of this example, it does not.

8.4.2 SABTE—standard configuration

8.4.2.1 Agent procedure

The agent performs the configuration procedure using a “Remote Operation Invoke | Confirmed Event Report” message with an MDC_NOTI_CONFIG event to send its configuration to the manager (see IEEE Std 11073-20601a-2010). The ConfigReport structure is used for the *event-info* field (see Table 3). For a SABTE agent with standard configuration ID 2400 (0x0960), the format and contents of the configuration notification message are as follows:

0xE7 0x00	APDU CHOICE Type(PrstApdu)
0x00 0xBC	CHOICE.length = 188
0x00 0xBA	OCTET STRING.length = 186
0x00 0x02	invoke-id = 2 (differentiates this message from any other outstanding)
0x01 0x01	CHOICE(Remote Operation Invoke | Confirmed Event Report)
0x00 0xB4	CHOICE.length = 180

0x00 0x00	obj-handle = 0 (MDS object)
0xFF 0xFF 0xFF 0xFF	event-time (set to 0xFFFFFFFF if RelativeTime is not supported)
0x0D 0x1C	event-type = MDC_NOTI_CONFIG
0x00 0xAA	event-info.length = 170 (start of ConfigReport)
0x09 0x60	config-report-id = 2400 (Dev-Configuration-Id value)
0x00 0x05	config-obj-list.count = 5 Measurement objects will be "announced"
0x00 0xA4	config-obj-list.length = 164
0x00 0x06	obj-class = MDC_MOC_VMO_METRIC_NU
0x00 0x01	obj-handle = 1 (→ 1st object is duration of patient use)
0x00 0x04	attributes.count = 4
0x00 0x24	attributes.length = 36
0x09 0x2F	attribute-id = MDC_ATTR_ID_TYPE
0x00 0x04	attribute-value.length = 4
0x00 0x80 0x56 0x58	MDC_PART_PHD_DM | MDC_SABTE_TIME_PD_USAGE_TOTAL
0x0A 0x46	attribute-id = MDC_ATTR_METRIC_SPEC_SMALL
0x00 0x02	attribute-value.length = 2
0xF0 0xC0	intermittent, stored-data, upd-aperiodic, msmt-aperiodic, manager-initiated and agent-initiated measured
0x09 0x96	attribute-id = MDC_ATTR_UNIT_CODE
0x00 0x02	attribute-value.length = 2
0x08 0xA0	MDC_DIM_MIN
0x0A 0x55	attribute-id = MDC_ATTR_ATTRIBUTE_VAL_MAP
0x00 0x0C	attribute-value.length = 12
0x00 0x02	AttrValMap.count = 2
0x00 0x08	AttrValMap.length = 8
0x0A 0x4C 0x00 0x02	MDC_ATTR_NU_VAL_OBS_BASIC | value length = 2
0x0A 0x82 0x00 0x08	MDC_ATTR_TIME_STAMP_BO | value length = 8
0x00 0x06	obj-class = MDC_MOC_VMO_METRIC_NU
0x00 0x02	obj-handle = 2 (→ 2nd object is duration of flow generation)
0x00 0x04	attributes.count = 4
0x00 0x24	attributes.length = 36
0x09 0x2F	attribute-id = MDC_ATTR_ID_TYPE
0x00 0x04	attribute-value.length = 4
0x00 0x80 0x56 0x54	MDC_PART_PHD_DM | MDC_SABTE_TIME_PD_FLOW_GEN_TOTAL
0x0A 0x46	attribute-id = MDC_ATTR_METRIC_SPEC_SMALL
0x00 0x02	attribute-value.length = 2
0xF0 0xC0	intermittent, stored-data, upd-aperiodic, msmt-aperiodic, manager-initiated and agent-initiated measured
0x09 0x96	attribute-id = MDC_ATTR_UNIT_CODE
0x00 0x02	attribute-value.length = 2

0x08 0xA0	MDC_DIM_MIN
0x0A 0x55	attribute-id = MDC_ATTR_ATTRIBUTE_VAL_MAP
0x00 0x0C	attribute-value.length = 12
0x00 0x02	AttrValMap.count = 2
0x00 0x08	AttrValMap.length = 8
0x0A 0x4C 0x00 0x02	MDC_ATTR_NU_VAL_OBS_BASIC | value length = 2
0x0A 0x82 0x00 0x08	MDC_ATTR_TIME_STAMP_BO | value length = 8
0x00 0x05	obj-class = MDC_MOC_VMO_METRIC_ENUM
0x00 0x03	obj-handle = 3 (→ 3th object is Device Mode Set)
0x00 0x03	attributes.count = 3
0x00 0x1E	attributes.length = 30
0x09 0x2F	attribute-id = MDC_ATTR_ID_TYPE
0x00 0x04	attribute-value.length = 4
0x00 0x80 0x00 0x00	MDC_PART_PHD_DM | MDC_SABTE_MODE_DEV_SET
0x0A 0x46	attribute-id = MDC_ATTR_METRIC_SPEC_SMALL
0x00 0x02	attribute-value.length = 2
0x60 0xC4	stored-data, upd-aperiodic, manager-initiated, agent-initiated, cat-setting
0x0A 0x55	attribute-id = MDC_ATTR_ATTRIBUTE_VAL_MAP
0x00 0x0C	attribute-value.length = 12
0x00 0x02	AttrValMap.count = 2
0x00 0x08	AttrValMap.length = 8
0x0A 0x49 0x00 0x02	MDC_ATTR_ENUM_OBS_VAL_SIMP_OID | value length = 2
0x0A 0x82 0x00 0x08	MDC_ATTR_TIME_STAMP_BO | value length = 8
0x00 0x05	obj-class = MDC_MOC_VMO_METRIC_ENUM
0x00 0x04	obj-handle = 4 (→ 4th object is Therapy Mode Set)
0x00 0x03	attributes.count = 3
0x00 0x1E	attributes.length = 30
0x09 0x2F	attribute-id = MDC_ATTR_ID_TYPE
0x00 0x04	attribute-value.length = 4
0x00 0x80 0x00 0x00	MDC_PART_PHD_DM | MDC_SABTE_MODE_THERAPY_SET
0x0A 0x46	attribute-id = MDC_ATTR_METRIC_SPEC_SMALL
0x00 0x02	attribute-value.length = 2
0x60 0xC4	stored-data, upd-aperiodic, manager-initiated, agent-initiated, cat-setting
0x0A 0x55	attribute-id = MDC_ATTR_ATTRIBUTE_VAL_MAP
0x00 0x0C	attribute-value.length = 12
0x00 0x02	AttrValMap.count = 2
0x00 0x08	AttrValMap.length = 8
0x0A 0x49 0x00 0x02	MDC_ATTR_ENUM_OBS_VAL_SIMP_OID | value length = 2
0x0A 0x82 0x00 0x08	MDC_ATTR_TIME_STAMP_BO | value length = 8

8.4.2.2 Manager procedure

The manager shall respond to a configuration notification message using a "Remote Operation Response | Confirmed Event Report" data message with an MDC_NOTI_CONFIG event using the ConfigReportRsp structure for the *event-info* field (see Table 3). As a response to the standard configuration notification message in 8.4.2.1, the format and contents of the manager's configuration notification response message are as follows:

`0xE7 0x00`	APDU CHOICE Type (PrstApdu)
`0x00 0x16`	CHOICE.length = 22
`0x00 0x14`	OCTET STRING.length = 20
`0x00 0x02`	invoke-id = 2 (mirrored from invocation)
`0x02 0x01`	CHOICE (Remote Operation Response | Confirmed Event Report)
`0x00 0x0E`	CHOICE.length = 14
`0x00 0x00`	obj-handle = 0 (MDS object)
`0x05 0x14 0xDB 0x12`	currentTime
`0x0D 0x1C`	event-type = MDC_NOTI_CONFIG
`0x00 0x04`	event-reply-info.length = 4
`0x09 0x60`	ConfigReportRsp.config-report-id = 2400
`0x00 0x00`	ConfigReportRsp.config-result = accepted-config

8.5 Operating procedure

8.5.1 General

Measurement data and status information are communicated from the SABTE agent during the Operating state. If not stated otherwise, the operating procedure for a SABTE agent of this standard shall be as specified in IEEE Std 11073-20601a-2010.

8.5.2 GET SABTE MDS attributes

See Table 4 for a summary of the GET service.

If the *attribute-id-list* field in the roiv-cmip-get service message is empty, the SABTE agent shall respond with a rors-cmip-get service message in which the attribute-list contains a list of all implemented attributes of the MDS object.

If the manager requests specific MDS object attributes, indicated by the elements in *attribute-id-list*, and the agent supports this capability, the SABTE shall respond with a rors-cmip-get service message in which the attribute-list contains a list of the requested attributes of the MDS object that are implemented. It is not required for a SABTE agent to support this capability. If this capability is not implemented, the SABTE agent shall respond with a "Remote Operation Error Result" (roer) service message (see IEEE Std 11073-20601a-2010) with the error-value field set to not_allowed_by_object (24).

8.5.3 Measurement data transmission

See Table 3, Table 52, Table 55, and Table 57 for a summary of the event report services available for measurement data transfer.

To limit the amount of data being transported within an APDU, the SABTE agent shall not include more than 25 temporarily stored measurements in a single event report. If more than 25 pending measurements are available for transmission, they shall be sent using multiple event reports or using PM-store mechanism. If multiple SABTE measurements are available, up to 25 measurements should be transmitted within a single event report. Alternatively, they may be transmitted using a single event report for each SABTE measurement. However, the former strategy is recommended to reduce overall message size and power consumption.

8.6 Time synchronization

Time synchronization between a SABTE agent and a manager may be used to coordinate the clocks used when reporting physiological events.

NOTE—The mechanism for synchronizing an agent to a manager is outside the scope of this standard.

If time synchronization is used, then this shall be reported in the Mds-Time-Info attribute of the MDS object.

9. Test associations

The test association provides a manufacturer the mechanism to test or demonstrate features of a product in a comprehensive manner. This clause defines the behavior of the standard SABTE agent during a test association. Support for test association is optional.

9.1 Behavior with standard configuration

An agent or manager entering a test association using the configuration ID for the standard SABTE device of this standard shall enter the Operating state in test mode. When in test mode, where possible, this should be indicated visually to any user. Normal functionality shall be suspended and any test data generated shall not be processed by the device as physiological data.

The SABTE agent shall send a single simulated therapy pressure of 100 hPa (a value never seen in normal usage and outside normal range) within 30 s of entering the Operating state. If the measurement-status attribute of the numeric object is implemented, then the test-data bit shall be set.

The test association is terminated in a manner consistent with the agent's normal behavior for terminating an association.

9.2 Behavior with extended configurations

This specification does not define a test association that uses an extended configuration.

10. Conformance

10.1 Applicability

This standard shall be used in conjunction with IEEE Std 11073-20601a-2010.

An implementation or a system can conform to the following elements of this standard:

— Domain information model class hierarchy and object definitions (object attributes, notifications, methods, and data type definitions)

— Nomenclature code values

— Protocol and service models

— Communication service model (association and configuration)

10.2 Conformance specification

This standard offers levels of conformance with respect to strict adherence to the standard device and the use of extensions for the following:

— Information model of a specific device

— Use of attributes, value ranges, and access methods

A vendor shall specify the level of conformance for an implementation based on this standard and provide details of the way in which the definitions of this standard and any extensions are applied.

Specifications shall be provided in the form of a set of implementation conformance statements (ICS) as detailed in 10.4.

This standard is used in conjunction with IEEE Std 11073-20601a-2010. It is recommended that the ICS for this standard be created first so that the ICS created for IEEE Std 11073-20601a-2010 may refer to the ICS for this standard where applicable.

10.3 Levels of conformance

10.3.1 General

This standard defines the following levels of conformance.

10.3.2 Conformance level 1: Base conformance

The application uses elements of the information, service, and communication models (object hierarchy, actions, event reports, and data type definitions) and the nomenclature scheme defined in IEEE Std 11073-20601a-2010 and the IEEE Std 11073-104zz documents. All mandatory features defined in the object definition tables and in the ICS tables are implemented. Furthermore, any conditional, recommended, or optional features that are implemented shall follow the requirements in IEEE Std 11073-20601a-2010 and ISO/IEEE 11073-104zz documents.

10.3.3 Conformance level 2: Extended nomenclature (ASN.1 and/or ISO/IEEE 11073-10101:2004 [B8])

Conformance level 2 meets conformance level 1 but also uses or adds extensions in at least one of the information, service, or nomenclature models. Extensions to nomenclature codes shall conform to the ISO/IEEE 11073-10101:2004 [B8] framework and lie within the private nomenclature extension range (0xF000 – 0xFFFF).

Extensions to the information or service models shall be fully defined using ASN.1 where appropriate and have their behavior fully described following the framework of IEEE Std 11073-20601a-2010 and/or ISO/IEEE 11073-20101:2004 [B10]. All extensions shall be specified and include reference to the definition for the extension, or where no publicly available reference is available, the definition of the extension should be appended to the conformance statement.

10.4 Implementation conformance statements

10.4.1 General format

The ICSs are provided as an overall conformance statement document that comprises a set of tables in the form given by the templates in the following clauses.

Each ICS table has the following columns:

Index	Feature	Reference	Req/Status	Support	Comment

The table column headings have the following meaning:

- Index: an identifier (e.g., a tag) of a specific feature.
- Feature: briefly describes the characteristic for which a conformance statement is being made.
- Reference: to the clause/paragraph within this document or an external source for the definition of the feature (may be empty).
- Req/Status: specifies the conformance requirement (e.g., mandatory or recommended)—in some cases, this standard does not specify conformance requirements but requests the status of a particular feature be provided.
- Support: specifies the presence or absence of a feature and any description of the characteristics of the feature in the implementation. This column is to be filled out by the implementer.
- Comment: contains any additional information on the feature. This column is to be filled out by the implementer.

Subclauses 10.4.2 through 10.4.6 specify the format of the specific ICS tables.

10.4.2 General implementation conformance statement

The general ICS specifies the versions/revisions that are supported by the implementation and high-level system behavior.

Table 59 shows general ICSs.

Table 59—ISO/IEEE 11073-10424 general ICS table

Index[a]	Feature	Reference	Req/Status	Support	Comment
GEN 11073-10424-1	Implementation description	—	Identification of the device/ application. Description of functionality.		
GEN 11073-10424-2	Standards followed and their revisions	(Standard documents)	(Set of existing revisions)	(Set of supported revision)	
GEN 11073-10424-3	Nomenclature document used and revision	(Standard documents)	(Set of existing revisions)	(Set of supported revisions)	
GEN 11073-10424-4	Conformance Adherence—Level 1 -	See 10.3.2	Base conformance declaration that device meets the following IEEE Std 11073-10424 conformance requirements: a) All mandatory requirements shall be implemented. b) If implemented, conditional, recommended, and optional requirements shall conform to standard.	Yes/No (No is not expected as No implies that the implementation is non-conformant)	
GEN 11073-10424-5	Conformance Adherence —Level 2	See 10.3.3	In addition to GEN 11073-10424-4, if the device implements extensions and/or additions, they shall conform to nomenclature codes from ASN.1 and/or 10101 framework. These extensions should also be defined in ICS tables pointing toward their reference.	Yes/No	
GEN 11073-10424-6	Object Containment Tree	See 6.3	Provide Object Containment Diagram showing relations between object instances used by the application. A conforming imple-mentation uses only object relations as defined in the DIM.		
GEN 11073-10424-7	Nomenclature document used and revision	(Standard documents)	(Set of existing revisions)	(Set of supported revision)	

Table 59—ISO/IEEE 11073-10424 general ICS table *(continued)*

Index[a]	Feature	Reference	Req/Status	Support	Comment
GEN 11073-10424-8	Data Structure Encoding	—	—	Description of encoding method(s) for ASN.1 data structures	
GEN 11073-10424-9	Use of Private Objects	—	Does the implementation use objects that are not defined in the DIM?	Yes/No (If yes: explain in Table 25)	
GEN 11073-10424-10	Use of Private Nomenclature Extensions	—	Does the implementation use private extensions to the nomenclature (i.e., 0xF000-0xFFFF codes from ISO/IEEE 11073-10101:2004 [B8])? Private Nomenclature extensions are *only* allowed if the standard nomenclature does not include the specific terms required by the application.	Yes/No (If yes: explain in the Table 28)	
GEN 11073-10424-11	11073-20601 Conformance		Provide the conformance report required by IEEE Std 11073-20601a-2010.		

[a] The prefix GEN11073-10424- is used for the index in the general ICSs table.

10.4.3 DIM MOC implementation conformance statement

The DIM MOC ICS defines which objects are implemented. Information on each object shall be provided as a separate row in the template of Table 60.

Table 60—Template for DIM MOC ICS table

Index	Feature	Reference	Req/Status	Support	Comment
MOC–*n*	Object description	Reference to the clause in the standard or other location where the object is defined.	Implemented	Specify restrictions, e.g., maximum number of supported instances.	

The *n* in the Index column should be the object handle for implementations that have predefined objects. Otherwise the Index column shall simply be a unique number (1..*m*).

All private objects should be specified and include either a reference to the definition for the object, or where no publicly available reference is available, the definition of the object should be appended to the conformance statement.

The Support column should indicate any restrictions for the object implementation.

An object containment diagram (class instance diagram) should be provided as part of the DIM MOC ICS.

10.4.4 MOC attribute ICS

The MOC attribute ICS defines which attributes, including any inherited attributes, are used/supported in each object of an implementation. Information on each attribute of an object shall be provided as a separate row in the template of Table 61. A separate MOC attribute ICS shall be provided for each object.

Table 61—Template for MOC attribute ICS table

Index	Feature	Reference	Req/Status	Support	Comment
ATTR–*n*–*x*	Attribute Name. Extended attributes shall include the attribute ID also.	Fill in the reference to the ASN.1 structure if the attribute is not defined in this standard.	M = Mandatory / C = Conditional / R = Recommended / O = Optional (as per definition in Attribute Definition Tables)	Implemented? Yes/No Static/Dynamic Specify restrictions, (e.g., value ranges). Describe how attribute is accessed (e.g., Get, Set, sent in config event report, sent in a data event report). Describe any specific restrictions.	

The Support column shall specify whether the attribute is implemented; for extension attributes, whether the attribute value is static or dynamic; any value ranges; restrictions on attribute access or availability; and any other information.

The *n* in the Index column refers to the ID of the managed object for which the table is supplied (i.e., the index of the managed object as specified in the MOC ICS). There is one separate table for each supported managed object.

The *x* in the Index column is a unique serial number (1..*m*).

10.4.5 MOC notification implementation conformance statement

The MOC notification ICS specifies all implemented notifications (typically in the form of the event report service) that are emitted by the agent. Table 62 provides a template for use. One table has to be provided for each object that supports special object notifications. One row of the table shall be used for each notification.

Table 62—Template for MOC notification ICS table

Index	Feature	Reference	Req/Status	Support	Comment
NOTI–*n*–*x*	Notification Name and Notification ID	Reference to the clause in the standard or other location where the event is defined.		The Support column shall specify how the notification is sent and any restrictions.	

The *n* in the Index column refers to the ID of the managed object for which the table is supplied (i.e., the index of the managed object as specified in the POC ICS). There is one separate table for each managed object that supports specific object notifications (i.e., events).

The *x* in the Index column is a unique serial number (1..*m*).

All private notifications should be specified and include reference to the definition for the notification. Where no publicly available reference is available, the definition of the notification should be appended to the conformance statement.

10.4.6 MOC nomenclature conformance statement

The MOC nomenclature ICS specifies all nonstandard nomenclature codes that are utilized by the agent. Table 63 provides a template for use. One row of the table is to be used for each nomenclature element.

Table 63—Template for MOC nomenclature ICS table

Index	Feature	Reference	Req/Status	Support	Comment
NOME–n	Nomenclature name and nomenclature value	Reference to the clause in the standard or other location where the nomenclature is defined or used.		Describe how the nomenclature is used. Describe any specific restrictions.	

The *n* in the Index column is a unique serial number (1..*m*).

Annex A

(informative)

Bibliography

Bibliographical references are resources that provide additional or helpful material but do not need to be understood or used to implement this standard. Reference to these resources is made for informational use only.

[B1] AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications, Version 2.0, Berry, R. B., et al., for the American Academy of Sleep Medicine.

[B2] IEC 60601-1:2007, Ed. 3, Medical electrical equipment—Part 1: General requirements for basic safety and essential performance.[8]

[B3] IEC 60601-2, Medical electrical equipment—Part 2: Particular requirements for the basic safety and essential performance for specific device. (See the entire series of standards)

[B4] IEC 62304:2006/EN 62304:2006, Medical device software—Software life-cycle processes.[9]

[B5] IEC 80001-1:2010, Application of risk management for IT-networks incorporating medical devices—Part 1: Roles, responsibilities, and activities.

[B6] ISO 14971:2007, Medical devices—Application of risk management to medical devices.[10]

[B7] ISO/IEC 80601-2, Medical electrical equipment—Part 2: Particular requirements for the basic safety and essential performance for specific device. (See the entire series of standards)

[B8] ISO/IEEE 11073-10101:2004, Health informatics—Point-of-care medical device communication—Part 10101: Nomenclature.[11]

[B9] ISO/IEEE 11073-10201:2004, Health informatics—Point-of-care medical device communication—Part 10201: Domain information model.

[B10] ISO/IEEE 11073-20101:2004, Health informatics—Point-of-care medical device communication—Part 20101: Application profile—Base standard.

[B11] ITU-T Rec. X.680-2002, Information technology—Abstract Syntax Notation One (ASN.1): Specification of basic notation.[12]

[8] IEC publications are available from the International Electrotechnical Commission (http://www.iec.ch/). IEC publications are also available in the United States from the American National Standards Institute (http://www.ansi.org/).
[9] EN publications are available from the European Committee for Standardization (CEN) (http://www.cen.eu/).
[10] ISO publications are available from the ISO Central Secretariat (http://www.iso.org/). ISO publications are also available in the United States from the American National Standards Institute (http://www.ansi.org/).
[11] ISO/IEEE publications are available from the ISO Central Secretariat, 1, ch. de la Voie-Creuse, Case Postale 56, CH-1211, Geneva 20, Switzerland (http://www.iso.ch/). ISO/IEEE publications are also available from The Institute of Electrical and Electronics Engineers (http://standards.ieee.org/).
[12] ITU publications are available from the International Telecommunication Union (http://www.itu.int/). This specification may be found specifically at http://www.itu.int/ITU-T/studygroups/com17/languages/X.680-0207.pdf.

Annex B

(normative)

Any additional ASN.1 definitions

B.1 Efficacy annotations bit mapping

The extension to the enumeration class for efficacy annotations requires the following ASN.1 structure definition:

```
SABTEEfficacyAnnotations::= BITS-32 {
                    sabte-annotation-epoch-undetermined-start(0),
                    sabte-annotation-epoch-undetermined-stop(1),
                    sabte-annotation-epoch-breathing-artifact-start(2),
                    sabte-annotation-epoch-breathing-artifact-stop(3),
                    sabte-annotation-epoch-breathing-spontaneous-start(4),
                    sabte-annotation-epoch-breathing-spontaneous-stop(5),
                    sabte-annotation-epoch-breathing-timed-start(6),
                    sabte-annotation-epoch-breathing-timed-stop(7),
                    sabte-annotation-epoch-snoring-start(8),
                    sabte-annotation-epoch-snoring-stop(9),
                    sabte-annotation-epoch-csr-start(10),
                    sabte-annotation-epoch-csr-stop(11),
                    sabte-annotation-event-undetermined-start(12),
                    sabte-annotation-event-undetermined-stop(13),
                    sabte-annotation-event-flow-limitation-start(14),
                    sabte-annotation-event-flow-limitation-stop(15),
                    sabte-annotation-event-hypopnoea-unclassified-start(16),
                    sabte-annotation-event-hypopnoea-unclassified-stop(17),
                    sabte-annotation-event-hypopnoea-obstructive-start(18),
                    sabte-annotation-event-hypopnoea-obstructive-stop(19),
                    sabte-annotation-event-hypopnoea-central-start(20),
                    sabte-annotation-event-hypopnoea-central-stop(21),
                    sabte-annotation-event-apnoea-unclassified-start(22),
                    sabte-annotation-event-apnoea-unclassified-stop(23),
                    sabte-annotation-event-apnoea-obstructive-start(24),
                    sabte-annotation-event-apnoea-obstructive-stop(25),
                    sabte-annotation-event-apnoea-mixed-start(26),
                    sabte-annotation-event-apnoea-mixed-stop(27),
```

```
                sabte-annotation-event-apnoea-central-start(28),
                sabte-annotation-event-apnoea-central-stop(29)
        }
```

B.2 Compliance annotations bit mapping

The extension to the enumeration class for compliance annotations requires the following ASN.1 structure definition:

```
SABTEComplinanceAnnotations::= BITS-16 {
                sabte-annotation-session-undetermined-start(0),
                sabte-annotation-session-undetermined-stop(1),
                sabte-annotation-session-therapy-start(2),
                sabte-annotation-session-therapy-stop(3),
                sabte-annotation-session-usage-start(4),
                sabte-annotation-session-usage-stop(5)
        }
```

B.3 PHD DM status bit mapping

The extension to the enumeration class for PHD DM status requires the following ASN.1 structure definition:

```
PHDDMStat::= BITS-32 {
                device-status-undetermined(0),
                device-status-reset(1),
                /* reserved for future extension (2) */
                /* reserved for future extension (3) */
                /* reserved for future extension (4) */
                device-status-error(5),
                device-status-error-mechanical(6),
                device-status-error-electronic(7),
                device-status-error-software(8),
                device-status-error-battery(9),
                /* reserved for future extension (10) */
                /* reserved for future extension (11) */
                /* reserved for future extension (12) */
                /* reserved for future extension (13) */
                /* reserved for future extension (14) */
                device-status-service(15),
                device-status-service-time-sync-required(16),
                device-status-service-calibration-required(17),
                device-status-service-replenishment-required(18),
                /* reserved for future extension (19) */
```

```
        /* reserved for future extension (20) */
        /* reserved for future extension (21) */
        /* reserved for future extension (22) */
        /* reserved for future extension (23) */
        /* reserved for future extension (24) */
        device-status-battery-low(25),
        device-status-battery-depleted(26),
        device-status-battery-replaced(27),
        device-status-battery-interrupted(28)
        /* reserved for future extension (29) */
        /* reserved for future extension (30) */
        /* reserved for future extension (31) */
    }
```

B.4 Autostart/-stop bit mapping

The extension to the enumeration class for autostart/-stop requires the following ASN.1 structure definition:

```
SABTEAutoStartStop::= BITS-16 {
        sabte-autostart-on(0),
        sabte-autostop-on(1)
    }
```

Annex C

(normative)

Allocation of identifiers

C.1 General

This annex contains the nomenclature codes used in this standard and not found in IEEE Std 11073-20601a-2010. For those not contained in this annex, the normative definition is found in IEEE Std 11073-20601a-2010.

C.2 Definitions of terms and codes

The format used here follows that of ISO/IEEE 11073-10101:2004 [B8].

```
/*****************************************************************************
* From Infrastructure (MDC_PART_INFRA) (8)
*****************************************************************************/
#define MDC_DEV_SPEC_PROFILE_SABTE              4121    /*                    */
#define MDC_DEV_SUB_SPEC_PROFILE_CPAP           4244    /*                    */
#define MDC_DEV_SUB_SPEC_PROFILE_CPAP_AUTO      4245    /*                    */
#define MDC_DEV_SUB_SPEC_PROFILE_BPAP           4246    /*                    */
#define MDC_DEV_SUB_SPEC_PROFILE_BPAP_AUTO      4247    /* reserved for future extension */
#define MDC_DEV_SUB_SPEC_PROFILE_ACSV           4248    /* reserved for future extension */
/*****************************************************************************
* From Personal Health Device Disease Management (MDC_PART_PHD_DM) (128)
*****************************************************************************/
#define MDC_PHD_DM_DEV_STAT                     20000   /*                    */
#define MDC_SABTE_TIME_PD_FLOW_GEN_TOTAL        22100   /*                    */
#define MDC_SABTE_TIME_PD_USAGE_TOTAL           22104   /*                    */
#define MDC_SABTE_TIME_PD_USAGE_W_HUM           22108   /*                    */
#define MDC_SABTE_TIME_PD_USAGE_WO_HUM          22112   /*                    */
#define MDC_SABTE_TIME_PD_SNORING_TOTAL         22116   /*                    */
#define MDC_SABTE_TIME_PD_CSR_TOTAL             22120   /*                    */
#define MDC_SABTE_TIME_PD_RAMP_SET              22136   /*                    */
#define MDC_SABTE_FLOW_TOTAL                    22140   /*                    */
#define MDC_SABTE_FLOW_WO_PURGE                 22144   /*                    */
#define MDC_SABTE_FLOW_RESP                     22148   /*                    */
#define MDC_SABTE_AHI                           22180   /*                    */
#define MDC_SABTE_AHI_TOTAL                     22184   /*                    */
#define MDC_SABTE_AHI_UNCLASS                   22188   /*                    */
#define MDC_SABTE_AHI_OBSTRUC                   22192   /*                    */
#define MDC_SABTE_AHI_CENT                      22196   /*                    */
```

```
#define MDC_SABTE_LVL_HUMID_STAGE_SET 22220 /* */
#define MDC_SABTE_LVL_HUMID_TEMP_SET 22224 /* */
#define MDC_SABTE_LVL_HUMID_HUM_SET 22228 /* */
#define MDC_SABTE_LVL_TRIG_SENS_SET 22232 /* */
#define MDC_SABTE_LVL_INSP_PRESS_RISE_SET 22236 /* */
#define MDC_SABTE_LVL_ADAPT_SET 22240 /* */
#define MDC_SABTE_MODE_ADAPT_FREEZE_SET 22260 /* */
#define MDC_SABTE_MODE_ADAPT_FREEZE_OFF 22261 /* */
#define MDC_SABTE_MODE_ADAPT_FREEZE_ON 22262 /* */
#define MDC_SABTE_MODE_AUTOSTARTSTOP_SET 22264 /* */
#define MDC_SABTE_MODE_DEV_SET 22268 /* */
#define MDC_SABTE_MODE_DEV_UNDETERMINED 22269 /* */
#define MDC_SABTE_MODE_DEV_STANDBY 22270 /* */
#define MDC_SABTE_MODE_DEV_THERAPY 22271 /* */
#define MDC_SABTE_MODE_DEV_MASK_FITTING 22272 /* */
#define MDC_SABTE_MODE_DEV_DRYING 22273 /* */
#define MDC_SABTE_MODE_DEV_EXPORTING 22274 /* */
#define MDC_SABTE_MODE_THERAPY_SET 22280 /* */
#define MDC_SABTE_MODE_THERAPY_UNDETERMINED 22281 /* */
#define MDC_SABTE_MODE_THERAPY_CPAP 22282 /* */
#define MDC_SABTE_MODE_THERAPY_CPAP_AUTO 22283 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_S 22284 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_T 22285 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_ST 22286 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_S_AUTO 22287 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_T_AUTO 22288 /* */
#define MDC_SABTE_MODE_THERAPY_BPAP_ST_AUTO 22289 /* */
#define MDC_SABTE_MODE_THERAPY_ACSV 22290 /* */
#define MDC_SABTE_PATT_COMPLIANCE_CLS 22300 /* */
#define MDC_SABTE_PATT_EFFICACY_CLS 22308 /* */
#define MDC_SABTE_PRESS 22340 /* */
#define MDC_SABTE_PRESS_MIN 22341 /* */
#define MDC_SABTE_PRESS_MAX 22342 /* */
#define MDC_SABTE_PRESS_MEAN 22343 /* */
#define MDC_SABTE_PRESS_P50 22347 /* */
#define MDC_SABTE_PRESS_P90 22349 /* */
#define MDC_SABTE_PRESS_P95 22350 /* */
#define MDC_SABTE_PRESS_INSTANT 22351 /* */
#define MDC_SABTE_PRESS_TARGET 22360 /* */
#define MDC_SABTE_PRESS_CPAP_SET 22364 /* */
#define MDC_SABTE_PRESS_CPAP_AUTO_MIN_SET 22368 /* */
#define MDC_SABTE_PRESS_CPAP_AUTO_MAX_SET 22372 /* */
#define MDC_SABTE_PRESS_IPAP_SET 22376 /* */
#define MDC_SABTE_PRESS_EPAP_SET 22380 /* */
```

```
#define MDC_SABTE_PRESS_RAMP_START_SET      22396   /*                  */
#define MDC_SABTE_RESP_RATE_MIN             22401   /*                  */
#define MDC_SABTE_RESP_RATE_MAX             22402   /*                  */
#define MDC_SABTE_RESP_RATE_MEAN            22403   /*                  */
#define MDC_SABTE_RESP_RATE_P50             22407   /*                  */
#define MDC_SABTE_RESP_RATE_P90             22409   /*                  */
#define MDC_SABTE_RESP_RATE_P95             22410   /*                  */
#define MDC_SABTE_RESP_RATE_INSTANT         22411   /*                  */
#define MDC_SABTE_RESP_RATE_SET             22436   /*                  */
#define MDC_SABTE_RATIO_IE_MIN              22441   /*                  */
#define MDC_SABTE_RATIO_IE_MAX              22442   /*                  */
#define MDC_SABTE_RATIO_IE_MEAN             22443   /*                  */
#define MDC_SABTE_RATIO_IE_P50              22447   /*                  */
#define MDC_SABTE_RATIO_IE_P90              22449   /*                  */
#define MDC_SABTE_RATIO_IE_P95              22450   /*                  */
#define MDC_SABTE_RATIO_IE_INSTANT          22451   /*                  */
#define MDC_SABTE_RATIO_IE_SET              22476   /*                  */
#define MDC_SABTE_VOL_LEAK                  22480   /*                  */
#define MDC_SABTE_VOL_LEAK_MIN              22481   /*                  */
#define MDC_SABTE_VOL_LEAK_MAX              22482   /*                  */
#define MDC_SABTE_VOL_LEAK_MEAN             22483   /*                  */
#define MDC_SABTE_VOL_LEAK_P50              22487   /*                  */
#define MDC_SABTE_VOL_LEAK_P90              22489   /*                  */
#define MDC_SABTE_VOL_LEAK_P95              22490   /*                  */
#define MDC_SABTE_VOL_LEAK_INSTANT          22491   /*                  */
#define MDC_SABTE_VOL_MINUTE_MIN            22521   /*                  */
#define MDC_SABTE_VOL_MINUTE_MAX            22522   /*                  */
#define MDC_SABTE_VOL_MINUTE_MEAN           22523   /*                  */
#define MDC_SABTE_VOL_MINUTE_P50            22527   /*                  */
#define MDC_SABTE_VOL_MINUTE_P90            22529   /*                  */
#define MDC_SABTE_VOL_MINUTE_P95            22530   /*                  */
#define MDC_SABTE_VOL_MINUTE_INSTANT        22531   /*                  */
#define MDC_SABTE_VOL_TIDAL_MIN             22561   /*                  */
#define MDC_SABTE_VOL_TIDAL_MAX             22562   /*                  */
#define MDC_SABTE_VOL_TIDAL_MEAN            22563   /*                  */
#define MDC_SABTE_VOL_TIDAL_P50             22567   /*                  */
#define MDC_SABTE_VOL_TIDAL_P90             22569   /*                  */
#define MDC_SABTE_VOL_TIDAL_P95             22570   /*                  */
#define MDC_SABTE_VOL_TIDAL_INSTANT         22571   /*                  */
/************************************************************************************
* From Dimensions (MDC_PART_DIM) (4)
************************************************************************************/
#define MDC_DIM_PERCENT                     544     /* %                */
#define MDC_DIM_MILLI_L                     1618    /* ml               */
```

```
#define MDC_DIM_MIN                 2208    /* min          */
#define MDC_DIM_RESP_PER_MIN        2784    /* resp min     */
#define MDC_DIM_L_PER_MIN           3072    /* l min-1      */
#define MDC_DIM_HECTO_PASCAL        3842    /* hPa          */
#define MDC_DIM_EVT_PER_HR          4732    /* event h-1    */
```

C.3 Systematic derivations of terms and codes

Systematic derivations of nomenclature and codes are outlined in Table C.1, Table C.2, and Table C.3.

Table C.1—Infrastructure nomenclature and codes (MDC_PART_INFRA)

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Profile | Device | SABTE	Sleep apnoea breathing therapy equipment	SABTE	Profile of SABTE device specialization.	MDC_DEV_SPEC_PROFILE_ SABTE	4121
Profile, Sub | Device | SABTE, CPAP	CPAP device		Sub-Profile CPAP of SABTE device specialization. See 6.5.2.	MDC_DEV_SUB_SPEC_ PROFILE_CPAP	4240
Profile, Sub | Device | SABTE, CPAP, Auto	Auto-CPAP device		Sub-Profile Auto-CPAP of SABTE device specialization. See 6.5.3.	MDC_DEV_SUB_SPEC_ PROFILE_CPAP_AUTO	4241
Profile, Sub | Device | SABTE, BPAP	BPAP device		Sub-Profile BPAP of SABTE device specialization. See 6.5.4.	MDC_DEV_SUB_SPEC_ PROFILE_BPAP	4242
Profile, Sub | Device | SABTE, BPAP, Auto	Auto-BPAP device		Sub-Profile Auto-BPAP of SABTE device specialization.	MDC_DEV_SUB_SPEC_ PROFILE_BPAP_AUTO	4243
Profile, Sub | Device | SABTE, AcSV	AcSV device		Sub-Profile AcSV of SABTE device specialization.	MDC_DEV_SUB_SPEC_ PROFILE_ACSV	4244

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM)

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Disease Management | | DeviceStatus | Personal Health Device	PHD DM status		Common PHD disease management status object. See 5.4.2 and 6.9.4.	MDC_PHD_DM_DEV_STAT	20000
Duration | Total | FlowGeneration | SABTE	Duration of flow generation		Time period where SABTE was powered on and was providing airflow. See 5.4.1 and 6.7.13.	MDC_SABTE_TIME_PD_FLOW_ GEN_TOTAL	22100
Duration | Total | Usage | SABTE	Compliance		Total time period where SABTE was providing therapy to the patient during a usage session. See 5.2.1 and 6.7.2.	MDC_SABTE_TIME_PD_ USAGE_TOTAL	22104

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Duration | WithHumidifier | Usage | SABTE	Compliance with attached humidifier		Time period where SABTE was providing therapy to the patient during a usage session with attached humidifier. See 5.2.1 and 6.7.2.	MDC_SABTE_TIME_PD_ USAGE_W_HUM	22108
Duration | WithoutHumidifier | Usage | SABTE	Compliance without attached humidifier		Time period where SABTE was providing therapy to the patient during a usage session without attached humidifier. See 5.2.1 and 6.7.2.	MDC_SABTE_TIME_PD_ USAGE_WO_HUM	22112
Duration | Total | Snoring | SABTE	Snoring duration		Time period where snoring occurs during a usage session. See 5.3.11 and 6.7.11.	MDC_SABTE_TIME_PD_ SNORING_TOTAL	22116
Duration | Total | CSR | SABTE	Cheyne-Stokes respiration (CSR) duration	CSR duration	Time period where CSR occurs during a usage session. See 5.3.12 and 6.7.12.	MDC_SABTE_TIME_PD_CSR_ TOTAL	22120
Duration | Setting | Ramp | SABTE	Ramp duration set		Setting of therapy pressure at the start of the sleep ramp. See 5.6.4.2 and 6.7.16.	MDC_SABTE_TIME_PD_RAMP_ SET	22136
Flow | Total | Gas | SABTE	Total device airflow waveform		Sequence of total device airflow samples. See 5.3.6 and 6.8.4.	MDC_SABTE_FLOW_TOTAL	22140
Flow | WithoutPurgeFlow | Gas | SABTE	Device airflow without purge flow waveform		Sequence of device airflow samples without purge flow. See 5.3.6 and 6.8.4.	MDC_SABTE_FLOW_WO_ PURGE	22144
Flow | Respiration | Gas | SABTE	Respiration airflow waveform		Sequence of respiration airflow samples. See 5.3.6 and 6.8.4.	MDC_SABTE_FLOW_RESP	22148
Index | Ratio(Number, Duration) | Apnoea, Hypopnoea | SABTE	Apnoea hypopnoea index		Object containing compound apnoea hypopnoea indexes. See 5.3.1 and 6.7.4.	MDC_SABTE_AHI	22180
Index | Ratio(Number, Duration), Total | Apnoea, Hypopnoea | SABTE	Apnoea hypopnoea index	AHI	Total number of all apnoea and hypopnoea events occurring during a usage session divided by the hours of sleep. See 5.3.1 and 6.7.3.	MDC_SABTE_AHI_TOTAL	22184
Index | Ratio(Number, Duration) | Apnoea, Hypopnoea, Unclassified | SABTE	Unclassified apnoea hypopnoea index	uAHI	Total number of all unclassified apnoea and hypopnoea events occurring during a usage session divided by the hours of sleep. See 5.3.1 and 6.7.3.	MDC_SABTE_AHI_UNCLASS	22188

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Index | Ratio(Number, Duration) | Apnoea, Hypopnoea, Obstructive, Mixed | SABTE	Obstructive apnoea hypopnoea index	oAHI	Total number of all mixed and obstructive events occurring during a usage session divided by the hours of sleep. See 5.3.1 and 6.7.3.	MDC_SABTE_AHI_OBSTRUC	22192
Index | Ratio (Number, Duration) | Apnoea, Hypopnoea, Central | SABTE	Central apnoea hypopnoea index	cAHI	Total number of all central apnoea and central hypopnoea events occurring during a usage session divided by the hours of sleep. See 5.3.1 and 6.7.3.	MDC_SABTE_AHI_CENT	22196
Level | Stage, Setting | Humidifier | SABTE	Humidifier relative stage set		Setting of humidifier relative stage. See 5.6.2 and 6.7.14.	MDC_SABTE_LVL_HUMID_ STAGE_SET	22220
Level | Temperature, Setting | Humidifier | SABTE	Humidifier relative air output temperature set		Setting of humidifier relative air output temperature. See 5.6.2 and 6.7.14.	MDC_SABTE_LVL_HUMID_ TEMP_SET	22224
Level | Humidity, Setting | Humidifier | SABTE	Humidifier relative humidity set		Setting of humidifier relative humidity. See 5.6.2 and 6.7.14.	MDC_SABTE_LVL_HUMID_ HUM_SET	22228
Level | TriggerSensitivity, Setting | | SABTE	Trigger sensitivity set		Setting of target inspiratory and expiratory trigger sensitivity. See 5.6.9.5 and 6.7.25.	MDC_SABTE_LVL_TRIG_ SENS_SET	22232
Level | InspirationPressureRise, Setting | | SABTE	Inspiration pressure rise set	P Rise	Setting of pressure rise during inspiration. See 5.6.6 and 6.7.26.	MDC_SABTE_LVL_INSP_ PRESS_RISE_SET	22236
Level | Setting | Adaption | SABTE	Pressure adaption level set		Setting of pressure adaption during expiration and/or inspiration. See 5.6.5.1 and 6.7.17.	MDC_SABTE_LVL_ADAPT_SET	22240
Mode | Freeze, Setting | Adaption | SABTE	Pressure adaption freeze set		Setting of pressure adaption freeze feature. See 5.6.5.2 and 6.9.8.	MDC_SABTE_MODE_ADAPT_ FREEZE_SET	22260
Mode | Freeze, Off | Adaption | SABTE	Pressure adaption freeze disabled		Disabled option of pressure adaption freeze. See 5.6.5.2 and 6.9.8.	MDC_SABTE_MODE_ADAPT_ FREEZE_OFF	22261
Mode | Freeze, On | Adaption | SABTE	Pressure adaption freeze enabled		Enabled option of pressure adaption freeze. See 5.6.5.2 and 6.9.8.	MDC_SABTE_MODE_ADAPT_ FREEZE_ON	22262
Mode | Setting | Autostart-/stop | SABTE	Autostart-/stop set		Setting of autostart and autostop feature. See 5.6.3 and 6.9.7.	MDC_SABTE_MODE_ AUTOSTARTSTOP_SET	22264
Mode | Setting | Device | SABTE	Device mode set		Setting of SABTE device state. See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_SET	22268

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Mode | Undetermined | Device | SABTE	Device mode undetermined		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ UNDETERMINED	22269
Mode | Standby | Device | SABTE	Device mode standby		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ STANDBY	22270
Mode | Therapy | Device | SABTE	Device mode therapy		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ THERAPY	22271
Mode | Mask Fitting | Device | SABTE	Device mode mask fitting		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ MASK_FITTING	22272
Mode | Drying | Device | SABTE	Device mode drying		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ DRYING	22273
Mode | Exporting | Device | SABTE	Device mode exporting		See 5.5.1 and 6.9.5.	MDC_SABTE_MODE_DEV_ EXPORTING	22274
Mode | Setting| Therapy | SABTE	Therapy mode set		Setting of SABTE therapy state. See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_SET	22280
Mode | Undetermined | Therapy | SABTE	Therapy mode undetermined		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_UNDETERMINED	22281
Mode | CPAP | Therapy | SABTE	Therapy mode CPAP		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_THERAPY _CPAP	22282
Mode | CPAP, Auto | Therapy | SABTE	Therapy mode Auto-CPAP		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_CPAP_AUTO	22283
Mode | BPAP, S | Therapy | SABTE	Therapy mode BPAP S		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_S	22284
Mode | BPAP, T | Therapy | SABTE	Therapy mode BPAP T		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_T	22285
Mode | BPAP, ST | Therapy | SABTE	Therapy mode BPAP ST		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_ST	22286
Mode | BPAP, S, Auto | Therapy | SABTE	Therapy mode Auto-BPAP S		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_S_AUTO	22287
Mode | BPAP, T, Auto | Therapy | SABTE	Therapy mode Auto-BPAP T		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_T_AUTO	22288
Mode | BPAP, ST, Auto | Therapy | SABTE	Therapy mode Auto-BPAP ST		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_BPAP_ST_AUTO	22289
Mode | AcSV | Therapy | SABTE	Therapy mode AcSV		See 5.6.1 and 6.9.6.	MDC_SABTE_MODE_ THERAPY_ACSV	22290
Pattern | Classification | Compliance | SABTE	Compliance annotations		Compliance annotations of usage sessions. See 5.2.2 and 6.9.2.	MDC_SABTE_PATT_ COMPLIANCE_CLS	22300
Pattern | Classification | Efficacy | SABTE	Efficacy annotations		Efficacy annotations of therapy sessions. See 5.3.13 and 6.9.3.	MDC_SABTE_PATT_EFFICACY_ CLS	22308
Pressure | | Gas | SABTE	Therapy pressure waveform		Sequence of therapy pressure samples. See 5.3.3 and 6.8.2.	MDC_SABTE_PRESS	22340
Pressure | Minimum | Gas | SABTE	Minimum therapy pressure	P min	Minimum delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_MIN	22341
Pressure | Maximum | Gas | SABTE	Maximum therapy pressure	P max	Maximum delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_MAX	22342

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Pressure | Mean | Gas | SABTE	Mean therapy pressure	P mean	Mean delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_MEAN	22343
Pressure | P50 | Gas | SABTE	50th percentile of therapy pressure	P50	50th percentile of delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_P50	22347
Pressure | P90 | Gas | SABTE	90th percentile of therapy pressure	P90	90th percentile of delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_P90	22349
Pressure | P95 | Gas | SABTE	95th percentile of therapy pressure	P95	95th percentile of delivered therapy pressure during a usage session. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_P95	22350
Pressure | Instantaneous | Gas | SABTE	Instantaneous therapy pressure	P	Instantaneous value of delivered therapy pressure. See 5.3.2 and 6.7.5.	MDC_SABTE_PRESS_INSTANT	22351
Pressure | Target | Gas | SABTE	Target therapy pressure waveform		Sequence of target therapy pressure samples. See 5.3.3 and 6.8.2.	MDC_SABTE_PRESS_TARGET	22360
Pressure | CPAP, Setting | | SABTE	CPAP pressure set	P CPAP set	Setting of target therapy pressure in CPAP mode during a therapy session. See 5.6.7.1 and 6.7.18.	MDC_SABTE_PRESS_CPAP_SET	22364
Pressure | CPAP, Auto, Minimum, Setting | | SABTE	Auto-CPAP minimum pressure set	Pmin APAP set	Setting of minimum target therapy pressure in Auto-CPAP mode during a therapy session. See 5.6.8.1 and 6.7.19.	MDC_SABTE_PRESS_CPAP_AUTO_MIN_SET	22368
Pressure | CPAP, Auto, Maximum, Setting | | SABTE	Auto-CPAP maximum pressure set	Pmax APAP set	Setting of maximum target therapy pressure in Auto-CPAP mode during a therapy session. See 5.6.8.2 and 6.7.20.	MDC_SABTE_PRESS_CPAP_AUTO_MAX_SET	22372
Pressure | IPAP, Setting | | SABTE	IPAP pressure set	P IPAP set	Setting of target inspiration therapy pressure in BiLevel PAP mode during a breath cycle. See 5.6.9.1 and 6.7.21.	MDC_SABTE_PRESS_IPAP_SET	22376
Pressure | EPAP, Setting | | SABTE	EPAP pressure set	P EPAP set	Setting of target expiration therapy pressure in BiLevel PAP mode during a breath cycle. See 5.6.9.2 and 6.7.22.	MDC_SABTE_PRESS_EPAP_SET	22380
Pressure | Start, Setting | Ramp | SABTE	Ramp start pressure set		Setting of length of the sleep ramp. See 5.6.4.1 and 6.7.15.	MDC_SABTE_PRESS_RAMP_START_SET	22396
Rate | Minimum | Breath | SABTE	Minimum respiration rate	RR min	Minimum respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_MIN	22401

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Rate | Maximum | Breath | SABTE	Maximum respiration rate	RR max	Maximum respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_MAX	22402
Rate | Mean | Breath | SABTE	Mean respiration rate	RR mean	Mean respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_MEAN	22403
Rate | P50 | Breath | SABTE	50th percentile of respiration rate		50th percentile of respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_P50	22407
Rate | P90 | Breath | SABTE	90th percentile of respiration rate		90th percentile of respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_P90	22409
Rate | P95 | Breath | SABTE	95th percentile of respiration rate		95th percentile of respiration rate during a usage session. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_P95	22410
Rate | Instantaneous | Breath | SABTE	Instantaneous respiration rate	RR	Instantaneous value of respiration rate. See 5.3.7 and 6.7.7.	MDC_SABTE_RESP_RATE_INSTANT	22411
Rate | Setting | Breath | SABTE	Respiratory rate set	RR set	Setting of target breathing frequency in BiLevel PAP mode during a therapy session. See 5.6.9.3 and 6.7.23.	MDC_SABTE_RESP_RATE_SET	22436
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), Minimum | Gas | SABTE	Minimum I:E ratio	TI/TE min	Minimum I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_MIN	22441
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), Maximum | Gas | SABTE	Maximum I:E ratio	TI/TE max	Maximum I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_MAX	22442
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), Mean | Gas | SABTE	Mean I:E ratio	TI/TE mean	Mean I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_MEAN	22443
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), P50 | Gas | SABTE	50th percentile of I:E ratio		50th percentile of I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_P50	22447
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), P90 | Gas | SABTE	90th percentile of I:E ratio		90th percentile of I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_P90	22449

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), P95 | Gas | SABTE	95th percentile of I:E ratio		95th percentile of I:E ratio during a usage session. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_P95	22450
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), Instantaneous | Gas | SABTE	Instantaneous I:E ratio	TI/TE	Instantaneous value of I:E ratio. See 5.3.10 and 6.7.10.	MDC_SABTE_RATIO_IE_INSTANT	22451
Ratio | Duration(InspirationPhase), Duration(ExpirationPhase), Setting | Gas | SABTE	I:E ratio set	TI/TE set	Setting of target ratio between duration of the inspiration to the duration of the expiration in BiLevel PAP mode during a breath cycle. See 5.6.9.4 and 6.7.24.	MDC_SABTE_RATIO_IE_SET	22476
Volume | | Leakage | SABTE	Leakage waveform		Sequence of leakage samples. See 5.3.5 and 6.8.3.	MDC_SABTE_VOL_LEAK	22480
Volume | Minimum | Leakage | SABTE	Minimum leakage		Minimum leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_MIN	22481
Volume | Maximum | Leakage | SABTE	Maximum leakage		Maximum leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_MAX	22482
Volume | Mean | Leakage | SABTE	Mean leakage		Mean leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_MEAN	22483
Volume | P50 | Leakage | SABTE	50th percentile of leakage		50th percentile of leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_P50	22487
Volume | P90 | Leakage | SABTE	90th percentile of leakage		90th percentile of leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_P90	22489
Volume | P95 | Leakage | SABTE	95th percentile of leakage		95th percentile of leakage during a usage session. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_P95	22490
Volume | Instantaneous | Leakage | SABTE	Instantaneous leakage		Instantaneous value of leakage. See 5.3.4 and 6.7.6.	MDC_SABTE_VOL_LEAK_INSTANT	22491
Volume | OneMinute, Minimum | Gas | SABTE	Minimum respir. minute volume	RMV min	Minimum respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_MIN	22521
Volume | OneMinute, Maximum | Gas | SABTE	Maximum respir. minute volume	RMV max	Maximum respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_MAX	22522
Volume | OneMinute, Mean | Gas | SABTE	Mean respir. minute volume	RMV mean	Mean respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_MEAN	22523
Volume | OneMinute, P50 | Gas | SABTE	50th percentile of respir. minute volume		50th percentile of respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_P50	22527

Table C.2—Personal Health Device Disease Management nomenclature and codes (MDC_PART_PHD_DM) *(continued)*

Systematic name	Common term	Acronym	Description/definition	Reference ID	Code
Volume | OneMinute, P90 | Gas | SABTE	90th percentile of respir. minute volume		90th percentile of respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_P90	22529
Volume | OneMinute, P95 | Gas | SABTE	95th percentile of respir. minute volume		95th percentile of respiratory minute volume during a usage session. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_P95	22530
Volume | OneMinute, Instantaneous | Gas | SABTE	Instantaneous respir. minute volume	RMV	Instantaneous value of respiratory minute volume. See 5.3.9 and 6.7.9.	MDC_SABTE_VOL_MINUTE_INSTANT	22531
Volume | Minimum | Lung, Tidal | SABTE	Minimum respir. tidal volume	VT min	Minimum respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_MIN	22561
Volume | Maximum | Lung, Tidal | SABTE	Maximum respir. tidal volume	VT max	Maximum respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_MAX	22562
Volume | Mean | Lung, Tidal | SABTE	Mean respir. tidal volume	VT mean	Mean respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_MEAN	22563
Volume | P50 | Lung, Tidal | SABTE	50th percentile of respir. tidal volume		50th percentile of respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_P50	22567
Volume | P90 | Lung, Tidal | SABTE	90th percentile of respir. tidal volume		90th percentile of respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_P90	22569
Volume | P95 | Lung, Tidal | SABTE	95th percentile of respir. tidal volume		95th percentile of respiratory tidal volume during a usage session. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_P95	22570
Volume | Instantaneous | Lung, Tidal | SABTE	Instantaneous respir. tidal volume	VT	Instantaneous value of respiratory tidal volume. See 5.3.8 and 6.7.8.	MDC_SABTE_VOL_TIDAL_INSTANT	22571

Table C.3—Dimensions nomenclature and codes (MDC_PART_DIM)

Dimension	Unit of measurement	Symbol (not normative)	Reference ID	Code
Dimension-less	10^{-2} (percent)	%	MDC_DIM_PERCENT	544
L^3 (volume)	10^{-3} liter(s)	ml	MDC_DIM_MILLI_L	1618
T (time)	Minute	min	MDC_DIM_MIN	2208
Special vital signs rates	Respirations per minute	resp min^{-1}	MDC_DIM_RESP_PER_MIN	2784
L^3T^{-1} (volume flow rate)	Liter(s) per minute	l min^{-1}	MDC_DIM_L_PER_MIN	3072
$L^{-1}MT^{-2}$ (pressure)	Hectopascal	hPa	MDC_DIM_HECTO_PASCAL	3842
Special vital signs rates	Events per hour	evt h^{-1}	MDC_DIM_EVT_PER_HR	4732

Annex D

(informative)

Message sequence examples

Figure D.1 shows a sequence diagram of the messaging procedure corresponding to the following use case. The user of a SABTE agent device intends to connect it to a manager device for the first time. The SABTE is capable of transmitting the duration of flow generation. Thus, it operates as an extended configuration.

a) When the user connects the SABTE, the manager does not recognize the agent's configuration and sends a response to the agent's association request with the result *accepted-unknown-config*. See E.2.2.2 and E.2.3.3 for the corresponding PDU examples.

b) As a consequence of this, the agent negotiates its configuration information to the manager. After getting confirmation from the manager accepting the agent's configuration, the agent device is ready to send measurements. Both devices enter the Operating state. See E.3.2.2 and E.3.2.3 for the corresponding PDU examples.

c) Subsequently, the manager may request the MDS object attributes of the agent by sending a data message with the "Remote Operation Invoke | Get" command. Note that the manager may request the MDS object attributes as soon as the agent enters the Associated state, including the Configuring and Operating substates. As a response, the agent reports its MDS object attributes to the manager using a Data message with the "Remote Operation Response | Get" command. See E.4.1.2 and E.4.1.3 for the corresponding PDU examples.

d) As a next step, the agent transmit the duration of flow generation data to the manager using a confirmed event report. After having successfully received the measurement data, the manager sends a confirmation to the agent. See E.5.1 and E.5.2 for the corresponding PDU examples.

e) The user ends the data transmission session (e.g., by pushing a proper button on the device or just by not using the device for a duration longer than a certain time period). As a consequence, the agent disassociates from the manager by sending an association release request. The manager responds with an association release response. See E.6.1 and E.6.2 for the corresponding PDU examples.

f) When the agent requests to associate to the manager for the next data transmission session (e.g., the next day), the result in the manager's response is accepted, as it already knows the agent's configuration from the previous measurement session. Both devices transition directly to the Operating state.

g) Finally, the last two steps shown are similar as in item d) and item e). The agent transmit the duration of flow generation data followed by releasing the association.

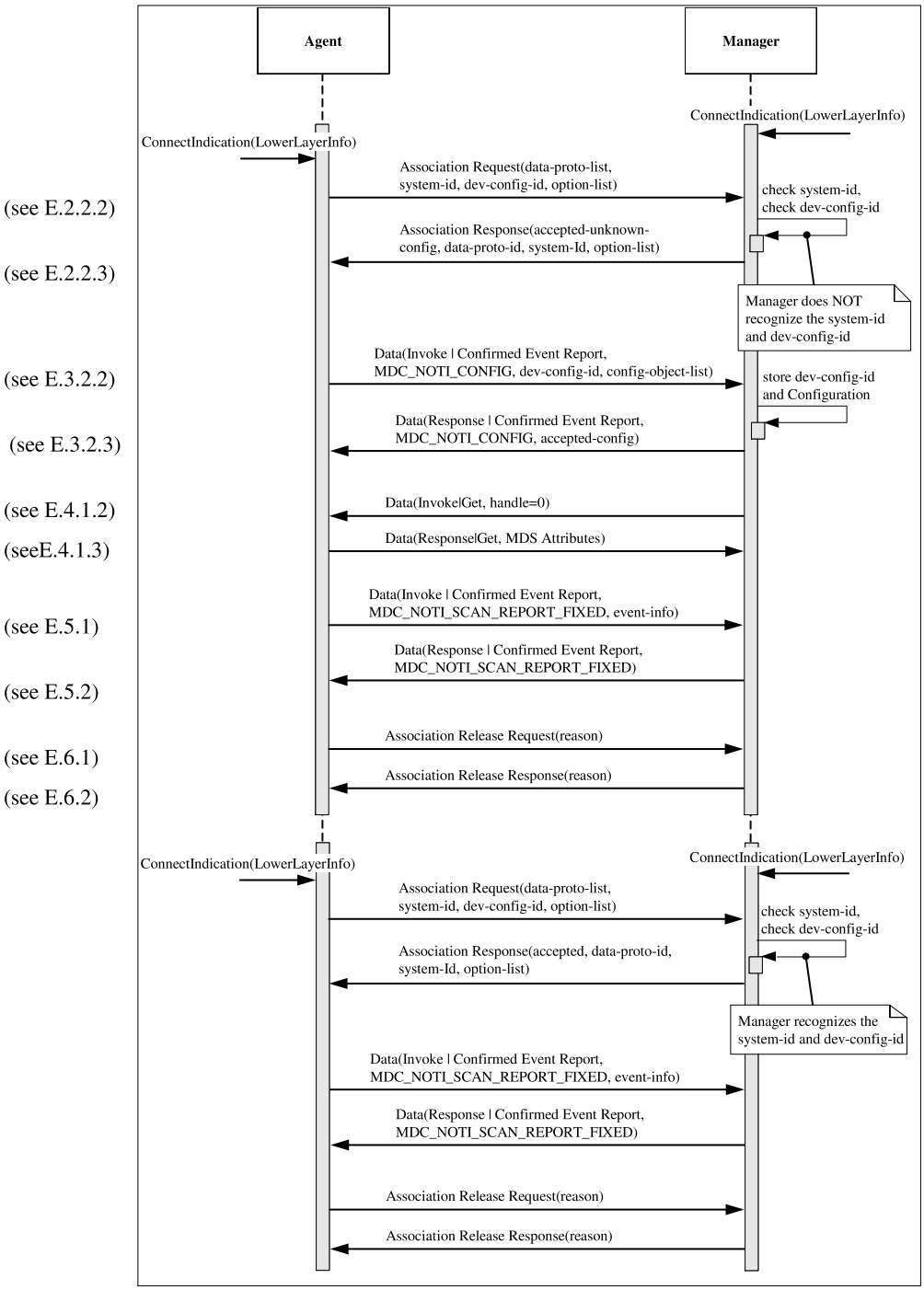

Figure D.1—Sequence diagram for SABTE example use case

Annex E

(informative)

Protocol data unit examples

E.1 General

This annex shows binary examples of messages exchanged between a SABTE agent and a manager. Three different scenarios containing the association and configuration information exchanges are presented in E.2 and E.3. The first scenario illustrates the case when the agent intends to operate using an extended configuration. The manager does not have the configuration declared by the agent from a prior association. The second illustrates the agent presenting the same extended configuration to the manager, and the manager does have the configuration from the previously transferred configuration exchange. Finally, the agent presents a standard configuration to the manager, and the manager has the configuration because the manager has been preprogrammed with this configuration.

E.2 Association information exchange

E.2.1 General

When the transport connection is established between the manager and the agent, they both enter the Unassociated state. When the agent sends an association request, both manager and agent enter the Associating state.

E.2.2 Extended configuration

E.2.2.1 General

In this exchange, the agent sends an association request intending to use an extended configuration during measurement transfer. However, the manager does not have this configuration.

E.2.2.2 Association request

The SABTE agent sends the following message to the manager. The agent intends to associate using an extended configuration.

0xE2 0x00	APDU CHOICE Type (AarqApdu)
0x00 0x32	CHOICE.length = 50
0x80 0x00 0x00 0x00	assoc-version
0x00 0x01 0x00 0x2A	data-proto-list.count = 1 | length = 42
0x50 0x79	data-proto-id = 20601
0x00 0x26	data-proto-info length = 38
0x40 0x00 0x00 0x00	protocolVersion set to 11073-20601a
0xA0 0x00	encoding rules = MDER or PER
0x80 0x00 0x00 0x00	nomenclatureVersion

```
0x00 0x00 0x00 0x00      functionalUnits – no Test Association capabilities
0x00 0x80 0x00 0x00      systemType = sys-type-agent
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
0x40 0x00                dev-config-id – extended configuration
0x00 0x01                data-req-mode-flags
0x01 0x00                data-req-init-agent-count, data-req-init-manager-count
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.2.2.3 Association response

A manager responds to the agent that it can associate but does not have the SABTE extended configuration (i.e., there is the need for the agent to send its configuration).

```
0xE3 0x00                APDU CHOICE Type (AareApdu)
0x00 0x2C                CHOICE.length = 44
0x00 0x03                result = accepted-unknown-config
0x50 0x79                data-proto-id = 20601
0x00 0x26                data-proto-info length = 38
0x40 0x00 0x00 0x00      protocolVersion set to 11073-20601a
0x80 0x00                encoding rules = MDER
0x80 0x00 0x00 0x00      nomenclatureVersion
0x00 0x00 0x00 0x00      functionalUnits – normal Association
0x80 0x00 0x00 0x00      systemType = sys-type-manager
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x88 0x77 0x66 0x55 0x44 0x33 0x22 0x11
0x00 0x00                manager's response to config-id is always 0
0x00 0x00                manager's response to data-req-mode-flags is always 0
0x01 0x00                data-req-init-agent-count and data-req-init-manager-count are always 0
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.2.3 Previously known extended configuration

E.2.3.1 General

This exchange illustrates a transaction that takes place after a session beginning with an exchange such as E.2.2 has occurred.

E.2.3.2 Association request

The SABTE agent sends the following message to the manager. The agent intends to associate using an extended configuration.

```
0xE2 0x00                APDU CHOICE Type (AarqApdu)
0x00 0x32                CHOICE.length = 50
0x80 0x00 0x00 0x00      assoc-version
0x00 0x01 0x00 0x2A      data-proto-list.count = 1 | length = 42
0x50 0x79                data-proto-id = 20601
0x00 0x26                data-proto-info length = 38
0x40 0x00 0x00 0x00      protocolVersion set to 11073-20601a
0xA0 0x00                encoding rules = MDER or PER
```

```
0x80 0x00 0x00 0x00      nomenclatureVersion
0x00 0x00 0x00 0x00      functionalUnits – no Test Association capabilities
0x00 0x80 0x00 0x00      systemType = sys-type-agent
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
0x40 0x00                dev-config-id – extended configuration
0x00 0x01                data-req-mode-flags
0x01 0x00                data-req-init-agent-count = 1 | data-req-init-manager-count = 0
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.2.3.3 Association response

A manager responds to the agent that it can associate with, recognizes, and accepts and has the extended configuration of the SABTE (i.e., there is no need for the agent to send its configuration).

```
0xE3 0x00                APDU CHOICE Type (AareApdu)
0x00 0x2C                CHOICE.length = 44
0x00 0x00                result = accepted
0x50 0x79                data-proto-id = 20601
0x00 0x26                data-proto-info length = 38
0x40 0x00 0x00 0x00      protocolVersion set to 11073-20601a
0x80 0x00                encoding rules = MDER
0x80 0x00 0x00 0x00      nomenclatureVersion
0x00 0x00 0x00 0x00      functionalUnits – normal Association
0x80 0x00 0x00 0x00      systemType = sys-type-manager
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x88 0x77 0x66 0x55 0x44 0x33 0x22 0x11
0x00 0x00                manager's response to config-id is always 0
0x00 0x00                manager's response to data-req-mode-flags is always 0
0x00 0x00                data-req-init-agent-count and data-req-init-manager-count are always 0
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.2.4 Standard configuration

E.2.4.1 General

This transaction would occur if an agent presents an association request incorporating the dev-config-id corresponding to a standard configuration. The manager has the configuration because it has been programmed with this configuration according to the information presented in this standard.

E.2.4.2 Association request

The SABTE agent sends the following message to the manager. The agent intends to associate using a standard configuration. The agent is willing to enter into a test association as defined in Clause 9.

```
0xE2 0x00                APDU CHOICE Type (AarqApdu)
0x00 0x32                CHOICE.length = 50
0x80 0x00 0x00 0x00      assoc-version
0x00 0x01 0x00 0x2A      data-proto-list.count = 1 | length = 42
0x50 0x79                data-proto-id = 20601
0x00 0x26                data-proto-info length = 38
```

```
0x40 0x00 0x00 0x00      protocolVersion set to 11073-20601a
0xA0 0x00                encoding rules = MDER or PER
0x80 0x00 0x00 0x00      nomenclature version
0x40 0x00 0x00 0x00      functional units, has test association capabilities
0x00 0x80 0x00 0x00      systemType = sys-type-agent
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88
0x09 0x60                dev-config-id – standard configuration 2400
0x00 0x01                data-req-mode-flags
0x01 0x00                data-req-init-agent-count = 1 | data-req-init-manager-count = 0
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.2.4.3 Association response

A manager responds to the agent that it can associate with, recognizes, and accepts and has the SABTE standard configuration (i.e., there is no need for the agent to send its configuration). The manager does not start a test association.

```
0xE3 0x00                APDU CHOICE Type (AareApdu)
0x00 0x2C                CHOICE.length = 42
0x00 0x00                result = accepted
0x50 0x79                data-proto-id = 20601
0x00 0x26                data-proto-info length = 38
0x40 0x00 0x00 0x00      protocolVersion set to 11073-20601a
0x80 0x00                encoding rules = MDER
0x80 0x00 0x00 0x00      nomenclatureVersion
0x00 0x00 0x00 0x00      functionalUnits
0x80 0x00 0x00 0x00      systemType = sys-type-manager
0x00 0x08                system-id length = 8 and value (manufacturer- and device- specific)
0x88 0x77 0x66 0x55 0x44 0x33 0x22 0x11
0x00 0x00                Manager’s response to config-id is always 0
0x00 0x00                Manager’s response to data-req-mode-capab is always 0
0x00 0x00                data-req-init-agent-count and data-req-init-manager-count are always 0
0x00 0x00 0x00 0x00      optionList.count = 0 | optionList.length = 0
```

E.3 Configuration information exchange

E.3.1 General

If the association is not rejected or aborted, the agent and manager transition from the Associating state into one of two states. If the manager’s AssociateResult code is accepted, the agent and manager enter the operating state. If the manager’s AssociateResult code is accepted-unknown-config, the agent and manager enter the Configuring state.

E.3.2 Extended configuration

E.3.2.1 General

This exchange takes place when the manager returns the AssociateResult code of accepted-unknown-config. The agent presents a description of its configuration corresponding to the dev-config-id it presented in the association request.

E.3.2.2 Remote operation invoke event report configuration

The SABTE agent sends the description of its extended configuration. It does this by sending a confirmed event report of type MDC_NOTI_CONFIG.

0x00 0x02	invoke-id = 2 (differentiates this message from any other outstanding)
0x01 0x01	CHOICE(Remote Operation Invoke | Confirmed Event Report)
0x00 0x3C	CHOICE.length = 60
0x00 0x00	obj-handle = 0 (MDS object)
0xFF 0xFF 0xFF 0xFF	event-time (set to 0xFFFFFFFF if RelativeTime is not supported)
0x0D 0x1C	event-type = MDC_NOTI_CONFIG
0x00 0x32	event-info.length = 50 (start of ConfigReport)
0x40 0x00	config-report-id = 16384 (Dev-Configuration-Id value)
0x00 0x01	config-obj-list.count = 1 Measurement objects will be "announced"
0x00 0x2C	config-obj-list.length = 44
0x00 0x06	obj-class = MDC_MOC_VMO_METRIC_NU
0x00 0x01	obj-handle = 1 (→ 1st object is duration of flow generation)
0x00 0x04	attributes.count = 4
0x00 0x24	attributes.length = 36
0x09 0x2F	attribute-id = MDC_ATTR_ID_TYPE
0x00 0x04	attribute-value.length = 4
0x00 0x80 0x56 0x54	MDC_PART_PHD_DM | MDC_SABTE_TIME_PD_FLOW_GEN_TOTAL
0x0A 0x46	attribute-id = MDC_ATTR_METRIC_SPEC_SMALL
0x00 0x02	attribute-value.length = 2
0xF0 0xC0	intermittent, stored-data, upd-aperiodic, msmt-aperiodic, manager-initiated and agent-initiated measured
0x09 0x96	attribute-id = MDC_ATTR_UNIT_CODE
0x00 0x02	attribute-value.length = 2
0x08 0xA0	MDC_DIM_MIN
0x0A 0x55	attribute-id = MDC_ATTR_ATTRIBUTE_VAL_MAP
0x00 0x0C	attribute-value.length = 12
0x00 0x02	AttrValMap.count = 2
0x00 0x08	AttrValMap.length = 8
0x0A 0x4C 0x00 0x02	MDC_ATTR_NU_VAL_OBS_BASIC | value length = 2
0x0A 0x82 0x00 0x08	MDC_ATTR_TIME_STAMP_BO | value length = 8

E.3.2.3 Remote operation response event report configuration

The manager responds that it can utilize the agent's configuration. The manager does by sending the Confirmed Event Report response with a config-result of accepted-config.

0xE7 0x00	APDU CHOICE Type (PrstApdu)
0x00 0x16	CHOICE.length = 22
0x00 0x14	OCTET STRING.length = 20
0x00 0x02	invoke-id = 0x1235 (mirrored from invocation)
0x02 0x01	CHOICE (Remote Operation Response | Confirmed Event Report)
0x00 0x0E	CHOICE.length = 14
0x00 0x00	obj-handle = 0 (MDS object)
0x00 0x00 0x00 0x00	currentTime = 0
0x0D 0x1C	event-type = MDC_NOTI_CONFIG
0x00 0x04	event-reply-info.length = 4
0x40 0x00	ConfigReportRsp.config-report-id = 0x4000
0x00 0x00	ConfigReportRsp.config-result = accepted-config

E.3.3 Known configuration

E.3.3.1 General

This exchange takes place when the manager returns the AssociateResult code of accepted because the manager had previously received and processed the configuration corresponding to the dev-config-id sent by the agent. In this case, there is no exchange of configuration information, and the manager and agent have moved into the Operating state.

E.3.3.2 Remote operation invoke event report configuration

Since the manager was already aware of the agent's configuration, the Configuring state is skipped, and no event report invocation is generated by the agent.

E.3.3.3 Remote operation response event report configuration

The Configuring state has been skipped. No event report invocation is generated by the agent, so the manager does not generate any response.

E.3.4 Standard configuration

E.3.4.1 General

This exchange takes place when the manager returns the AssociateResult code of accepted because the manager had previously been programmed with the documented standard configuration corresponding to the dev-config-id sent by the agent. In this case, there is no exchange of configuration information, and the manager and agent have moved into the Operating state.

E.3.4.2 Remote operation invoke event report configuration

Since the manager had been programmed with the agent's configuration, the Configuring state is skipped, and no event report invocation is generated by the agent.

E.3.4.3 Remote operation response event report configuration

The Configuring state has been skipped. No event report invocation is generated by the agent, so the manager does not generate any response.

E.4 GET MDS attributes service

E.4.1.1 General

The GET MDS attributes is invoked at any time, when an agent is in Associated state.

E.4.1.2 Get all medical device system attributes request

The manager queries the agent for its MDS Object attributes.

0xE7 0x00	APDU CHOICE Type (PrstApdu)
0x00 0x0E	CHOICE.length = 14
0x00 0x0C	OCTET STRING.length = 12
0x00 0x03	invoke-id = 3 (differentiates this message from any other outstanding, choice is implementation specific)
0x01 0x03	CHOICE (Remote Operation Invoke | Get)
0x00 0x06	CHOICE.length = 6
0x00 0x00	handle = 0 (MDS object)
0x00 0x00	attribute-id-list.count = 0 (all attributes)
0x00 0x00	attribute-id-list.length = 0

E.4.1.3 Get response with all MDS attributes

The SABTE agent responds to the manager with its attributes. Furthermore, some optional fields are communicated as well.

0xE7 0x00	APDU CHOICE Type (PrstApdu)
0x00 0x68	CHOICE.length = 104
0x00 0x66	OCTET STRING.length = 102
0x00 0x03	invoke-id = 3 (mirrored from request)
0x02 0x03	CHOICE (Remote Operation Response | Get)
0x00 0x60	CHOICE.length = 96
0x00 0x00	handle = 0 (MDS object)
0x00 0x06	attribute-list.count = 6
0x00 0x5A	attribute-list.length = 90
0x0A 0x5A	attribute id = MDC_ATTR_SYS_TYPE_SPEC_LIST
0x00 0x08	attribute-value.length = 8
0x00 0x01	TypeVerList count = 1
0x00 0x04	TypeVerList.length = 4

```
0x10 0x19                  type = MDC_DEV_SPEC_PROFILE_SABTE
0x00 0x01                  version = version1 of the specialization
0x09 0x28                  attribute id = MDC_ATTR_ID_MODEL
0x00 0x14                  attribute-value.length = 20
0x00 0x0A 0x54 0x68        string length = 10 | “TheCompany”
0x65 0x43 0x6F 0x6D
0x70 0x61 0x6E 0x79
0x00 0x06 0x53 0x41        string length = 6 | “SABTE\0”
0x42 0x54 0x45 0x00
0x09 0x84                  attribute-id = MDC_ATTR_SYS_ID
0x00 0x0A                  attribute-value.length = 10
0x00 0x08 0x11 0x22 0x33 0x44 0x55 0x66 0x77 0x88  octet string length = 8 | EUI-64
0x0A 0x44                  attribute-id = MDC_ATTR_DEV_CONFIG_ID
0x00 0x02                  attribute-value.length = 2
0x40 0x00                  dev-config-id = 16384 (extended-config-start)
0x09 0x2D                  attribute-id = MDC_ATTR_ID_PROD_SPECN
0x00 0x12                  attribute-value.length = 18
0x00 0x01                              ProductionSpec.count = 1
0x00 0x0E                              ProductionSpec.length = 14
0x00 0x01                              ProductionSpecEntry.spec-type = 1 (serial-number)
0x00 0x00                              ProductionSpecEntry.component-id = 0
0x00 0x08                  string length = 8 | ProductionSpecEntry.prod-spec = “DE124567”
0x44 0x45 0x31 0x32
0x34 0x35 0x36 0x37
0x0A 0x81                  attribute-id = MDC_ATTR_TIME_BO
0x00 0x08                  attribute-value.length = 8
0xC9 0x6B 0x55 0xEC        Base-Offset-Time-Stamp = 2007-02-01T12:05:00.00
0x00 0x00 0x00 0x00        3379254764;0
```

E.5 Data reporting

E.5.1 Confirmed measurement data transmission

The agent sends a spontaneous event report to the manager with measurement observations.

```
0xE7 0x00                  APDU CHOICE Type (PrstApdu)
0x00 0x2A                  CHOICE.length = 42
0x00 0x28                  OCTET STRING.length = 40
0x00 0x04                  invoke-id = 4
0x01 0x01                  CHOICE(Remote Operation Invoke | Confirmed Event Report)
0x00 0x22                  CHOICE.length = 34
0x00 0x00                  obj-handle = 0 (MDS object)
0xFF 0xFF 0xFF 0xFF        event-time = 0xFFFFFFFF
0x0D 0x1D                  event-type = MDC_NOTI_SCAN_REPORT_FIXED
0x00 0x18                  event-info.length = 24
0xF0 0x00                  ScanReportInfoFixed.data-req-id = 0xF000
0x00 0x01                  ScanReportInfoFixed.scan-report-no = 1
0x00 0x01                  ScanReportInfoFixed.obs-scan-fixed.count = 1
0x00 0x0E                  ScanReportInfoFixed.obs-scan-fixed.length = 14
0x00 0x01                  ScanReportInfoFixed.obs-scan-fixed.value[0].obj-handle = 1
0x00 0x0C                  ScanReportInfoFixed.obs-scan-fixed.value[0]. obs-val-data.length = 12
0x00 0x00 0x21 0x48        Simple-Nu-Observed-Value = 8520 (min)
```

0xCA 0x98 0xB9 0x88	Base-Offset-Time-Stamp = 2007-09-17T08:30:00.00
0x00 0x00 0x00 0x00	3399006600;0

E.5.2 Response to confirmed measurement data transmission

The manager confirms receipt of the agent's event report.

0xE7 0x00	APDU CHOICE Type (PrstApdu)
0x00 0x12	CHOICE.length = 18
0x00 0x10	OCTET STRING.length = 16
0x00 0x04	invoke-id = 4 (mirrored from invocation)
0x02 0x01	CHOICE(Remote Operation Response | Confirmed Event Report)
0x00 0x0A	CHOICE.length = 10
0x00 0x00	obj-handle = 0 (MDS object)
0x00 0x00 0x00 0x00	currentTime = 0
0x0D 0x1D	event-type = MDC_NOTI_SCAN_REPORT_FIXED
0x00 0x00	event-reply-info.length = 0

E.6 Disassociation

E.6.1 Association release request

The SABTE agent sends the following message to the manager.

0xE4 0x00	APDU CHOICE Type (RlrqApdu)
0x00 0x02	CHOICE.length = 2
0x00 0x00	reason = normal

E.6.2 Association release response

A manager responds to the agent that it can release association.

0xE5 0x00	APDU CHOICE Type (RlreApdu)
0x00 0x02	CHOICE.length = 2
0x00 0x00	reason = normal

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