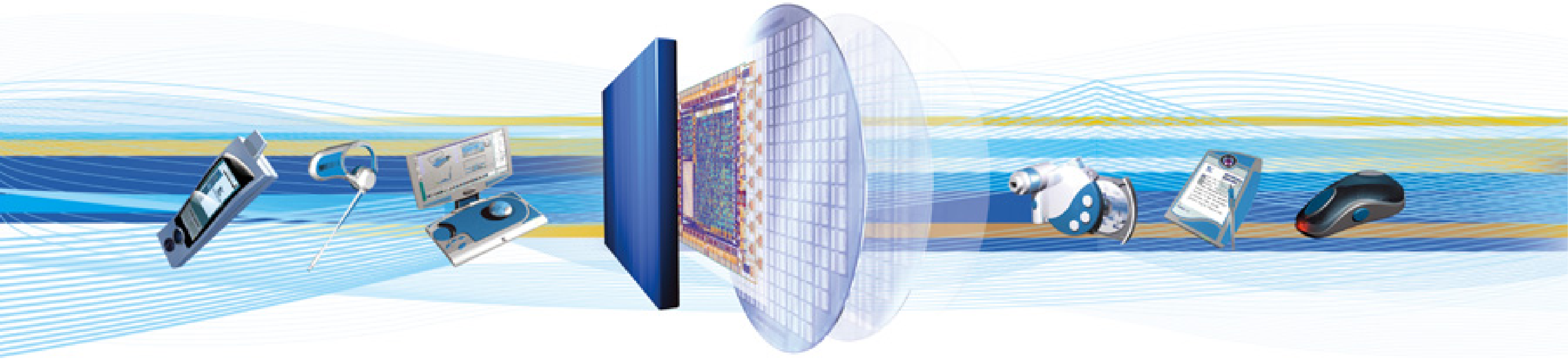
CSR Synergy®

CSR Synergy Bluetooth 18.2.0

PHDC – Personal Health Device Communication - Manager

API Description

November 2011



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Bluetooth®

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1 Introduction

1.1 Introduction and Scope

Individual health device manufacturers have already been using Bluetooth to securely and reliably interconnect their own devices. However, such interconnections have typically included proprietary components, and thus have not provided for full interoperability in terms of discovery of services, data channel management, communication semantics and transmission data formats. To solve the problem of interoperability, the 11073-series of IEEE standards were introduced.

A system ISO/IEEE 11073-20601 Personal Health Data Exchange Protocol (known as 20601) and compatible 11073-104xx device specialization operating over HDP and MCAP allow strong application and functional interoperability between health device Sources (Agents) from one manufacturer and health device Sinks (Managers) from a different manufacturer.

The generality in the 20601 set of standards allows scope to optimize interoperability of devices and clear ambiguity in mechanisms by reducing options in the underlying standard. Continua alliance focuses on these aspects to optimize the interoperability of device and enhance end-user experience. In addition, the Continua health alliance establishes an ecosystem of personal health systems allowing an end-to-end interoperability. The implication is a system wherein personal health devices and transfer measurements to host devices (like a mobile phone or a portable). The stored measurements can later be shared to a server in cloud were data can be collaborated with a medical practitioner or peers.

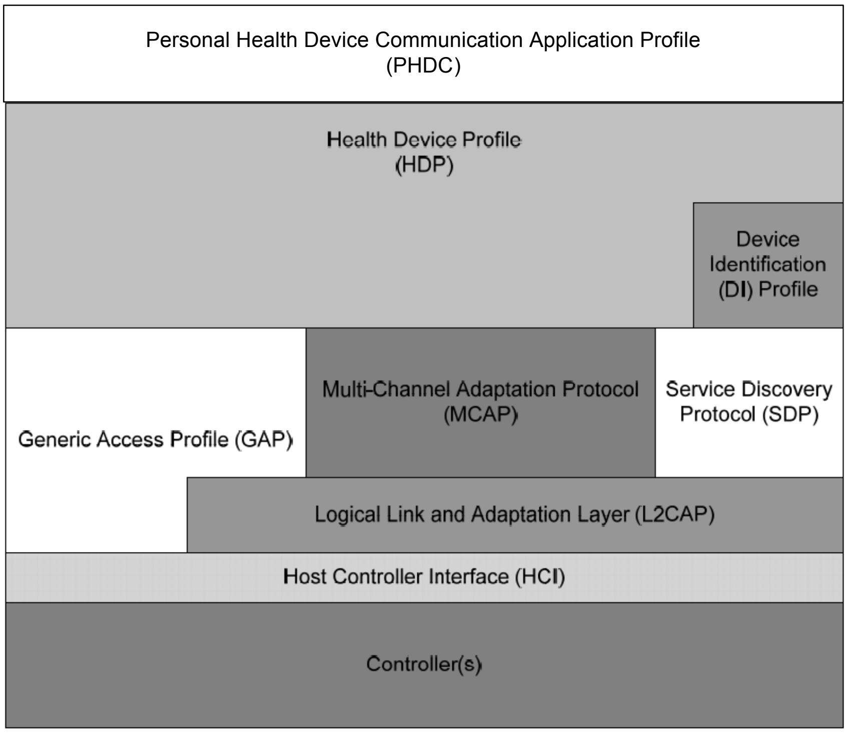

Personal Health Device Communication Application Profile
(PHDC)
Health Device Profile
(HDP)
Device
Identification
(DI) Profile
Generic Access Profile (GAP)
Multi-Channel Adaptation Protocol
(MCAP)
Service Discovery
Protocol (SDP)
Logical Link and Adaptation Layer (L2CAP)
Host Controller Interface (HCI)
Controller(s)

Figure 1: Schematic of Health sub-system

The CSR Synergy PHDC implements both a Manager and an Agent complying to Continua design guidelines.

This API document describes the functionality and message interface provided by CSR Synergy Bluetooth PHDC Manager Module for using the 20601 functionality.

The Manager supports the following devices types:

- Blood Pressure Monitor
- Weighing Scale

1.2 Sequence Overview

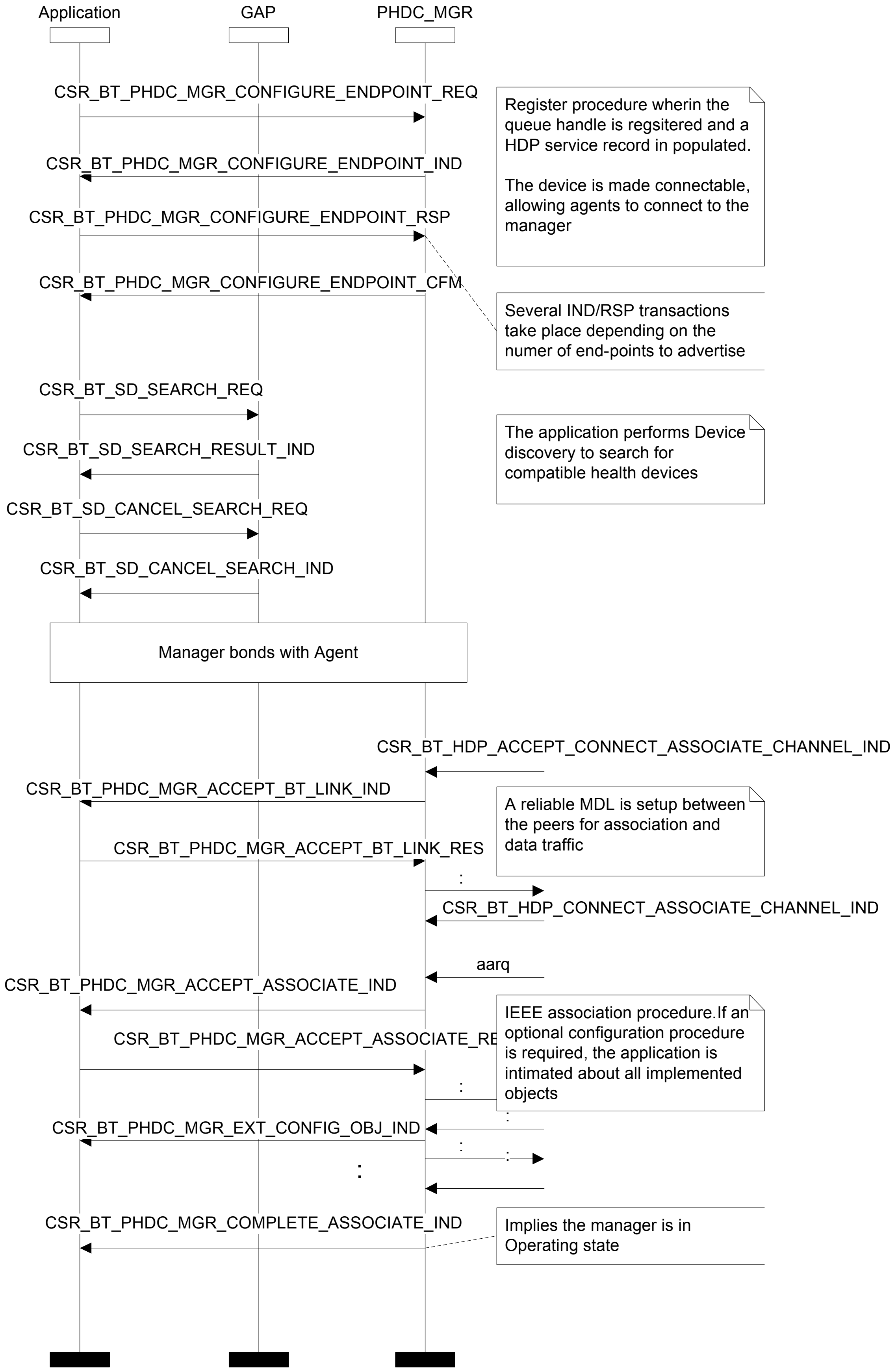
A typical scenario is a blood pressure monitor taking measurements and transfers this information to a hosting device like a mobile phone or a laptop. A sensor like a blood pressure monitor is called an agent and the hosting device like a mobile phone is called a manager.

Before agents can connect to a manager, the manager application advertises a service record in order to allow agents to determine compatibility and support for the device. The manager application will send a CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_REQ to register its queue handle, advertise a HDP service record and make it connectable. It is the onus of the manager to find compatible agents and pair with the agent. The application can use the CSR Synergy GAP API for this purpose and pair with a suitable agent.

Before the agent can transmit measurements to the manager, it is necessary that the agent conveys its capabilities and the format of the measurements to the manager. This is conveyed by initiating the association procedure. It is usually the agent that initiates connection to establish a data channel but it could also be the manager. If the agent initiates the creation of the MCL and MDL, a CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND is received by the manager application. It is the choice of the manager to accept or reject the connection. It will indicate its choice by responding with a CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_RES. Once the reliable MDL is connected, the manager shall receive a CSR_BT_HDP_CONNECT_ASSOCIATE_CHANNEL_IND. Likewise, if the manager application decides to create a reliable link, it shall send a CSR_BT_PHDC_MGR_SETUP_BT_LINK_REQ. The application will receive CSR_BT_PHDC_MGR_SETUP_BT_LINK_CFM as a confirmation that the data channel is connected.

If the manager has previously communicated with this device, or it has been programmed to understand the collection of objects, attributes and data transmission details (e.g. “standard configuration”), then the manager will respond by accepting the association, at which point the agent and manager are considered to be in the Operating state. If the manager is not familiar with enough details of the agent’s implementation, then the manager will accept the association, but will ask that the agent to describe its implementation by means of a configuration process. The objects received during the configuration process are indicated to the application using the CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND. It is recommended that application decode the data so as conclude the syntax of the received measurement and if the measurements are sent in fixed template or a variable format.

If the association and configuration is acceptable, the manager will send a CSR_BT_PHDC_MGR_COMPLETE_ASSOCIATE_IND and move to the operating state. In this state the manager can receive data.


Application
GAP
PHDC_MGR
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_REQ
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_RSP
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_CFM
CSR_BT_SD_SEARCH_REQ
CSR_BT_SD_SEARCH_RESULT_IND
CSR_BT_SD_CANCEL_SEARCH_REQ
CSR_BT_SD_CANCEL_SEARCH_IND
Manager bonds with Agent
CSR_BT_HDP_ACCEPT_CONNECT_ASSOCIATE_CHANNEL_IND
CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND
CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_RES
CSR_BT_HDP_CONNECT_ASSOCIATE_CHANNEL_IND
aarq
CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_IND
CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_RE
CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND
CSR_BT_PHDC_MGR_COMPLETE_ASSOCIATE_IND

Register procedure wherin the queue handle is regsitered and a HDP service record in populated.

The device is made connectable, allowing agents to connect to the manager

Several IND/RSP transactions take place depending on the numer of end-points to advertise

The application performs Device discovery to search for compatible health devices

A reliable MDL is setup between the peers for association and data traffic

IEEE association procedure.If an optional configuration procedure is required, the application is intimated about all implemented objects

Implies the manager is in Operating state

Figure 2: System Overview - 1

The agent shall transfer is measurements in using a scan report. The measurements are indicated to the application using the CSR_BT_PHDC_MGR_BPM_BP_IND or any appropriate message. If it is not able to understand the measurement, it will send the received measurement in a CSR_BT_PHDC_MGR_DS_IND to the application.

When either the agent or the manager terminates an association, it may do so by issuing an association release request. The device on the other end of the link responds with an association release response. At this point, the 20601 layer informs HDP to disconnect the communications link. If the agent initiates the disassociation, the manager application shall send a CSR_BT_DISASSOCIATE_IND after it has responded with an association release response. When the agent disconnects the MDL, the manager shall send a CSR_BT_PHDC_MGR_BT_LINK_REL_IND once the MDL is released. The manager can initiate a disassociation by sending the CSR_BT_DISASSOCIATE_REQ. At the end of the procedure, a CSR_BT_DISASSOCIATE_CFM is sent to the application.

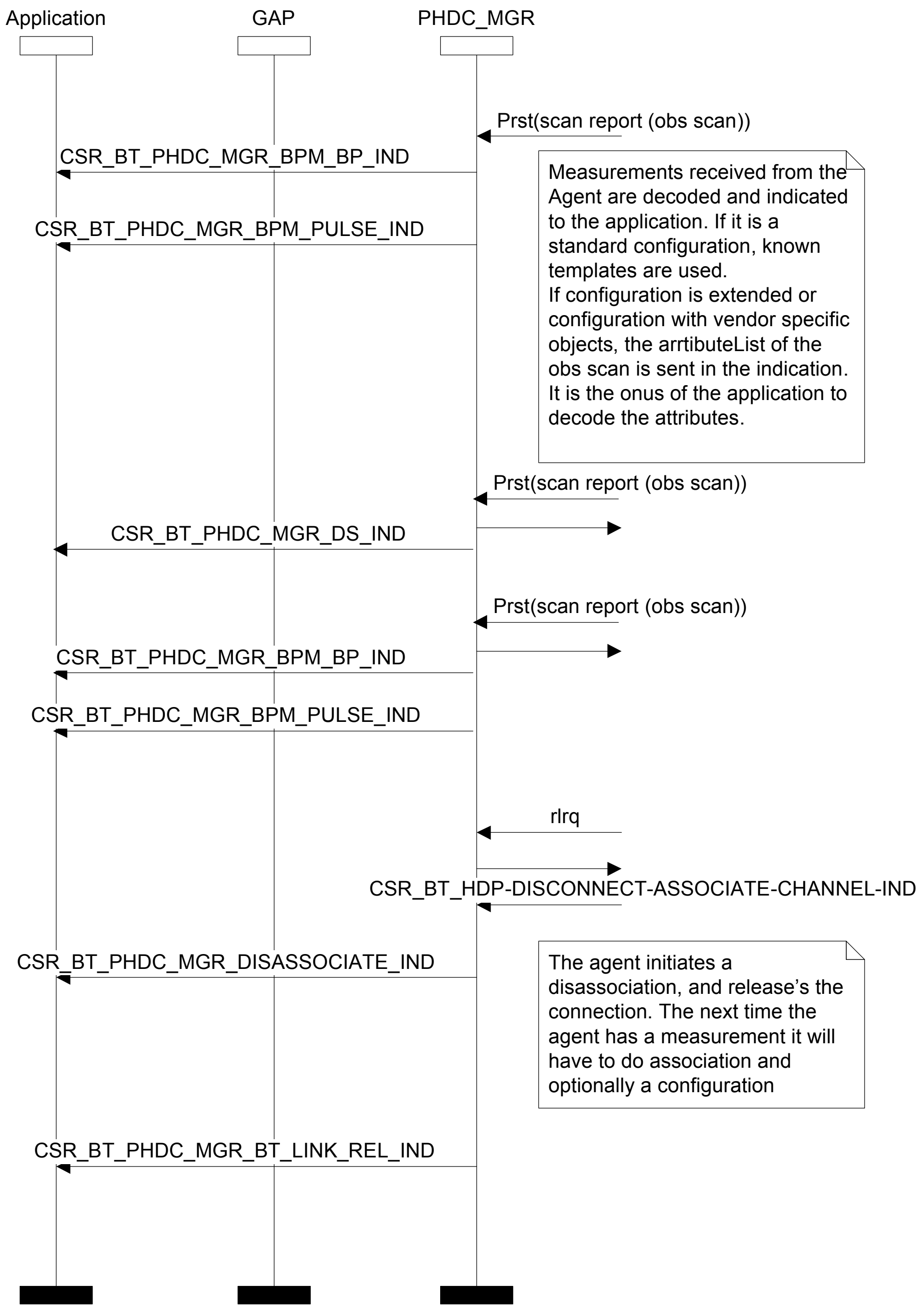

Application
GAP
PHDC_MGR
Prst(scan report (obs scan))
CSR_BT_PHDC_MGR_BPM_BP_IND
CSR_BT_PHDC_MGR_BPM_PULSE_IND
Measurements received from the Agent are decoded and indicated to the application. If it is a standard configuration, known templates are used. If configuration is extended or configuration with vendor specific objects, the arrtibuteList of the obs scan is sent in the indication. It is the onus of the application to decode the attributes.
Prst(scan report (obs scan))
CSR_BT_PHDC_MGR_DS_IND
Prst(scan report (obs scan))
CSR_BT_PHDC_MGR_BPM_BP_IND
CSR_BT_PHDC_MGR_BPM_PULSE_IND
rlrq
CSR_BT_HDP-DISCONNECT-ASSOCIATE-CHANNEL-IND
CSR_BT_PHDC_MGR_DISASSOCIATE_IND
The agent initiates a disassociation, and release's the connection. The next time the agent has a measurement it will have to do association and optionally a configuration
CSR_BT_PHDC_MGR_BT_LINK_REL_IND

Figure 3: System Overview - 2

2 Interface Description

In this section, a series of MSCs are shown to explain the usage of the PHDC application profile. The primitives and the functions available to the application are also described in the subsections of this chapter.

2.1 Configure

As part of service initialisation, the application has to register its queue handle with the PHDC Manager Service. It also requires advertising the device modalities and other relevant parameters that the hosting device shall support by defining a HDP service record. A manager device is also required to be connectable so that agents can connect to the device when they have measurements to transfer. This is done by calling the CsrBtPhdcMgrConfigureEndPointReqSend() function, which register its HDP service record and make the device connectable.

The request triggers a series of indication/response exchange between the manager and the application. This allows the application to define characteristics of each end-point it wants to advertise.

The manager shall indicate the endpoint in the CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND for which it requires information. The application should respond with a CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_RSP by calling the CsrBtPhdcMgrConfgiureEndPointRspSend() for every indication.

The application can use the response to define the various characteristics for the requested end-point. The application can also optionally decide to multiple certain modalities on a single end-point by setting the ‘reuseMdepId‘ parameter.

The application will receive as many indications as the number of end-points it has requested (refer ‘numOfMdep’ parameter in CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_REQ).

When the service record is registered and the device ready to accept connection a CSR_BT_PHDC_MGR_CONFIGURE_ ENDPOINT_CFM primitive is sent to the application.

#	Type	Argument	Description
1	CsrSchedQid	appHandle	Queue handle of the application
2	dm_security_level_t	secLevel	Security level of the device being activated
3	CsrCharString*	serviceName	The ServiceName attribute is a string containing the name of the service represented by a service record.
4	CsrCharString*	serviceDescription	String containing a brief description of the service. Less than 200 characters.
5	CsrCharString*	providerName	String containing the name of the person or organization providing the service
6	CsrTime	sniffTimeOut	Time (in ms) the MCL must be idle before requesting sniff mode for the connection. If set to 0x0000, MCAP will never request sniff mode for the connection.
7	CsrUint8	numOfMdep	Number of end points to advertise in the service record

#	Type	Argument	Description
8	CsrUint8	supportedProcedures	This is a one byte bit-mask that indicates the MCAP procedures that are to be supported by HDP service - CSR_BT_HDP_SUPPORT_RECONNECT_INITIATION – Supports Reconnect Initiation 3 - CSR_BT_HDP_SUPPORT_RECONNECT_ACCEPTANCE - Supports Reconnect Acceptance 4 - CSR_BT_HDP_SUPPORT_CSP – Supports Clock Synchronization Protocol - CSR_BT_HDP_SUPPORT_SYNC_MASTER_ROLE – Supports Sync-Master Role
9	CsrUint8	numOfActiveDeviceConnections	Defines the number of simultaneous Agents that can connect to the Manager.

Table 1: Arguments for CsrBtPhdcMgrConfigureEndpointReqSend

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND
3	CsrBtMdepId	mdepId	It identifies one or more logical functions advertised in the service record. It also allows HDP to multiplex communication meant for different logical functions using the services of the MCAP layer. The identifier is auto-generated by HDP service layer.

Table 2: Parameters in CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND

#	Type	Argument	Description
1	CsrBtMdepId	mdepId	Set to mdepId received in CsrBtPhdcMgrConfigureEndPointInd
2	CsrBtMdepDataType	datatype	Identifies the Device Data Specialization advertised on this end point CSR_BT_HDP_DEVICE_TYPE_OXIM CSR_BT_HDP_DEVICE_TYPE_BP CSR_BT_HDP_DEVICE_TYPE_TEMP CSR_BT_HDP_DEVICE_TYPE_SCALE CSR_BT_HDP_DEVICE_TYPE_GLUCOSE CSR_BT_HDP_DEVICE_TYPE_HF_CARDIO CSR_BT_HDP_DEVICE_TYPE_HF_STRENGTH CSR_BT_HDP_DEVICE_TYPE_ACTIVITY_HUB CSR_BT_HDP_DEVICE_TYPE_AI_MED_MINDER
3	CsrBtMdepRole	role	Indicates if this end-point is a Source or a Sink CSR_BT_HDP_MDEP_SOURCE CSR_BT_HDP_MDEP_SINK
4	CsrUtf8String*	description	Short description of the end-point
5	CsrBool	reuseMdepId	Set to TRUE or FALSE. - TRUE implies that this device modality is to be multiplexed on ‘mdepId.’ - FALSE implies that this device modality should be defined on a separate end-point.

Table 3: Arguments for CsrBtPhdcMgrConfigureEndPointResSend

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_CONFIGURE_ ENDPOINT_CFM
2	CsrBtResultCode	resultCode	The result code of the operation. Possible values depends on the value of resultSupplier. If e.g. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
3	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 4: Parameters in a CSR_BT_PHDC_MGR_CONFIGURE_ ENDPOINT_CFM primitive

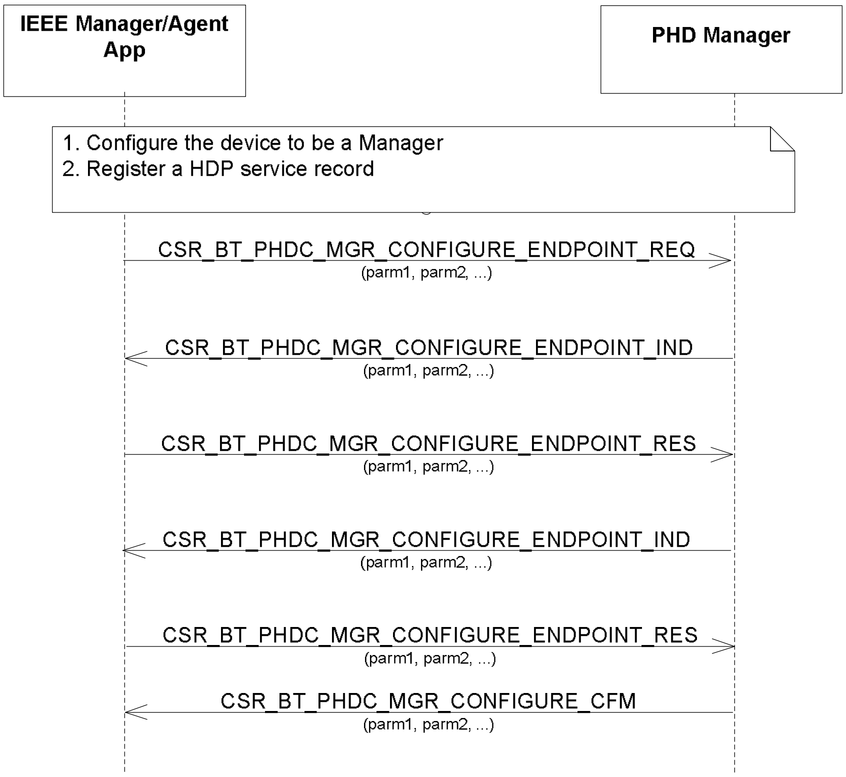

IEEE Manager/Agent App
PHD Manager
1. Configure the device to be a Manager
2. Register a HDP service record
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_REQ
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_RES
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_IND
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_CONFIGURE_ENDPOINT_RES
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_CONFIGURE_CFM
(parm1, parm2, ...)

Figure 4: Configuration Sequence

2.2 Service Search

A service search can be initiated for a particular device (‘deviceAddr’) by the Manager application by calling the CsrBtPhdcMgrGetDeviceCapabReqSend(). This API allows the application to search for agents implementing a particular device specialisation.

If there are device modalities in the remote device matching the search criteria (‘mdepDataTypeMask’), a CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_IND primitive is sent to the application during the operation.

An agent can advertise more than one service record. If the search criteria is met by these service records, a CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_IND is sent to application for every service record advertising the device modalities the search criteria in the mask. The application can use the psmIdentifier to distinguish the different service records on the remote device.

When the service search operation is complete, a CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_CFM prim is sent to the application.

#	Type	Argument	Description
1	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device.
2	CsrUint8	mdepDataTypeMask	Bit Mask of the Device Specializations CSR_BT_DEVICE_BLOOD_PRESSURE CSR_BT_DEVICE_WEIGHT_SCALE CSR_BT_DEVICE_PEDOMETER CSR_BT_DEVICE_BODY_COMPOSITION CSR_BT_DEVICE_BODY_TEMP

Table 5: Arguments for CsrBtPhdcMgrGetDeviceCapabReqSend

1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_IND
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device.
3	CsrUint32	psmIdentifier	The psmIdentifer identifies the PSM's of the remote device. The high 31~16 bits contain the Control PSM and the 15~0 bits contain the Data PSM. It is necessary that these values come from a recent search of the device capabilities as the agent may change its service record.
4	CsrCharString*	providerName	The ProviderName is a string containing the name of the person or organization providing the service.
5	CsrCharString*	serviceName	The ServiceName is a string containing the name of the service represented by a service record.
6	CsrUint8	supportedFeatureListLength	Number of supported features in the supportedFeatureList
7	CsrBtHdpMdep	supportedFeatureList	A list of MDEP endpoint ID and its associated features like MDEP Datatype, Role and Description.

Table 6: Parameters in a CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_CFM
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the peer device.
3	CsrBtResultCode	resultCode	The result code of the operation. Possible values depends on the value of resultSupplier. If e.g. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
4	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 7: Parameters in a CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_CFM primitive

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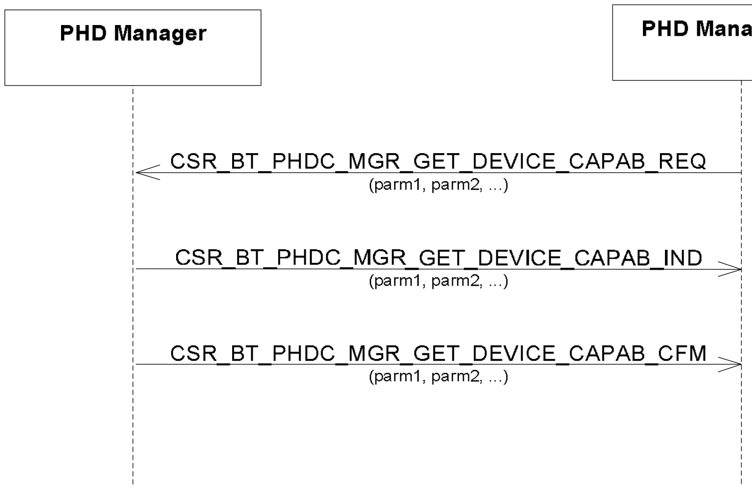
PHD Manager
PHD Manager App
CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_REQ
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_IND
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_GET_DEVICE_CAPAB_CFM
(parm1, parm2, ...)

Figure 5: Device Search Sequence

2.3 Association

It is the onus of the Manger complying to the Continua Design Guidelines to initiate pairing with the agent device. The approach allows the Agent to be aware of a device hosting a Continua Manager.

Before data measurements can be transferred between a Manager and an Agent, the capabilities and the types of measurements that the Agent is capable of , compatibility of versions between the Agent and the Manager have to be agreed upon by the association and configuration procedures.

For the purpose of exchange of association and measurement data, a data channel has to be setup between the Agent and the Manager. The connection setup can be initiated by either end.

If the agent initiates the creation of an MDL, it is indicated to the application by sending the CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND primitive. The application can accept or reject the connection by calling the CsrBtPhdcMgrAcceptBtLinkResSend() function.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device.

Table 8: Parameters in CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND primitive

#	Type	Argument	Description
1	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device
2	CsrtBool	accept	TRUE – Accept the connection FALSE – Reject the connection
3	CsrUint16	maxPacketLength	Maximum transmission unit supported by the device for the connection

Table 9: Arguments for CsrBtPhdcMgrAcceptBtLinkResSend

After the reliable channel is established, the peer device shall intiate the association procedure. The manager shall send a CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_IND signal to the application indicating the 'devConfigId' the device configuration to the application. Either the application can accept or reject the association depending on if it supports the configuration or the system Id of the agent is compatible. The application will respond by calling the CsrBtPhdcMgrAcceptAssociateResSend() function.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_IND
2	CsrUint16	devConfigId	Device configuration Id of remote device
3	CsrUint8	systemId[8]	System Id of remote device
4	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device

Table 10: Parameters in CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_IND primitive

#	Type	Argument	Description
1	CsrUint32	psmIdentifier	The Instance Id is a unique Id generated for each connection. The higher 16 bits contain the Control PSM of the peer device and the lower 16 bits the Data PSM.
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remoter device.
3	CsrUint8	systemId[8]	System Id of the local device
4	CsrtBool	accept	Set to TRUE or FALSE.

Table 11: Arguments for CsrBtPhdcMgrAcceptAssociateResSend

If an extended configuration is accepted, the Manager shall send CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND for every object implemented in the Agent. The data payload is a MDER encoded byte stream of ConfigObject. (Refer Appendix A). It is recommended that the application decodes the data array according to the MDC_ATTR_ATTRIBUTE_VAL_MAP received for the agent . This is important to decipher measurements for vendor specific objects and objects, which are not standard.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND
2	CsrUint16	devConfigId	Device configuration Id of remote device
3	CsrBtDeviceAddr	deviceAddr	Bluetooth address of remote device
4	CsrUint16	objHandle	Object Handle of the defined Object in Agent
5	CsrUint16	opCode	Indicates if this is an indication indicating a new Object or updating an existing Object. CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_OPCODE_NEW CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_OPCODE_UPDATE
6	CsrUint16	dataLength	Length of data
7	CsrUint8	*data	Pointer to payload data of received attributes

Table 12: Parameters in CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND primitive

The completion of association (and optional configuration procedure) is indicated to the application by sending the CSR_BT_PHDC_MGR_ASSOCIATE_IND signal.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_ASSOCIATE_COMPLETE_IND
2	CsrUint32	psmIdentifier	The Instance Id is a unique Id generated for each connection. The higher 16 bits contain the Control PSM of the peer device and the lower 16 bits the Data PSM.
3	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device
4	CsrBtMdepId	mdepId	Mdepid set to mdepId received in CsrBtPhdcMgrConfigureEndPointInd

#	Type	Argument	Description
5	CsrUint16	mdepDataType	This attribute is a 16-bit value, with the value taken from the Bluetooth Assigned Numbers [3] to identify the Device Data Specialization code.
6	CsrUint16	maxPacketLength	Maximum transmission unit supported by the device for the connection.
7	CsrUint32	dataChannelId	Data Channel id set during association procedure
8	CsrBtResultCode	resultCode	The result code of the operation. Possible values depend on the value of resultSupplier. If eg. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
9	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 13: Parameters in CSR_BT_PHDC_MGR_ASSOCIATE_COMPLETE_IND primitive

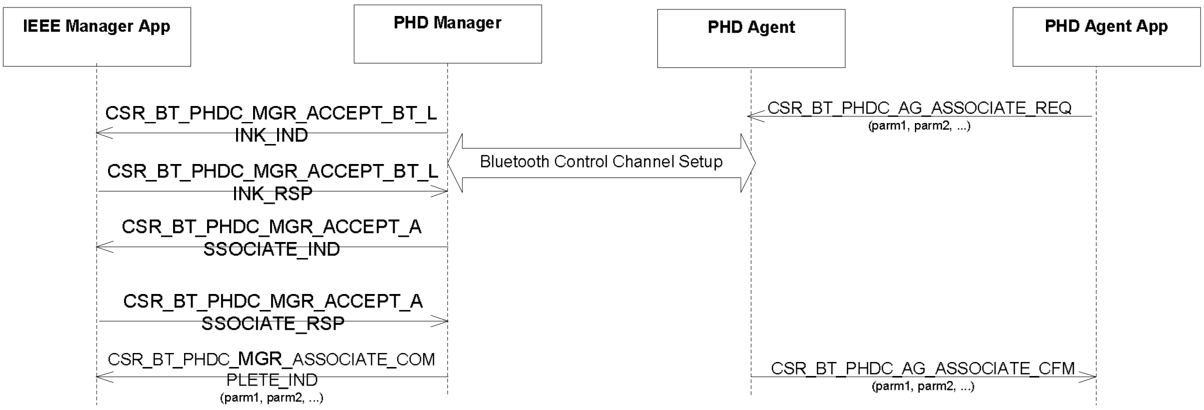
IEEE Manager App
PHD Manager
PHD Agent
PHD Agent App
CSR_BT_PHDC_AG_ASSOCIATE_REQ
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_IND
Bluetooth Control Channel Setup
CSR_BT_PHDC_MGR_ACCEPT_BT_LINK_RSP
CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_IND
CSR_BT_PHDC_MGR_ACCEPT_ASSOCIATE_RSP
CSR_BT_PHDC_MGR_ASSOCIATE_COMPLETE_IND
(parm1, parm2, ...)
CSR_BT_PHDC_AG_ASSOCIATE_CFM
(parm1, parm2, ...)

Figure 6: Association Sequence

The CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND could be received in the Operating state. This would happen when the Manager gets a notification that the Agent has changed a value of an existing attribute or added a new attribute to the object.

2.4 Association – Initiated by Manager

Certain use cases demand that the Manager connect to the Agent instead of waiting for a Bluetooth connection setup from the Agent device. In these scenario's, the Manager can initiate a Bluetooth connection by setting-up a MDL between the peer end-points. The Agent may choose to accept the setup and proceed with the 20601 Association procedure followed by an optional Configuration phase.

The Manager application shall initiate the MDL connection by sending the CSR_BT_PHDC_MGR_SETUP_BT_LINK_REQ. The peer end may choose to accept or reject the connection setup. In either case, a CSR_BT_PHDC_MGR_SETUP_BT_LINK_CFM would indicate the result of the operation.

After the lower layers agree on a configuration and the data channel is connected, the Manager application shall receive a CSR_BT_PHDC_MGR_SETUP_BT_LINK_CFM. A success would mean that the Manager is waiting for an association request from the Agent. A timer shall monitor for inactivity on the link and trigger disconnect of the link on timeout.

#	Type	Argument	Description
1	CsrUint32	psmIdentifier	The psmIdentifer identifies the PSM's of the remote device. The high 31~16 bits contain the Control PSM and the 15~0 bits contain the Data PSM. It is necessary that these values come from a recent search of the device capabilities as the agent may change its service record.
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device
3	CsrBtMdepId	mdepId	The endpoint of the remote device to which the manager application connection setup is required. Mdepid set to mdepId received in CsrBtPhdcMgrConfigureEndPointInd
4	CsrUint16	mdepDataType	This attribute is a 16-bit value, with the value taken from the Bluetooth Assigned Numbers [3] to identify the Device Data Specialization code.
5	CsrUint16	maxPacketLength	Maximum length of Application protocol data unit supported by the device for the connection.

Table 14: Arguments for CsrBtPhdcMgrSetupBtLinkReqSend

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_ASSOCIATE_CFM
2	CsrUint32	psmIdentifier	The Instance Id is a unique Id generated for each connection. The higher 16 bits contain the Control PSM of the peer device and the lower 16 bits the Data PSM.
3	CsrBtDeviceAddr	deviceAddr	Bluetooth address of the remote device
4	CsrBtMdepId	mdepId	Mdepid set to mdepId received in CsrBtPhdcMgrConfigureEndPointInd
5	CsrUint16	maxPacketLength	Maximum transmission unit supported by the device for the connection.
6	CsrUint32	dataChannelId	Data Channel id set during association procedure
7	CsrBtResultCode	resultCode	The result code of the operation. Possible values depends on the value of resultSupplier. If e.g. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
8	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 15: Parameters in CSR_BT_PHDC_MGR_SETUP_BT_LINK_CFM primitive

2.5 Disassociation

The Manager application triggers an IEEE 11073-20601 disassociation procedure by calling CsrBtPhdcMgrDisassoicateReqSend function. After the disassociation procedure complete, MDL is deleted and the data channel is disconnected. The completion of the procedure is indicated the by the CSR_BT_PHDC_MGR_DISASSOCIATE_CFM signal.

#	Type	Argument	Description
1	CsrUint32	dataChannelId	Data Channel id set during association procedure

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#	Type	Argument	Description
2	CsrUint8	rlrqReason	Reason for disassociation - Normal - no-more-configurations - configuration-changed

Table 16: Arguments for CsrBtPhdcMgrDisassociateReqSend function

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_DISASSOCIATE_CFM
	CsrUint32	dataChannelId	Data Channel id set during association procedure
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of remote device
3	CsrBtResultCode	resultCode	The result code of the operation. Possible values depends on the value of resultSupplier. If e.g. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
4	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 17: Parameters in a CSR_BT_PHDC_MGR_DISASSOCIATE_CFM primitive

If the peer device initiates the disassociation procedure, the CSR_BT_PHDC_MGR_DISASSOCIATE_IND signal is sent to the application. The signal indicates that disassociation procedure is completed.

This signal is also received when an IEEE 110973-20601 abrt is received from the peer device or a message is received in an inappropriate state causing the FSM to move to Unassociated State. In this case, it is sent by the Manager without waiting for the data channel to be disconnected. It is recommended that the Manager application waits for a timeout period (on receiving CSR_BT_PHDC_MGR_BT_LINK_REL_IND) before initiating a connection to the remote device.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_DISASSOCIATE_IND
	CsrUint32	dataChannelId	Data Channel id set during association procedure
2	CsrBtDeviceAddr	deviceAddr	Bluetooth address of remote device
3	CsrBtResultCode	resultCode	The result code of the operation. Possible values depends on the value of resultSupplier. If eg. the resultSupplier == CSR_BT_SUPPLIER_CM then the possible result codes can be found in csr_bt_cm_prim.h. All values which are currently not specified in the respective prim.h file are regarded as reserved and the application should consider them as errors.
4	CsrBtSupplier	resultSupplier	This parameter specifies the supplier of the result given in resultCode. Possible values can be found in csr_bt_result.h

Table 18: Parameters in a CSR_BT_PHDC_MGR_DISASSOCIATE_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_BT_LINK_REL_IND
2	CsrUint32	dataChannelId	Data Channel id set during association procedure

Table 19: Parameters in a CSR_BT_PHDC_MGR_BT_LINK_REL_IND

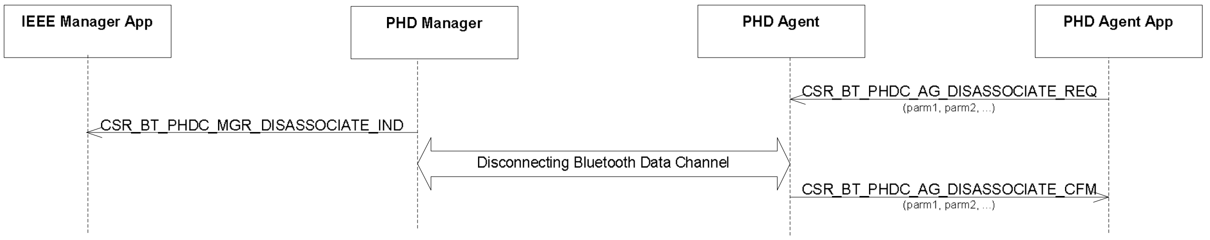

IEEE Manager App
PHD Manager
PHD Agent
PHD Agent App
CSR_BT_PHDC_AG_DISASSOCIATE_REQ
(parm1, parm2, ...)
CSR_BT_PHDC_MGR_DISASSOCIATE_IND
Disconnecting Bluetooth Data Channel
CSR_BT_PHDC_AG_DISASSOCIATE_CFM
(parm1, parm2, ...)

Figure 7: Disassociation Sequence

If the peer device initiates the disassociation procedure, a CSR_BT_PHDC_MGR_BT_LINK_REL_IND is sent by the Manger to the application to indicate this event. This signal is also sent when an Abort Message is received and the MDL is deleted.

2.6 Receiving Measurements

Measurements are received as event reports. Each event report can have several observation scans. Each observation scan is decoded and based on device specialization and the configuration, one of the below signals is sent to the application.

CSR_BT_PHDC_MGR_BPM_BP_IND
CSR_BT_PHDC_MGR_BPM_PULSE_IND
CSR_BT_PHDC_MGR_WS_WEIGHT_IND
CSR_BT_PHDC_MGR_WS_HEIGHT_IND
CSR_BT_PHDC_MGR_WS_BMI_IND
CSR_BT_PHDC_MGR_DS_DATA_IND

If the manager has accepted a standard configuration, the received the measurement is decoded and sent in one of the templates.

However, if the manager is unable to decode the data (usually for an extended configuration or a configuration with vendor specific objects), the observation scan is sent in a CSR_BT_PHDC_MGR_DS_DATA_IND to the application. It is up to the application to decode vendor specific objects and variations in extended configurations. It is recommended that the application decodes the data received in a CSR_BT_PHDC_MGR_EXT_CONFIG_OBJ_IND and decipher the attribute MDC_ATTR_ATTRIBUTE_VAL_MAP attribute. If this attribute exists, the agent is using the 20601 fixed format else it reporting the measurements in the variable format.

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_BPM_PULSE_IND
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	personId	If multiple persons supported by the agent this ID specifies which it is, otherwise CSR_BT_PHDC_MGR_PERSON_ID_NA
4	CsrUint16	unitCode	Measurement Unit code
5	CsrBtPhdcMgrAbsoluteTime	time	Time of measurement
6	CsrUint16	pulse	Pulse value

Table 20: Parameters in a CSR_BT_PHDC_MGR_BPM_PULSE_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_BPM_BP_IND

#	Type	Argument	Description
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	personId	If multiple persons supported by the agent this ID specifies which it is, otherwise `CSR_BT_PHDC_MGR_PERSON_ID_NA`
4	CsrUint16	unitCode	Measurement Unit code
5	CsrBtPhdcMgrAbsoluteTime	time	Time of measurement
6	CsrUint16	systolicPressure	Systolic Pressure Measurement value
7	CsrUint16	diastolicPressure	Diastolic Pressure Measurement value
8	CsrUint16	meanArterialPressure	Mean Arterial Pressure Measurement value

Table 21: Parameters in a CSR_BT_PHDC_MGR_BPM_BP_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_WS_WEIGHT_IND
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	personId	If multiple persons supported by the agent this ID specifies which it is, otherwise `CSR_BT_PHDC_MGR_PERSON_ID_NA`
4	CsrUint16	unitCode	Measurement Unit code
5	CsrBtPhdcMgrAbsoluteTime	time	Time of measurement
6	CsrUint16	weight	Weight Measurement value

Table 22: Parameters in a CSR_BT_PHDC_MGR_WS_WEIGHT_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_WS_HEIGHT_IND
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	personId	If multiple persons supported by the agent this ID specifies which it is, otherwise `CSR_BT_PHDC_MGR_PERSON_ID_NA`
4	CsrUint16	unitCode	Measurement Unit code
5	CsrBtPhdcMgrAbsoluteTime	time	Time of measurement
6	CsrUint16	height	Height Measurement value

Table 23: Parameters in a CSR_BT_PHDC_MGR_WS_HEIGHT_IND primitive

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_WS_BMI_IND
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	personId	If multiple persons supported by the agent this ID specifies which it is, otherwise `CSR_BT_PHDC_MGR_PERSON_ID_NA`
4	CsrUint16	unitCode	Measurement Unit code
5	CsrBtPhdcMgrAbsoluteTime	time	Time of measurement

#	Type	Argument	Description
6	CsrUint16	bmi	BMI Measurement value

Table 24: Parameters in a CSR_BT_PHDC_MGR_WS_BMI_IND primitive

#	Type	Argument	Description
1	CsrUint8	century	
2	CsrUint8	year	
3	CsrUint8	month	
4	CsrUint8	day	
5	CsrUint8	hour	
6	CsrUint8	minute	
7	CsrUint8	second	
8	CsrUint8	secondFractions	

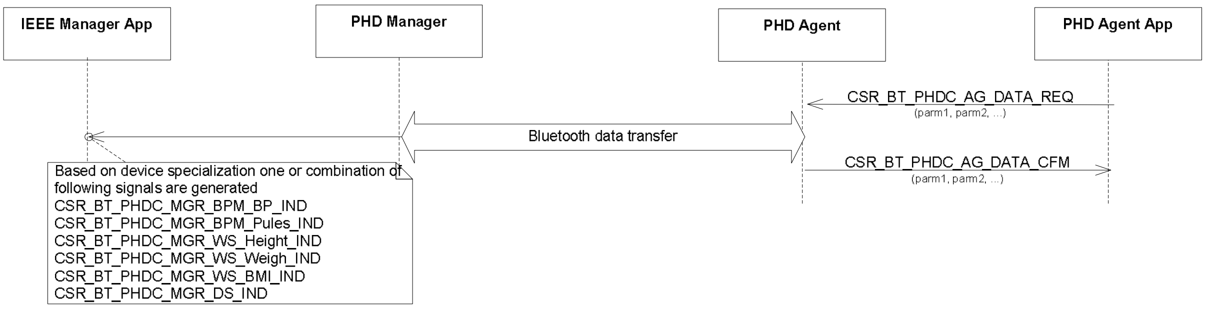
Table 25: Members of structure CsrBtPhdcMgrAbsoluteTime

CSR_BT_PHDC_MGR_DS_DATA_IND is sent for

- Vendor specific data
- Extended configuration objects which are not part of standard configuration

#	Type	Argument	Description
1	CsrBtPhdcMgrPrim	type	Signal identity – always set to CSR_BT_PHDC_MGR_DS_DATA_IND
2	CsrUint32	dataChannelId	A 32 bit Id that identifies the channel on which the data is received
3	CsrUint16	objectHandle	Object Handle
4	CsrUint16	personId	Number of data nodes
5	CsrUint16	scanReportType	Report type
6	CsrUint16	dataLength	Length of data
7	CsrUint8	*data	Pointer to payload data

Table 26: Parameters in a CSR_BT_PHDC_MGR_DS_DATA_IND primitive



Based on device specialization one or combination of
following signals are generated
CSR_BT_PHDC_MGR_BPM_BP_IND
CSR_BT_PHDC_MGR_BPM_Pules_IND
CSR_BT_PHDC_MGR_WS_Height_IND
CSR_BT_PHDC_MGR_WS_Weigh_IND
CSR_BT_PHDC_MGR_WS_BMI_IND
CSR_BT_PHDC_MGR_DS_IND

Figure 8 : Data send Sequence

3 Document References

Document	Reference
Personal Health Device Communication – Application Profile, ISO/IEEE P11073 - 20601	[1]

Terms and Definitions

BlueCore®	Group term for CSR's range of Bluetooth wireless technology chips
Bluetooth®	Set of technologies providing audio and data transfer over short-range radio connections
CSR	Cambridge Silicon Radio
PHDC	Personal Health Device Communication
MDS	Medical Device System

Document History

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