RW BLE Glucose Profile (GLP) Interface Specification

Interface Specification

RW-BLE-PRF-GLP-IS

Version 8.00

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Revision History

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1.0	2014-02-21	First version	FBE
7.00	2014-06-30	Updated for BLE 4.1	FBE
7.01	2014-11-27	API Update -> renaming	FBE
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Abbreviations

Abbreviation	Original Terminology
API	Application Programming Interface
BLE	Bluetooth Low Energy
DIS	Device Information Service
GLPC	Glucose Profile Collector
GLPS	Glucose Profile Sensor
GLP	Glucose Profile
GLS	Glucose Service
RACP	Record Access Control Point
GAP	Generic Access Profile
GATT	Generic Attribute Profile
RW	RivieraWaves

1   Overview

1.1   Document Overview

This document describes the non-standard interface of the RW BLE Glucose Profile implementation. Along this document, the interface messages will be referred to as API messages for the profile block(s).

Their description will include their utility and reason for implementation for a better understanding of the user and the developer that may one day need to interface them from a higher application.

1.2   Protocol Overview

The Bluetooth Low Energy Glucose profile enables the user to manage measurements from a Glucose sensor device and also configure it for different use cases. Within the profile, two roles can be supported: **Collector** and **Sensor**. The Collector must support the GAP Central Role and the Sensor, the GAP Peripheral role. The profile requires a connection to be established between the two devices for its functionality.

The functionality of a profile requires the presence of certain services and attributes on one of the two devices, which the other device can manipulate. In this case, the Glucose device must have one instance of the Glucose Service(GLS) and one instance of Device Information Service(DIS) in its attribute database. The Glucose Profile Collector (GLPC) will discover these services and their characteristics, and it may then configure them to cause the Glucose Profile Sensor (GLPS) device to take measurements and notify them to the Collector.

The various documents edited by the Bluetooth SIG Medical Working group present different use cases for this profile, their GATT, GAP and security, mandatory and optional requirements. The GLP profile and GLS, DIS services specifications have been adopted by the Bluetooth SIG on April 3rd 2012 (**[1], [2], [3]).** Their related Test Specifications have been released at the same time and are referenced **[4], [5], [6]**.

The profile is implemented in the RW-BLE software stack as two tasks, one for each role. Each task has an API decided after the study of the profile specifications and test specifications, and it is considered to be minimalistic and designed for a future application which would combine the profile functionality with the device connectivity and security procedures.

1.3   Firmware Implementation Overview

Basically, if a device needs only be Glucose Profile Sensor, the firmware should be compiled with this role only, and inversely for the Collector role. Glucose database is created dynamically in peripheral role.

The Applications which will control the roles on end-products are responsible with creating the connection between the devices, using suggested advertising intervals and data, connection intervals, security levels, etc. The Profile implementation allows modulating the behavior depending on the final needs. Profile role enabling should be immediate after connection creation in order to allow correct profile behavior with the peer device.

2   Glucose Profile Sensor

This role is meant to be activated on the device that acts as Glucose sensor and sends measurement values to the Collector. It implies it is a GAP Peripheral. The FW task for this role will act following the configuration set by the Collector in the GLS characteristics. Please refer to "glps_task.h" for implementation of this API.

This task only has two states, IDLE and CONNECTED.
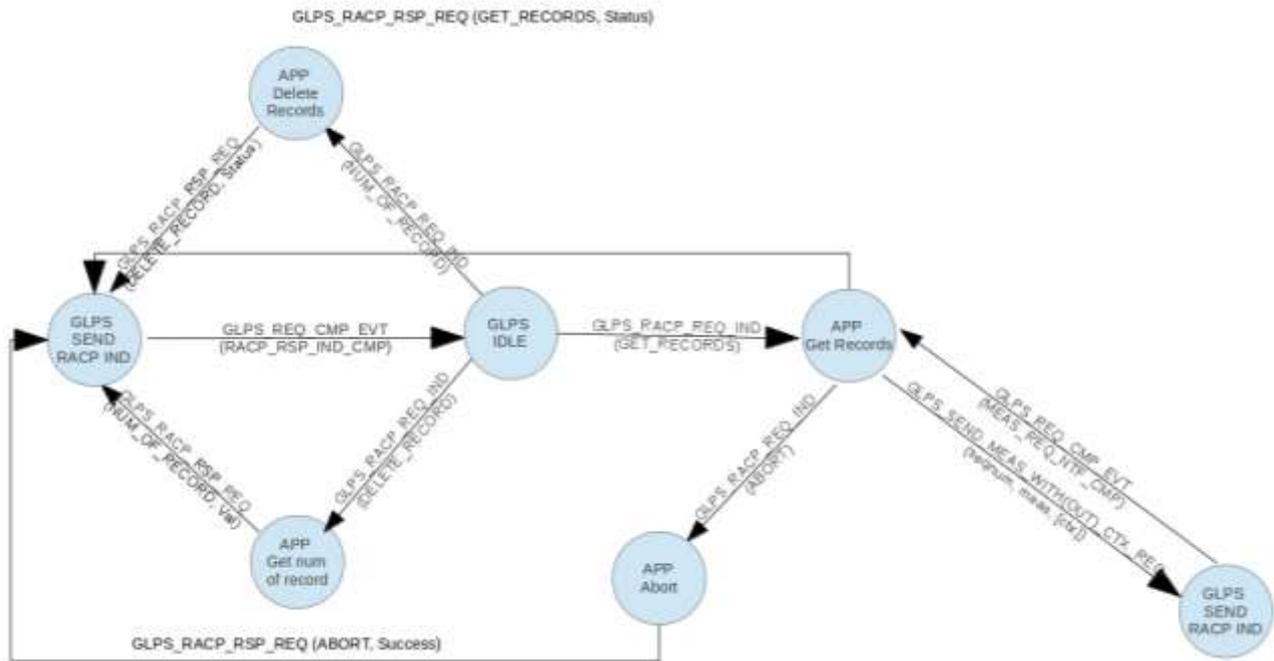
Glucose Profile Sensor Record Access Control Point Operations State Machine

1.1   Initialization / Database Creation

During the initialization phase of the device, to use the Glucose Service task, the GLPS task has to be allocated and corresponding attribute database initialized, using GAPM API. Application has to send GAPM_PROFILE_TASK_ADD_CMD [8] with specific device required security level and following parameters.

Parameters:

Type	Parameters	Description
uint16_t	features	Glucose sensor features (see Table 13: Glucose Measurement Context Flags (bit field))
uint8_t	meas_ctx_supported	Flag used to add or not measurement context in database.

Please note that the Glucose profile requires the presence of three DIS characteristic : *Manufacturer Name String, Model Number String and System Identifier*. It is application's responsibility to add an instance of the DIS into the database by using the DISS_CREATE_DB_REQ API message (please see the RW BLE Device Information Service Interface Specification document [10]).

2.1   GLPS_ENABLE_REQ

Parameters:

Type	Parameters	Description
uint8_t	evt_cfg	Glucose sensor event configuration (notification, indication) configured by peer device during another connection (Bonded information) - bit 1: Glucose measurement notifications enabled - bit 2: Glucose measurement context notifications enabled - bit 4: Record Access Control Point (RACP) indications enabled

Response:

> GLPS_ENABLE_RSP

Description:

> This API message is used for restoring the Glucose Sensor bond data. Before sending this message, a BLE connection shall exist with peer device.

2.2   GLPS_ENABLE_RSP

Parameters:

Type	Parameters	Description
uint8_t	status	Status error code: (see [7])

Description:

> This API message is used by the Glucose sensor role to inform the Application that bond data for this connection have been taken in account.

2.3   GLPS_CFG_INDNTF_IND

Parameters:

Type	Parameters	Description
uint8_t	evt_cfg	Glucose sensor event configuration (notification, indication) configured by peer device (Bonded information) - bit 1: Glucose measurement notifications enabled - bit 2: Glucose measurement context notifications enabled - bit 4: Record Access Control Point (RACP) indications enabled

Description:

> Event triggered when peer device modify notification/indication configuration of Glucose Sensor role characteristics. If peer device has been bonded, configuration that collector has set in GLS attributes (evt_cfg) shall be kept by application in a non-volatile memory for next time this profile role is enabled.

2.4   GLPS_SEND_MEAS_WITHOUT_CTX_CMD

Parameters:

Type	Parameters	Description
uint16_t	seq_num	Measurement Sequence Number
struct glp_meas	meas	Glucose Measurement Structure (see Table 2)

Response:

GLPS_CMP_EVT

Description:

This message is used by the application (which handles the Glucose device driver and measurements) to send a glucose measurement without following measurement context information.

Upon reception of this request, GLPS task will check if the necessary action (notification) is possible with the current configuration set by the Collector, and it will send glucose measurement notification to the peer device collector.

Notification sent confirmation will be triggered by GLPS_CMP_EVT message. Request field will be set to GLPS_SEND_MEAS_REQ_NTF_CMP (see Table 27).

2.5   GLPS_SEND_MEAS_WITH_CTX_CMD

Parameters:

Type	Parameters	Description
uint16_t	seq_num	Measurement sequence number
struct glp_meas	meas	Glucose measurement structure (see Table 2)
Struct glp_meas_ctx	ctx	Glucose measurement context structure (see Table 3)

Response:

GLPS_CMP_EVT

Description:

This message is used by the application (which handles the Glucose device driver and measurements) to send a glucose measurement with following measurement context information.

Upon reception of this request, GLPS task will check if the necessary action (notification) is possible with the current configuration set by the Collector, and it will send glucose measurement notification to the peer device collector.

Notification sent confirmation will be triggered by GLPS_CMP_EVT message. Request field will be set to GLPS_SEND_MEAS_REQ_NTF_CMP (see Table 27).

2.6   GLPS_RACP_REQ_RCV_IND

Parameters:

Type	Parameters	Description
struct glp_racp_req	racp_req	Record Access Control Point (RACP) request Structure (see Table 4)

Response: GLPS_RACP_RSP_REQ

Description:

This message is trigged by glucose sensor role when peer collector request to perform a Record Access Control Point (RACP) action.

This action could be report glucose measurements, report number of measurement, delete measurements or abort an on-going operation (see Table 23). This action contains a filter describing which glucose measurement are concerned by the operation.

Possible operations:

- GLP_REQ_REP_STRD_RECS: Report stored records

- GLP_REQ_REP_NUM_OF_STRD_RECS: Report number of stored records

- GLP_REQ_DEL_STRD_RECS: Delete stored records

- GLP_REQ_ABORT_OP: Abort on-going operation.

Note: During an on-going operation, any other request from peer device will be automatically refused by Glucose service, except GLP_REQ_ABORT_OP (Abort operation). In that case on-going operation shall be stopped. Finally GLPS_RACP_RSP_REQ message shall be sent by application with GLP_REQ_ABORT_OP op_code and status equals GLP_RSP_SUCCESS.

2.7   GLPS_SEND_RACP_RSP_CMD

Parameters:

Type	Parameters	Description
uint16_t	num_of_record	Number of records found (Should be set only if RACP operation code equals GLP_REQ_REP_NUM_OF_STRD_RECS)
uint8_t	op_code	RACP Request operation code (see Table 23)
uint8_t	status	RACP Request operation status code (see Table 25)

Response: GLPS_CMP_EVT

Description:

This message is used by the application to send Record Access Control Point (RACP) request response. If requested operation is GLP_REQ_REP_NUM_OF_STRD_RECS, number of stored record should be set; else it will be ignored by Glucose sensor role. Status code should be set according to Glucose profile error code (see Table 25).

Response sent confirmation will be triggered by GLPS_CMP_EVT message. Request field will be set to GLPS_SEND_RACP_RSP_IND_CMP (see Table 27).

2.8   GLPS_CMP_EVT

Parameters:

Type	Parameters	Description
uint8_t	request	**Completed Request type (see** Table 27Table 26: Record Access Control Point (RACP) Filter Type**)**
uint8_t	status	Status error code: (see [7])

Description:

Confirmation response sent by Glucose sensor role when a requested action has been performed:

- GLPS_SEND_MEAS_REQ_NTF_CMP: Glucose measurement notification sent completed

- GLPS_SEND_RACP_RSP_IND_CMP: Record Access Control Point Response Indication sent completed

3   Glucose Profile Collector

This role is meant to be activated on the device that will collect the Glucose measurements from the Glucose sensor. It implies it is a GAP Central. The FW task for this role will discover the GLS present on the peer Server, after establishing connection, and will allow configuration of the GLS attributes if so required. Please refer to "glpc_task.h" for implementation of this API.

**Important Note**: The TASK_GLPC task is multi-instantiated, one instance is created for each connection for which the profile will be enabled and each of these instances will have a different task ID. Thus, it is very important for the application to keep the source task ID of the GLPC_ENABLE_CFM message to be able to communicate with the peer device linked to this task ID once it has been enabled.
The term TASK_GLPC_IDX will be used in the rest of the document to refer to any instance of the Glucose Profile Client Role Task. The term TASK_GLPC will refer to the first instance of this task.

A few proprietary error codes are defined for this role: (see [7])
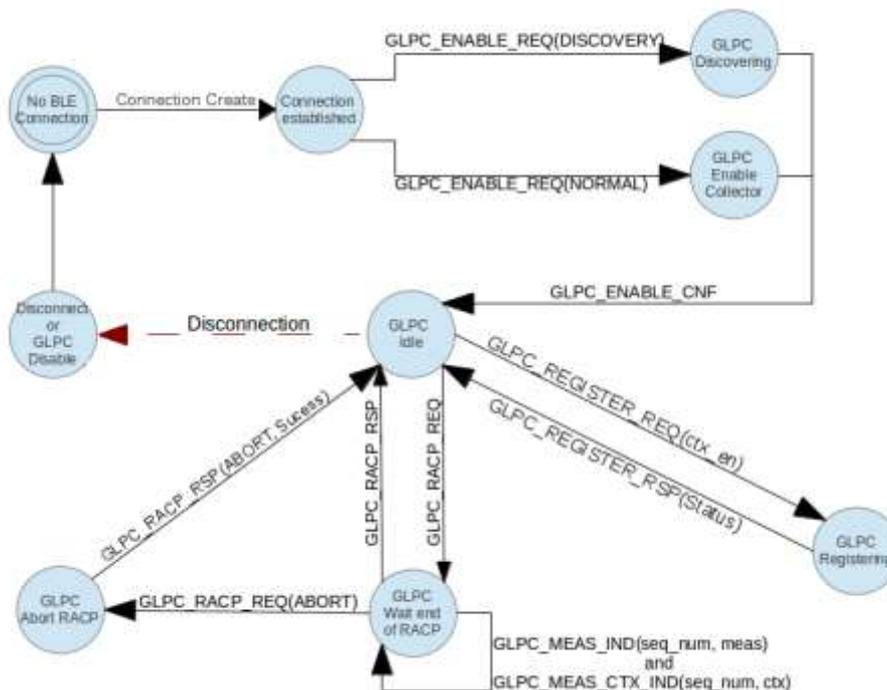
Glucose Profile Collector State Machine

1.1   Initialization

During the initialization phase of the device, to use the Glucose Client task, the GLPC task has to be allocated using GAPM API. Application has to send GAPM_PROFILE_TASK_ADD_CMD [8].

3.1   GLPC_ENABLE_REQ

Parameters:

Type	Parameters	Description
uint8_t	con_type	Connection type: 1st discovery(configuration)(0) or normal connection.(1)
struct gls_content	gls	Existing handle values GLS (see Table 1)

Type	Parameters	Description
struct prf_svc	svc	**service info (see** Table 7Table 6: Record Access Control Point (RACP) Operation Filter)
struct prf_char_inf	chars[0]	Glucose Measurement characteristic (see Table 8)
struct prf_char_inf	chars[1]	Glucose Measurement Context characteristic (see Table 8)
struct prf_char_inf	chars[2]	Glucose Feature characteristic (see Table 8)
struct prf_char_inf	chars[3]	Record Access Control Point (RACP) characteristic (see Table 8)
struct prf_char_desc_inf	descs[0]	Glucose Measurement client configuration descriptor (see Table 9)
struct prf_char_desc_inf	descs[1]	Glucose Measurement Context client configuration descriptor (see Table 9)
struct prf_char_desc_inf	descs[2]	Record Access Control Point (RACP) client configuration descriptor (see Table 9)

Table 1: Glucose Content Structure (struct gls_content)

Response:

GLPC_ENABLE_RSP

Description:

This API message is used for enabling the Collector role of the Glucose profile. This Application message contains BLE connection handle, the connection type and the previously saved discovered GLS details on peer.

The connection type may be 0 = Connection for discovery/initial configuration or 1 = Normal connection. This parameter is used by Application to discover peer device services once at first connection. Application shall save information to reuse them for other connections (bon data). During normal connection, previously discovered device information can be reused.

This is useful since most use cases allow Glucose sensor to disconnect the link once all measurements have been sent to Collector.

If it is a discovery /configuration type of connection, the GLS parameters are useless; they will be filled with 0's.

Otherwise they will contain pertinent data which will be kept in the Collector environment while enabled. It allows for the Application to not be aware of attribute details.

For a normal connection, the response to this request is sent right away after saving the GLS content in the environment and registering GLPC in GATT to receive the indications and notifications for the known attribute handles in GLS that would be notified/indicated. For a discovery connection, discovery of the peer GLS is started and the response will be sent at the end of the discovery with the discovered attribute details.

3.2   GLPC_ENABLE_RSP

Parameters:

Type	Parameters	Description
uint8_t	status	Enable status: discovery error code if anything goes wrong during a configuration type connection. (see Error Codes)
struct gls_content	gls	Existing handle values GLS (see Table 1)

Description:

> This API message is used by the Collector to either send the discovery results of GLS on the Glucose sensor or confirm enabling of the Collector role, or to simply confirm enabling of Collector role if it is a normal connection and the attribute details are already known.

3.3   GLPC_REGISTER_REQ

Parameters:

Type	Parameters	Description
bool	meas_ctx_en	Register or not Glucose measurement context notifications

Response:

> GLPC_REGISTER_RSP

Description:

> This API message is used by the application to register to Glucose sensor notifications and indications. According to peer available characteristics, it performs in one action all event registration. This shall be performed after enabling collector first time Glucose sensor is used. This registration shall be kept by peer device if bonding procedure has been performed.

> This procedure shall be done before doing any Record Access Control Point requests.

3.4   GLPC_REGISTER_RSP

Parameters:

Type	Parameters	Description
uint8_t	status	Status Error code: (see Error Codes)

Description:

> This API message is used by the Collector role to inform the Application about Glucose sensor event registration status.

3.5   GLPC_READ_FEATURES_REQ

Parameters:

> None

Response:

> GLPC_READ_FEATURES_RSP

Description:

This API message is used by the application read peer Glucose sensor features.

3.6   GLPC_READ_FEATURES_RSP

Parameters:

Type	Parameters	Description
uint8_t	features	Glucose sensor features (See Table 14)
uint8_t	status	Status Error code: (see Error Codes)

Description: This API message is used by the Collector role to inform the Application of received peer Glucose sensor features.

3.7   GLPC_RACP_REQ

Parameters:

Type	Parameters	Description
struct glp_racp_req	racp_req	Record Access Control Point (RACP) Request (see Table 4)

Response:

GLPC_RACP_RSP

Description:

This API message is used by Application to request execution of a RACP Request on peer Glucose sensor.

This action could be report glucose measurements, report number of measurement, delete measurements or abort an on-going operation (seeTable 23). This action contains a filter describing which glucose measurement are concerned by the operation.

Possible operations:

- ◦   GLP_REQ_REP_STRD_RECS: Report stored records

- ◦   GLP_REQ_REP_NUM_OF_STRD_RECS: Report number of stored records

- ◦   GLP_REQ_DEL_STRD_RECS: Delete stored records

- ◦   GLP_REQ_ABORT_OP: Abort on-going operation.

Note: During an on-going operation, any other request from collector shall be refused by Glucose service, except GLP_REQ_ABORT_OP (Abort operation). In that case on-going operation shall be stopped by glucose sensor. RACP response message shall be received from peer Glucose sensor with GLP_REQ_ABORT_OP op_code and status equals GLP_RSP_SUCCESS.

3.8   GLPC_RACP_RSP

Parameters:

Type	Parameters	Description
struct glp_racp_rsp	racp_rsp	Record Access Control Point (RACP) Response (see Table 5)

Description: This API message is used by the Collector role to inform the Application of a status of Record Access Control Point Action. It shall contain status of executed request or number of stored measurement records if GLP_REQ_REP_NUM_OF_STRD_RECS has been requested.

3.9   GLPC_MEAS_IND

Parameters:

Type	Parameters	Description
uint16_t	seq_num	Glucose measurement sequence number
struct glp_meas	meas_val	Glucose measurement Structure (see Table 2)

Description: This API message is used by the Collector role to inform the Application of a received Glucose measurement value. This value should be received within a RACP request (GLP_REQ_REP_STRD_RECS), but it could be send out of request by Glucose sensor.

3.10   GLPC_MEAS_CTX_IND

Parameters:

Type	Parameters	Description
uint16_t	seq_num	Glucose measurement sequence number
struct glp_meas_ctx	ctx	Glucose measurement context Structure (see Table 3)

Description: This API message is used by the Collector role to inform the Application of a received Glucose measurement context value. This value should be received within a RACP request (GLP_REQ_REP_STRD_RECS), but it could be send out of request by Glucose sensor. It shall be trigger by Glucose sensor only if corresponding glucose measurement previously received has GLP_MEAS_CTX_INF_FOLW in its measurement flag.

4   Miscellaneous

4.1   Error Codes

See RW BLE Host Error Code Interface Specification [7]

4.2   Types

Type	Parameters	Description
struct prf_date_time	base_time	Measurement Base Time (See Table 10)
int8_t	padding	Padding byte
int16_t	time_offset	Measurement time offset in seconds
prf_sfloat	concentration	Glucose Concentration - units of kg/L or mol/L
uint16_t	status	Sensor Status Annunciation (see Table 17)
uint8_t	type	Measurement type (see Table 15)
uint8_t	location	Sample Location (see Table 16)
uint8_t	flags	Measurement Flags (see Table 14)

Table 2: Glucose Measurement Structure (struct glp_meas)

Type	Parameters	Description
prf_sfloat	carbo_val	Carbohydrate - units of kilograms
uint16_t	exercise_dur	Exercise Duration (in seconds)
prf_sfloat	med_val	Medication value (units of kilograms or liters)
prf_sfloat	hba1c_val	HbA1c value
uint8_t	carbo_id	Carbohydrate ID (see Table 18)
uint8_t	meal	Meal ID (see Table 19)
uint8_t	tester	Tester (see Table 20)
uint8_t	health	Health (see Table 21)
uint8_t	exercise_intens	Exercise Intensity (in percent)
uint8_t	med_id	Medication ID (see Table 22)
uint8_t	flags	Measurement context flags (see Table 13)
uint8_t	ext_flags	For future use

Table 3: Glucose Measurement Context Structure (struct glp_meas_ctx)

Type	Parameters	Description
uint8_t	op_code	Operation code (see Table 23)
uint8_t	padding	Padding byte
struct glp_filter	filter	Operation filter structure (see Table 6)

Table 4: Record Access Control Point (RACP) Request

Type	Parameters	Description
uint8_t	op_code	Operation code (see Table 23)
uint8_t	operator	Operator code (ignored, always set to null)
Present if op_code = GLP_REQ_NUM_OF_STRD_RECS_RSP		
uint16_t	num_of_record	Number of record
Present if op_code = GLP_REQ_RSP_CODE		
uint8_t	op_code_req	Request Op Code (see Table 23)
uint8_t	status	Response Code status (see Table 25)

Table 5: Record Access Control Point (RACP) Response

Type	Parameters	Description
uint8_t	operator	Function operator (see Table 24)
uint8_t	filter_type	Filter type (See Table 26)
Present for Sequence number filtering (filter_type = GLP_FILTER_SEQ_NUMBER)		
uint16_t	min	Min sequence number
uint16_t	max	Max sequence number
Present for User facing time filtering (filter_type = GLP_FILTER_USER_FACING_TIME)		
struct prf_date_time	facetime_min	Min User facing time (See Table 10)
struct prf_date_time	facetime_max	Max User facing Time (See Table 10)

Table 6: Record Access Control Point (RACP) Operation Filter

Type	Parameters	Description
uint16_t	shdl	Start handle
uint16_t	ehdl	End handle

Table 7: Service Handle Structure (struct prf_svc)

Type	Parameters	Description
uint16_t	char_hdl	Characteristic handle
uint16_t	val_hdl	Value handle
uint8_t	prop	Characteristic properties

Table 8: Characteristic Info Structure (struct prf_char_inf)

Type	Parameters	Description
uint16_t	desc_hdl	Descriptor handle

Table 9: Characteristic Descriptor Info Structure (struct prf_char_desc_inf)

Type	Parameters	Description
uint16_t	year	Year
uint8_t	month	Month (1-12)
uint8_t	day	Day (1-31)
uint8_t	hour	Hour (0-24)
uint8_t	min	Minutes (0-60)
uint8_t	sec	Seconds (0-60)

Table 10: Time Stamp Structure (struct prf_date_time)

Value	Name	Description
0x80	GLP_ERR_PROC_ALREADY_IN_PROGRESS	RACP Procedure already in progress
0x81	GLP_ERR_IMPROPER_CLI_CHAR_CFG	Client Characteristic Configuration Descriptor Improperly Configured

Table 11: Glucose Sensor Error codes

Bit	Val	Name	Description
0	1	GLP_MEAS_TIME_OFF_PRES	Time Offset Present
	0	GLP_MEAS_TIME_OFF_NOT_PRES	Time Offset Not Present
1	1	GLP_MEAS_GL_CTR_TYPE_AND_SPL_LOC_PRES	Glucose Concentration, Type and Sample Location Present
	0	GLP_MEAS_GL_CTR_TYPE_AND_SPL_LOC_NOT_PRES	Glucose Concentration, Type and Sample Location Not Present
2	1	GLP_MEAS_GL_CTR_UNITS_MOL_L	Glucose Concentration in mol/L
	0	GLP_MEAS_GL_CTR_UNITS_KG_L	Glucose Concentration in Kg/L
3	1	GLP_MEAS_SENS_STAT_ANNUN_PRES	Sensor Status Annunciation Present
	0	GLP_MEAS_SENS_STAT_ANNUN_NOT_PRES	Sensor Status Annunciation Not Present
4	1	GLP_MEAS_CTX_INF_FOLW	Context Information Follows
	0	GLP_MEAS_CTX_INF_NOT_FOLW	Context Information Not Follows

Table 12: Glucose Measurement Flags (bit field)

Bit	Val	Name	Description
0	1	GLP_CTX_CRBH_ID_AND_CRBH_PRES	Carbohydrate ID And Carbohydrate Present
	0	GLP_CTX_CRBH_ID_AND_CRBH_NOT_PRES	Carbohydrate ID And Carbohydrate Not Present
1	1	GLP_CTX_MEAL_PRES	Meal Present
	0	GLP_CTX_MEAL_NOT_PRES	Meal Not Present
2	1	GLP_CTX_TESTER_HEALTH_PRES	Tester-Health Present
	0	GLP_CTX_TESTER_HEALTH_NOT_PRES	Tester-Health Not Present
3	1	GLP_CTX_EXE_DUR_AND_EXE_INTENS_PRES	Exercise Duration And Exercise Intensity Present
	0	GLP_CTX_EXE_DUR_AND_EXE_INTENS_NOT_PRES	Exercise Duration And Exercise Intensity Not Present

4	1	GLP_CTX_MEDIC_ID_AND_MEDIC_PRES	Medication ID And Medication Present
	0	GLP_CTX_MEDIC_ID_AND_MEDIC_NOT_PRES	Medication ID And Medication Not Present
5	1	GLP_CTX_MEDIC_VAL_UNITS_L	Medication Value Units in liters
	0	GLP_CTX_MEDIC_VAL_UNITS_KG	Medication Value Units in kilograms
6	1	GLP_CTX_HBA1C_PRES	HbA1c Present
	0	GLP_CTX_HBA1C_NOT_PRES	HbA1c Not Present
7	1	GLP_CTX_EXTD_F_PRES	Extended Flags Present
	0	GLP_CTX_EXTD_F_NOT_PRES	Extended Flags Not Present

Table 13: Glucose Measurement Context Flags (bit field)

Bit	Val	Name	Description
0	1	GLP_FET_LOW_BAT_DET_DUR_MEAS_SUPP	Low Battery Detection During Measurement Supported
	0	GLP_FET_LOW_BAT_DET_DUR_MEAS_NOT_SUPP	Low Battery Detection During Measurement Not Supported
1	1	GLP_FET_SENS_MFNC_DET_SUPP	Sensor Malfunction Detection Supported
	0	GLP_FET_SENS_MFNC_DET_NOT_SUPP	Sensor Malfunction Detection Not Supported
2	1	GLP_FET_SENS_SPL_SIZE_SUPP	Sensor Sample Size Supported
	0	GLP_FET_SENS_SPL_SIZE_NOT_SUPP	Sensor Sample Size Not Supported
3	1	GLP_FET_SENS_STRIP_INSERT_ERR_DET_SUPP	Sensor Strip Insertion Error Detection Supported
	0	GLP_FET_SENS_STRIP_INSERT_ERR_DET_NOT_SUPP	Sensor Strip Insertion Error Detection Not Supported
4	1	GLP_FET_SENS_STRIP_TYPE_ERR_DET_SUPP	Sensor Strip Type Error Detection Supported
	0	GLP_FET_SENS_STRIP_TYPE_ERR_DET_NOT_SUPP	Sensor Strip Type Error Detection Not Supported
5	1	GLP_FET_SENS_RES_HIGH_LOW_DET_SUPP	Sensor Result High-Low Detection Supported
	0	GLP_FET_SENS_RES_HIGH_LOW_DET_NOT_SUPP	Sensor Result High-Low Detection Not Supported
6	1	GLP_FET_SENS_TEMP_HIGH_LOW_DET_SUPP	Sensor Temperature High-Low Detection Supported
	0	GLP_FET_SENS_TEMP_HIGH_LOW_DET_NOT_SUPP	Sensor Temperature High-Low Detection Not Supported
7	1	GLP_FET_SENS_RD_INT_DET_SUPP	Sensor Read Interrupt Detection Supported
	0	GLP_FET_SENS_RD_INT_DET_NOT_SUPP	Sensor Read Interrupt Detection Not Supported
8	1	GLP_FET_GEN_DEV_FLT_SUPP	General Device Fault Supported
	0	GLP_FET_GEN_DEV_FLT_NOT_SUPP	General Device Fault Not Supported
9	1	GLP_FET_TIME_FLT_SUPP	Time Fault Supported
	0	GLP_FET_TIME_FLT_NOT_SUPP	Time Fault Not Supported
10	1	GLP_FET_MUL_BOND_SUPP	Multiple Bond Supported
	0	GLP_FET_MUL_BOND_NOT_SUPP	Multiple Bond Not Supported

Table 14: Glucose Feature Flags (bit field)

Value	Name	Description
1	GLP_TYPE_CAPILLARY_WHOLE_BLOOD	Capillary Whole blood
2	GLP_TYPE_CAPILLARY_PLASMA	Capillary Plasma
3	GLP_TYPE_VENOUS_WHOLE_BLOOD	Venous Whole blood
4	GLP_TYPE_VENOUS_PLASMA	Venous Plasma
5	GLP_TYPE_ARTERIAL_WHOLE_BLOOD	Arterial Whole blood
6	GLP_TYPE_ARTERIAL_PLASMA	Arterial Plasma

7	GLP_TYPE_UNDETERMINED_WHOLE_BLOOD	Undetermined Whole blood
8	GLP_TYPE_UNDETERMINED_PLASMA	Undetermined Plasma
9	GLP_TYPE_INTERSTITIAL_FLUID	Interstitial Fluid (ISF)
10	GLP_TYPE_CTRL_SOLUTION	Control Solution

Table 15: Glucose measurement type

Value	Name	Description
1	GLP_LOC_FINGER	Finger
2	GLP_LOC_ALT_SITE_TEST	Alternate Site Test (AST)
3	GLP_LOC_EARLOBE	Earlobe
4	GLP_LOC_CTRL_SOLUTION	Control solution
15	GLP_LOC_SPL_LOC_VAL_NOT_AVA	Sample Location value not available

Table 16: Glucose measurement Sample Location

Value	Name	Description
0	GLP_MEAS_STATE_DEV_BAT_LOW	Device battery low at time of measurement
1	GLP_MEAS_STATE_SENS_MFNC_OR_FLTING	Sensor malfunction or faulting at time of measurement
2	GLP_MEAS_STATE_SPL_SIZE_INSUFF	Sample size for blood or control solution insufficient at time of measurement
3	GLP_MEAS_STATE_STRIP_INSERT_ERR	Strip insertion error
4	GLP_MEAS_STATE_STRIP_TYPE_INCOR_FOR_DEV	Strip type incorrect for device
5	GLP_MEAS_STATE_SENS_RES_HIGHER	Sensor result higher than the device can process
6	GLP_MEAS_STATE_SENS_RES_LOWER	Sensor result lower than the device can process
7	GLP_MEAS_STATE_SENS_TEMP_TOO_HIGH	Sensor temperature too high for valid test/result at time of measurement
8	GLP_MEAS_STATE_SENS_TEMP_TOO_LOW	Sensor temperature too low for valid test/result at time of measurement
9	GLP_MEAS_STATE_SENS_RD_INTED	Sensor read interrupted because strip was pulled too soon at time of measurement
10	GLP_MEAS_STATE_GEN_DEV_FLT	General device fault has occurred in the sensor
11	GLP_MEAS_STATE_TIME_FLT	Time fault has occurred in the sensor and time may be inaccurate

Table 17: Glucose measurement Sensor Status Annunciation

Value	Name	Description
1	GLP_CID_BREAKFAST	Breakfast
2	GLP_CID_LUNCH	Lunch
3	GLP_CID_DINNER	Dinner
4	GLP_CID_SNACK	Snack
5	GLP_CID_DRINK	Drink
6	GLP_CID_SUPPER	Supper
7	GLP_CID_BRUNCH	Brunch

Table 18: Glucose measurement context Carbohydrate ID

Value	Name	Description
1	GLP_MEAL_PREPRANDIAL	Preprandial (before meal)

2	GLP_MEAL_POSTPRANDIAL	Postprandial (after meal)
3	GLP_MEAL_FASTING	Fasting
4	GLP_MEAL_CASUAL	Casual (snacks, drinks, etc.)
5	GLP_MEAL_BEDTIME	Bedtime

Table 19: Glucose measurement context Meal

Value	Name	Description
1	GLP_TESTER_SELF	Self
2	GLP_TESTER_HEALTH_CARE_PROFESSIONAL	Health Care Professional
3	GLP_TESTER_LAB_TEST	Lab test
15	GLP_TESTER_TESTER_VAL_NOT_AVA	Tester value not available

Table 20: Glucose measurement context tester type

Value	Name	Description
1	GLP_HEALTH_MINOR_HEALTH_ISSUES	Minor health issues
2	GLP_HEALTH_MAJOR_HEALTH_ISSUES	Major health issues
3	GLP_HEALTH_DUR_MENSES	During menses
4	GLP_HEALTH_UNDER_STRESS	Under stress
5	GLP_HEALTH_NO_HEALTH_ISSUES	No health issues
15	GLP_HEALTH_HEALTH_VAL_NOT_AVA	Health value not available

Table 21: Glucose measurement context personal health feeling

Value	Name	Description
1	GLP_MEDID_RAPID_ACTING_INSULIN	Rapid acting insulin
2	GLP_MEDID_SHORT_ACTING_INSULIN	Short acting insulin
3	GLP_MEDID_INTER_ACTING_INSULIN	Intermediate acting insulin
4	GLP_MEDID_LONG_ACTING_INSULIN	Long acting insulin
5	GLP_MEDID_PRE_MIXED_INSULIN	Pre-mixed insulin

Table 22: Glucose measurement context medication identification

Value	Name	Description
1	GLP_REQ_REP_STRD_RECS	Report stored records (Operator: Value from Operator Table)
2	GLP_REQ_DEL_STRD_RECS	Delete stored records (Operator: Value from Operator Table)
3	GLP_REQ_ABORT_OP	Abort operation (Operator: Null 'value of 0x00 from Operator Table')
4	GLP_REQ_REP_NUM_OF_STRD_RECS	Report number of stored records (Operator: Value from Operator Table)
5	GLP_REQ_NUM_OF_STRD_RECS_RSP	Number of stored records response (Operator: Null 'value of 0x00 from Operator Table')
6	GLP_REQ_RSP_CODE	Response Code (Operator: Null 'value of 0x00 from Operator Table')

Table 23: Record Access Control Point (RACP) OP Code

Value	Name	Description
1	GLP_OP_ALL_RECS	All records
2	GLP_OP_LT_OR_EQ	Less than or equal to
3	GLP_OP_GT_OR_EQ	Greater than or equal to
4	GLP_OP_WITHIN_RANGE_OF	Within range of (inclusive)
5	GLP_OP_FIRST_REC	First record(i.e. oldest record)
6	GLP_OP_LAST_REC	Last record (i.e. most recent record)

Table 24: Record Access Control Point (RACP) Operator

Value	Name	Description
1	GLP_RSP_SUCCESS	Success
2	GLP_RSP_OP_CODE_NOT_SUP	Op Code not supported
3	GLP_RSP_INVALID_OPERATOR	Invalid Operator
4	GLP_RSP_OPERATOR_NOT_SUP	Operator not supported
5	GLP_RSP_INVALID_OPERAND	Invalid Operand
6	GLP_RSP_NO_RECS_FOUND	No records found
7	GLP_RSP_ABORT_UNSUCCESSFUL	Abort unsuccessful
8	GLP_RSP_PROCEDURE_NOT_COMPLETED	Procedure not completed
9	GLP_RSP_OPERAND_NOT_SUP	Operand not supported

Table 25: Record Access Control Point (RACP) Response Code

Value	Name	Description
1	GLP_FILTER_SEQ_NUMBER	Filter using Sequence number
2	GLP_FILTER_USER_FACING_TIME	Filter using Facing time

Table 26: Record Access Control Point (RACP) Filter Type

Value	Name	Description
0	GLPS_SEND_MEAS_REQ_NTF_CMP	Glucose measurement notification sent completed
1	GLPS_SEND_RACP_RSP_IND_CMP	Record Access Control Point Response Indication

Table 27: Glucose sensor type of request completed

References

[1]	**Title**	Glucose Profile		
	Reference	GLP_SPEC_V10r00		
	Version	V10r00	**Date**	April 3rd 2012
	Source	Bluetooth SIG – Medical Working Group		

[2]	**Title**	Glucose Service		
	Reference	GLS_V10r00		
	Version	V10r00	**Date**	April 3rd 2012
	Source	Bluetooth SIG – Medical Working Group		

[3]	**Title**	Device Information Service		
	Reference	DIS_SPEC_V10		
	Version	V10r00	**Date**	May 24th 2011
	Source	Bluetooth SIG – Medical Working Group		

[4]	**Title**	Glucose Profile (HRP) 1.0		
	Reference	GLP.TS.1.0.0		
	Version	1.0.0	**Date**	April 3rd 2012
	Source	Bluetooth SIG		

[5]	**Title**	Glucose Service (HRS) 1.0		
	Reference	GLS.TS.1.0.0		
	Version	1.0.0	**Date**	April 3rd 2012
	Source	Bluetooth SIG		

[6]	**Title**	Device Information Service (DIS) 1.0		
	Reference	DIS.TS.1.0.0		
	Version	1.0.0	**Date**	May 24th 2011
	Source	Bluetooth SIG		

[7]	Title	RW BLE Host Error Code Interface Specification		
	Reference	RW-BLE-HOST-ERR-CODE-IS		
	Version	7.00	Date	2014-06-30
	Source	RivieraWaves SAS		

[8]	Title	GAP Interface Specification		
	Reference	RW-BLE-GAP-IS		
	Version	7.00	Date	2014-06-30
	Source	RivieraWaves SAS		

[9]	Title	GATT Interface Specification		
	Reference	RW-BLE-GATT-IS		
	Version	7.00	Date	2014-06-30
	Source	RivieraWaves SAS		

[10]	Title	DIS Interface Specification		
	Reference	RW-BLE-DIS-IS		
	Version	0.1	Date	August 14th 2012
	Source	RivieraWaves SAS		