Bluetooth portable medical application with high accuracy ADC

APAC RA

Agenda

- **Overview**
  - Why Use Bluetooth in Portable Medical Devices?
  - What Are Portable Medical Devices
- **Technical introduction**
  - How to Optimize Power Efficiency
  - Increasing Accuracy of Portable Medical Devices
  - IoT Security in Portable Medical Devices
  - Typical Block Diagram
  - CGM(continuous glucose monitors)
- **Demo**
  - Create from an SoC empty example
  - Setup
  - App Test
  - How to do CGM service/profile qualification

Overview

The enabling wireless devices and applications must feature

- robust IoT device security,
- small form-factor, and
- high energy-efficiency

to enable accurate and safe operation with long life and low cost.
Bluetooth Low Energy (BLE) checks all the boxes,
providing manufacturers and device makers with an optimal wireless solution.

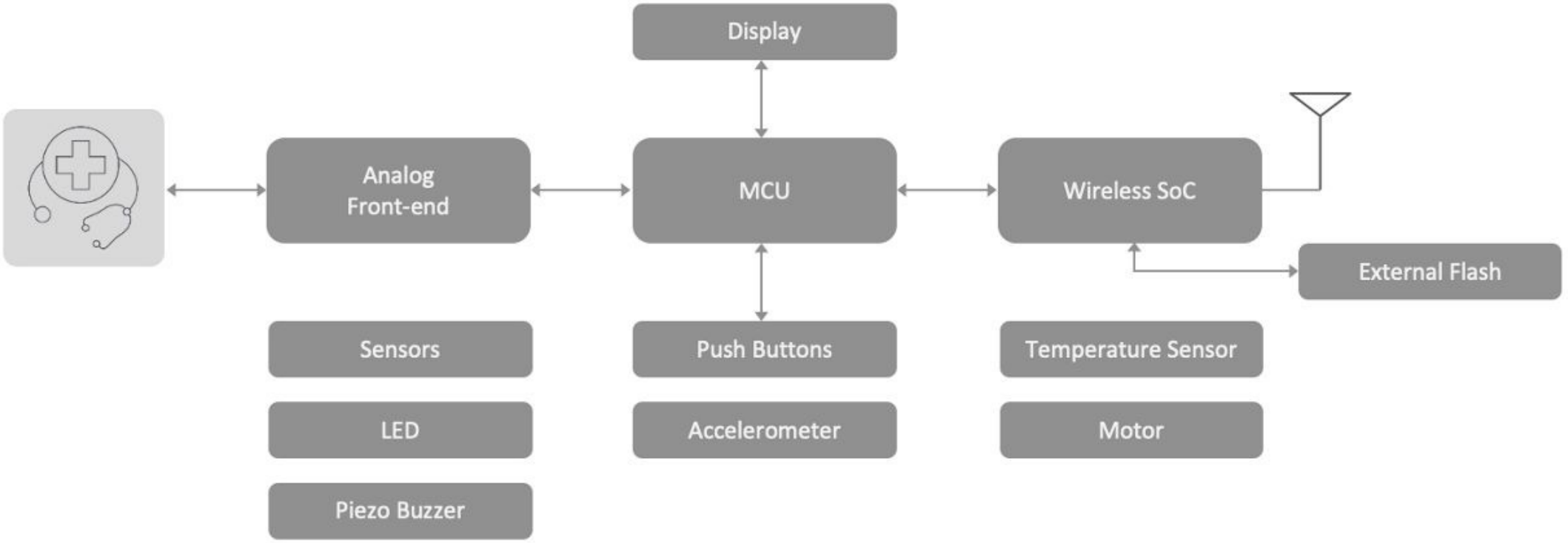
Portable Medical Devices

- Portable medical devices monitor and track a patient's physiological conditions continuously.
- The collected health data can be viewed **remotely** on a smartphone app via a Bluetooth connection by a healthcare professional.
- The wireless connected portable and wearable medical devices are crucial in enabling outpatient ambulatory care services.
- Bluetooth Low Energy is the most deployed wireless connectivity technology for portable medical devices such as:
  - **BGM**(blood glucose meters),
  - **CGM**(continuous glucose monitors),
  - blood pressure monitors, pulse oximeters, insulin pumps, cardiac monitoring systems, and more.

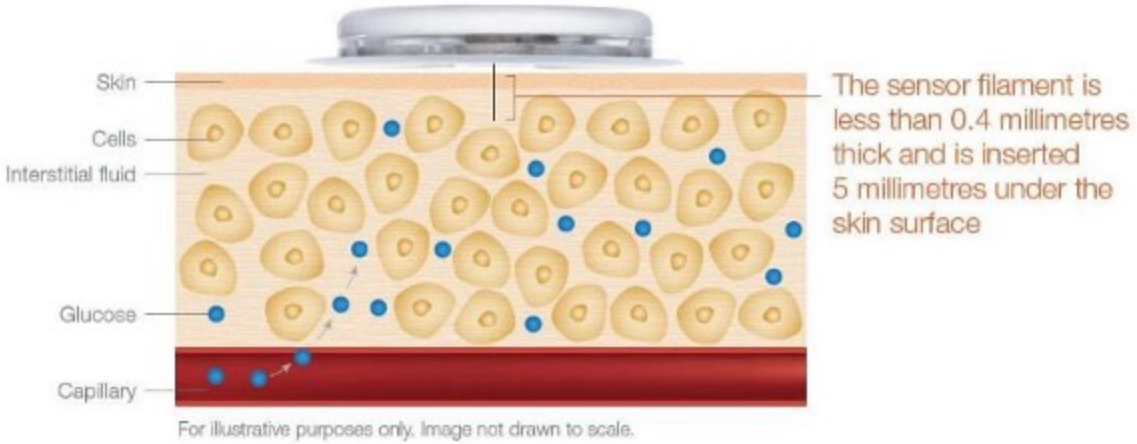
Design considerations

- How to Optimize Power Efficiency
- Increasing Accuracy of Portable Medical Devices
- IoT Security in Portable Medical Devices

Typical Block Diagram

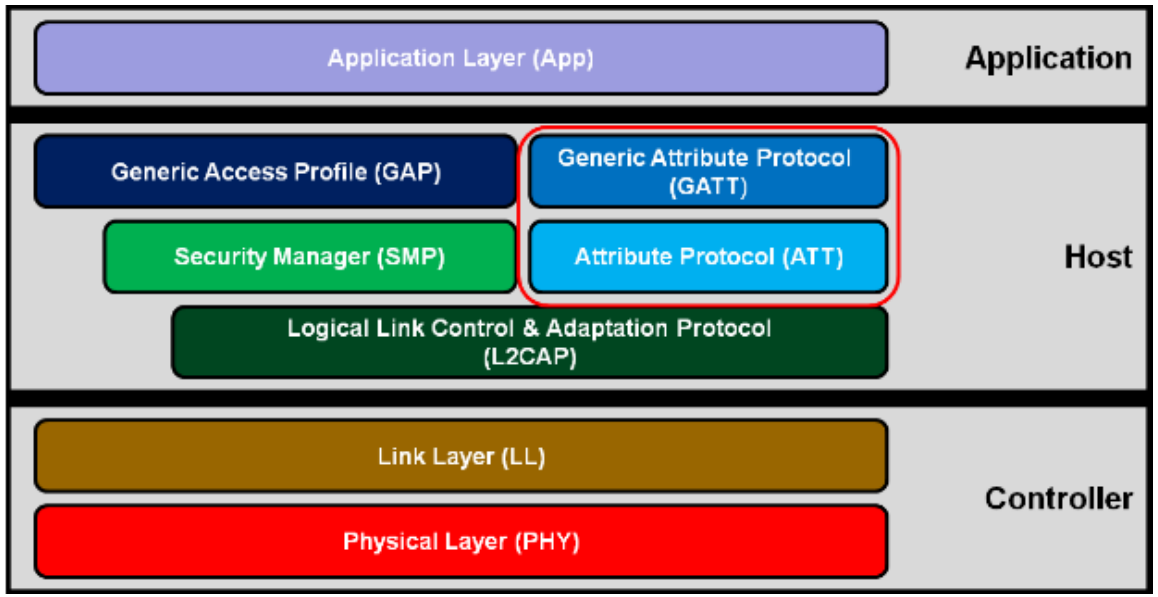


CGM(continuous glucose monitors)

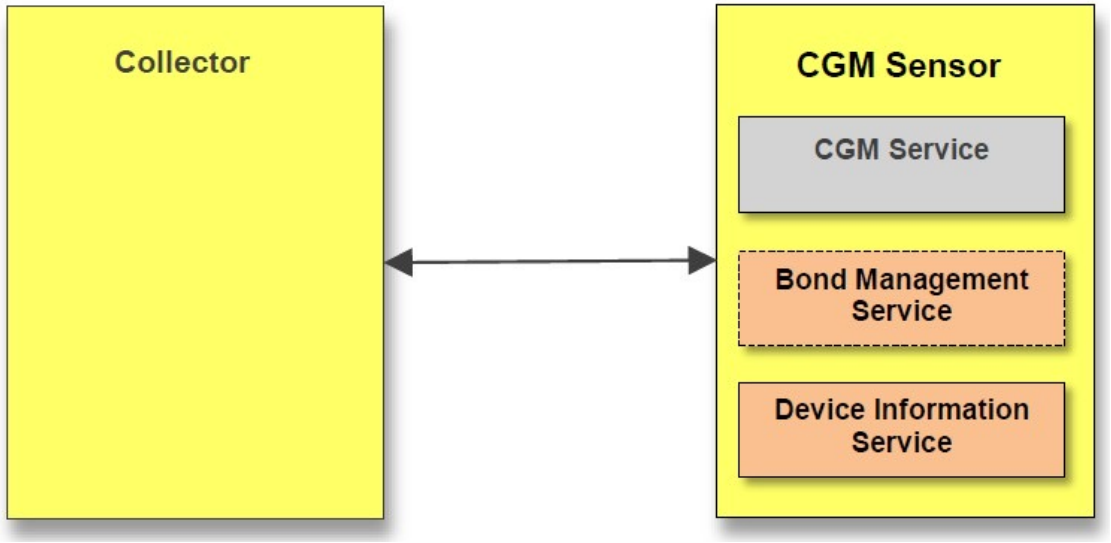


- **A continuous glucose monitor (CGM) is a device used for monitoring blood glucose on a continual basis by insulin-requiring people with diabetes, e.g. people with type I, type II diabetes or other types of diabetes (e.g. gestational diabetes).**
- **Continuous Glucose Monitoring (CGM) systems continually check glucose levels throughout the day and night and can alert you through Bluetooth, if your glucose levels go too high or too low, the system will alert you.**

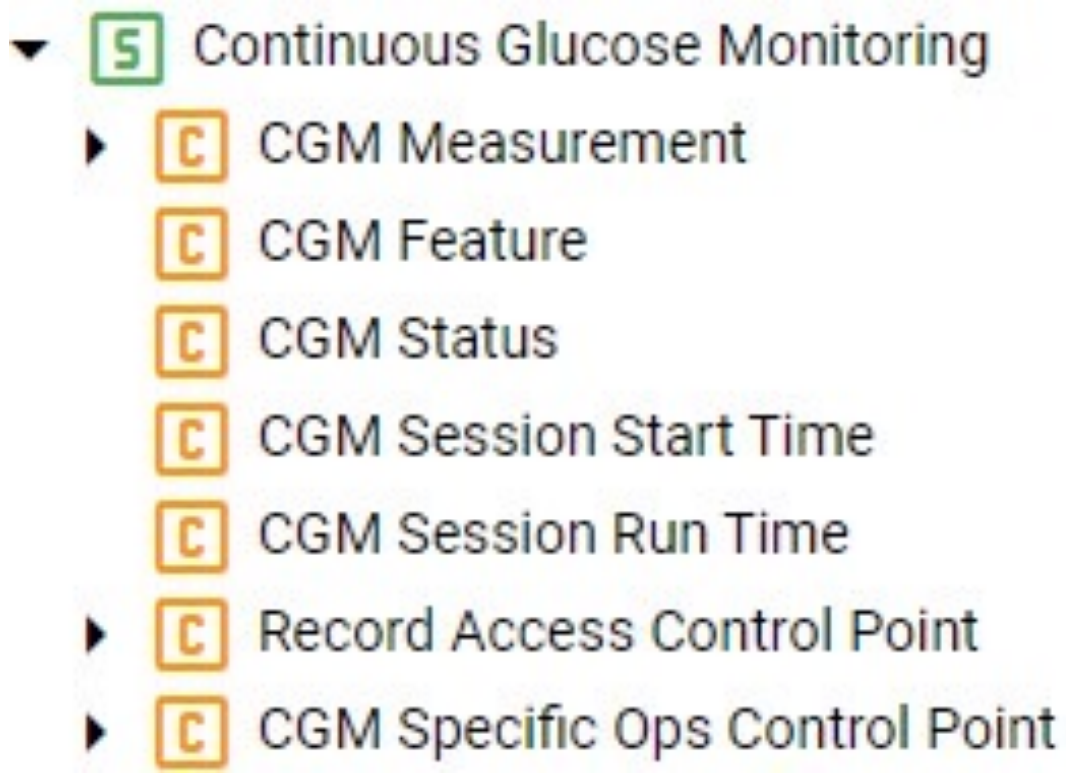
Bluetooth SIG CGM service/profile



- The CGM Sensor shall be a GATT Server.
- The CGM Collector shall be a GATT Client.



How SIG CGM service work



- CGM collector connect to the CGM sensor
- Collector set Notify of CGM Measurement characteristic
- Collector set indicate of CGM Specific Ops Control Point characteristic
- Collector start the session
- Sensor will continuously send notifications to collector
- Collector may stop the session

Demo

- Hardware
  - xG24 explorer kit
  - USB wire
- Software
  - Simplicity studio
  - Serial Debug Tool
  - Bootloader.s37
  - CGM.s37

Bluetooth Qualification

- **ALL Bluetooth® Products Must Be Qualified**
- **Completing the Bluetooth Qualification Process**
  - Qualification Process with **No Required Testing**
  - Qualification Process with **Required Testing**

Bluetooth Qualification

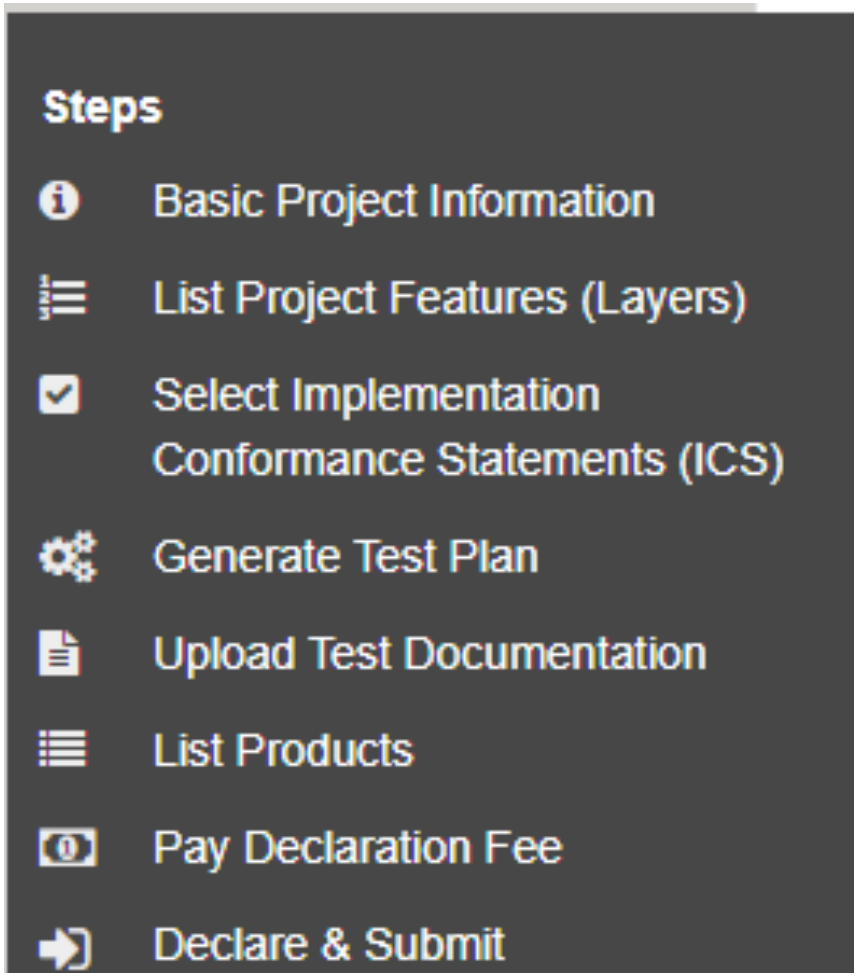
- RF-PHY
- Link layer
- Host layer
- Profile

Bluetooth Qualification

- **Silicon Labs has pre-qualified listings for all components**
  - Software-based BLE components (Link Layer and Host) QDIDs can be found in QSG169.

Bluetooth SDK version	Component	QDID
v2.13.x up to v3.1.x	Link Layer (Bluetooth 5.2)	Launch Studio Listing Details: 147971
"	Host stack (Bluetooth 5.2)	Launch Studio Listing Details: 146950
V3.2.x and above	Link Layer (Bluetooth 5.3)	Launch Studio Listing Details: 178212
"	Host stack (Bluetooth 5.3)	Launch Studio Listing Details: 175341

Profile Qualification



- **Use the Bluetooth Qualification tool Launch Studio to complete the Bluetooth Qualification Process.**
- **Follow the instruction and complete the Bluetooth Qualification**

PTS

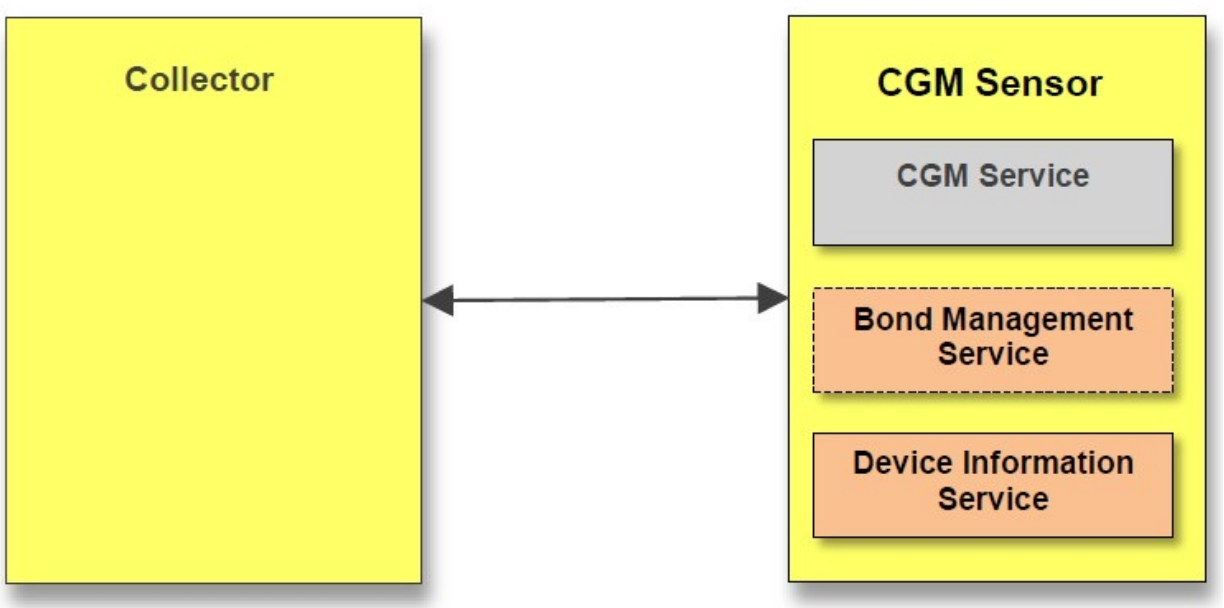
Automate protocol and profile interoperability testing.

The *Bluetooth*® Profile Tuning Suite (PTS) is testing software that automates compliance testing to the specified functional requirements of Bluetooth Host Parts and specifications that reside above the Host Controller Interface (HCI). The vision of the product is to provide complete and validated test coverage, of all specified functional requirements in scope, to the Bluetooth development and testing community.

- **Software: PTS**
- **Hardware: PTS dongle(Dongle Firmware Upgrade Software)**

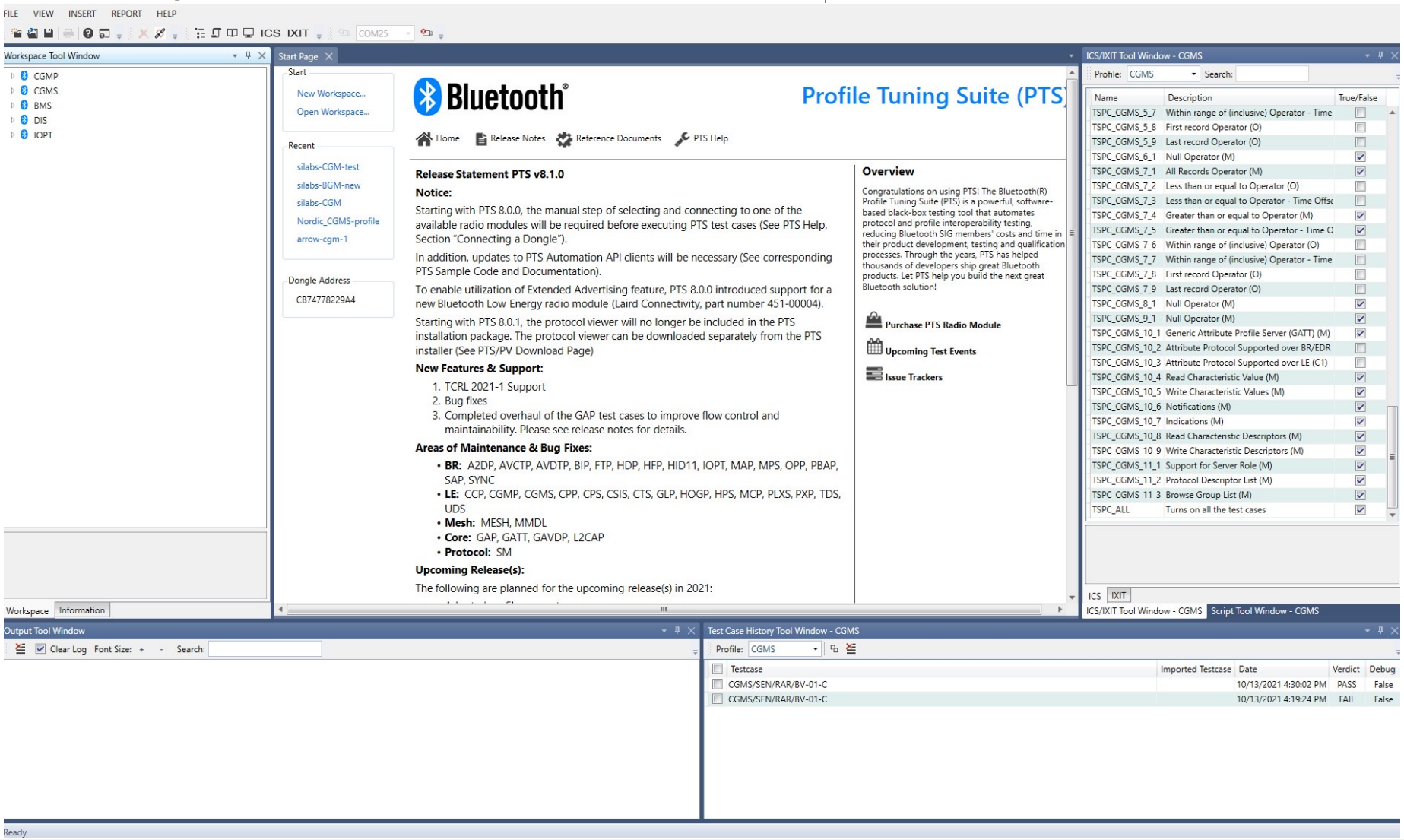
PTS

- The test diagram block and environment is as below



PTS

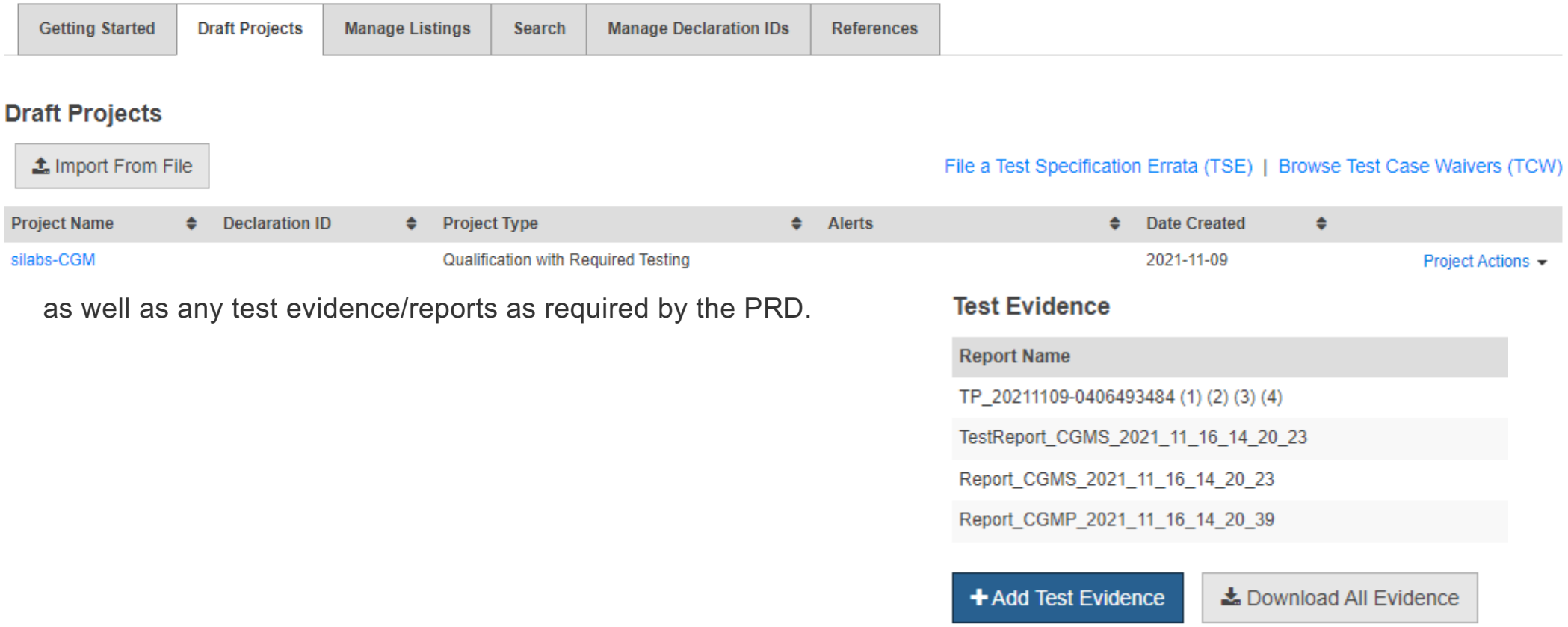
- **The whole picture of PTS is as below**



Launch Studio-Test Documentation

Test Documentation

- After finishing the PTS test, back to the Launch Studio project



as well as any test evidence/reports as required by the PRD.

Thank you!

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