DEMO_60LTR11_AUTO_BLE

Getting started with the XENSIV™ wireless presence detection sensor

About this document

Scope and purpose

This application note provides guidance on setting up and operating the XENSIV™ Wireless Presence Detection Sensor (DEMO_60LTR11_AUTO_BLE). It contains a step-by-step process for programming the sensor and addresses common troubleshooting issues. Additionally, it offers instructions for firmware updates and how to reprogram the sensor.

The XENSIV™ Wireless Presence Detection Sensor is an innovative device that highlights the BGT60LTR11AIP 60 GHz radar [1] capabilities when running in autonomous mode. It features a Bluetooth module (CYBLE-222014-01) [2] that wirelessly connects to Infineon's "60 GHz Radar" smartphone app. This technology enables the sensor to detect the presence of an object and its direction of motion. The DEMO_60LTR11_AUTO_BLE sensor is an excellent tool for evaluating the possibilities of radar in Internet of Things (IoT) edge applications.

Intended audience

The intended audience for this document are design engineers, technicians, and developers of electronic systems working with the XENSIV™ Wireless Presence Detection Sensor.

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1 Introduction

The XENSIV™ Wireless Presence Detection Sensor (DEMO_60LTR11_AUTO_BLE) is a battery-operated application with Infineon's XENSIV™ BGT60LTR11AIP 60 GHz radar and a Bluetooth module, CYBLE-222014-01, that wirelessly connects via Bluetooth low energy (BLE) with a smartphone running Infineon's 60 GHz Radar sensor app.

The smartphone app will communicate with the CYBLE-222014-01 to display the data from the BGT60LTR11AIP 60 GHz radar for presence detection and direction of motion.

Figure 1 DEMO_60LTR11_AUTO_BLE

2 Setup and operating instructions

Follow the steps below to set up and run the XENSIV™ Wireless Presence Detection Sensor:

1. Install Infineon's 60 GHz radar app from Apple App Store or the Google Play Store. Search for "Infineon 60 GHz radar" and choose "Install" and then "Open".
2. Install a CR2032 battery in the unit with the negative side down toward the PCB. Note: J1 is the positive contact, J2 is the negative contact. J1 and J2 labels can be seen on the PCB silkscreen when the battery is not installed. For more information on battery installation see Section **Error! Reference source not found.**.
3. There is a switch, SW1, that will be put in the "ON" position to operate. It can be switched off to conserve battery life when it is not in use, as shown in Figure 2.

Figure 2 Turn ON the sensor

4. Open the Infineon's "**60 GHz Radar**" dedicated app on either an Android or an iOS phone. Please Make sure Bluetooth is enabled on the phone.

Figure 3 60 GHz Radar smartphone app

5. Tap the "Connect" button on the app to connect to the sensor.

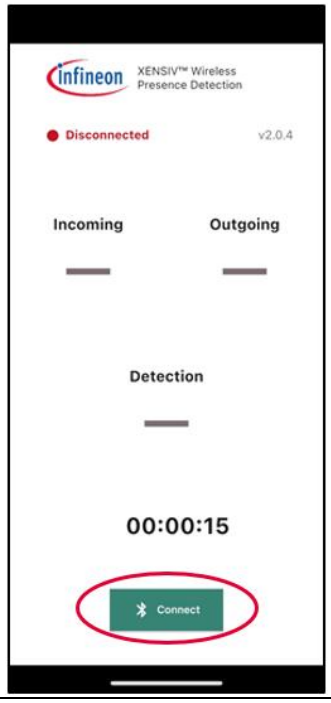

Figure 4 Connect your device

6. The “60 GHz Radar” app will give the message “Found device” and will automatically start radar detection. If it fails to connect and reports “Cannot find device”, see Section 5.1 to resolve.

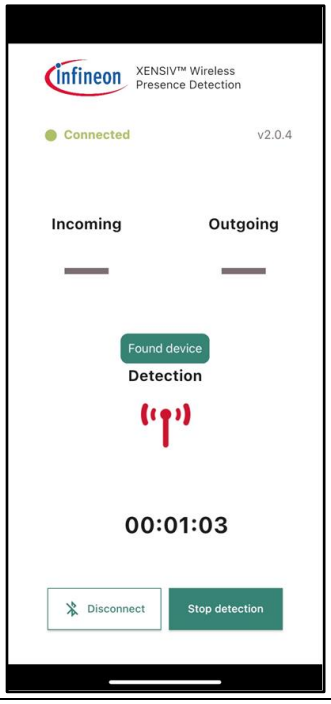

Figure 5 Found device

7. The “60 GHz Radar” app includes a detection indicator. The indicator will be green when the BGT60LTR11AIP detects a presence. It will be a red circle when no presence is detected. Hitting the “Stop detection” button will stop the radar, and a gray bar will replace the circle. Similarly, the incoming and outgoing labels on the app will show a green arrow pointing in the direction of motion.

When the XENSIV™ Wireless Presence Detection Sensor is fully operational and connected to the smartphone running the app, the output is as shown in Figure 6.

Figure 6 Device is successfully connected

8. The best method to demonstrate the XENSIV™ Wireless Presence Detection Sensor is to place it on a stationary platform with no moving objects behind it (for example, against a wall). The user should hold the connected phone and stand 1 to 8 m from the sensor, and then walk toward or away from the sensor to see the detection and directional sensing. To demonstrate detection vs. no detection, place the sensor facing a door, where the user can step behind a wall.

3 Assembly and battery replacement

3.1 Enclosure

The XENSIV™ Wireless Presence Detection Sensor consists of the plastic enclosure, the back cover and the battery insert holder with four screws to hold it in place.

Figure 7 Pictures of assembly

3.2 Battery installation and replacement

The battery is a CR2032 coin cell. The back cover snaps on and off; use the small indention to pry it off. The screws must be installed to hold the battery in its proper position to make good contact with the positive and negative terminals on the PCB. Place the battery with the positive side up, as shown.

4 Programming and UART debug interface

The XENSIV™ Wireless Presence Detection Sensor will come programmed to be fully operational. However, it may be necessary to program updates or customization.

4.1 Instructions for programming the .hex file

1. Remove the XENSIV™ Wireless Presence Detection Sensor PCB from the enclosure and attach it to the programming dongle. JTAG header J3 on the radar sensor will connect to JTAG header D4 on the programming dongle. Connection should be made such that pin 1 of D4 on the programming dongle will be mated to pin 2 of J3 on the XENSIV™ Wireless Presence Detection Sensor J3 connector. See **Error! Reference source not found.** for the proper position. Battery power is not needed, as power and ground connections will be supplied by the dongle when it is connected to the USB port on the computer.

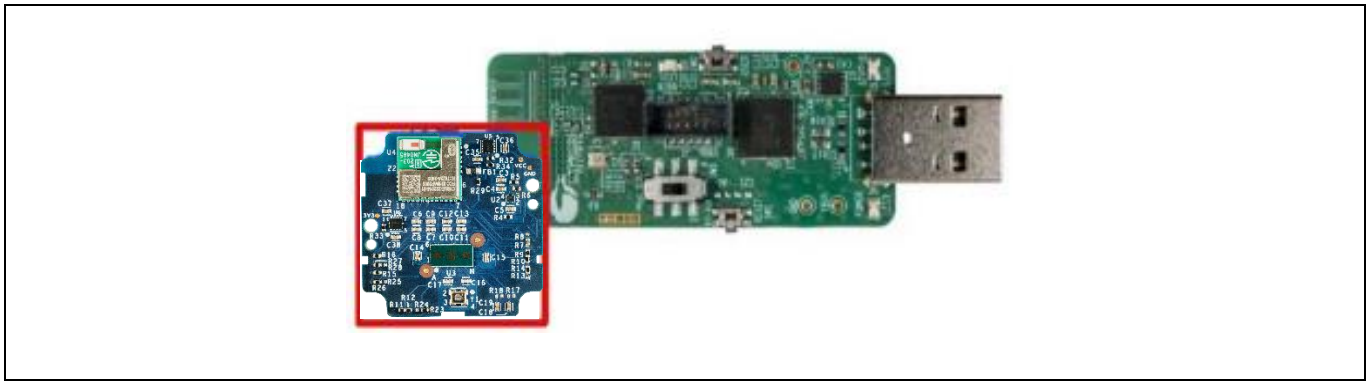

Figure 8 Connect the XENSIV™ Wireless Presence Detection Sensor to the programming dongle

Note: SW1 button on the dongle will touch the demo board and hold the demo board at a slight angle when attached via the JTAG snap connector. This will not interfere or cause issues with the programming operation. On the dongle board, ensure that switch SW3 is in the 3rd position (EZ-BLE).

2. Download and install the PSoC™ programmer at: https://www.infineon.com/cms/en/design-support/software/free-and-open-source-software-foss/cypress-programmer-foss-packages/
   The download will be an .exe file that will open an installer for the programming graphical user interface (GUI). Click through the installation steps.
3. Open the PSoC Programmer and plug the dongle into a USB port on the computer. It should look like **Error! Reference source not found.**:

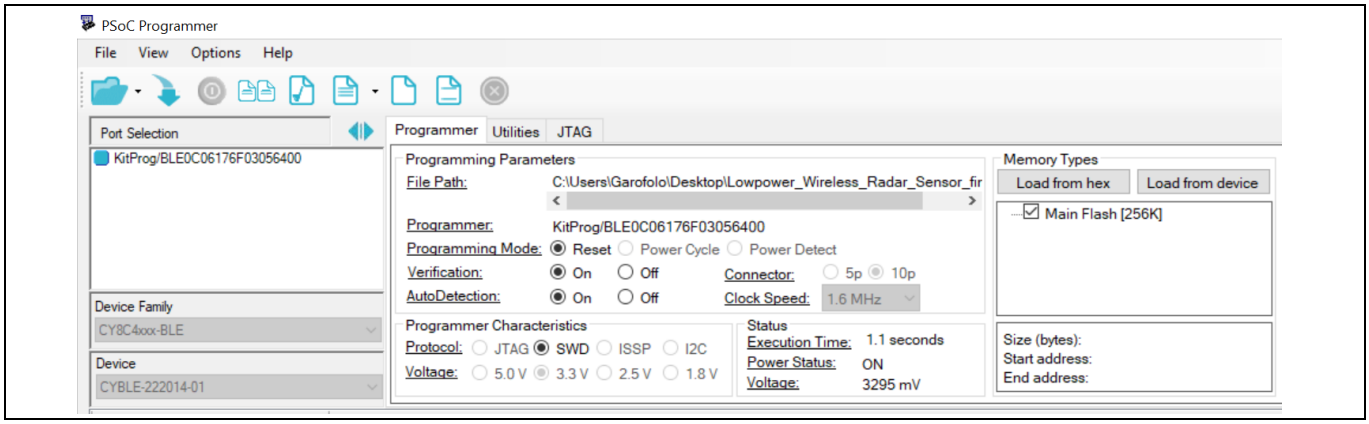

Figure 9 PSoC Programmer

4. Click on “KitProg/BLE0C6176F6F03056400” under “Port selection”. This will connect the dongle and “Actions” will report the following:

Actions	Results
Successfully Connected to KitProg/BLE0C06176F03056400 at 4:58:18 PM	KitProg Version 2.21
Opening Port at 4:58:18 PM	

Figure 10 Actions tab result

If a pop-up message states that Kitprog is out of date, see Section 5.2 to resolve.

5. Click on the folder icon at the top left-hand corner and a file browser will open. Browse to filename “**Lowpower_Wireless_Radar_Sensor_final.hex**”. The .hex file will show in the file path of the “Programming Parameters” section. A PSoC™ programmer GUI window should be set up like the illustration in **Error! Reference source not found.**.

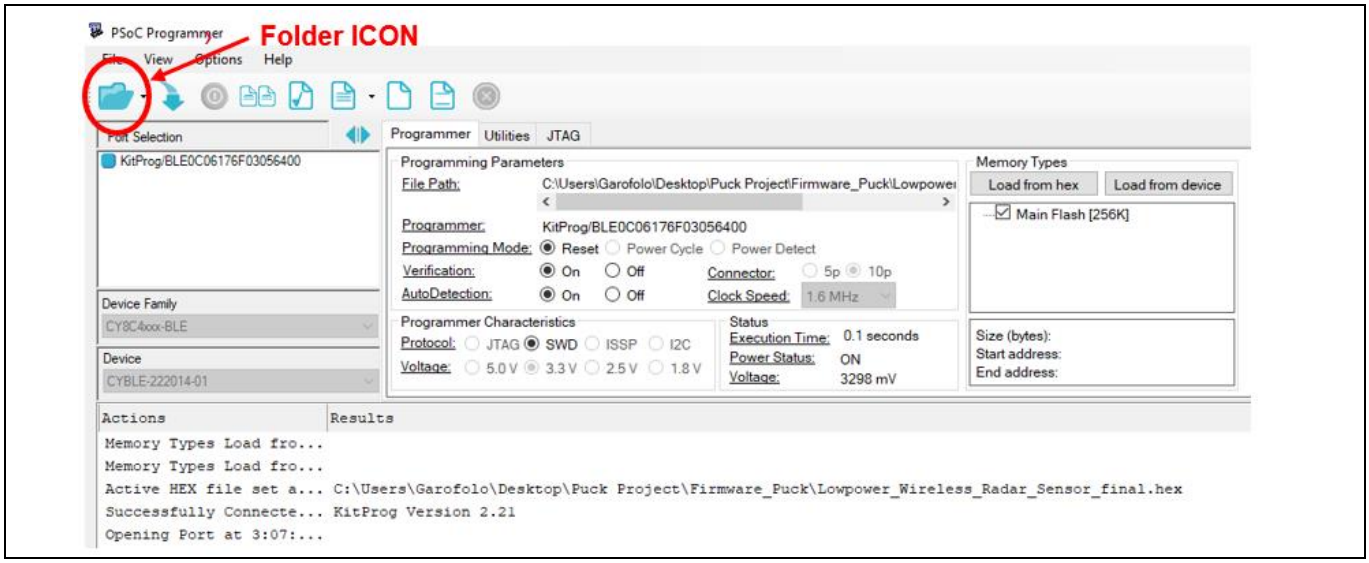

Figure 11 Browse firmware binary image

6. Click on the programming arrow icon at the top left-hand corner next to the folder icon. 
This will start the process of programming the PSoC™ 4 BLE device.
7. Once programming is complete, the “Actions” window will return “Programming Succeeded”, as shown in Figure 12.

Actions	Results
Program Finished at 5:12:03 PM	
	Programming Succeeded
	Doing Checksum
	Doing Protect
	Verifying of Flash Succeeded
	Verifying of Flash Starting...
	Programming of Flash Succeeded
	> Transfer rate: 10.51 KB/sec. 84480 bytes transferred (330 blocks x 256 bytes) in 7851 ms
	Programming of Flash Starting...
	Erase Succeeded
Device set to CYBLE-222014-01 at 5:11:40 PM	262144 FLASH bytes
Device Family set to CY8C4xxx-BLE at 5:11:40 PM	
	Automatically Detected Device: CYBLE-222014-01
	Silicon: 1A6B, Family: AA, Major/Minor Rev: AC
Program Requested at 5:11:39 PM	
Successfully Connected to KitProg/BLE0C06176F03056400 at 5:11:37 PM	KitProg Version 2.21
Opening Port at 5:11:35 PM	
Connected at 5:11:34 PM	KitProg/BLE0C06176F03056400

Figure 12 Program your device

8. Close the PSoC™ programmer GUI.

4.2 UART debug interface

The firmware programmed into the PSoC™ 4 BLE enables the UART to view serial data output of the XENSIV™ Wireless Presence Detection Sensor's execution steps.

1. Open Tera Term (or another serial terminal) and set the following: Serial, COM: choose "KitProg USB-UART (COMx)", as shown in Figure 13.

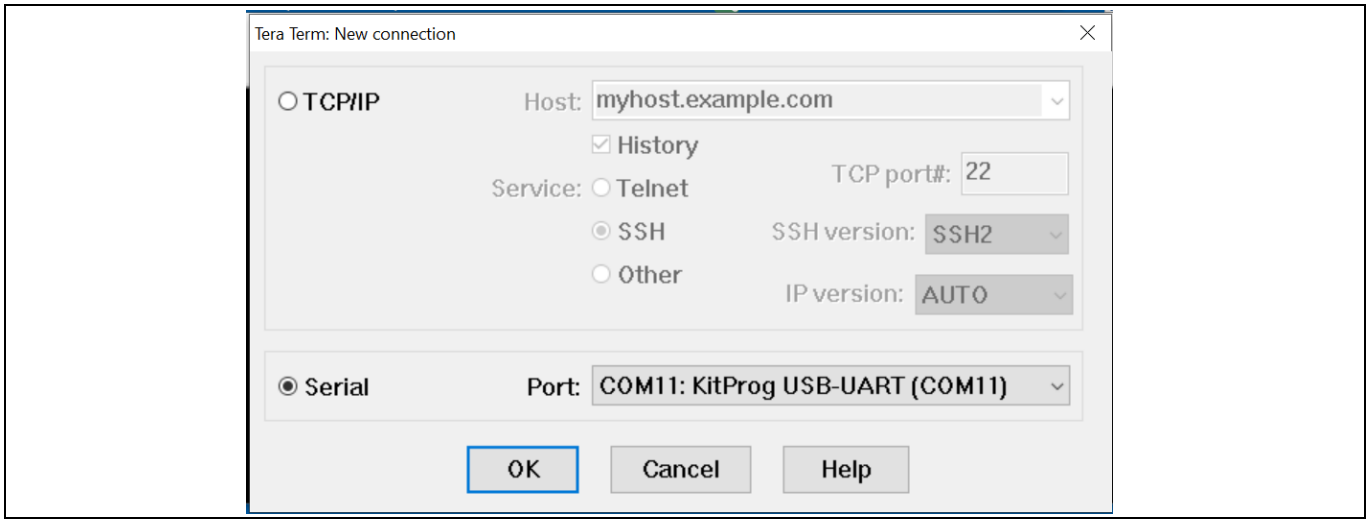

Figure 13 New connection using Tera Term

Setup the Serial COM Port, with the configuration shown in Figure 14.

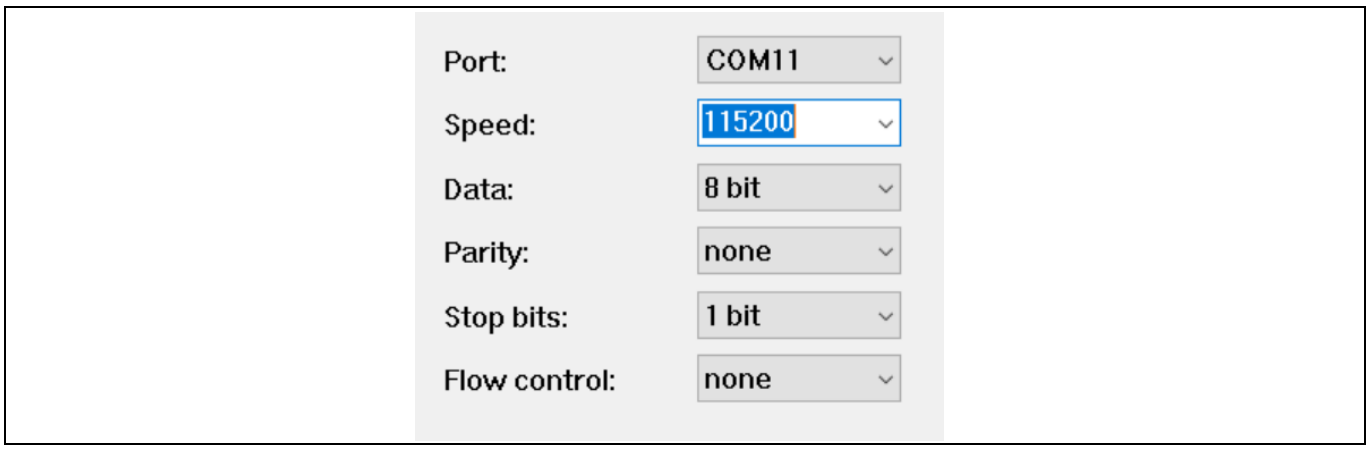

Figure 14 Serial COM Port configuration

2. Hit the "RESET SW1" button on the dongle with the XENSIV™ Wireless Presence Detection Sensor attached. **Error! Reference source not found.** shows the serial terminal output.

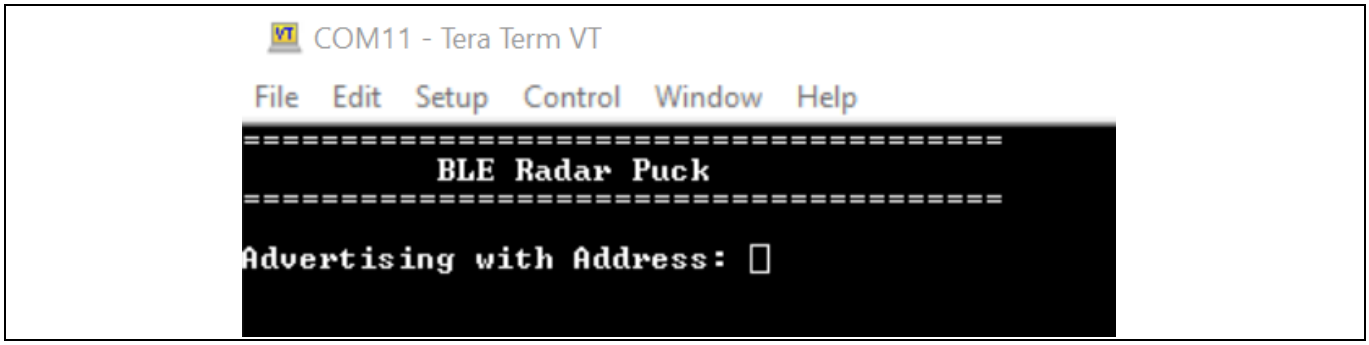

Figure 15 Serial terminal output after device reset

3. Open the Infeneon's "60 GHz Radar" app and click "Connect". The serial terminal will then output the presence detection status and direction of motion, as shown in **Error! Reference source not found.**.

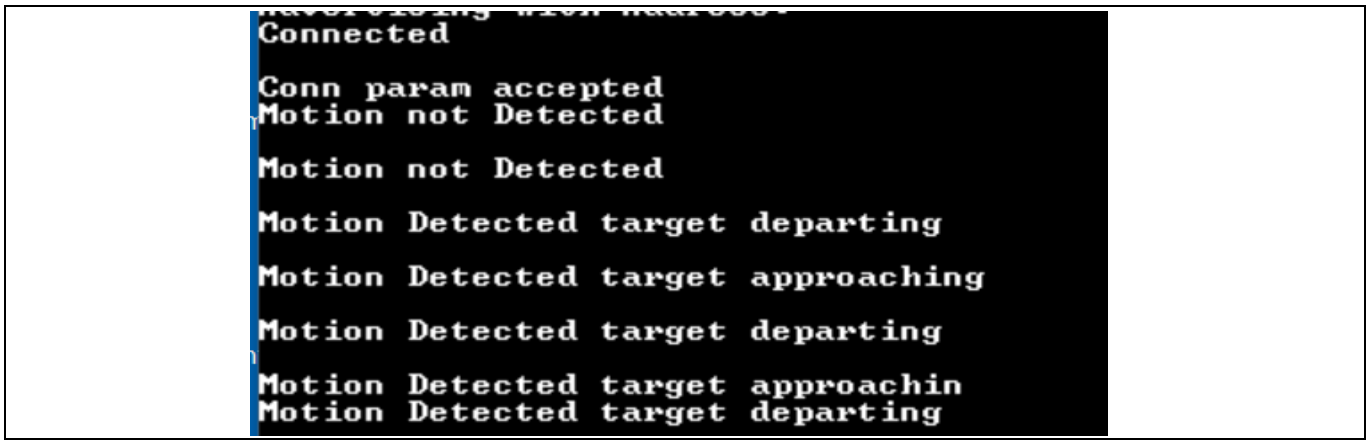

Figure 16 Serial terminal output showing motion detection status

5 Troubleshooting

5.1 “60 GHz Radar” app reports “Cannot find device”

- Measure the voltage of the CR2032 to ensure that it measures 2.7 V or greater. If it is lower than 2.7 V, replace the battery.
- Check to make sure Bluetooth is enabled on the smartphone that is running the "60 GHz Radar" app.
- Check to make sure the BLE device is showing in the XENSIV™ Wireless Presence Detection Sensor. It will show as "BLEPuck". Any scanner app can be used to check if it is broadcasting, e.g., CySmart, which is downloadable from the Apple App Store or Google Play Store. Open the scanner app, and BLEPuck should show up in the list of BLE devices, as shown in **Error! Reference source not found.**.

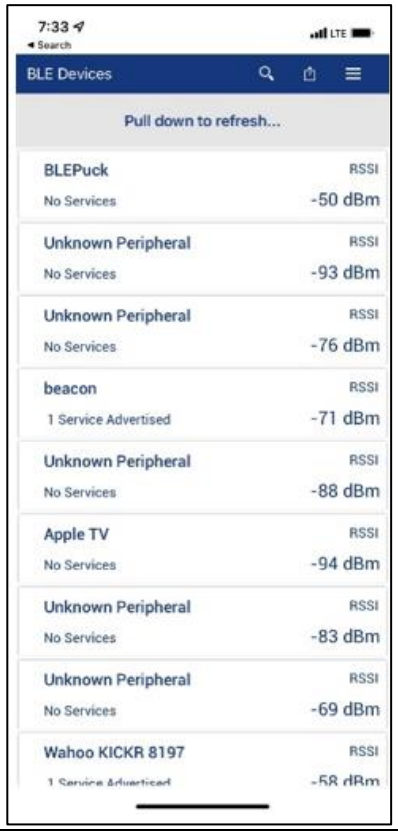

Figure 17 BLEPuck in BLE found devices list

- If BLEPuck still does not show after refreshing and waiting for more than a minute or two, power-cycle the XENSIV™ Wireless Presence Detection Sensor using SW1, as explained in Section 2, Step 3. Power-cycling the CYBLE-222014-01 device will put it back into broadcasting mode.
- Make sure the smartphone running the Infineon’s “60 GHz Radar” app is at least Bluetooth v4.2 compliant.

5.2 PSoC™ programmer communication failure

- If the PSoC™ programmer fails to communicate, a pop-up window will show the message shown in **Error! Reference source not found.**.

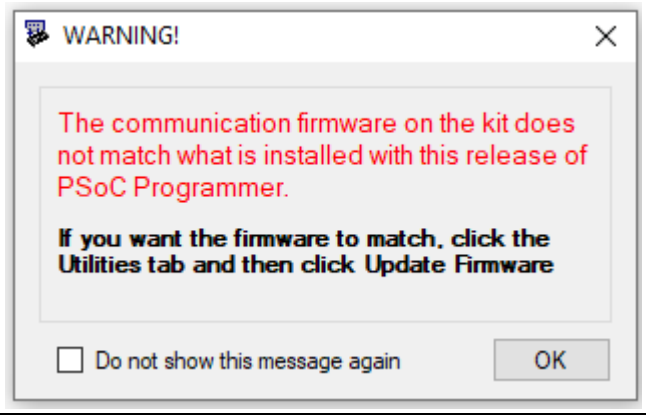

Figure 18 Programmer fails to communicate warning message

Click “OK”, and select the “Utilities” tab, then click the “Upgrade Firmware” button, as depicted in **Error! Reference source not found.**.

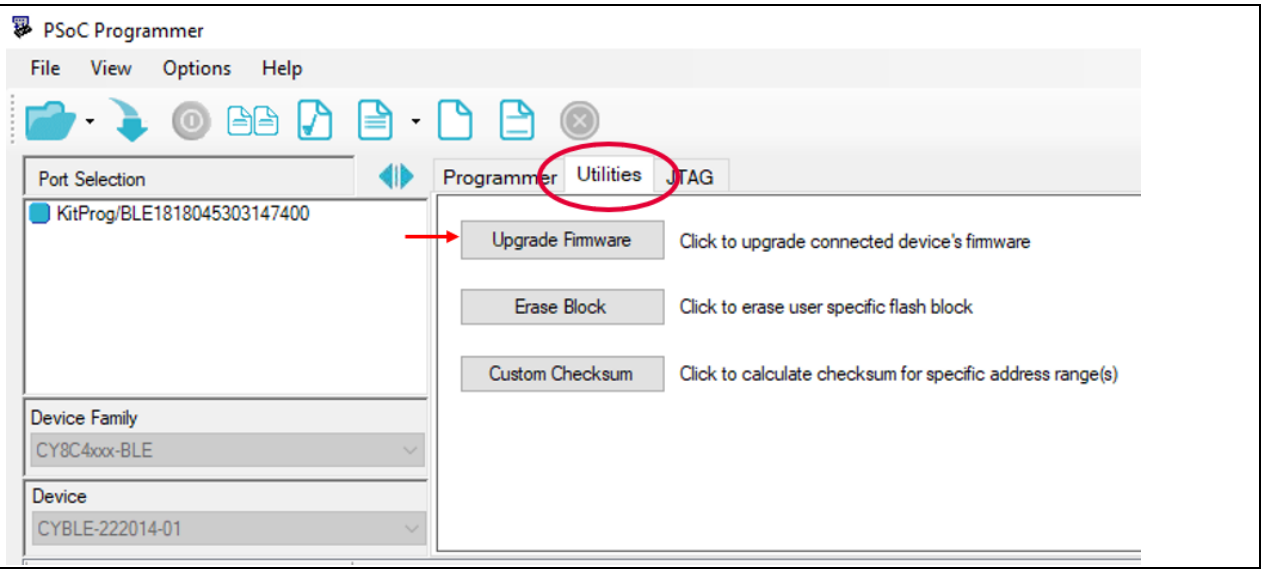

Figure 19 Upgrade firmware

This will upgrade the firmware of the programming dongle. The “Actions and Results” window will report the status during the update. The update will take several seconds before a “Firmware Update Finished” message is given.

Attention: DO NOT remove the dongle during the updating process.

6 Frequently asked questions (FAQs)

Q: What is the method to show demo to customers for BEST user experience?
A: The XENSIV™ Wireless Presence Detection Sensor should be placed on a stationary platform where there will be no moving objects behind it (for example, against a wall.) The user should hold the connected phone and stand 1 to 8 m from the sensor and walk towards or away from the sensor to see the directional sensing. To demonstrate detection versus no detection, place the sensor facing a door where the user can step behind a wall.

Q: What is the system architecture the demo?
A: Refer to the https://www.infineon.com/cms/en/product/evaluation-boards/demo_60ltr11_auto_ble/ for the block diagram.

Q: How long will the battery last?
A: The demo is not optimized for the lowest achievable power. If the demo is left running continuously, the battery will run for approximately 24 hours. In theory, with proper power optimization, a similar design could run for months depending on the implementation. Application notes are available for optimizing both PSoC 4 BLE (CYBLE-222014-01) and 60 GHz radar (BGT60LTR11AIP) to achieve the best low power performance for battery operation.

Q: What is the range?
A: The demo can cover an approximate range of 8.5 m and has a field of view (FOV) of around 90°. The plastic enclosure is not designed to provide optimal performance. For details on optimal performance see AN644 BGT60LTR11AIP radome design guide [1].

Q: What is needed to run the demo?
A: You will need a smartphone with Bluetooth capability, to host the Infineon “60GHz Radar” app, which is available for download in both the Apple and Google stores and can be found by searching for "XENSIV™ Wireless Presence Detection." Additionally, you will need a CR2032 battery to power the device

Q: What are typical application use cases for an application similar to the demo?
A: Thermostat, room occupancy, lighting control, automatic door, intrusion alarm, and many more.

Q: Can this demo be used to as an evaluation platform to fully analyze all the features of the BGT60LTR11AIP for a custom design?
A: No, this is an enablement demo to illustrate the BGT60LTR11AIP as an IoT edge application.

Q: Can this demo be used as a basis for a custom design application?
A: Yes, all hardware design files and source code for the smartphone app and PSoC™ 4 MCU with AIROC™ Bluetooth LE are available to use as a reference to start custom applications.

Q: Does the 60 GHz radar (BGT60LTR11AIP) require FCC certification?
A: Yes, 60 GHz radar is subject to rules and operational policies as stipulated in Section §15.255 of the Commission's Rules. For pre-certified solutions, please contact your Infineon sales team for information on 60 GHz radar modules.

References

[1] Infineon Technologies AG. BGT60LTR11AIP XENSIV™ 60GHz Radar Sensor

[2] Infineon Technologies AG. CYBLE-222014-01 AIROC™ Bluetooth® Module

[3] Infineon Technologies AG. AN644 BGT60LTR11AIP Radome Design Guide

Revision history

Document revision	Date	Description of changes
1.00	2023-01-20	Initial version

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Do you have a question about this document?

Email: erratum@infineon.com

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