24 GHz radar tools and development environment

XENSIV™ 24 GHz radar demo boards

About this document

Scope and purpose

This user manual describes the software and firmware environment required to use the radar applications offered with Infineon's industrial XENSIV™ 24 GHz radar demo boards: DEMO SENSE2GOL/MAKE, DEMO DISTANCE2GO, DEMO POSITION2GO, DEMO SENSE2GOL PULSE and DEMO DISTANCE2GOL.

It provides guidelines for novice users on how to build and run smart radar solutions, from basic movement detection to advanced motion detection and sensing, made easy with Infineon's 24 GHz radar chipsets, and using the Infineon firmware and software tools.

Intended audience

The intended audience for this document are design engineers, technicians, and developers of electronic systems, working with Infineon's XENSIV™ 24 GHz radar sensors.

Related documents

Additional information can be found in the documentation provided with the Radar Sense2GoL Pulse or Radar Distance2GoL tools in the Infineon Developer Center (IDC), or from www.infineon.com/24GHz.

Note: *Following the launch of our next generation of XENSIV™ Radar 24GHz DEMO boards with SENSE2GOL PULSE and DISTANCE2GOL, please be informed that these XENSIV™ Radar 24GHz demo boards are therefore discontinued: SENSE2GO, SENSE2GOL, DISTANCE2GO and POSITION2GO.*

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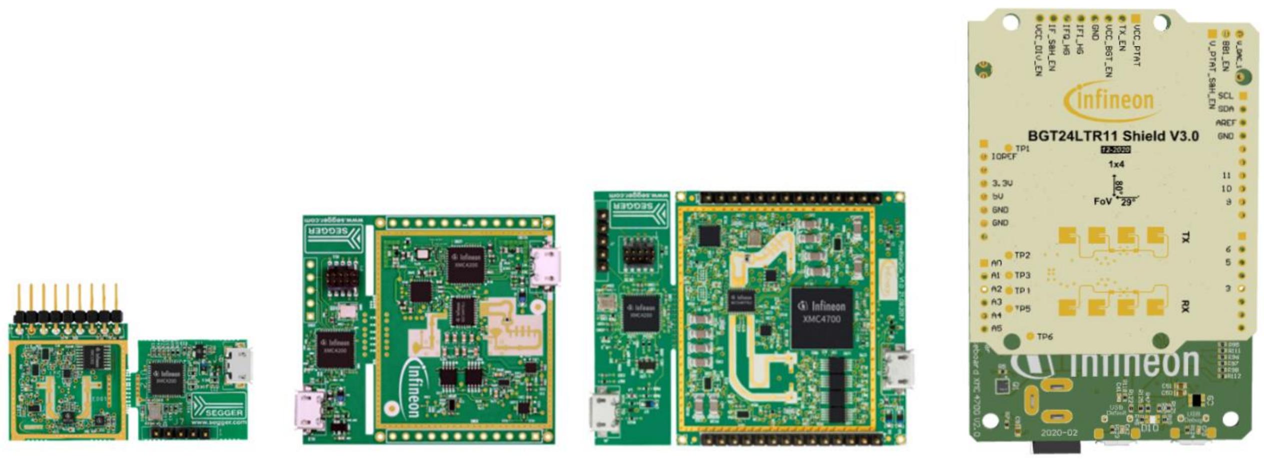
1 Introduction

The 24 GHz radar demo boards from Infineon are demonstration platforms as well as starter kits for Infineon's silicon-germanium (SiGe) based 24 GHz transceiver chipset BGT24 and 32-bit ARM® Cortex™-M based XMC™ microcontrollers.

- **DEMO SENSE2GOL (S2GL)** – BGT24LTR11 + XMC1302
  Infineon radar demo board based on the BGT24LTR11 – Doppler (motion, speed and direction of movement detection).
- **DEMO DISTANCE2GO (D2G)** – BGT24MTR11 + XMC4200
  Infineon radar demo board based on the BGT24MTR11 – Frequency Modulated Continuous Wave (FMCW) and Doppler (distance, speed and direction of movement detection).
- **DEMO POSITION2GO (P2G)** – BGT24MTR12 + XMC4700
  Infineon radar demo board based on the BGT24MTR12 using fast-chirp FMCW for tracking (angle, distance, speed and direction of movement detection).
- **DEMO SENSE2GOL PULSE (S2GLP)** – Radar Baseboard XMC4700 and BGT24LTR11 Shield with Arduino compatibility Infineon radar demo board based on the BGT24LTR11 – Doppler (motion, speed and direction of movement detection) with extremely low power consumption.
- **DEMO DISTANCE2GOL (D2GL)** – Radar Baseboard XMC4700 and BGT24LTR11 Shield with Arduino compatibility Infineon radar demo board based on the BGT24LTR11 – Software-Controlled FMCW (motion, speed, direction of movement of multiple targets detection and distance of closest human or moving target detection) with extremely low power consumption.

The 24 GHz radar demo kits provide a complete evaluation platform for radar systems including demonstration firmware and a highly interactive Graphical User Interface (GUI).



SENSE2GOL   DISTANCE2GO   POSITION2GO   SENSE2GOL PULSE / DISTANCE2GOL

Figure 1 Infineon XENSIV™ 24 GHz radar demo boards

Users can develop their own radar-based application firmware utilizing Infineon's powerful, free-of-charge toolchain DAVE™ for microcontroller programming, customize radar applications built on generated DAVE™ code, and run them on 24 GHz radar demo board.

2 Running radar applications

With each 24 GHz radar, Infineon offers various radar demonstration applications to demonstrate the radar kits' capabilities and to facilitate the development of user applications that can be used to detect:

- Motion, speed and direction of movement of multiple targets (approaching or departing)
- Distance of multiple targets
- Position of multiple targets

2.1 Tools and software set-up

2.1.1 Infineon Developer Center (IDC)

Before using the 24 GHz radar demo boards, as well as running the radar demonstration application, it is necessary to download the supporting software from Infineon.

In order to install and use Infineon plugins and tools, and gain access to the 24 GHz radar software package and documentation, you must first download and install the Infineon Developer Center (IDC) Launcher (former Infineon Toolbox) using this link: https://www.infineon.com/cms/en/design-support/tools/utilities/infineon-developer-center-idc-launcher/

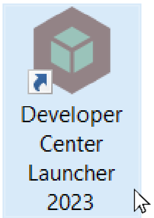


Figure 2 Run Infineon Developer Center Launcher

2.1.2 24 GHz radar IDC tools

Once the IDC Launcher is successfully installed, you can proceed with downloading the appropriate 24 GHz radar tool: Radar Sense2GoL, Radar Distance2Go, Radar Position2Go, Radar Sense2GoL Pulse or Radar Distance2GoL including software package and documentation, as detailed in the following instructions:

- Run the Infineon IDC Launcher by double-clicking on the tool icon on your Windows desktop. The program starts under the **My Tools** tab, as shown in Figure 3.

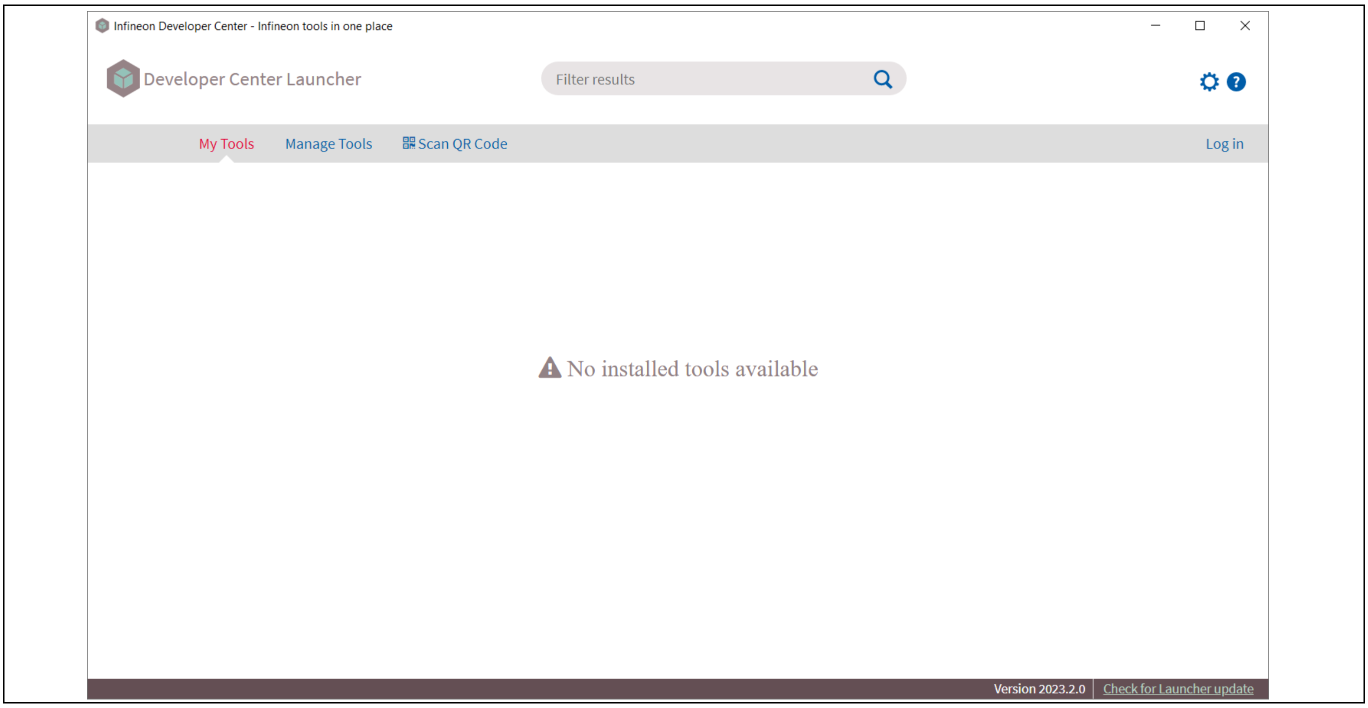


Figure 3 My Tools under IDC Launcher

- Click on the **Manage Tools** tab, then type the 24 GHz tool name of your choice (e.g., Radar Distance2GoL) in the search box and press **Enter**.

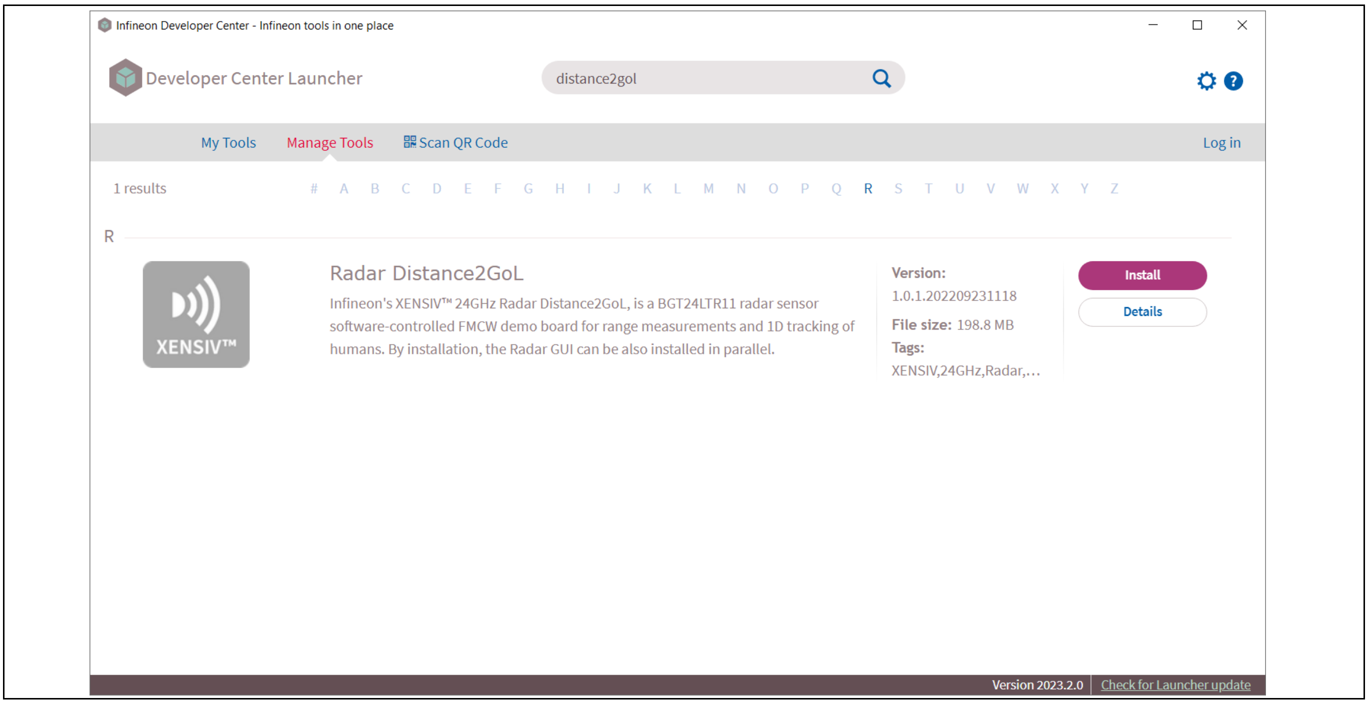


Figure 4 Radar tools installation via IDC

- Click on **Install**, and then on **Next**.
- Once installed, click on the installed tool icon to go to the start page.

As shown in Figure 5. By installing the Radar Distance2GoL tool, the Radar GUI tool can also be installed in parallel.

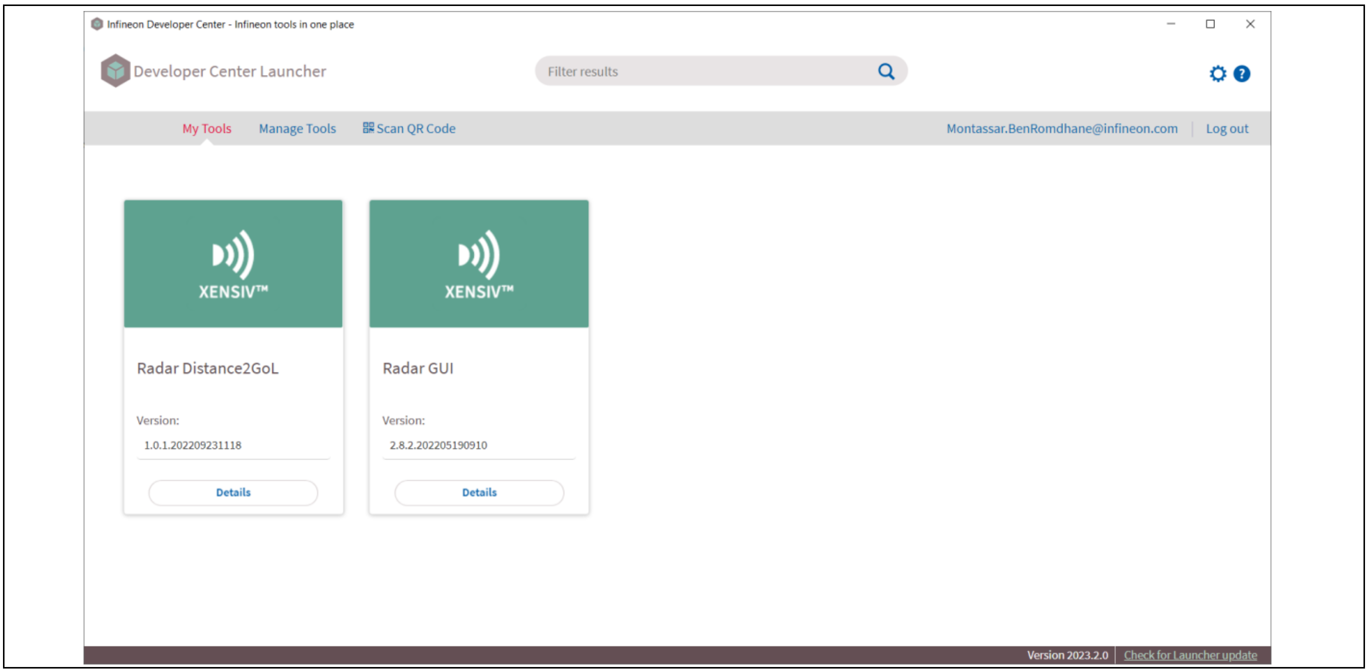


Figure 5 **24 GHz radar installed tools (e.g., Radar Distance2GoL)**

User can download and install the 24 GHz radar SW package following the steps on the "Getting started" page of each installed tool via the Infineon Developer Center (IDC).

Once installed, a folder (e.g., IFX_D2GL-HW-SW_V1.0.0) will be created on the specified path with the following structure:

- Firmware_Software – all software, firmware and drivers
- Hardware – all hardware-related files (e.g., schematics, Altium files)
- Documentation – all documentation (e.g., application notes)

2.1.3 XMC™ Flasher

The 24 GHz radar demonstration firmware is already pre-loaded in the Flash memory on the XMC™ microcontroller. This section describes how to use the binary images provided to reprogram the firmware applications. In addition to XMC™ Flasher, Radar GUI can also be used to flash new firmware into the device which is explained in section 2.2.1. The 24 GHz radar firmware package contains binary images (*.hex) of the applications provided in the subfolder **Binary**.

The XMC™ Flasher tool can be used for on-chip Flash programming to reprogram the radar application using a binary image, as follows:

- Connect the 24 GHz radar board to a PC with USB "type A to micro-B" cables through the embedded USB connector to power up the board or to debug.
- Use (*.hex) binary with the XMC™ Flasher tool to reprogram the radar firmware:
  - Start the **XMC™ Flasher** tool in the Infineon Developer Center (IDC) launcher

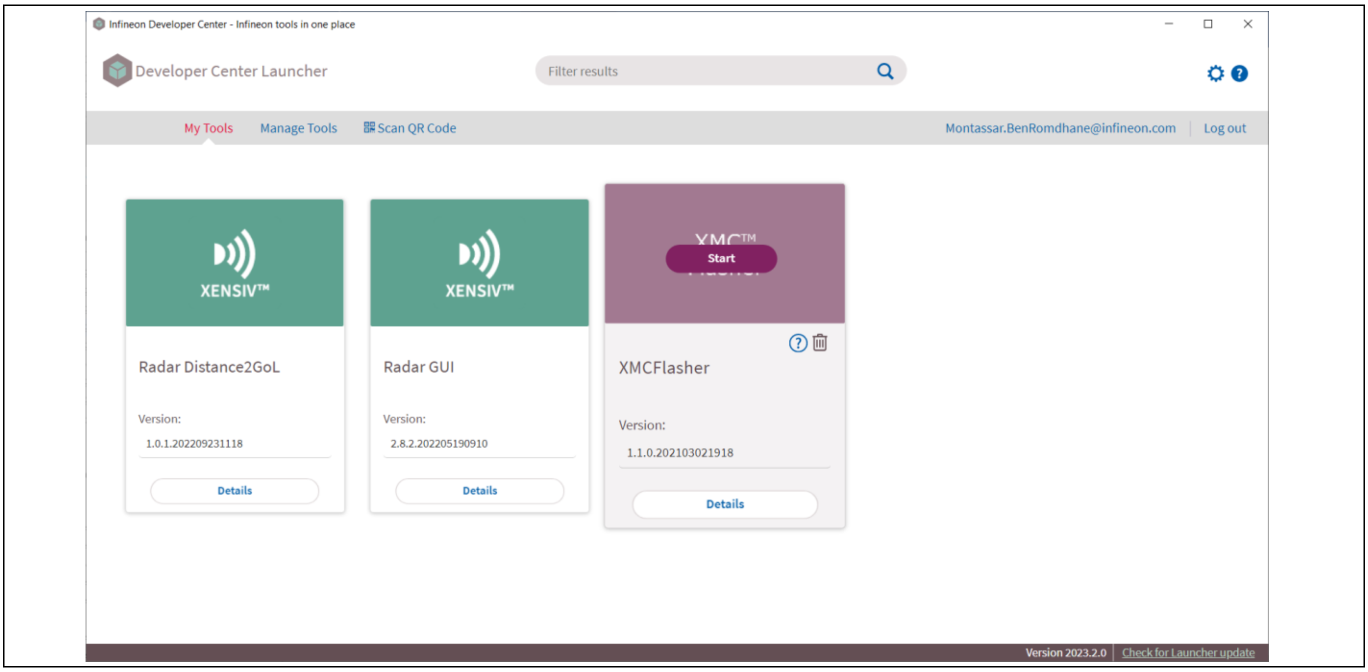


Figure 6 Start XMC™ Flasher tool

- Once started, click on the **Connect** button, then select the device name (refer to **Table 1** from the List of **Targets** window and confirm with the **OK** button.

Table 1 XMC™ devices embedded in 24 GHz radar boards

24 GHz radar board	XMC™ device target
DEMO SENSE2GOL	XMC1302-0016
DEMO DISTANCE2GO	XMC4200-256
DEMO POSITION2GO	XMC4700-2048
DEMO SENSE2GOL PULSE	XMC4700-2048
DEMO DISTANCE2GOL	XMC4700-2048

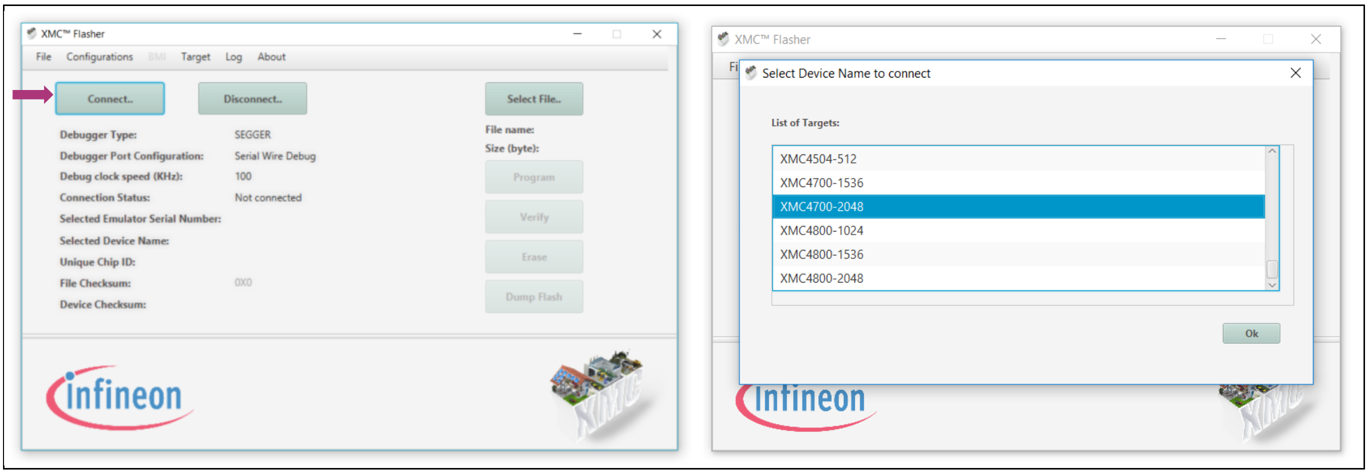
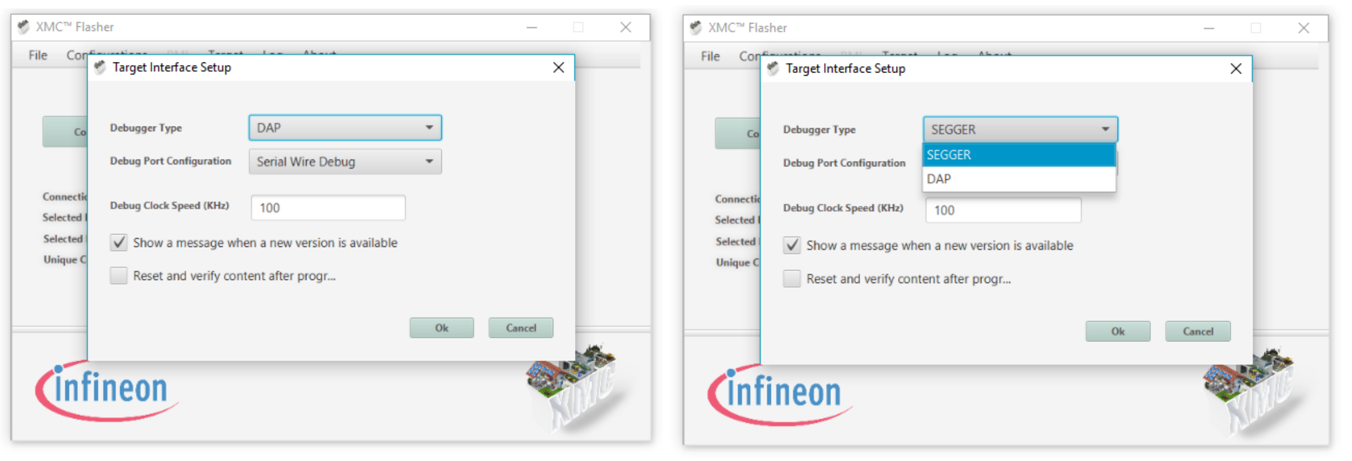


Figure 7 XMC™ Flasher device selection and connection

*Note: Please ensure that SEGGER J-Link drivers are installed before using the XMC™ Flasher tool. Otherwise, the default debugger type under XMC™ Flasher Target Interface Setup will be set to **DAP**, as shown in Figure 8a. Once installed, the user must change the debugger type to SEGGER, as shown in Figure 8b.*



(a) (b)

Figure 8 Change debugger type

- If the connection is established successfully, **Connection Status** turns to Connected. The **Unique Chip ID** is displayed as well.
- After connection is established, select the (*.hex) file by clicking on the **Select File**… button.

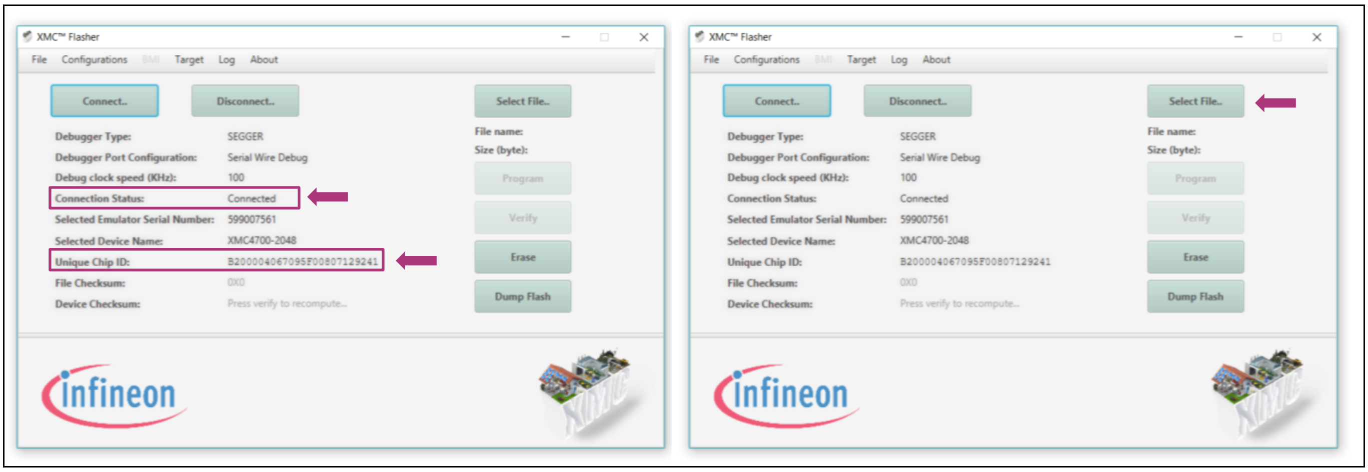


Figure 9 Binary image file selection

- Navigate to the **Binary** folder and select the (*.hex) file inside it (e.g., P2G_FW.hex), then click on Open in the dialog box.
- Successful selection of the (*.hex) file results in listing its filename below the **Select File...** button

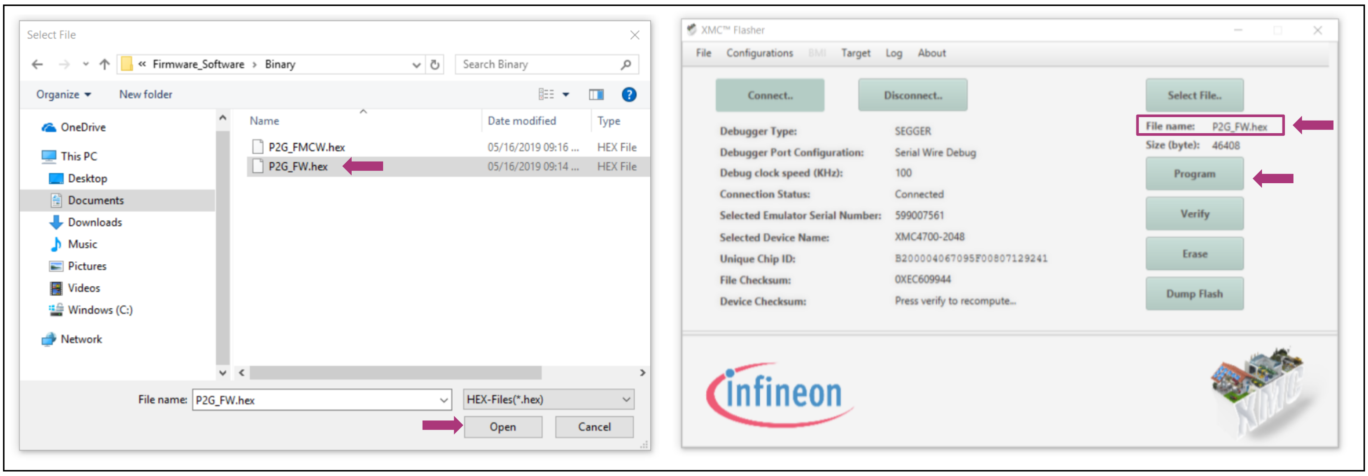


Figure 10 Binary image selection

- Click on the **Program** button, which opens the SEGGER progress window. It either verifies successful Flashing or shows an error message.
- If programming succeeds, the message **Programming is successful!** appears.

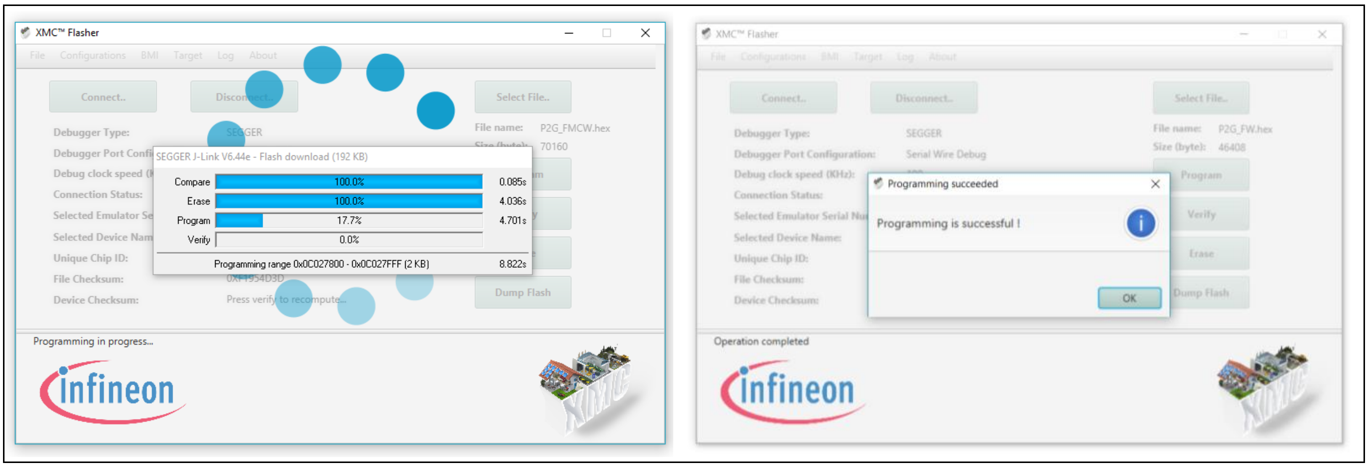


Figure 11 **Successful firmware programming**

Note: *The XMC™ Flasher requires a J-Link compatible debug-HW to connect to the target, which is already integrated in the 24 GHz Radar demo board.*

2.1.4 DAVE™ IDE

DAVE™ (Digital Application Virtual Engineer), is a free-of-charge Eclipse-based Integrated Development Environment (IDE) using a GNU C-compiler that provides an extensive, configurable and reusable code repository for an XMC™ industrial microcontroller powered by Arm® Cortex®-M processors.

It is a C/C++-language software development and code generation tool for XMC™ microcontroller applications using DAVE™ APPs to configure the MCU peripherals (ADC, DMA, CCU4…), which reduces development time and allows for quick porting of the firmware across XMC™-series MCUs.

DAVE v4.1.2 or higher should be installed, or any other third-party toolchain supporting Infineon Technologies XMC™ microcontrollers, e.g., Atollic, IAR, Keil MDK, Rowley or TASKING. The latest version of DAVE™ IDE (v4.5.0) can be downloaded from IDC using https://softwaretools.infineon.com/tools/com.ifx.tb.tool.daveide

2.2 Graphical User Interface (GUI) solutions

2.2.1 Radar GUI

Note: *The Radar GUI tool is only supporting DEMO DISTANCE2GO, DEMO POSITION2GO, DEMO SENSE2GOL PULSE and DEMO DISTANCE2GO 24GHz radar demo boards.*

Radar GUI is a Java-based highly interactive GUI for Windows XP/Vista/7/8/10. It provides graphical support for Infineon's radar devices and enables the visualization of real-time raw IF quadrature output signals and FFT spectrum and enables observation of the targets' distance and velocity information from a connected 24 GHz radar device.

Radar GUI offers several methods to record data in different formats for advanced signal processing and supports multiple recording options. Each option saves corresponding data in a dedicated file, as follows:

- **Raw data** – records raw IF data as they are received from the device; data are stored in a file with .raw extension
- **Time domain data** – records extracted time domain data (I/Q signals); data are stored in a file with .tdd extension

- **Frequency domain data** – records processed spectrum data; data are stored in a file with .fdd extension
- **Target data** – records radar target list data; data are stored in a file with .tgd extension

To run the Radar GUI as a standalone application on Windows, proceed as follows:

- Run **IDC launcher** by double-clicking on the launcher icon on your Windows desktop.
- Infineon automatically offers you the option to update Radar GUI. If a new version of the Radar GUI is available, a button labeled **Update** appears within the Radar GUI tab.
- Click on the **Update** button and afterward on the **Yes** button to confirm the update and get the new version of the Radar GUI tool.

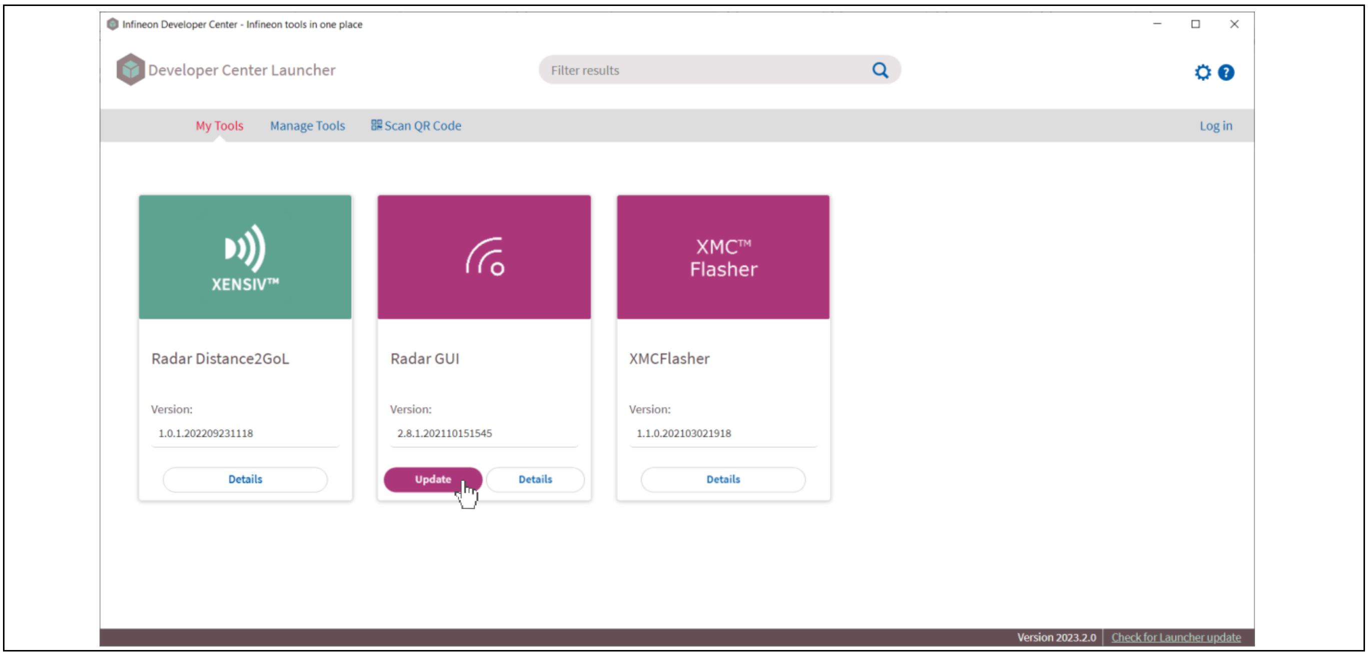


Figure 12 **Update Radar GUI tool to latest version**

- Click on the **Start** button of the Radar GUI application available under the **My Tools** tab.

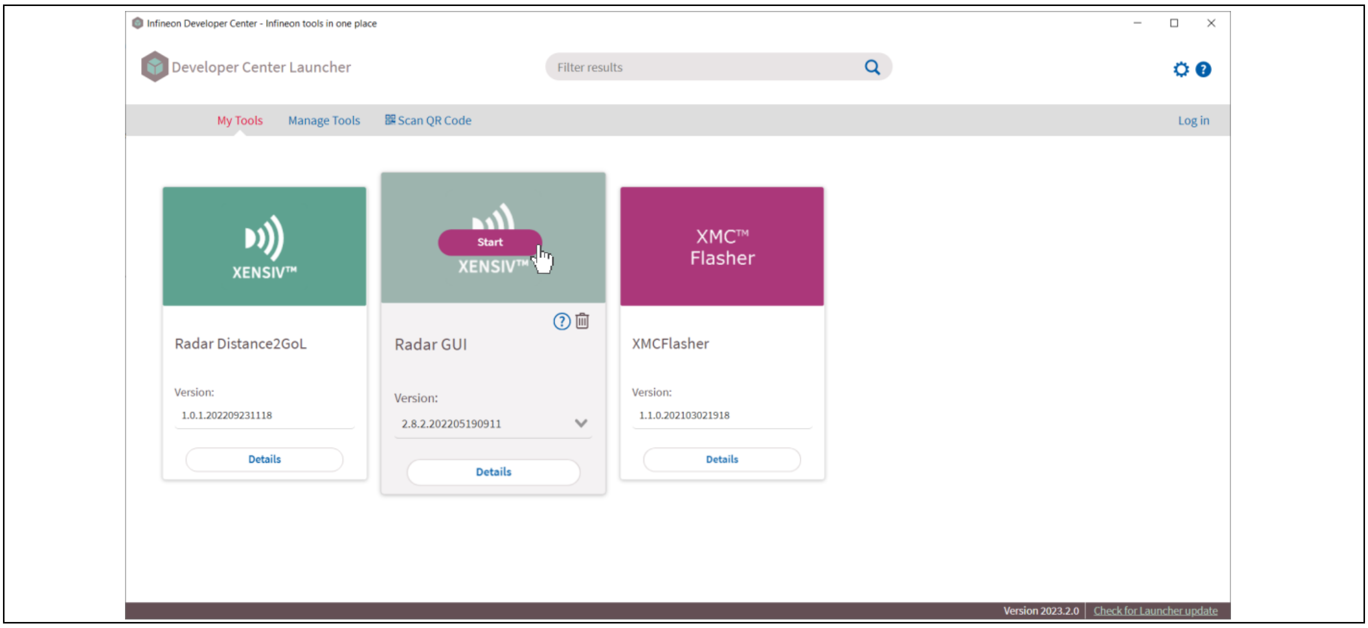


Figure 13 **Start Radar GUI tool**

- After launching the Radar GUI application, the compatibility of the firmware version running in your 24 GHz radar-connected device is checked. If a newer firmware version is available, a prompt to follow the links to update the firmware appears.

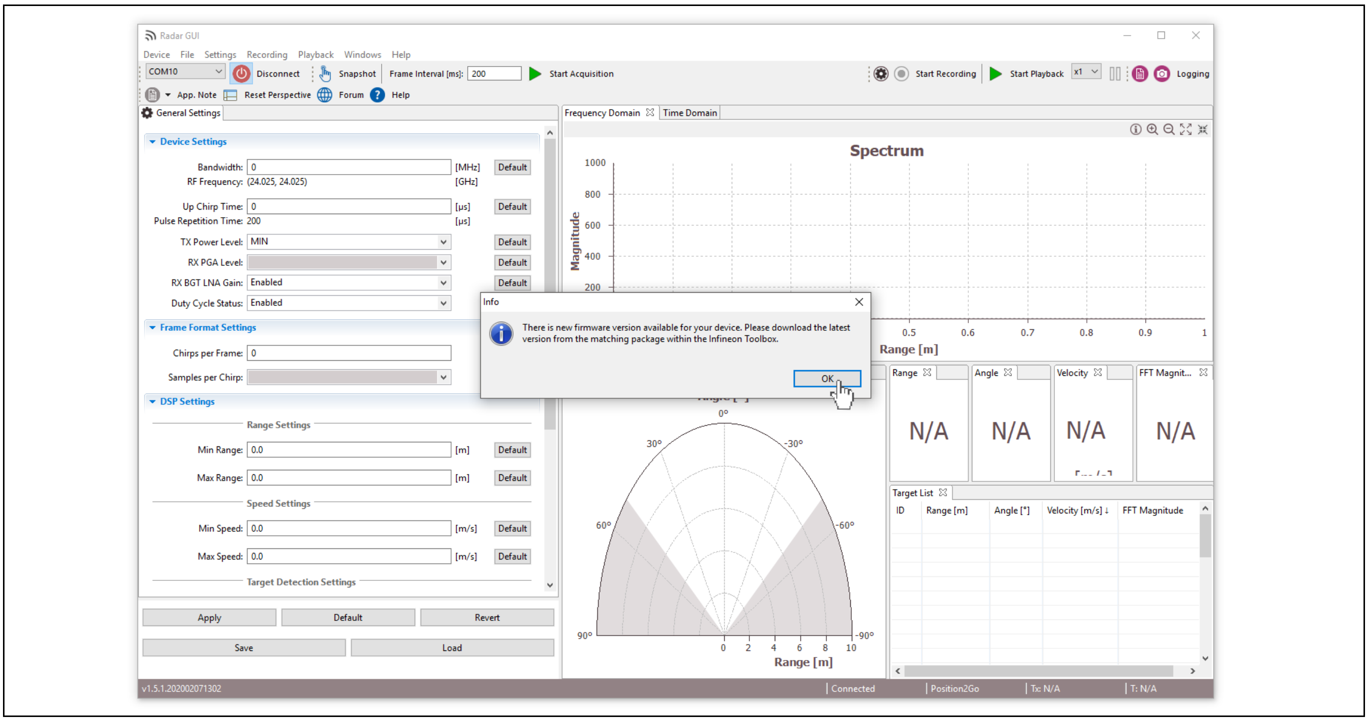


Figure 14 New firmware version available window

- Radar GUI automatically starts acquiring data from the 24 GHz radar board, when the radar firmware is running. Figure 15 shows the Radar GUI default screen acquiring FMCW data from DEMO POSITION2GO radar board, in which the Frequency Domain view displays the spectrum data for each antenna.
- For further information, please refer to the integrated Radar GUI help, which provides a complete overview of all features.

Figure 15 Radar GUI window details

- In addition to XMC™ Flasher, Radar GUI offers firmware flashing capability as well. In order to flash a new (*.hex) file (e.g., P2G_FW.hex), simply go to Device tab in Main Menu and select **Flash Firmware** option, as shown in Figure 16.

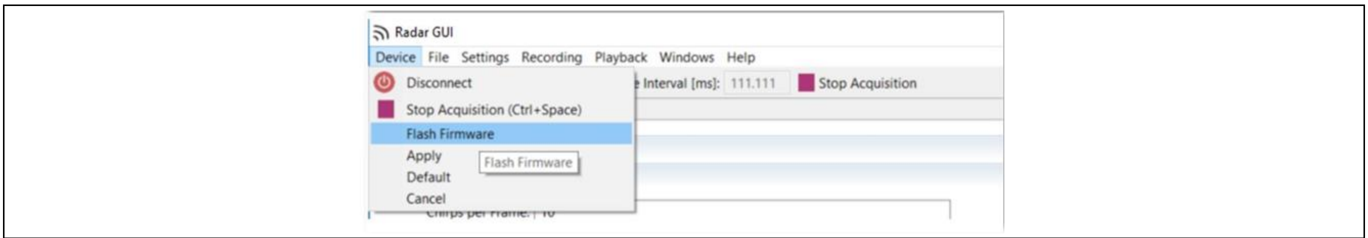


Figure 16 Flash firmware menu in Radar GUI

- A dialog box will appear where you can give path for your (*.hex) file or select from a preloaded list of available (*.hex) files (**Select Firmware**), as shown in Figure 17. You can also select your device, if not already detected by Radar GUI, from the drop down list of **Select Device**.
- Pressing the **Flash Firmware** button in the dialog box will start flashing the new (*.hex) file into the device.

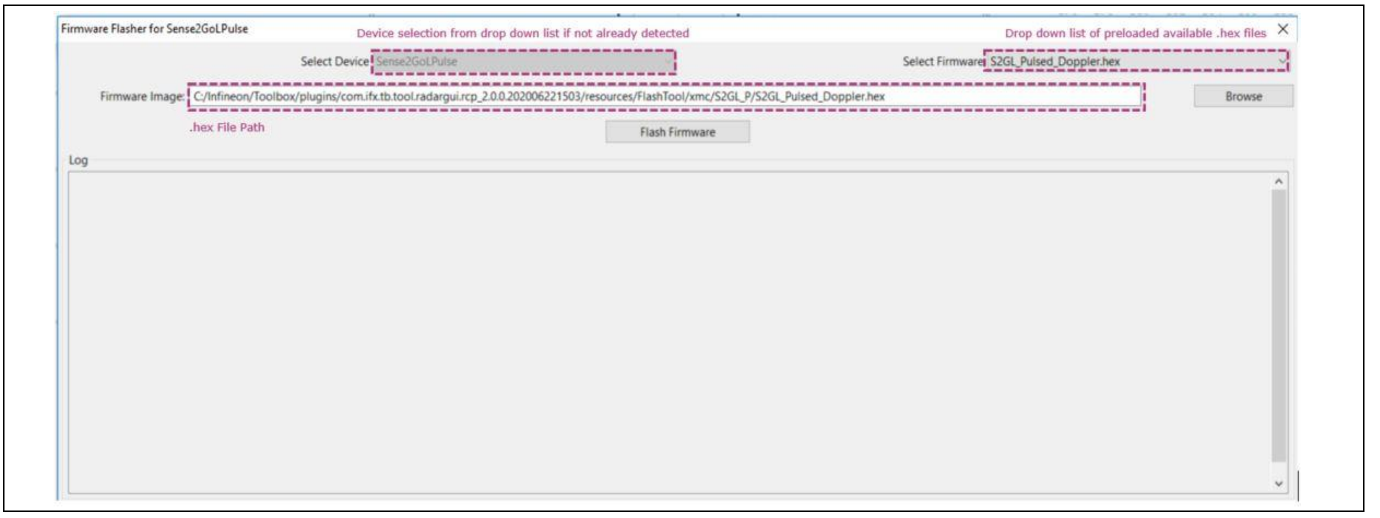


Figure 17 Firmware flasher interface in Radar GUI

- Successfully Flashed message would be generated in the end and Radar GUI can start data acquisition again if the **Connect** button is pressed, as shown in Figure 18.

Figure 18 Firmware flashing result

2.2.2 Micrium µC/Probe™ XMC™ GUI

Note: The Micrium GUI tool is only supporting DEMO SENSE2GOL/MAKE 24GHz radar demo boards and is not compatible with the Radar GUI.

µC/Probe™ XMC™ from Micrium® is a free-of-charge data monitoring and visualization tool to modify and track real-time data on the XMC™ target microcontroller in a non-intrusive way.

It enables designing a graphical dashboard with a wide range of widgets to control or fine-tune your XMC™ application, and it includes an eight-channel digital oscilloscope to visualize real-time data, controlled by a dedicated code that runs on the XMC™ target.

µC/Probe™ XMC™ is simple to install on a Windows PC and can be easily connected via the J-Link onboard debugger integrated into most of the XMC™ kits.

The latest version of µC/Probe™ XMC™ v4.3.0.9 is available for download from:
https://infineoncommunity.com/uC-Probe-XMC-software-download_ID712

The Radar Sense2GoL software package comes with a GUI based on a µC/Probe™ project from Micrium, which helps the user process collected raw data.

Here below an example, on how to run this Micrium-based GUI project, for the Sense2GoL device:

- Go to the **/Firmware_Software/GUI** folder inside the locally installed S2GL-HW-SW package.
- Double-click the µC/Probe™ **S2GL_GUI.wspx** project, to open the GUI.
- **S2GL_GUI.wspx** can be opened in Windows Explorer, or in S2GL_Doppler DAVE™ project explorer, as shown in Figure 19.

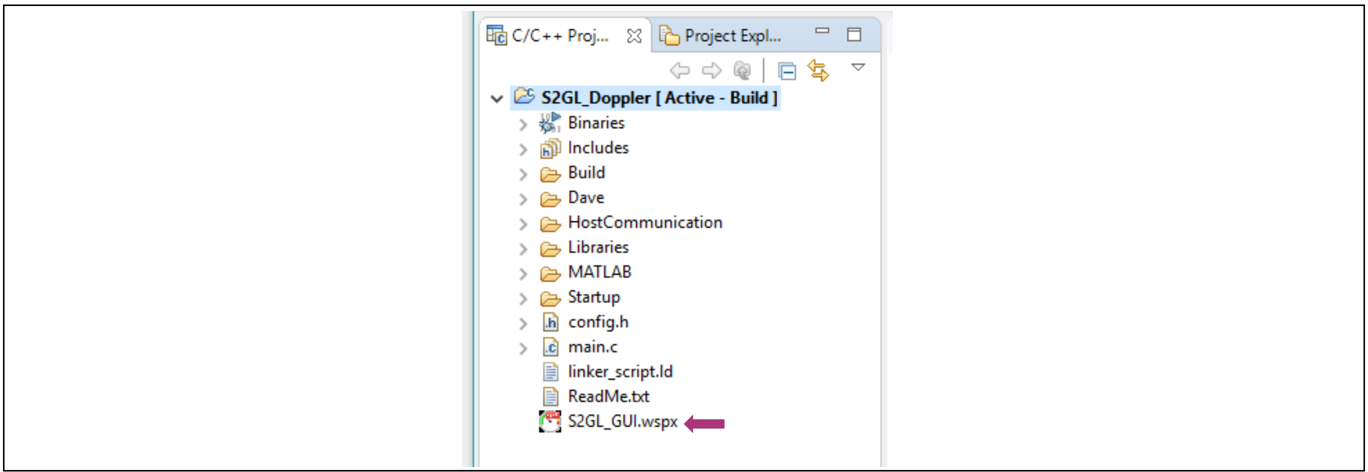


Figure 19 Open Sense2GoL Micrium GUI project

The µC/Probe™ needs to be provided by the XMC™ compiling and linking process output file (ELF file). This file containing the name, data type and address of all firmware global variables is parsed by the µC/Probe™ project.

A precompiled .elf file is already available in a **/Firmware_Software/GUI** folder called **S2GL_Doppler.elf**.

*Note: After building a project, object files and an application binary file (typically in ELF format) exist in the Debug folder in the Project Explorer view file tree. Please ensure you have imported the **S2GL_Doppler.elf** file into your Micrium project each time you modify and build your S2GL_Doppler project.*

Once the GUI project has opened, the following steps need to be executed:

- Connect your DEMO SENSE2GOL board via USB (please ensure the USB port on the debugger board is connected).
- Start the GUI by clicking on the **Run** button.

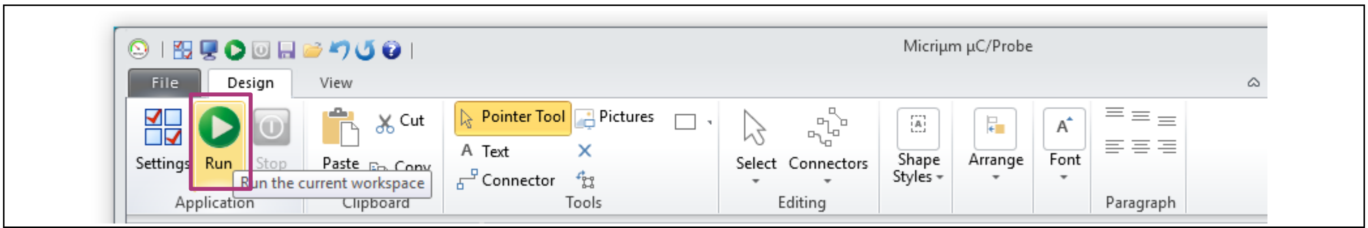


Figure 20 Run Micrium GUI workspace

- The GUI interface in Figure 21 should appear. The size of the GUI is not adaptive and may require some adjustments to fit the screen.
- Press the **START** button to begin data collection.

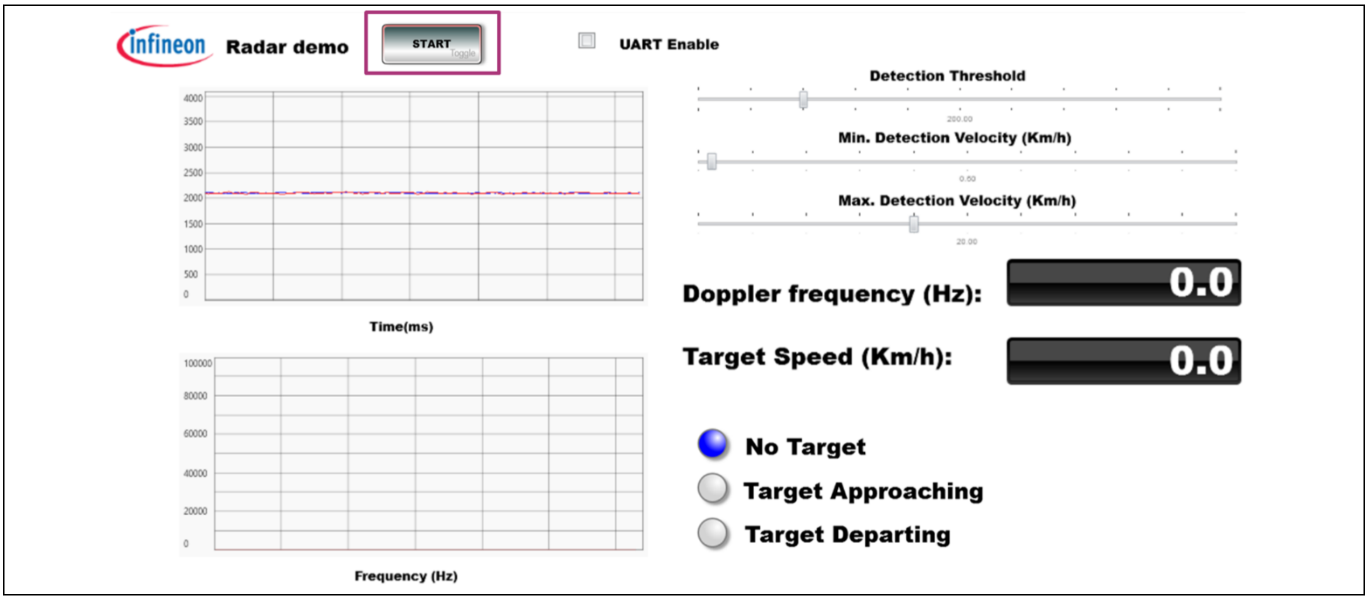


Figure 21 Start data collection

The radar should now detect movement and display data on the GUI:

- Time and frequency plots
- Threshold can also be set, default 200
- Minimum velocity (default 0.50 km/h) and maximum velocity (default 20 km/h)
- Maximum Doppler frequency and target speed
- Direction of movement

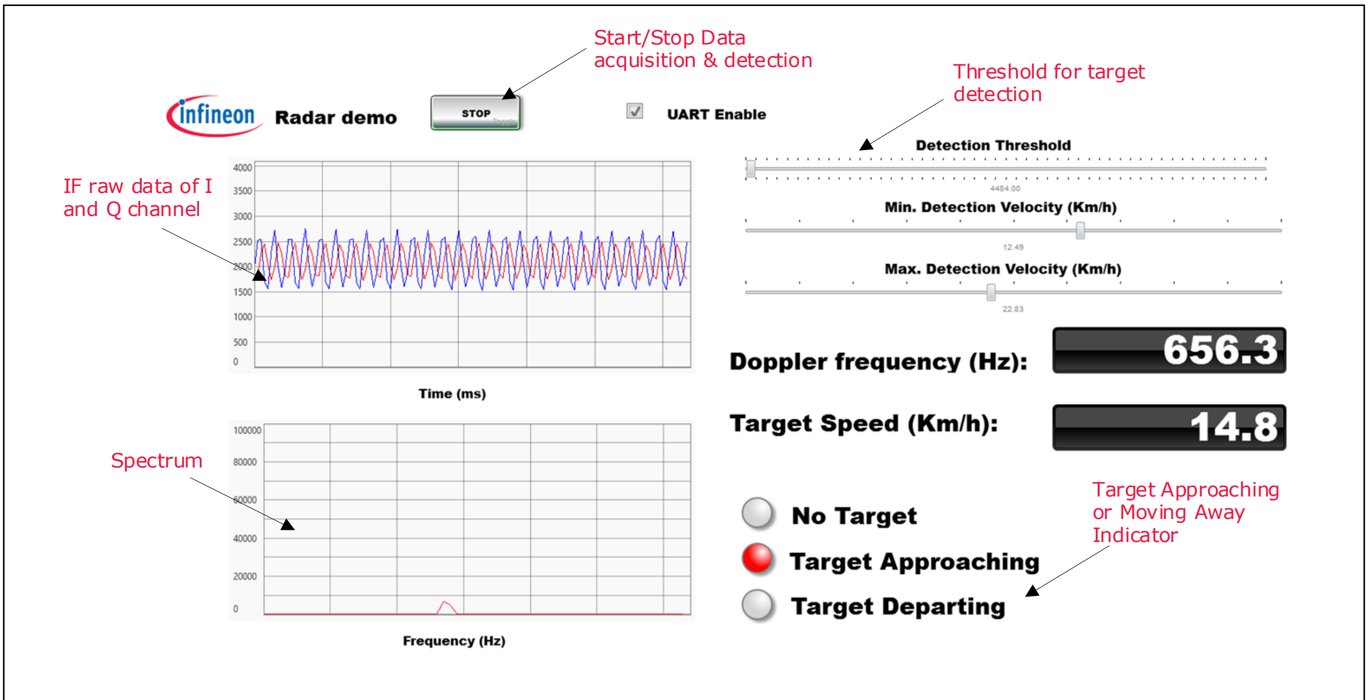


Figure 22 Data display on Micrium GUI

3 Customizing radar applications

Firmware (FW) is a piece of software written in C language to control different ICs and peripherals via the host processor, which is the XMC™ Cortex™-M MCU embedded in Infineon's 24 GHz radar demo boards.

The 24 GHz radar firmware is released as a ready-to-run DAVE™4 project, where source files are generated based on the DAVE™ APPs used, which are graphical-configurable application-oriented software components, used to enable quick reuse and customization.

This section explains how to customize, build, Flash and debug radar applications built on generated DAVE™ code, and run them on the 24 GHz radar demo board.

3.1 Building, Flashing and debugging the DAVE™ project

After installing the DAVE™ IDE, the user can start the program to build and load the 24 GHz radar firmware applications as follows:

- Download and unzip the 24 GHz radar firmware package, making sure not to modify the package folder structure.
- Open the project workspace with the DAVE™ toolchain:
  - Run the DAVE™ toolchain and wait for the program to start, which asks for the workspace location.
  - Enter a path or browse to the desired folder via the **Browse...** button and confirm the choice with the **OK** button.

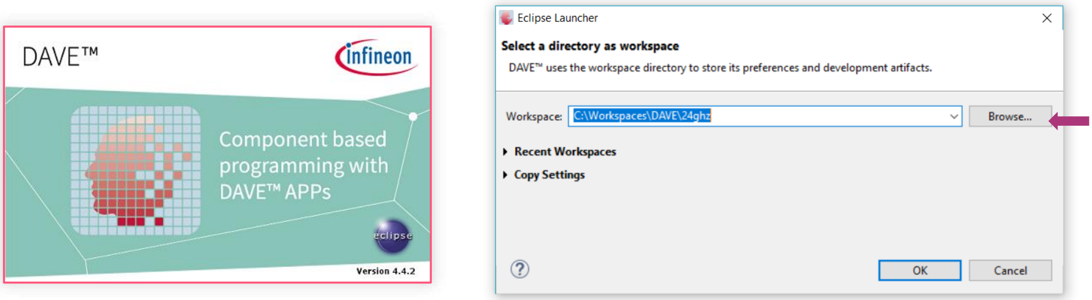


Figure 23 DAVE™ workspace launcher

Note: It is recommended that the active workspace folder is located not too many levels below the file system root to avoid build errors caused by exceeding the Windows path length character limitations.

  - Once the DAVE™ workspace is opened, select **Import...** in the File menu to display the Import dialog box.
  - Within the Import dialog box, select **Infineon**, **DAVE Project** and click on the **Next** button.

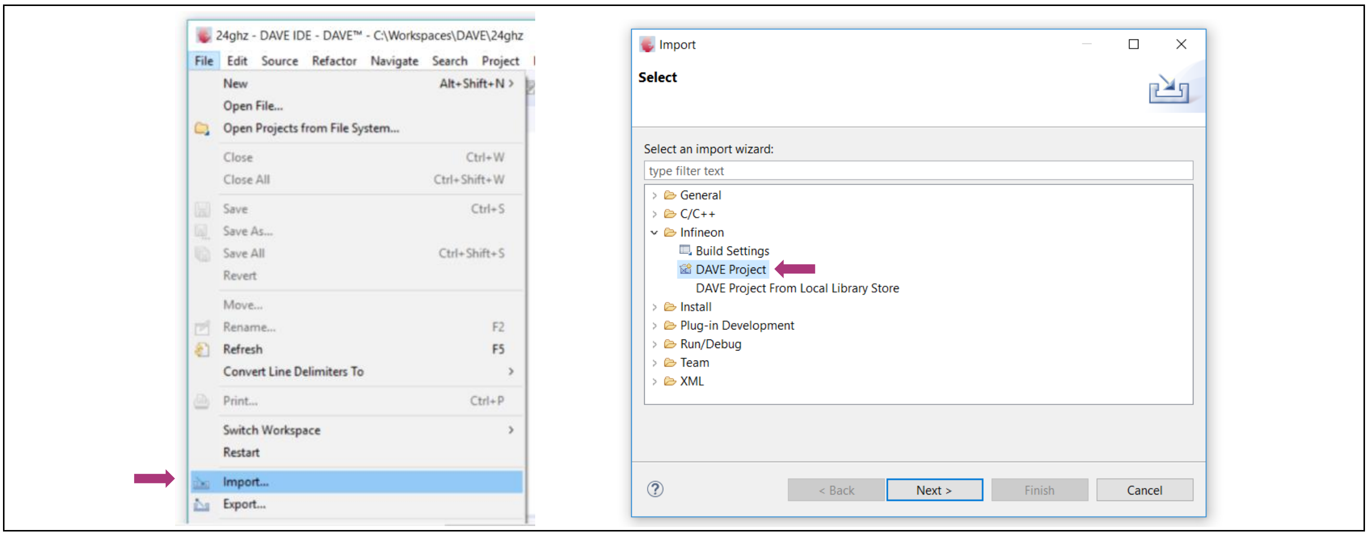


Figure 24 DAVE™ project import dialog box

- Check the **Copy Projects Into Workspace** checkbox.
- Select **Browse…** beside Select Root Directory.

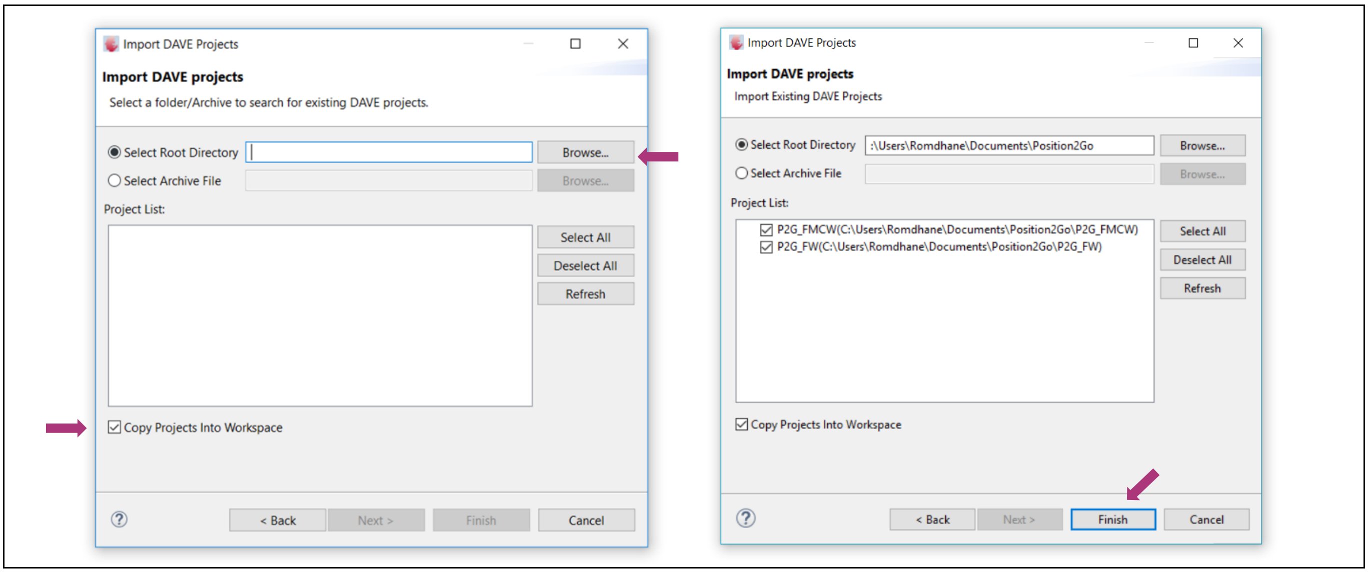


Figure 25 Import DAVE™ projects

- The project file should appear under the **Project List**. Click on the **Finish** button.
  A screen similar to Figure 26 should appear.

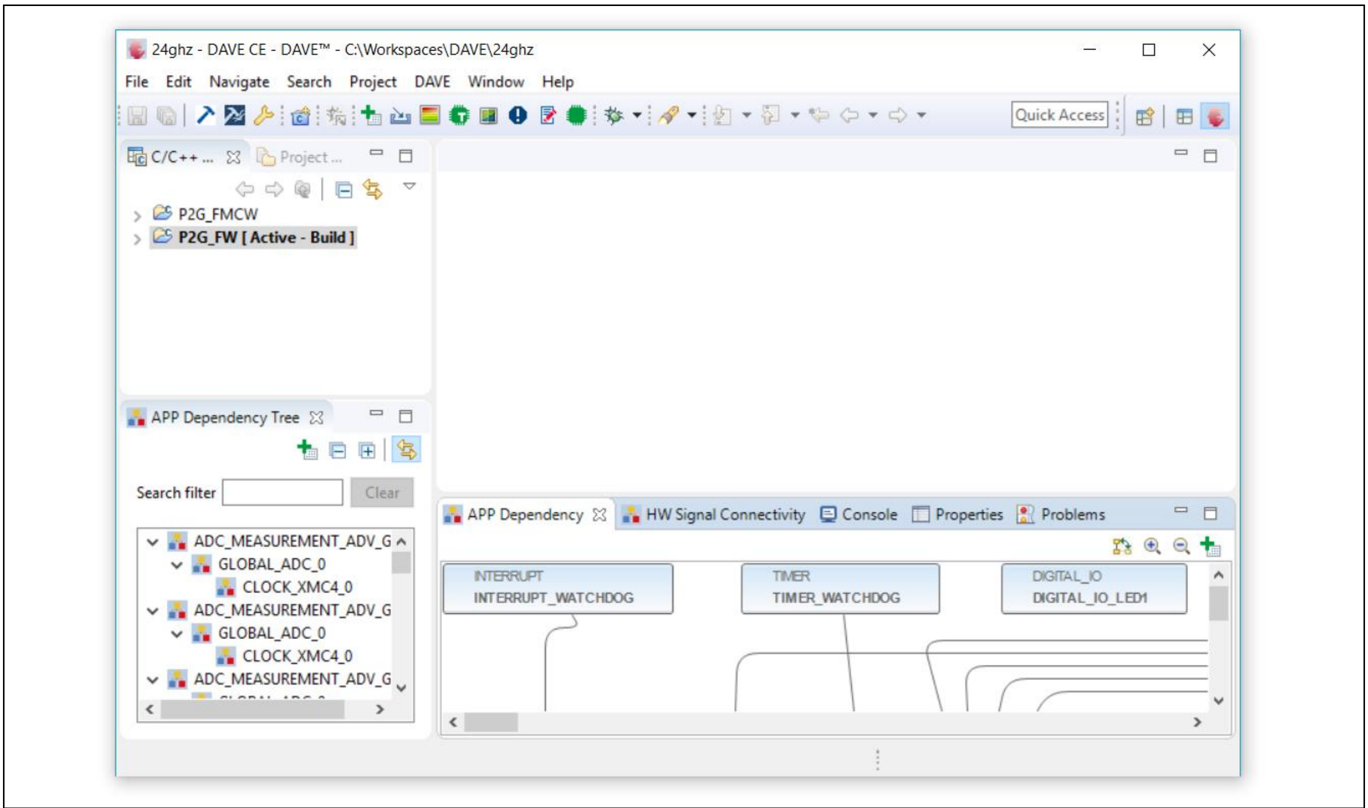


Figure 26 DAVE™ editor view

- There are two ways to build a project:
  - Click on **Build Active Project** (the icon with the blue hammer on a white background) in the toolbar.
  - Right-click on the active project e.g., P2G_FW [Active – Build] and then click on **Build Project**.

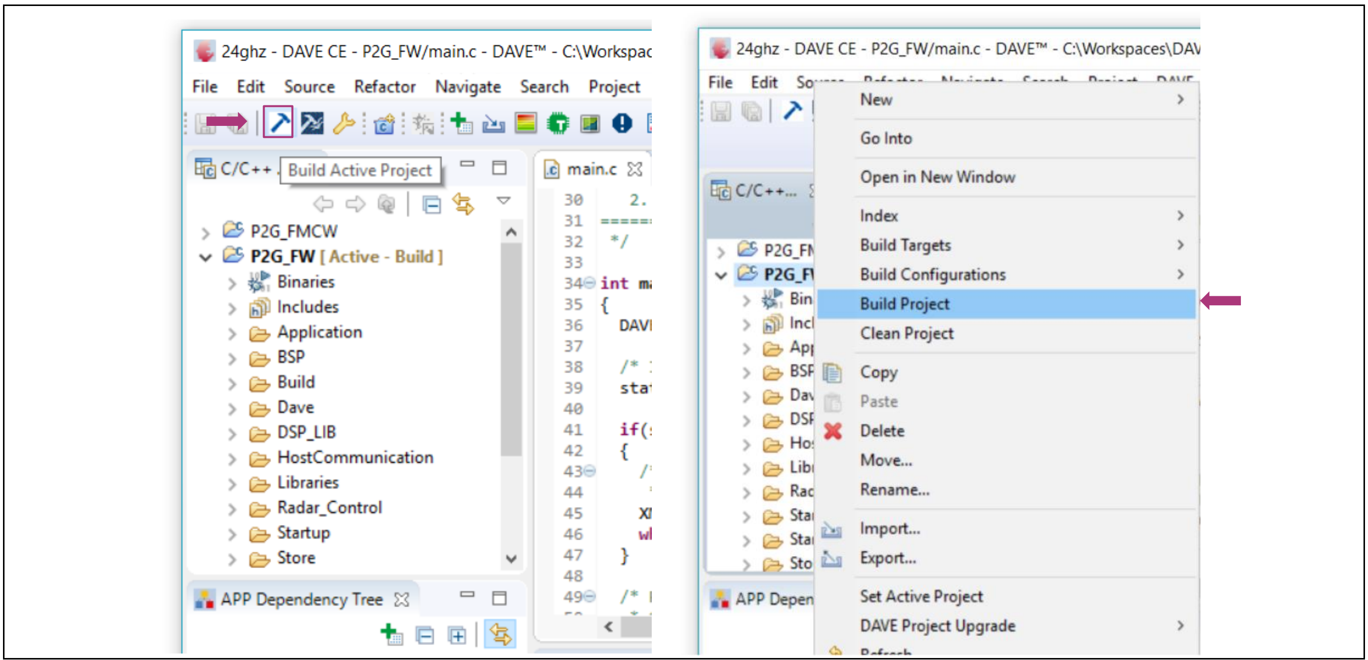


Figure 27 Build project options

- Check successful build in the Console window, where the build result details are displayed.

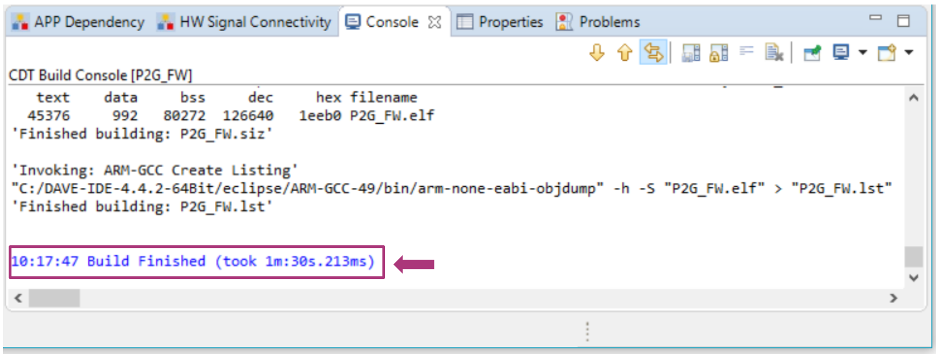


Figure 28 DAVE™ console

- Ensure that the debugger of the 24 GHz radar board is connected to the PC via USB “type A to micro-B” cable through the USB connector (e.g., X12 connector for DEMO POSITION2GO board).
- Set debug configurations by clicking on the drop-down menu of the **Debug** toolbar button (bug icon) and selecting **Debug Configurations…** as shown in Figure 29. Alternatively, press key F11 to directly start the debug session.

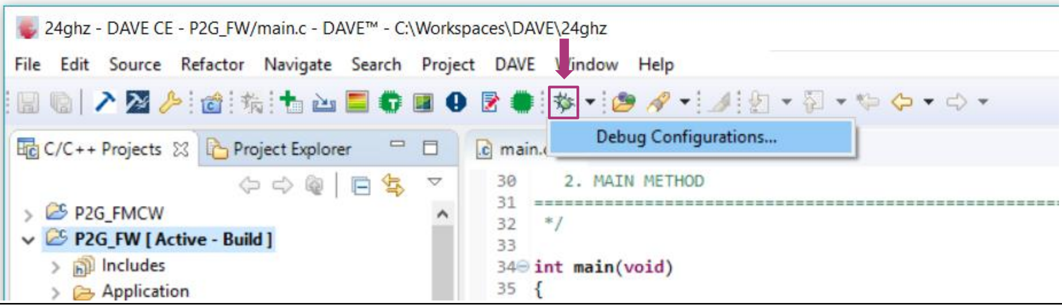


Figure 29 Start debug session toolbar button

If opening Debug Configurations, a window as shown in Figure 30 appears.

- Double-click on **GDB SEGGER J-Link Debugging** to create a new debug configuration.
- Click on the **Debug** button to Flash and start a debug session.

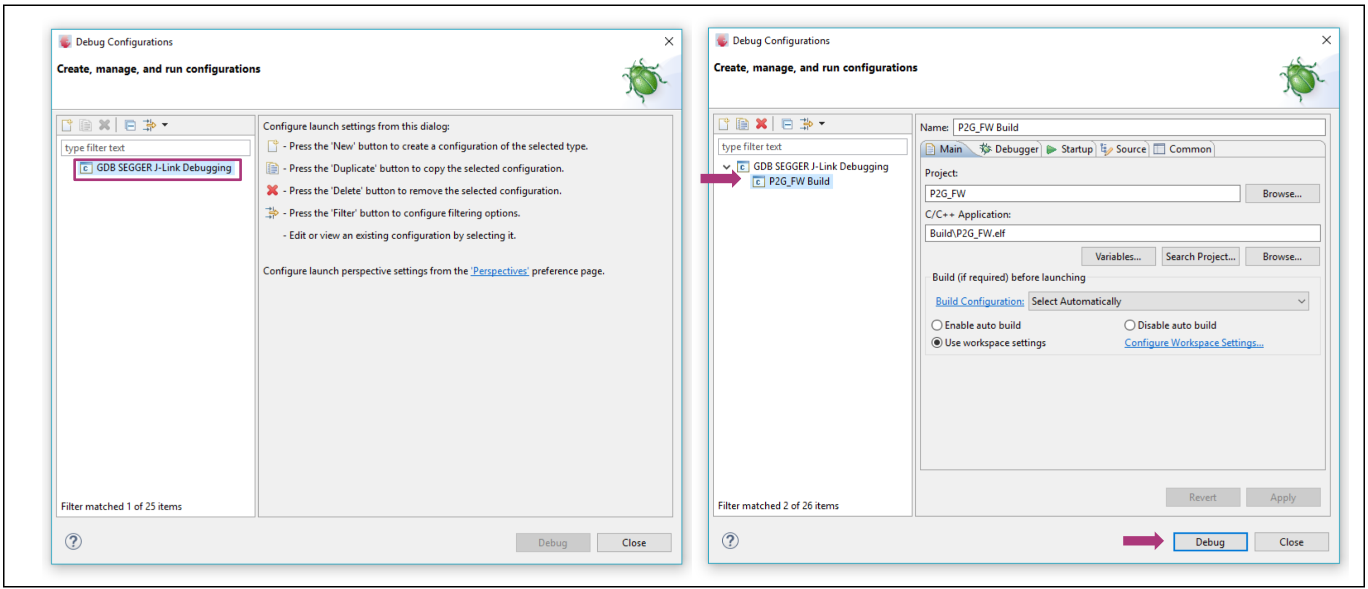


Figure 30 Debug configuration

- In this way, the Flashing process is started, the firmware image is loaded into the XMC™ microcontroller Flash memory and DAVE™ automatically switches to the debug perspective, as shown in Figure 31.

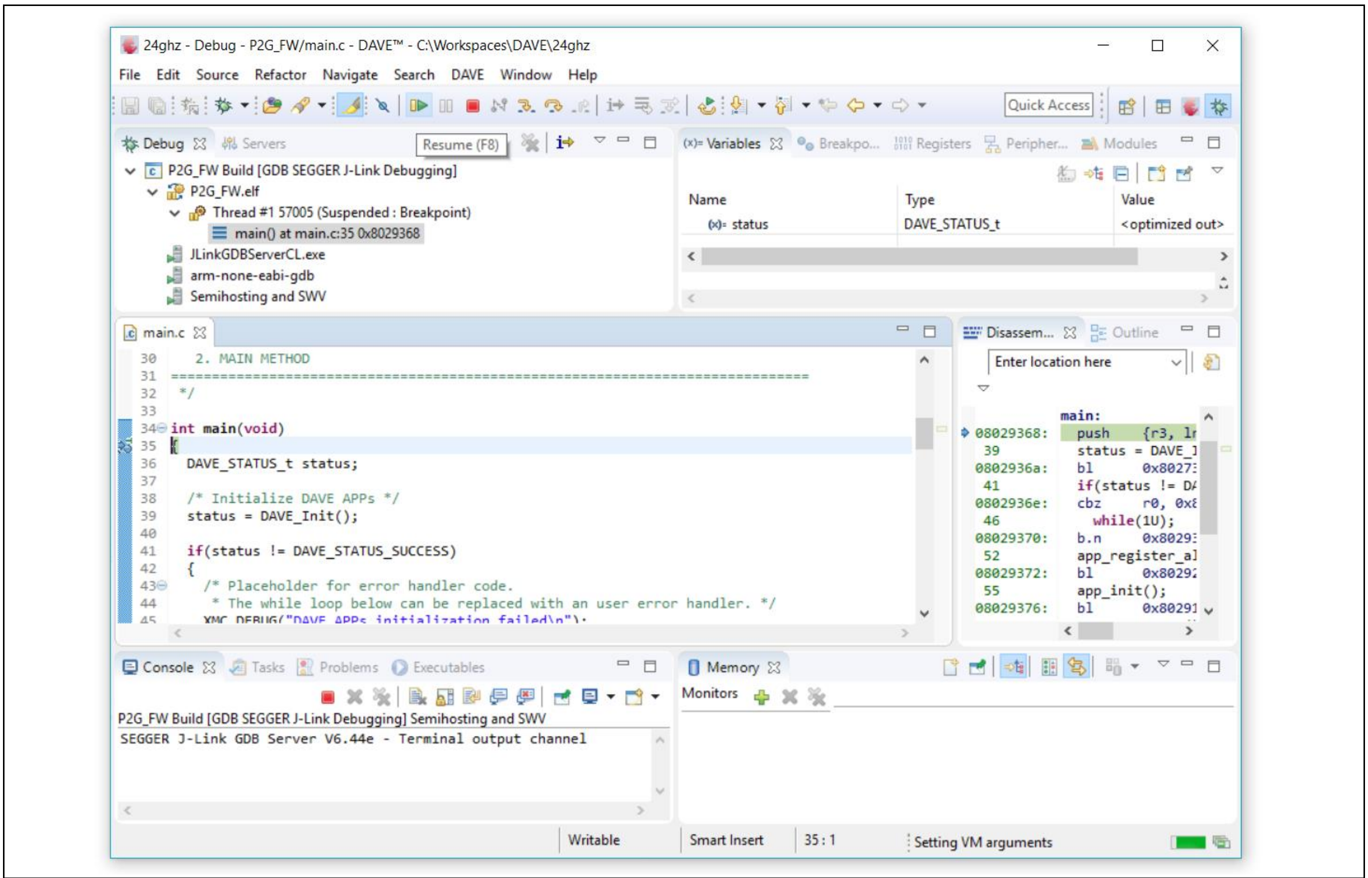


Figure 31 DAVE™ debug perspective

3.2 Firmware customization and configuration

The 24 GHz radar firmware is developed with Infineon's DAVE™ toolchain. It is a C/C++-language software development and code generation tool for XMC™ microcontroller applications using DAVE™ APPs to configure the MCU peripherals (ADC, DMA, CCU4…), which reduces development time and allows for quick porting of the firmware across XMC™-series MCUs.

The 24 GHz firmware projects can be customized by setting parameters in the configuration file **config.h**, which allows for customizing the drivers and algorithms for the user's radar application.

Table 2 lists some parameters that can be configured: enable, disable or modify some options by uncommenting and commenting or modifying the values of the related define statements.

Table 2 Define statements used for radar firmware configuration

Parameter	Description
DOPPLER_SAMPLING_FREQ_HZ	Sampling frequency for Doppler (units in Hz)
DOPPLER_FFT_SIZE	FFT length for Doppler mode, with zero padding
MINIMUM_RANGE_CM	Exclude targets below this distance (units in cm)
MAXIMUM_ RANGE_CM	Exclude targets beyond this distance (units in cm)
RANGE_DETECTION_THRESHOLD	FFT spectrum threshold to detect a target in FMCW mode
MINIMUM_SPEED_KMH	Filter out targets below this speed (units in km/h)
MAXIMUM_SPEED_KMH	Filter out targets above this speed (units in km/h)
SPEED_DETECTION_THRESHOLD	FFT spectrum threshold to detect a target in Doppler mode

On each change of the config.h file parameters' values, the project has to be re-built and Flashed again. Otherwise, that can be changed on the fly via the Radar GUI configurable fields.

4 Extracting radar raw data

The 24 GHz radar demo boards can use different interfaces, enabling the user to fetch raw data from the radar board as follows:

- MATLAB radar system interface
- C radar system interface
- UART radar system library interface

Supported radar communication libraries define a set of APIs to guarantee the data transfer through the host communication protocol.

4.1 Radar host communication protocol

The communication protocol is a generic protocol to exchange messages with microcontroller-based devices over a generic byte-stream connection (typically a virtual serial port via USB). The communication is always initiated by the host, while the connected microcontroller device responds to messages received from the host. The protocol defines two types of messages:

- Payload messages – contain a block of data with arbitrary size and meaning
- Status messages – contain a 16-bit status code

Messages from the host to the device are always payload messages. Whenever the device receives a payload message from the host, it responds with one (and only one) status message. The device may also send an arbitrary number of additional payload messages proceeding that status message. Once the device has sent the status message, it will not send any more messages until it receives a new message from the host.

Each message from the host to the device is addressed to a certain logical endpoint, and each message from the device to the host is sent from a logical endpoint. The number of logical endpoints is defined by the device.

Endpoints are used to define functional groups in the device and are continuously enumerated starting with 1. At least one logical endpoint is always present. Each logical endpoint is of a defined type, which defines the meaning of the message payload exchanged with that endpoint.

Additionally, each endpoint has a version number that allows it to distinguish between slight modifications of the endpoints' set of known messages. The host can query the type and version of the endpoints present in the device.

All data received from the connected device is returned through callbacks. For each message type that can be received from the device, a separate callback function type is defined.

Within the 24 GHz radar firmware project, the host communication library contains the USB interface on host communication protocol drivers.

4.2 MATLAB radar system interface

The MATLAB application interface defines a set of APIs and functions that help the user access a serial communication port and communicate with the radar-defined endpoints, enabling the user to extract the raw IF data from the radar module via the USB interface to the PC/laptop for further signal processing.

Please refer to **/Firmware_Software/Communication Library/ComLib_Matlab_Interface/RadarSystemDocumentation** for more details about the interface's set of classes and functions that can be used to control the 24 GHz radar board via MATLAB.

A coding example to interface with the 24 GHz radar board via MATLAB and extract raw data is available. (Refer to the extract_raw_data.m file.) In order to run this coding example, proceed as follows:

- Go to /**Firmware_Software/Communication Library/ComLib_Matlab_Interface /RadarSystemExamples/GettingStarted** folder and copy the path.
- Open MATLAB, then paste the path into the top tab, and the "**extract_raw_data.m**" file will show up on the left tab.
- Ensure that your 24 GHz radar board is connected, then click on **Run** to see the raw data.

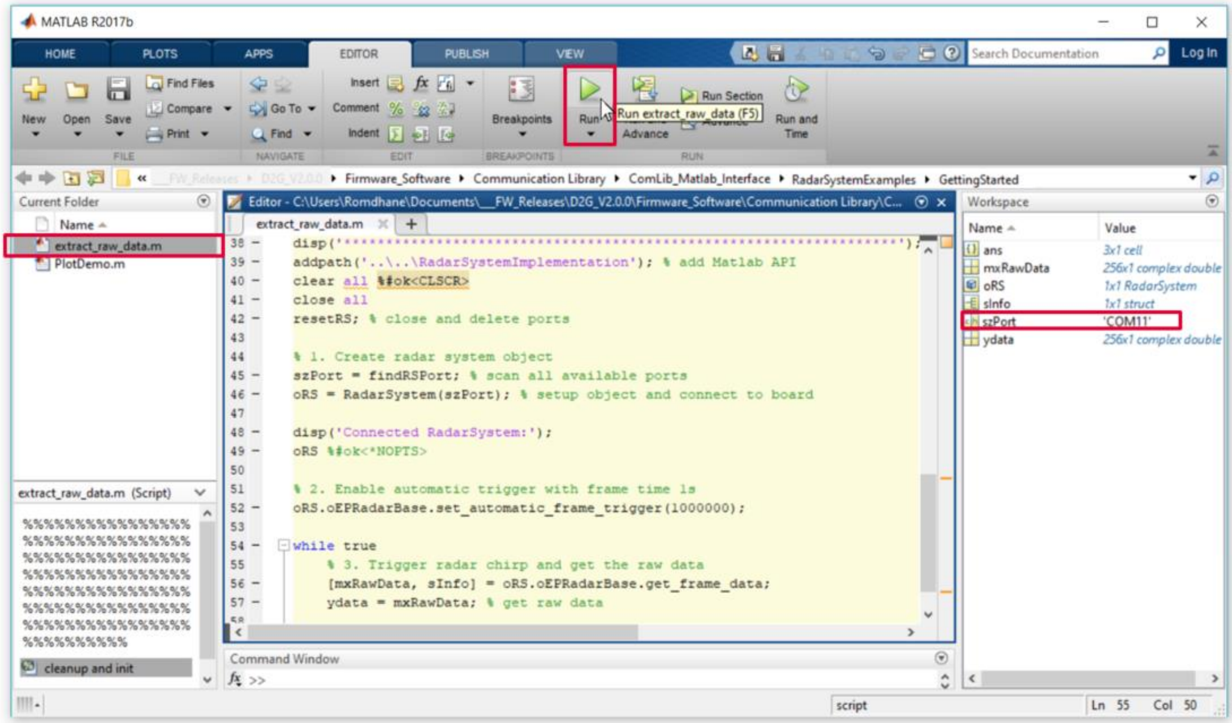


Figure 32 MATLAB radar system interface

Figure 33 shows the example running on MATLAB, extracting raw data from the DEMO DISTANCE2GO radar board.

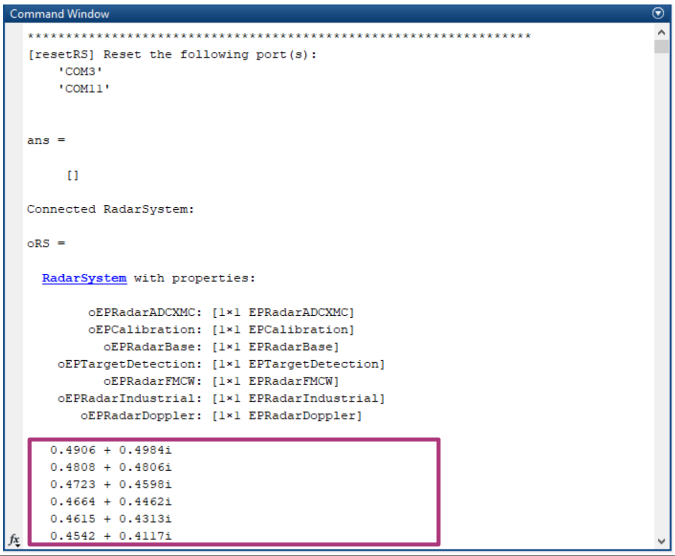


Figure 33 Raw data acquisition in MATLAB command window

4.3 C radar system interface

The C radar system interface defines a set of APIs that help user access a serial communication port and communicate with the radar-defined endpoints, enabling the user to demonstrate the capabilities of the 24 GHz modules.

Please refer to the **Firmware_Software/Communication Library/ComLib_C_Interface/documentation** for more details about the set of control parameters and methods that can be used to control the 24 GHz radar board using C communication library.

It is worth noting that the radar C communication library implements the API to access a serial communication port for Windows (COMPort_Windows.c), and Mac OS and Linux (COMPort_Unix.c) platforms.

Note: *The C radar system interface is only supported within the Radar Distance2Go, Radar Position2Go and Radar Sense2GoL Pulse and Radar Distance2GoL radar software packages.*

A coding example to interface with the 24 GHz radar board using C communication library, and to extract raw data, is available (refer to the **extract_raw_data.c** file). In order to run this coding example, proceed as follows:

- Go to the **/Firmware_Software/Communication Library/ComLib_C_Interface/**examples folder and copy the path.
- Open your appropriate C compiler, then create a C project.
- Import the **extract_raw_data.c** file, all source *.c files under **/ComLib_C_Interface/src** and also all header *.h files under **/ComLib_C_Interface/include**.
- Ensure that your 24 GHz radar board is connected, then **Compile** and **Run** your project to see the raw data.

Figure 34 shows the example running on Visual Studio, extracting raw data from a DEMO DISTANCE2GO radar board.

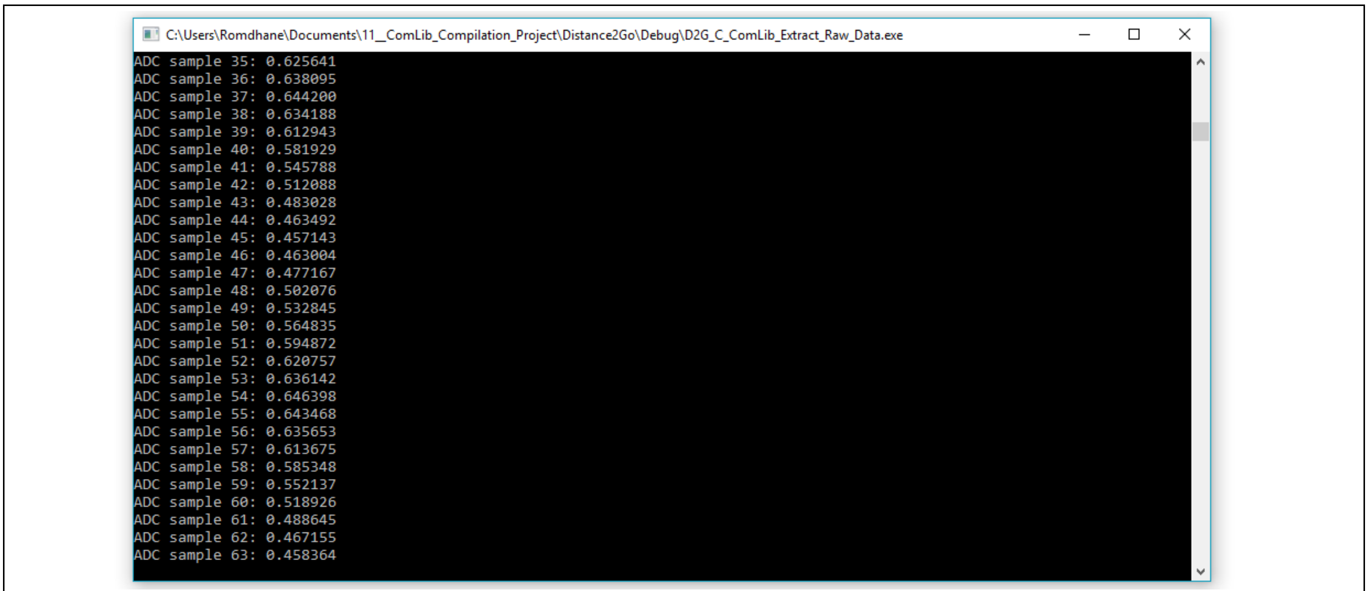


Figure 34 Raw data acquisition in Visual Studio shell

4.4 UART radar system interface

Note: The UART radar system interface is only supported within the Radar Sense2GoL radar software package.

The UART radar system interface defines a set of APIs that help the user access a serial communication port and communicate with the radar-defined endpoints, enabling the user to fetch sampled ADC data streamed by UART.

The UART radar system interface supports the following data to be dumped at the host:

- ADC raw data:
  - I and Q (first 256 samples of I, followed by next 256 samples of Q)
  - Only I (256 samples)
  - Only Q (256 samples)
- Doppler measurements and FFT spectrum
- Signed 16-bit, unsigned 16-bit and 32-bit

Using the transferred data via the UART radar system interface library, it is possible to view and export ADC data via a terminal program (e.g., PuTTY), or transfer it to MATLAB for processing.

PuTTY is a free SSH, Telnet and rlogin client for Windows systems. It is open-source software available with source code and is available for download at: https://www.putty.org/

In order to fetch raw data streamed by UART, PuTTY should be configured as follows:

- **UART configuration** – full-duplex, direct mode, 128000 baud rate, 8 data-bits, 1 stop-bit, no parity
- **COM port number** – depends on the host PC; look into the device manager for the COM port number of your connected 24 GHz radar board (e.g., COM53 for DEMO SENSE2GOL)

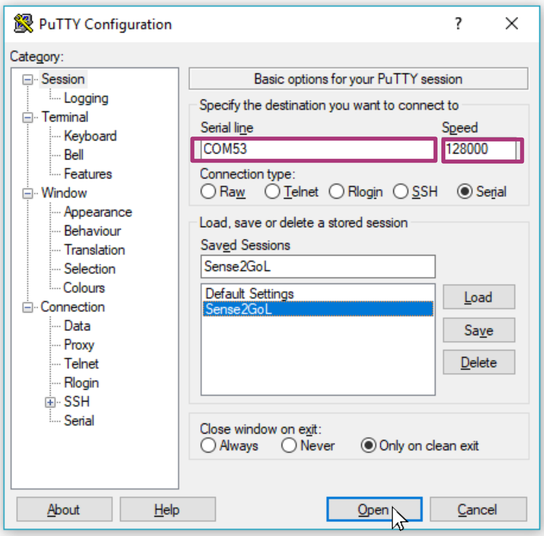


Figure 35 Configure PuTTY for raw data acquisition

Once configured, click the **Open** button to start a PuTTY serial session. ADC output data at the PuTTY shell for the I and Q raw samples looks as shown in Figure 36.

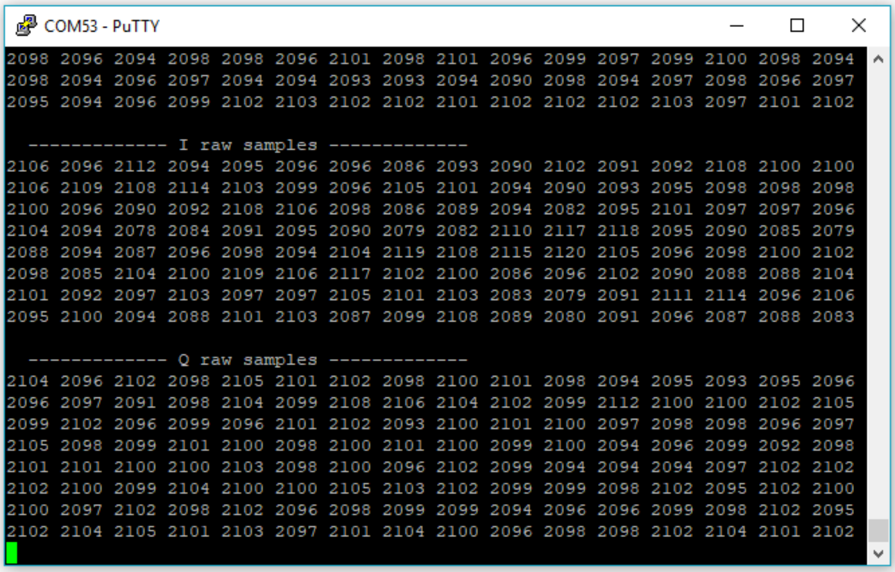


Figure 36 **Raw data acquisition in PuTTY shell**

References

[1] Infineon Technologies AG. AN543: DEMO DISTANCE2GO

[2] Infineon Technologies AG. AN553: DEMO POSITION2GO

[3] Infineon Technologies AG. AN597: DEMO SENSE2GOL

[4] Infineon Technologies AG. AN598: DEMO SENSE2GOL PULSE

[5] Infineon Technologies AG. AN615: DEMO DISTANCE2GOL

Revision history

Document revision	Date	Description of changes
1.00	2019-06-14	Initial version
1.10	2020-02-07	Added DEMO SENSE2GOL PULSE board features
1.20	2020-06-25	Added firmware flashing via Radar GUI details
1.30	2021-03-31	Added DEMO DISTANCE2GOL board features
1.40	2023-02-14	Miscellaneous document cleanup updates