

Quick Start Guide Sense2GoL Module

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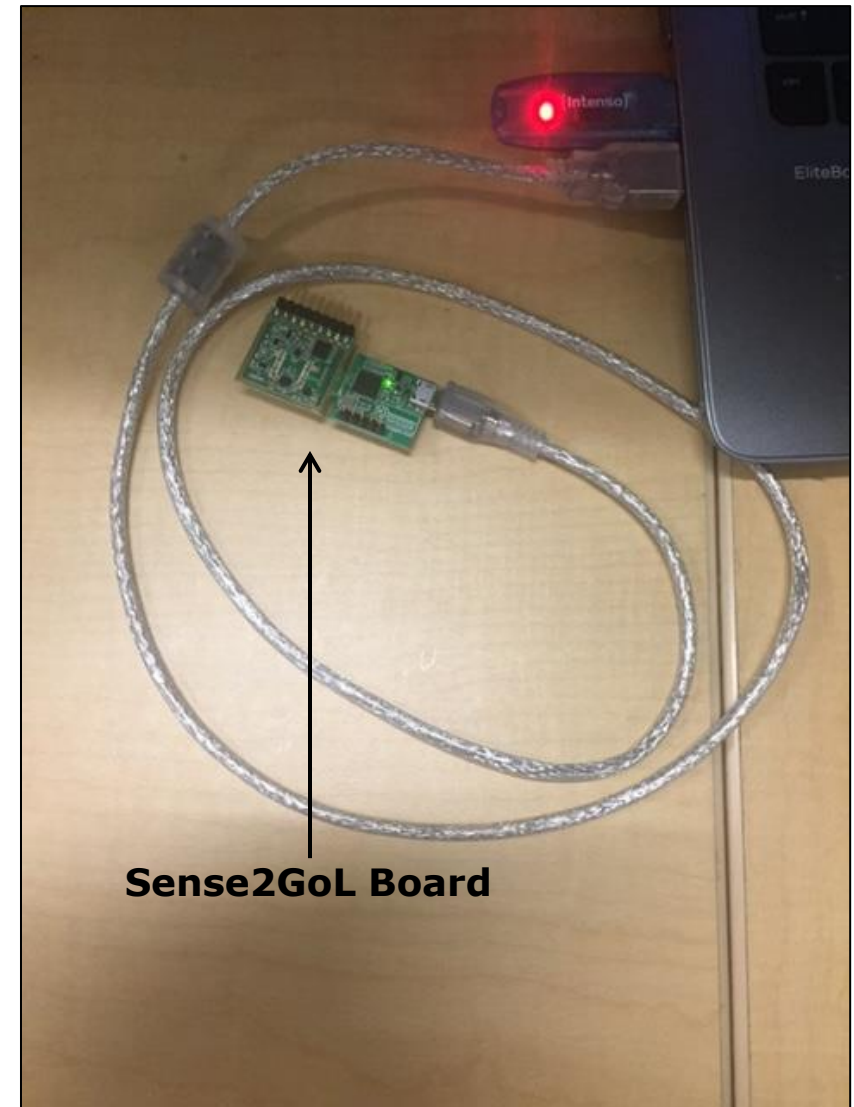
- 1 Overview
- 2 Development Tools Installation
- 3 Flashing and Debugging
- 4 Configuration/Customization
- 5 GUI
- 6 UART data streaming

- 1 Overview
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Contents of Sense2GoL Development Kit

- › Provided kit should contain
 - Sense2GoL 24GHz RADAR module
 - USB-to-micro-USB cable
 - USB stick containing firmware DAVE Project for Sense2GoL + GUI

- › Connect hardware as seen in picture



- 1 Overview
- 2 Development Tools Installation**
- 3 Flashing and Debugging
- 4 Configuration/Customization
- 5 GUI
- 6 UART data streaming

Tools Installation

Flashing Tools

1. XMC Flasher
2. XMC Serial Port Drivers

Visualization Tool

1. Micrium uC/Probe GUI

Firmware Development Tools

1. DAVE
2. Segger J-Link

Tools Installation

Flashing Tools

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Firmware Development Tools

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2. Segger J-Link

Flashing Tools

1. XMC Flasher

Installation Steps:

1. Download XMC Flasher **.zip file** from the following link



<http://www.infineon.com/cms/en/product/microcontroller/32-bit-industrial-microcontroller-based-on-arm-registered-cortex-registered-m/xmc-development-tools-software-tools-and-partner/xmc-programming-tools-from-infineon/channel.html?channel=5546d462557e6e890155a0532c605bfe>

XMC™ Flasher

Products

Documents

Forums

Support

A tiny and free of charge tool for XMC™ MCU flash programming

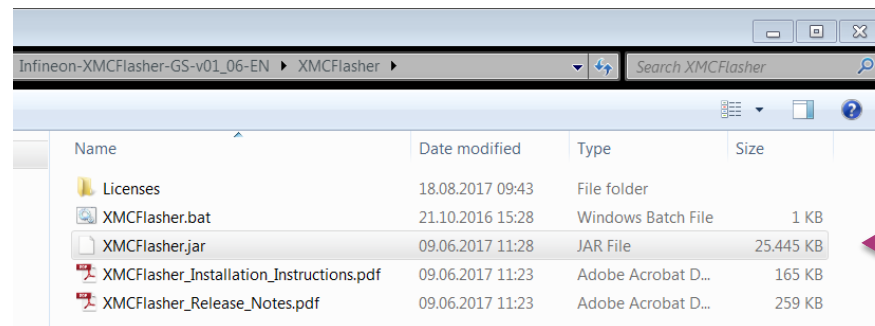
The new XMC™ Flasher is a tiny, free of charge programming tool for on-chip flash programming. It is written in Java and it supports basic functionalities like erasing, programming and verification (.hex and .srec), plus BMI handling. XMC™ Flasher requires a J-Link compatible debug-HW to connect to the target (integrated on most of the XMC™ kits or XMC™ Link).



Download here



2. Extract the downloaded .zip file and run the **XMCFlasher.jar** file



Flashing Tools

1. XMC Flasher

Note: Might need to install **Java** (32-bit or 64-bit) to run the XMCFlasher.jar file.



<https://java.com/en/download/>



The screenshot shows the Java website's download page. At the top is a red header with the Java logo, a search bar, and links for 'Download' and 'Help'. Below the header, on the left, is a sidebar with links for 'All Java Downloads', 'Report an issue', and a FAQ section. The main content area features a 'Free Java Download' section with the text 'Download Java for your desktop computer now!' and 'Version 8 Update 144'. A prominent red button labeled 'Free Java Download' is highlighted with a purple arrow. Below the button are links for 'What is Java?', 'Do I have Java?', and 'Need Help?'. Further down, there is a section titled 'Why download Java?' explaining the security benefits of updating.

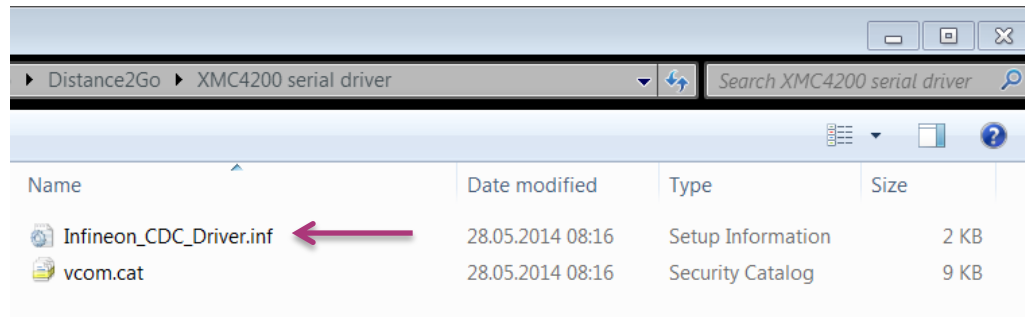
Flashing Tools

2. XMC Serial Port Drivers

- › If you are plugging in the XMC microcontroller for the first time into your PC/laptop, you will receive an error.



- › XMC serial drivers are part of deliverables, comes under the folder 'Driver'.

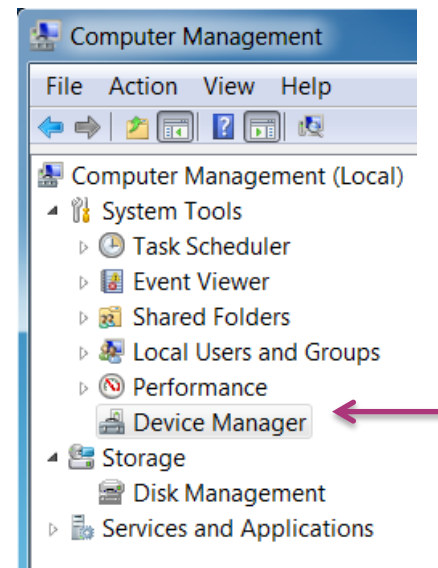
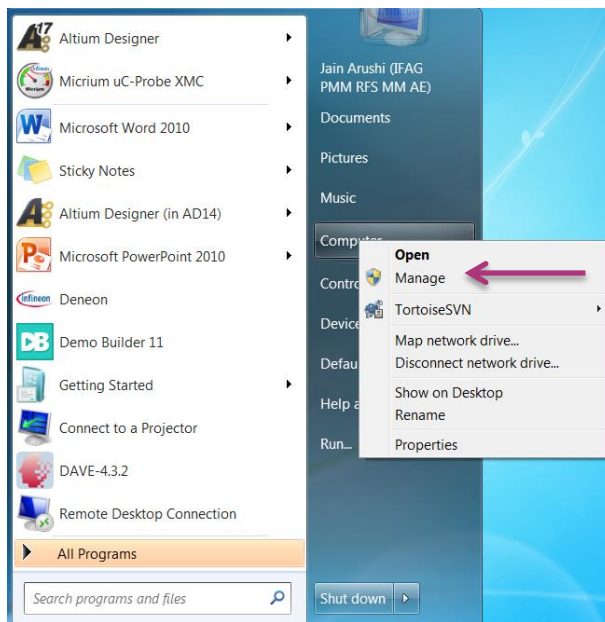


Flashing Tools

2. XMC serial port drivers

Installation Steps:

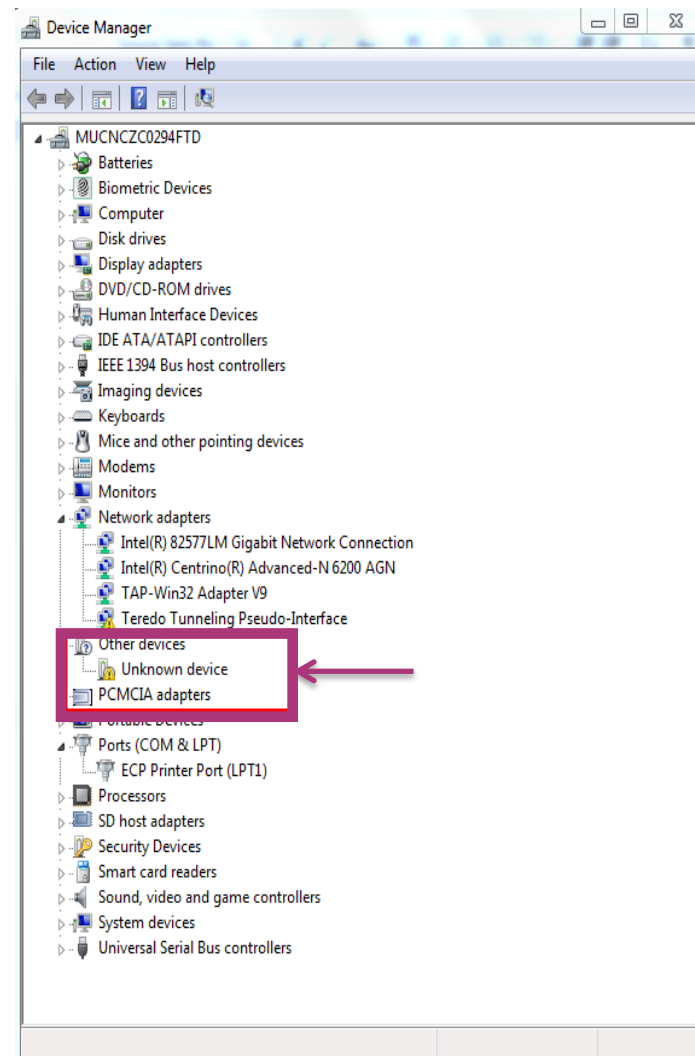
1. Right click on "My Computer"
2. Click "Manage" and a Computer Management window will be opened.
3. Click on "Device Manager"



Flashing Tools

2. XMC Serial Port Drivers

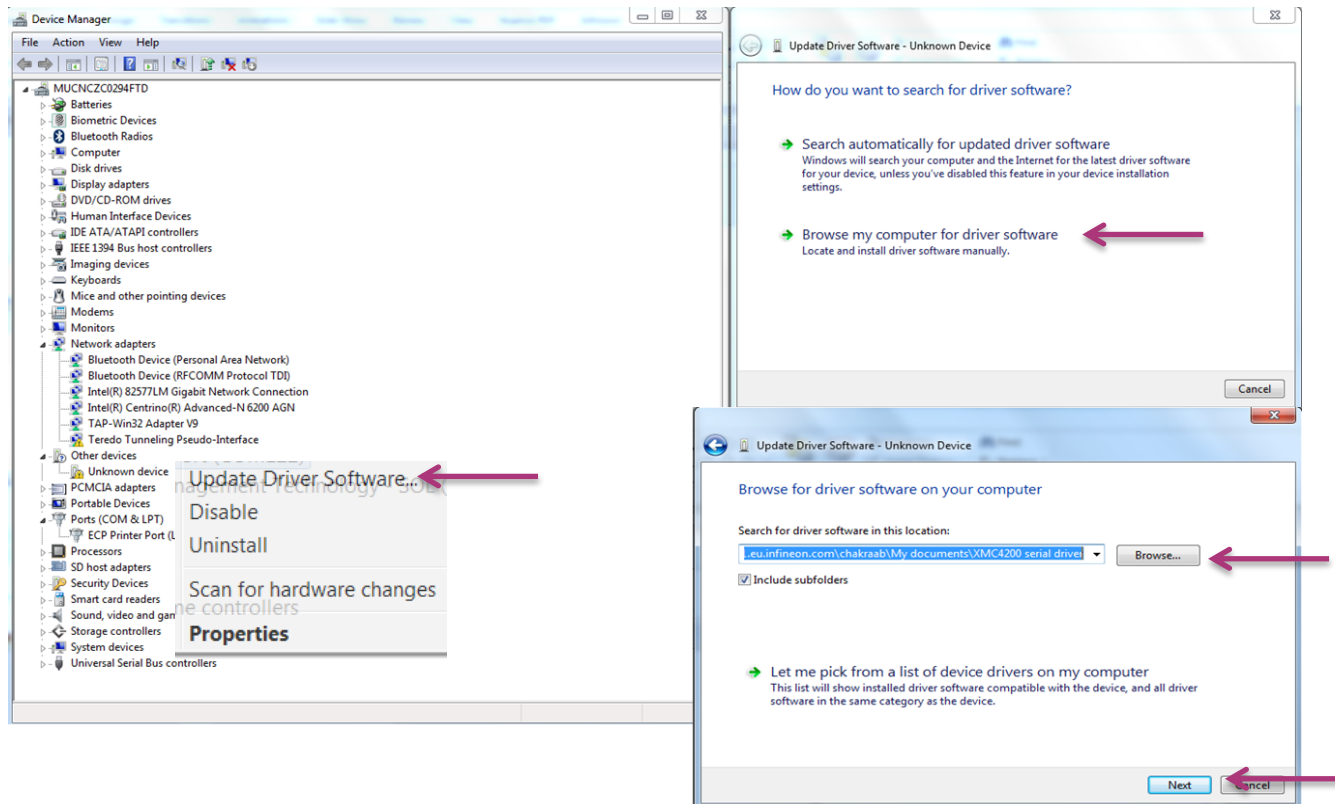
4. Now connect the demo board to the computer via USB and the board will be detected under the "Other devices" category.
5. Right click on "Unknown Device"



Flashing Tools

2. XMC Serial Port Drivers

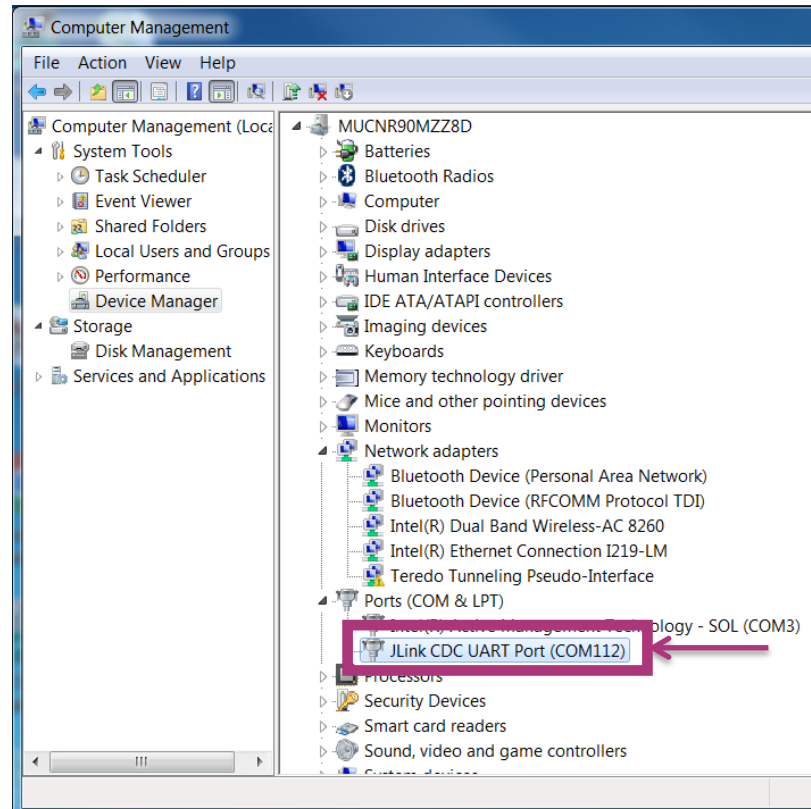
6. Click "Update Driver Software"
7. Select "Browse My Computer for Driver Software".
8. Now browse to the directory where the drivers are stored (it's part of deliverable in our case under 'Driver' folder) and click "Next".



Flashing Tools

2. XMC Serial Port Drivers

9. After successful installation, the board is listed under "Ports" category in "Device Manager" tab of computer management window.
 - › Note down the COM port to which the board is connected. This will be helpful for working with the software later.



Tools Installation

Flashing Tools

1. XMC Flasher
2. XMC Serial Port Drivers

Visualization Tool

1. Micrium uC/Probe GUI

Firmware Development Tools

1. DAVE
2. Segger J-Link

Development Tools

Installing uC/Probe

- › Installing Micrium uC/Probe: Install the latest version!
 - 1. If you have a previous version, uninstall it
 - 2. Download the latest version
https://infineoncommunity.com/uC-Probe-XMC-software-download_ID712
 - Fill out the form and you will get a personal download link

Register here to get your free download of **uC/Probe™ XMC™**

To download the software, please fill in the form below. We will send you the download link per email.

First Name*
Last Name*
Email Address*
Country*
City*
Company*
Business Phone

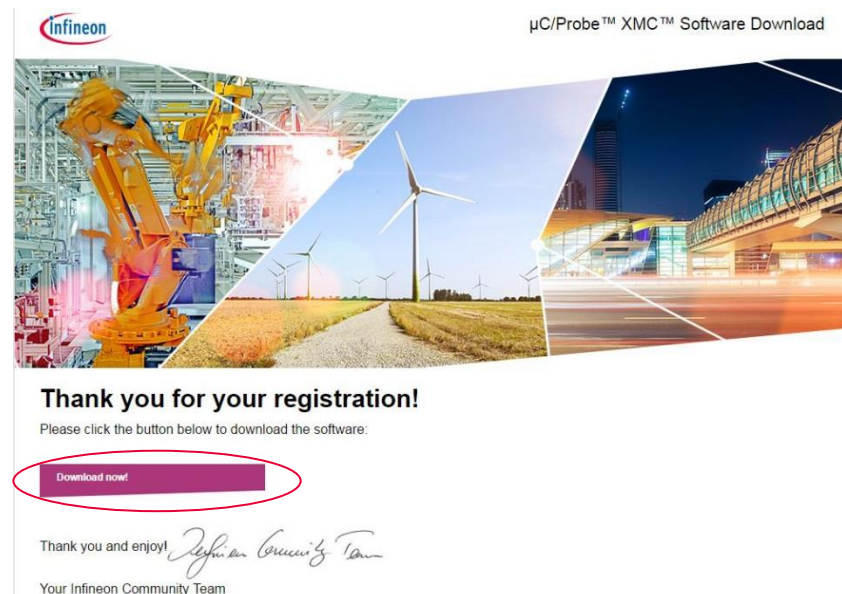
☒ Yes, I like to be part of the Infineon Community*

I agree that my personal data maintained above can be gathered, processed and used for sales promotion and market research by Infineon Technologies AG and its licensed distribution partners.

☒ Privacy Policy*
I have read the privacy policy and agree with it.

Submit >

* Required fields



Development Tools

Installing uC/Probe (cont'd)



- › 3. Unzip the downloaded zip file somewhere on your hard drive
- › 4. Depending on your PC, you may need to have administrator access to install software on your PC.
- › 5. Run the executable
- › 6. Agree to the license terms and then just keep clicking "Next" until installation is complete, then click "Finish"

Tools Installation

Flashing Tools

1. XMC Flasher
2. XMC 4200 serial port drivers

Visualization Tool

1. Micrium uC Probe GUI

Firmware Development Tools

1. DAVE
2. Segger J-Link

Firmware Development Tools

1. Installing DAVE

Installation Steps:

1. If you have a previous version of DAVE installed, check your hard drive location:



C:\Users\“your login name”\Infineon\D_LibraryStore_4.1

If this folder exists, rename or delete it.

2. Download the latest version of DAVE from





www.infineon.com/dave

- Scroll down to the “DAVE™ Download” link.



Download can take up to 1 hour!

| | | |
|-----------|--|--|
| | Forum | Ecosystem |
| | Email Support | Development Kits |
| | XMC™ MCUs | Rapid Prototyping Tools <ul style="list-style-type: none">• XMC™ Flasher Tool• XMC™ Link, Fun• XMC™ Pinout Tool• Others |
| DAVE™ |  Download | Free Eclipse based integrated development code repository, hardware resource m A complete download package is provided DAVE™ Release Note |
| DAVE™ SDK | | Development environment to modify i DAVE™ SDK is available as separate tool All DAVE™ APPs can be downloaded a |
| XMC™ Lib |  | Ready to use APIs for peripherals which Altium, ARM/KEIL, Atollic, IAR Systems |

1. Installing DAVE (cont'd)

3. Select either the **32-bit** or **64-bit** version depending on your system (leave DAVE™ SDK unchecked as it is not needed)
4. Fill out the form and you will get a personal download link

Please register here

Select the DAVE™ package(s) you would like to download

DAVE™ Packages* ☒ DAVE™ for Windows 32-bit ☐ DAVE™ for Windows 64-bit ☐ DAVE™ SDK for Windows 32-bit ☐ DAVE™ SDK for Windows 64-bit

Please fill-in your personal data

Email Address*

First Name*

Last Name*

Company*

Business Phone*

Country*

City*

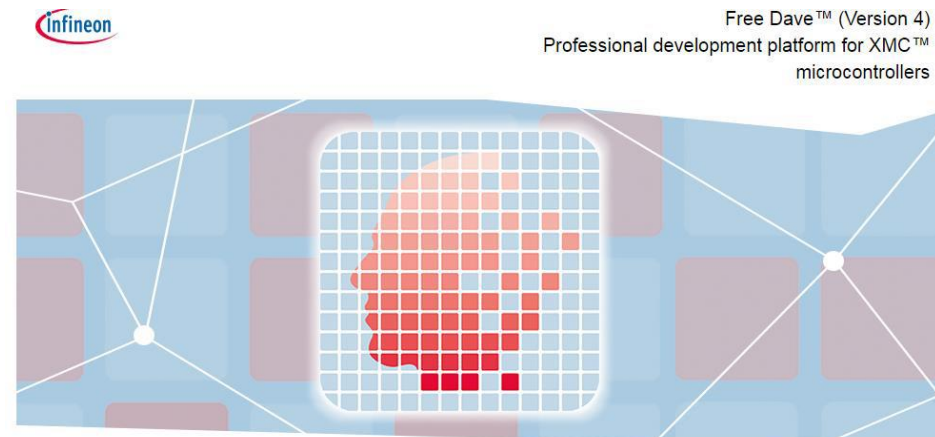
Target Application*

☒ Yes, I like to be part of the Infineon Community*

I agree that my personal data maintained above can be gathered, processed and used for sales promotion and market research by Infineon Technologies AG and its licensed distribution partners.

☒ Privacy Policy* I have read the privacy policy and agree with it.

Submit >



Thank you for your registration!

Please download your software here:

Download DAVE™ Windows 32-bit

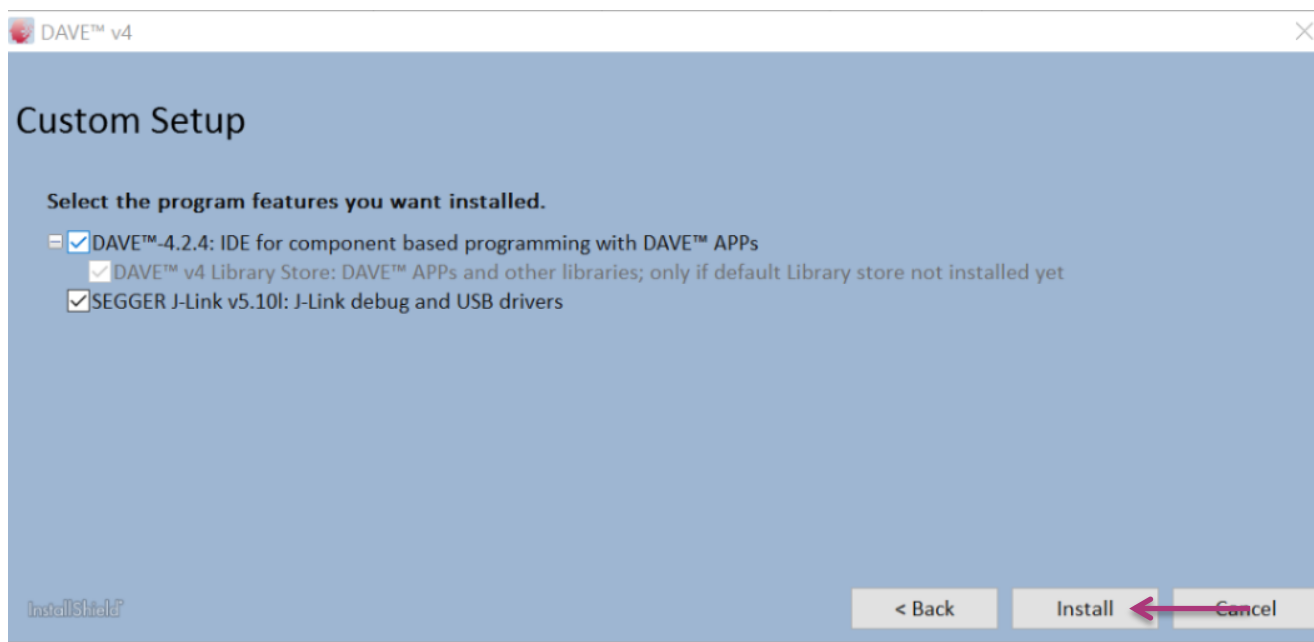
Sincerely,



Your Infineon Community Team

1. Installing DAVE (cont'd)

5. Unzip the downloaded zip file on your hard drive
6. Depending on your PC, you may need to have administrator access to install the software.
7. Start the executable and make sure to install DAVE, the Library Store and SEGGER drivers (all boxes checked)



Firmware Development Tools

2. Installing J-Link

8. Accept license agreement and keep clicking "Next" then click "Finish".
9. When the Segger JLINK installation starts, click "Next".



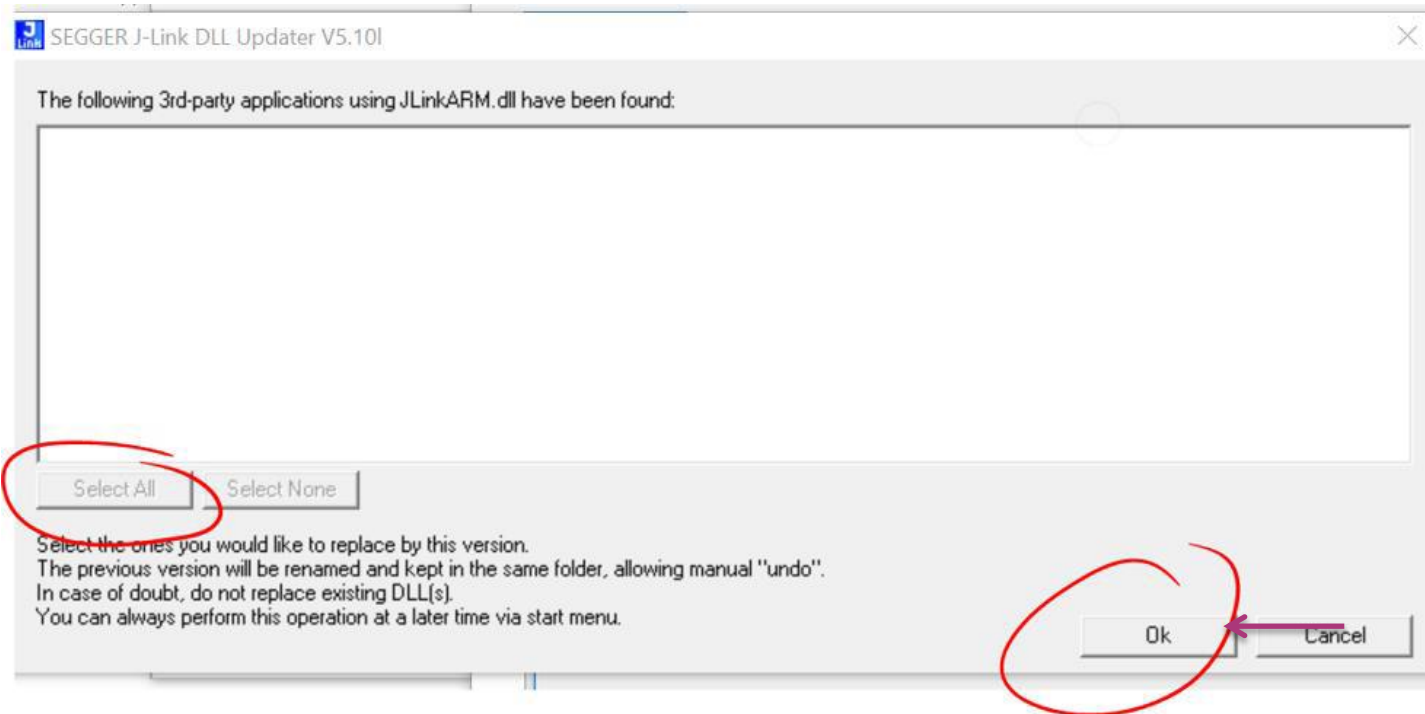
Firmware Development Tools

2. Installing J-Link (cont'd)

10. Keep clicking "Next".

11. If something like the screen below appears, click "Select All" (if it is not greyed out) and then "OK".

12. Click "Finish".



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Building, Flashing and Debugging Overview



Two ways to proceed from this step to flash the firmware:

1. XMC Flasher
2. Dave Project

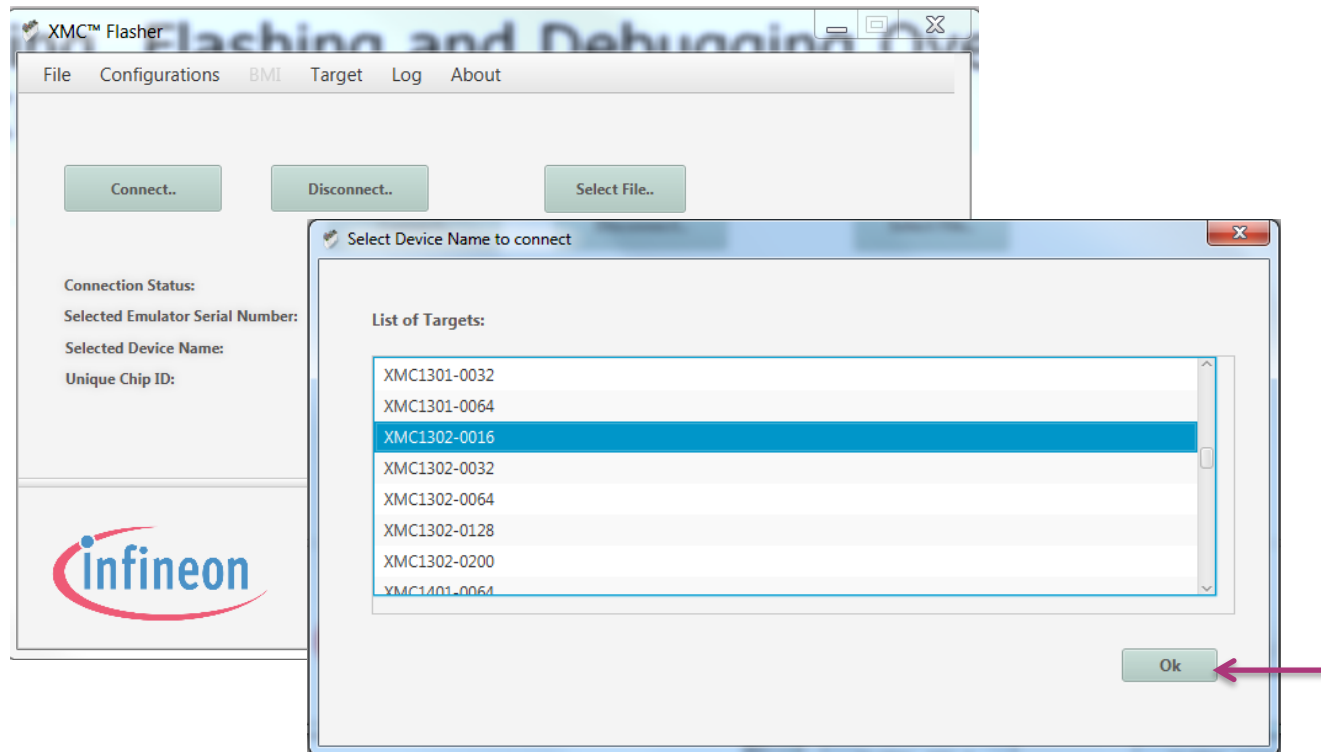
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

1. Open the XMC flasher .jar file and click on the connect button to select the device name



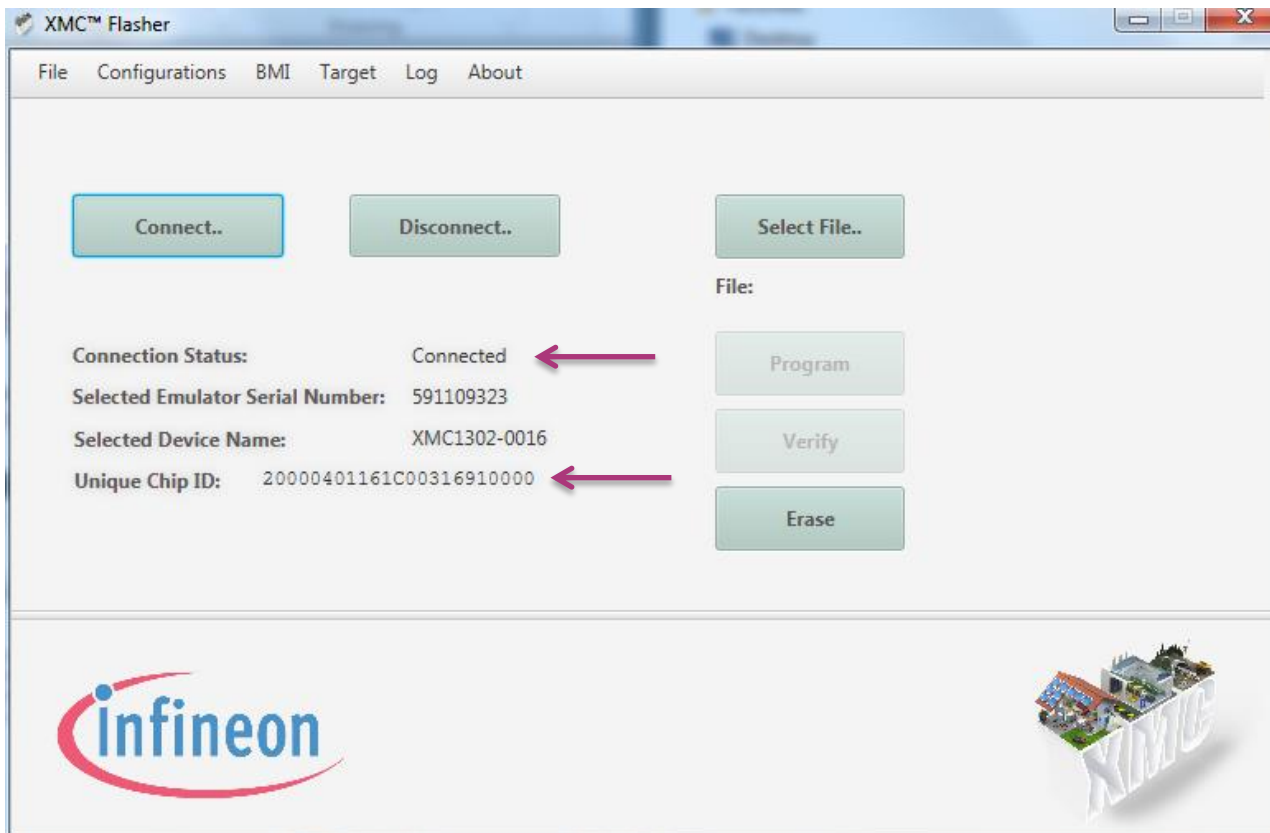
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

2. Select the Device name from new window opened (XMC1302-16), then click 'OK'.



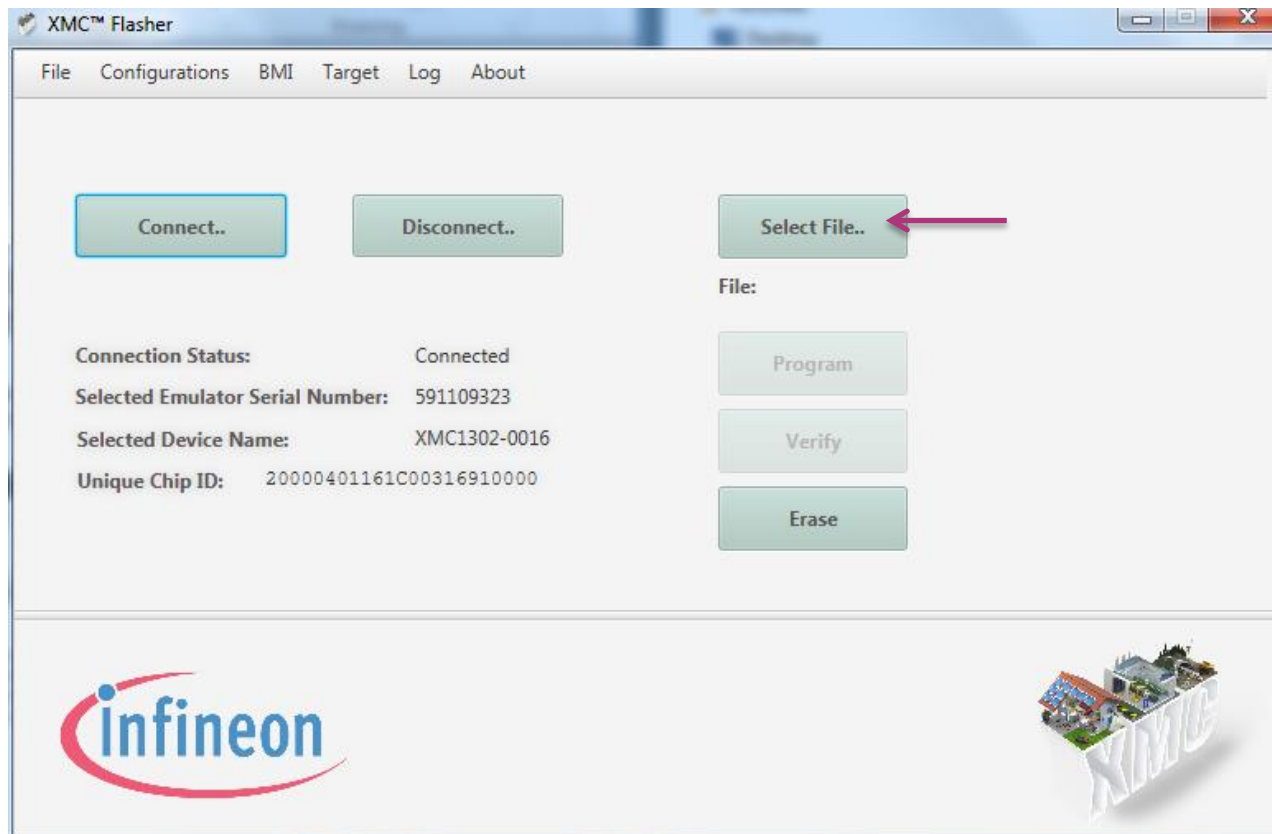
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

3. If connection is successful, then 'Connection Status' would be connected. You can then see the 'Unique Chip ID' as well.



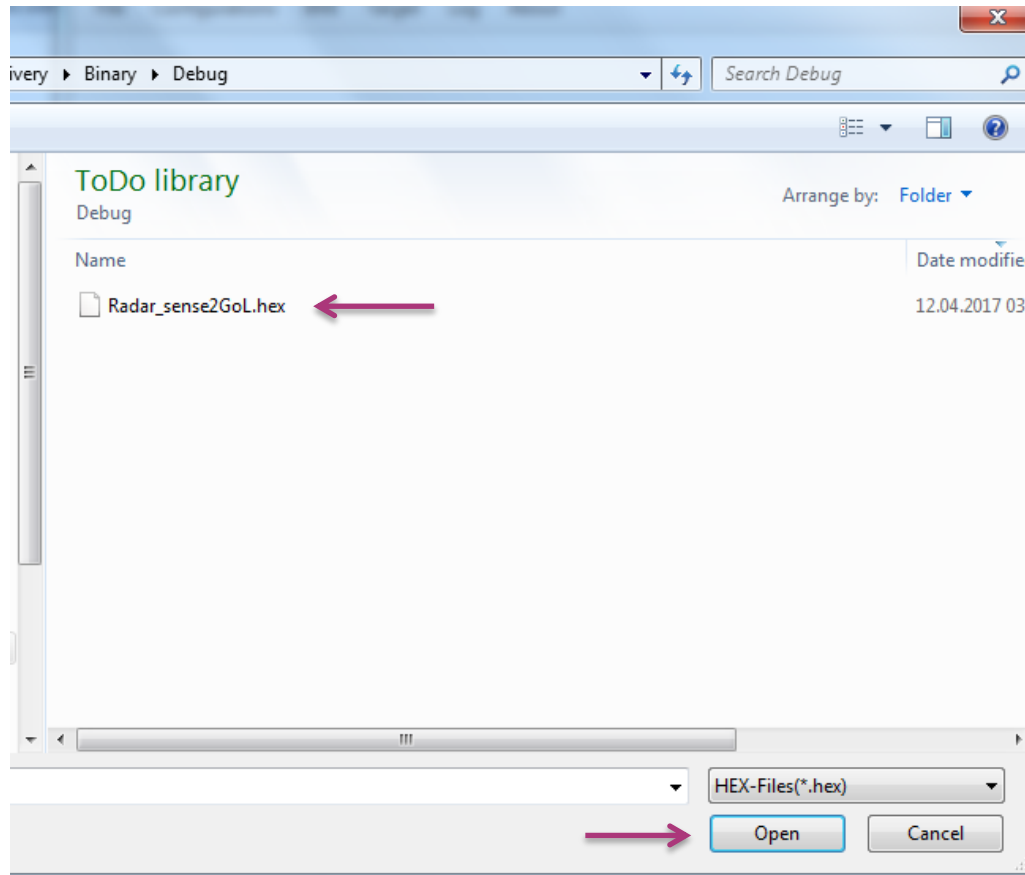
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

4. After connection is done, select the **.hex file** (firmware is flashed through .hex file) by clicking on Select File button.



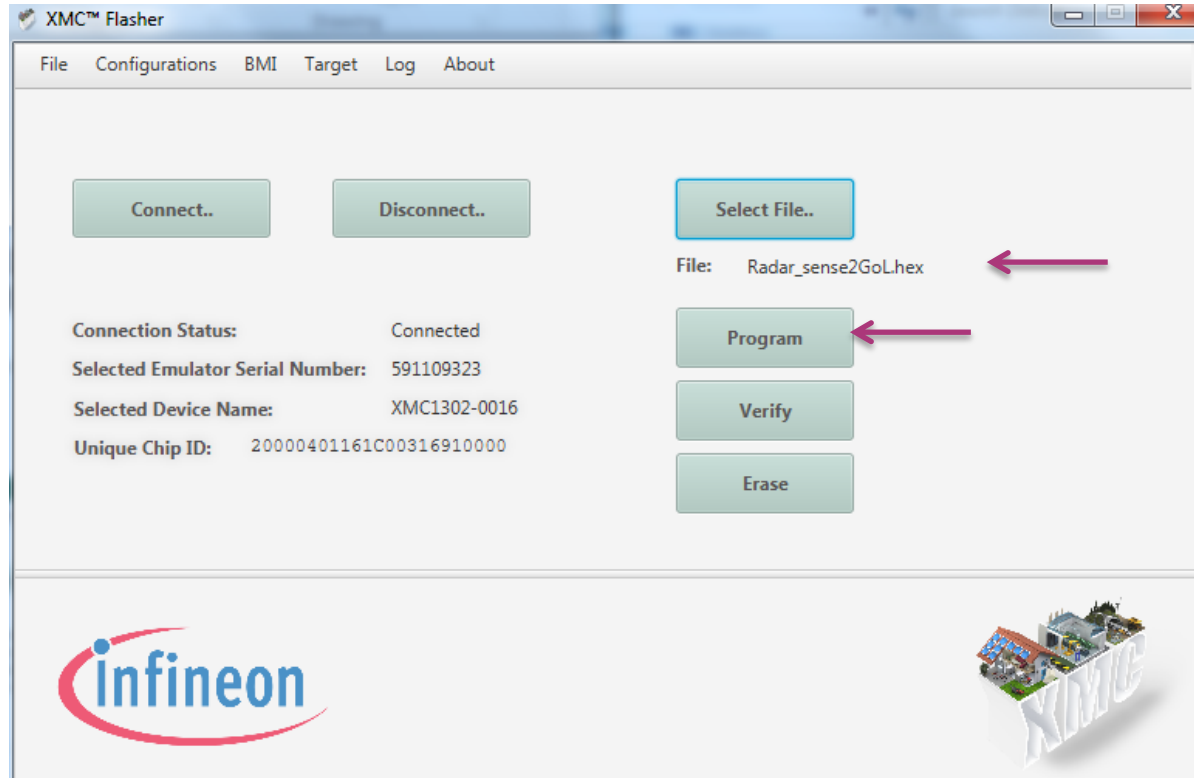
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

5. Navigate to the binary folder containing Radar_sense2GoL.hex file and select it.
6. Click on 'Open' in the dialogue box.



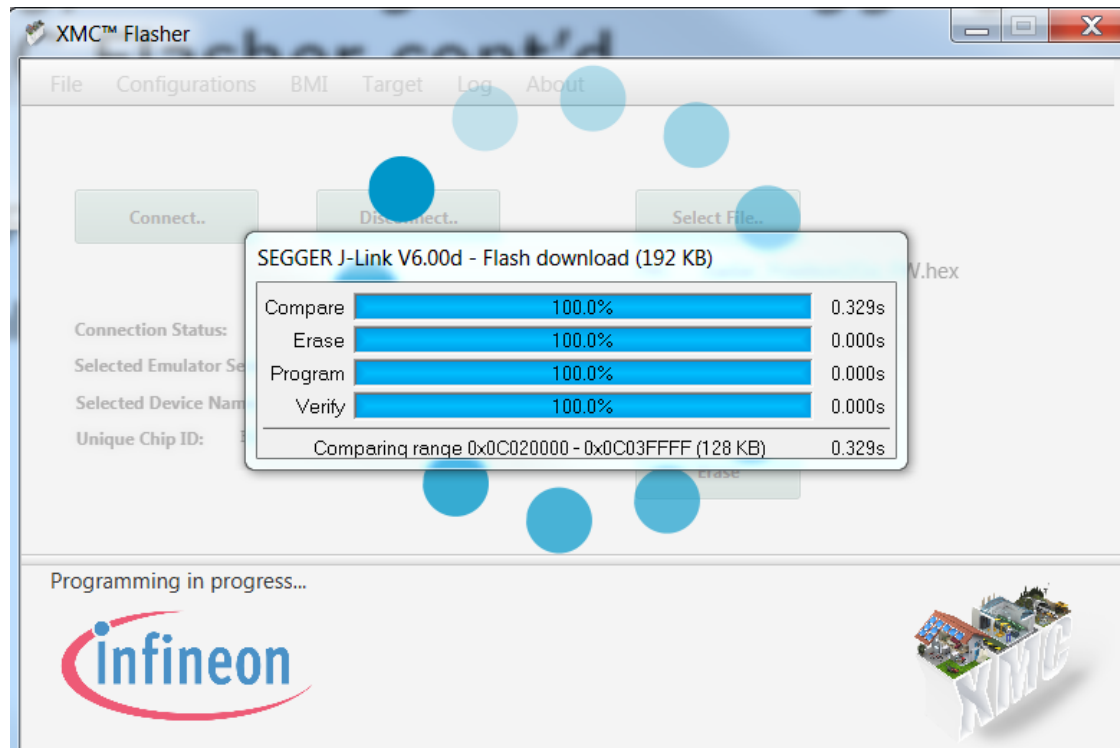
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

7. Successful selection of hex file will list the name of .hex file under 'Select File' button.
8. Now click 'Program' button.



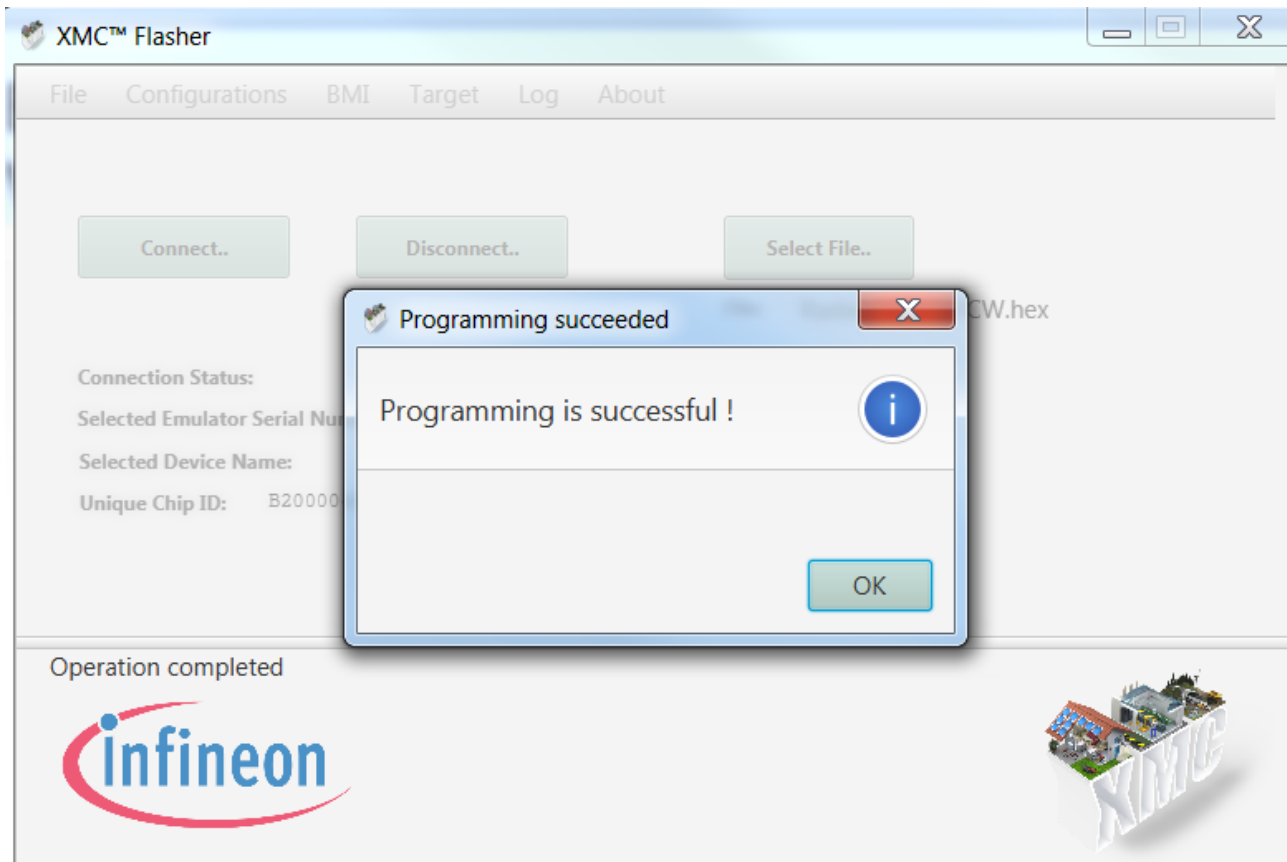
Building, Flashing and Debugging Overview Via XMC Flasher cont'd

9. SEGGER progress window will open. It will also verify if the .hex file is flashed or not.



Building, Flashing and Debugging Overview Via XMC Flasher cont'd

Congrats! You have successfully flashed the firmware using XMC Flasher.



Building, Flashing and Debugging Overview

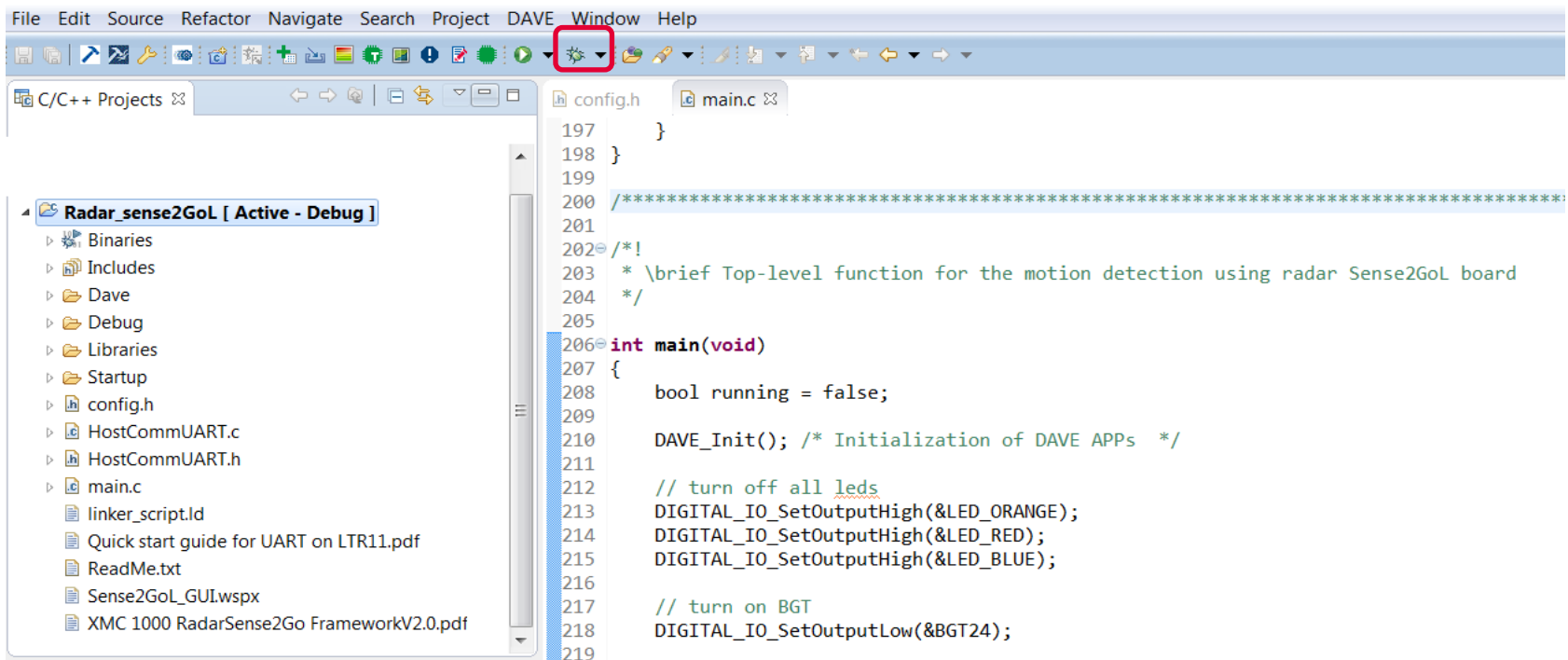


Two ways to proceed from this step to flash the firmware;

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2. Dave Project

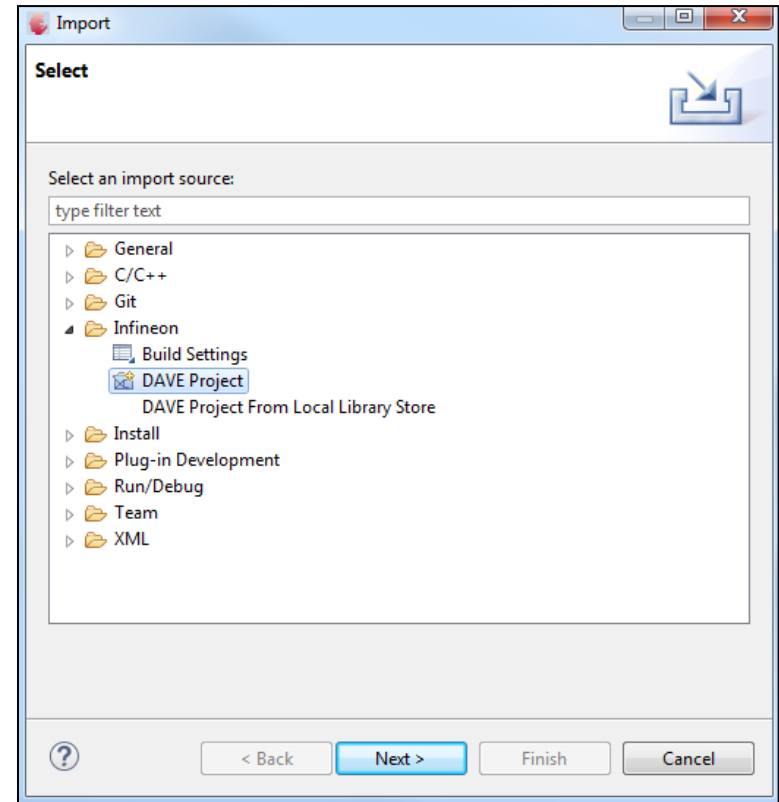
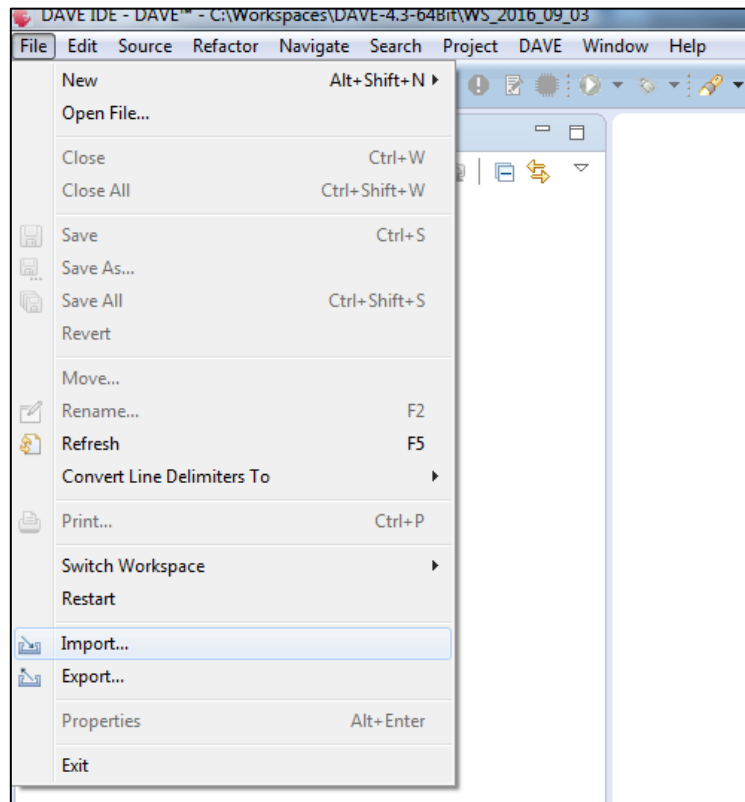
Building, Flashing and Debugging DAVE project

- › 1. Import/Open FW project in DAVE
- › 2. Connect Sense2GoL kit via USB
- › 3. Create Debug Configurations
 - To start flashing and debugging within the DAVE project



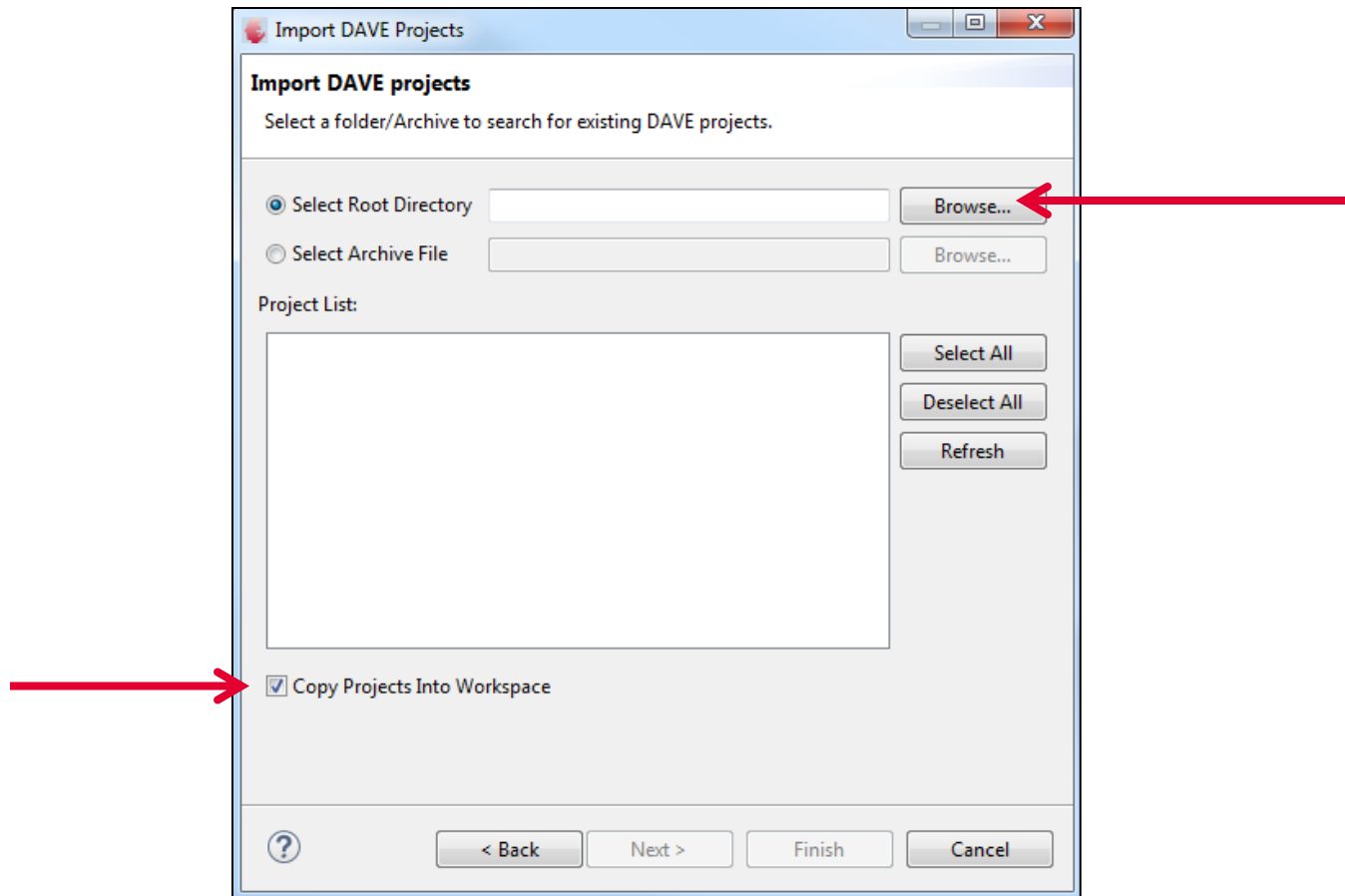
Building, Flashing and Debugging DAVE: Importing Project

- › To import the Sense2GoL firmware project into DAVE:
 - Navigate to File > Import
 - Infineon > DAVE Project



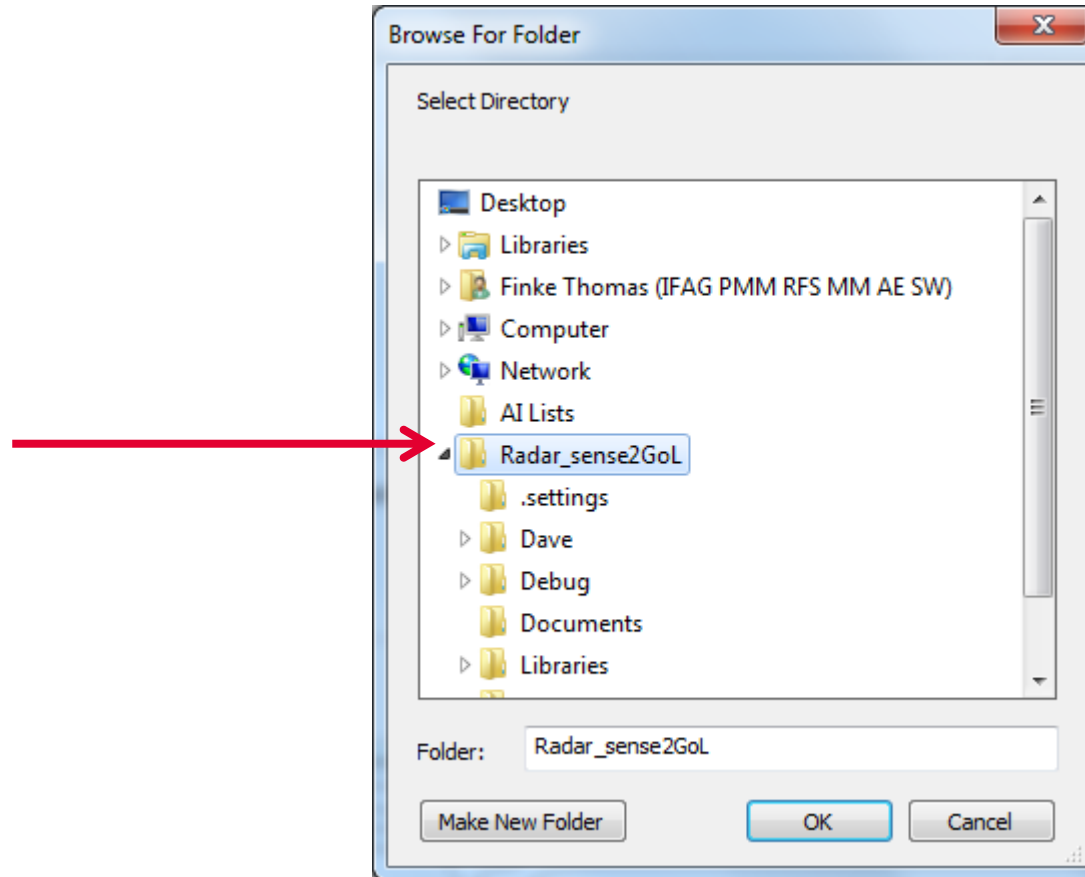
Building, Flashing and Debugging DAVE: Importing Project

- › Check “Copy Projects Into Workspace”
- › Select “Browse” beside “Select Root Directory”



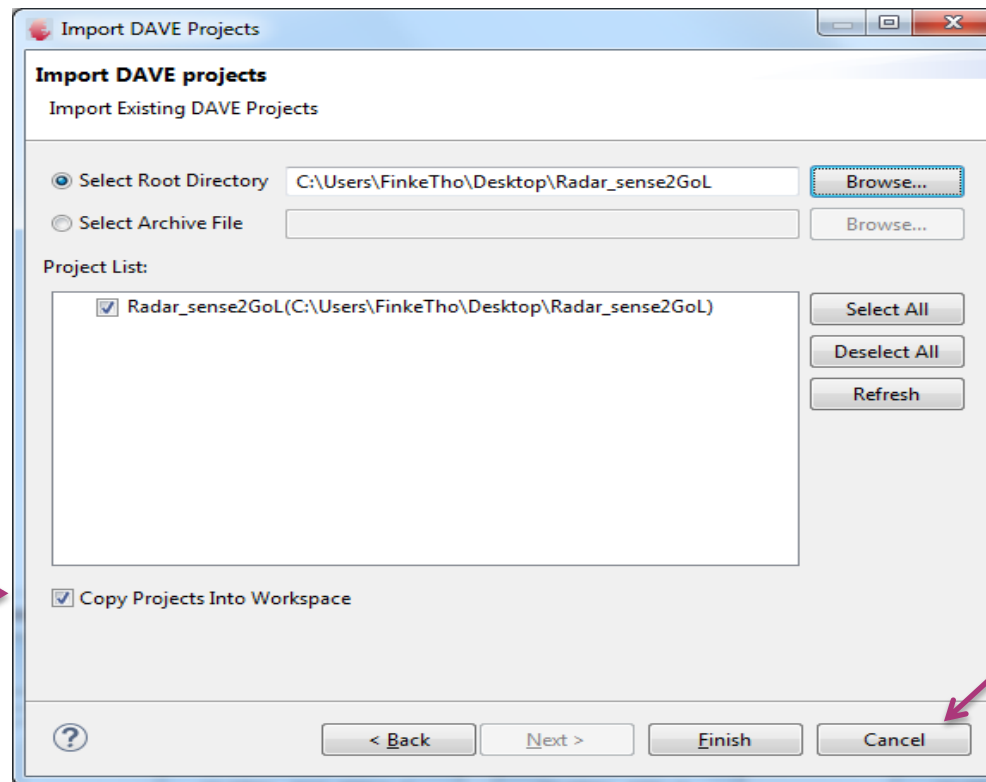
Building, Flashing and Debugging DAVE: Specifying Root Directory

- › Select 'Radar_sense2GoL' folder from location where you have extracted the .zip file of DAVE project. For example, here we have in the Desktop/Radar_sense2GoL



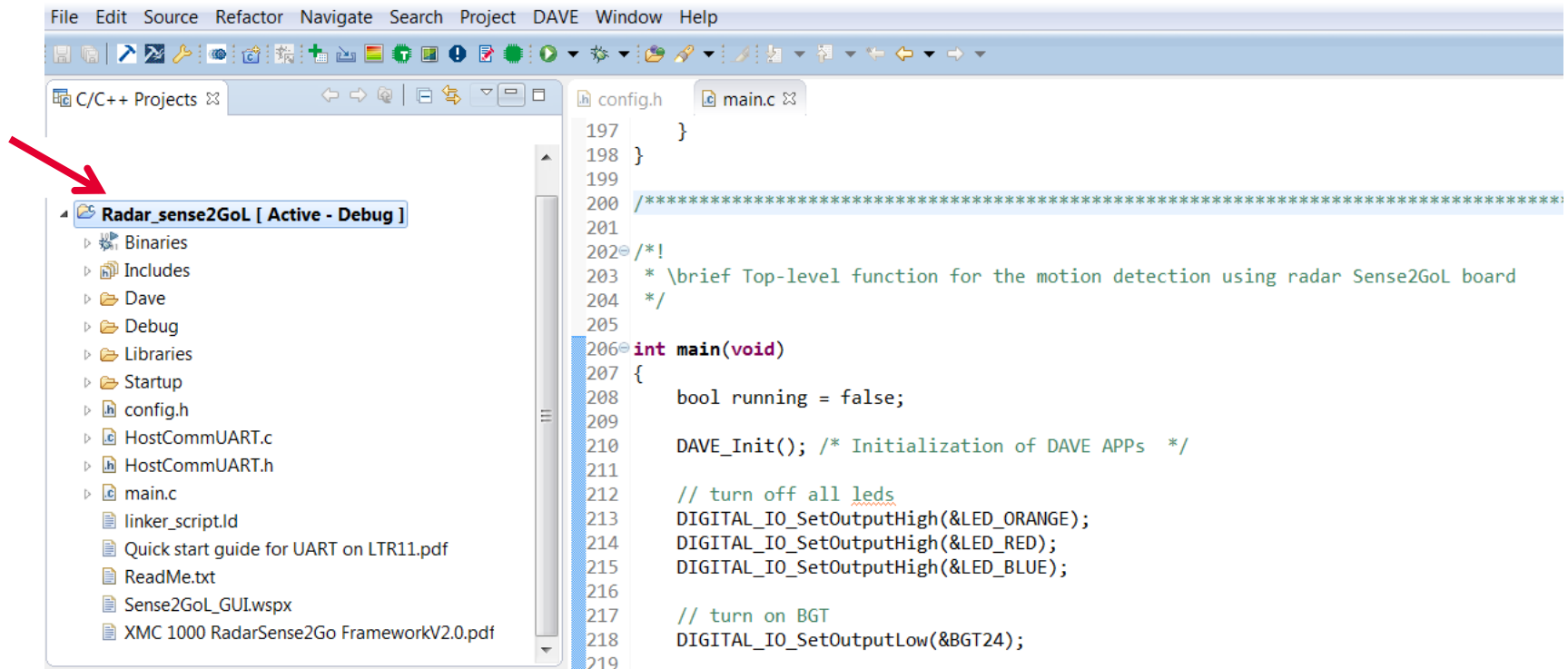
Building, Flashing and Debugging DAVE: Import project

- › The Project File should appear under Project List. Press 'Finish'.
- › Check 'Copy Projects Into Workspace'



Building, Flashing and Debugging DAVE: Finalized Import

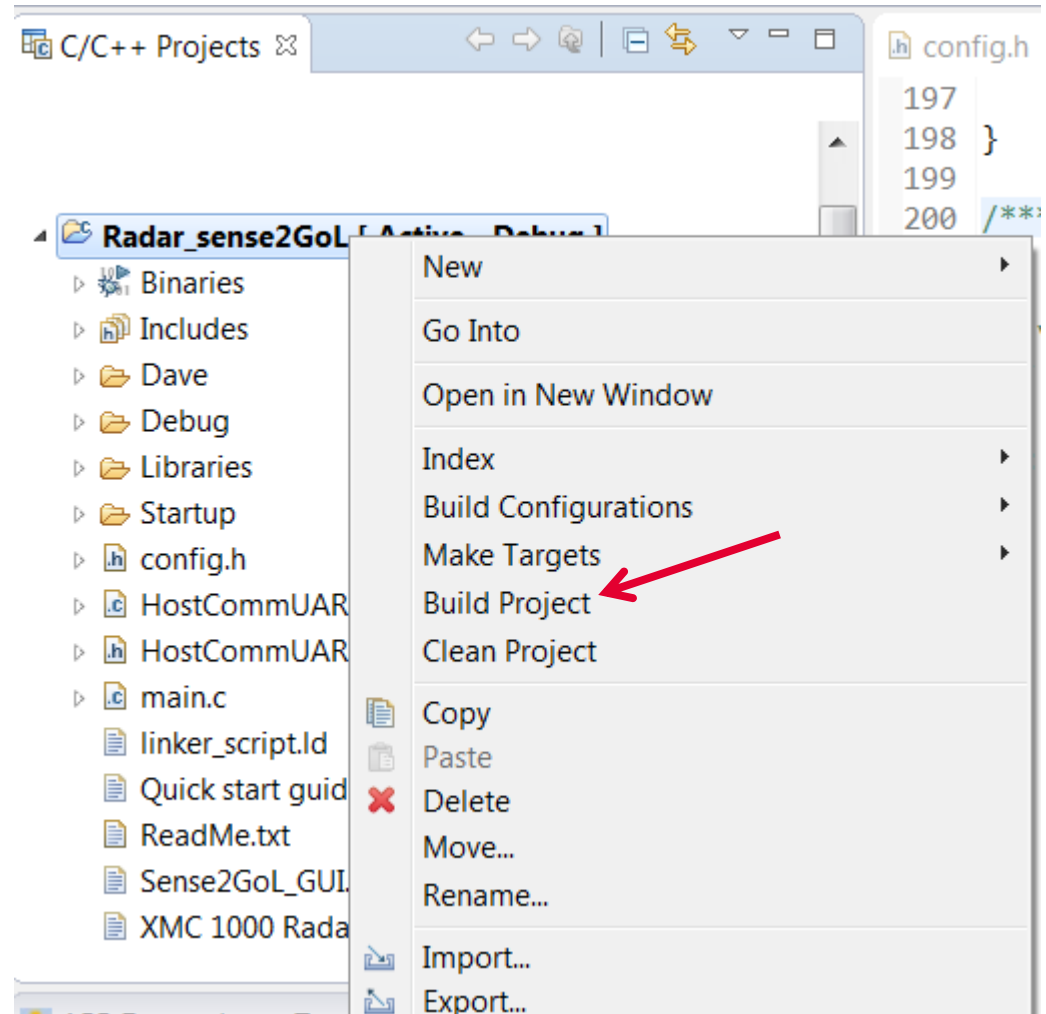
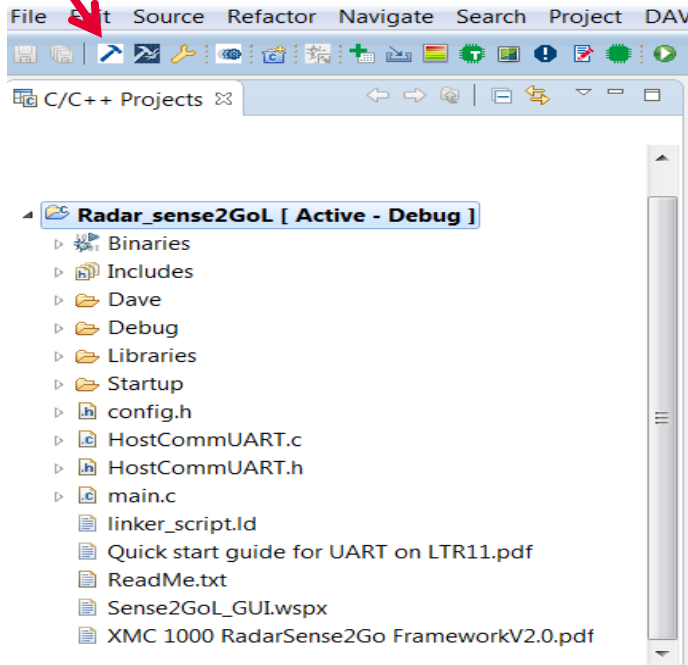
- › The following should appear. Expand the project dropdown



Building, Flashing and Debugging

DAVE: Building Project

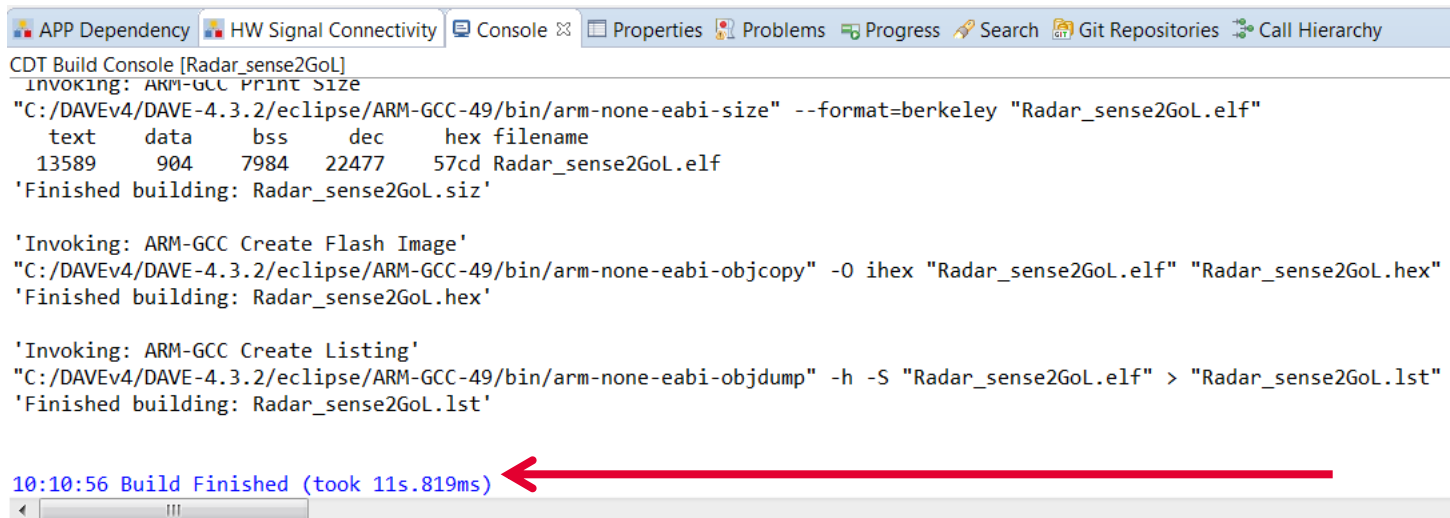
- › Build Active Project via toolbar button OR right-click Active Project → Build Project
- May take some time to build



Building, Flashing and Debugging

DAVE: Build Finish

- › Confirm successfully built by looking in the console...



```
CDT Build Console [Radar_sense2GoL]
Invoking: ARM-GCC Print Size
"C:/DAVEv4/DAVE-4.3.2/eclipse/ARM-GCC-49/bin/arm-none-eabi-size" --format=berkeley "Radar_sense2GoL.elf"
  text    data    bss    dec    hex filename
 13589    904    7984   22477   57cd Radar_sense2GoL.elf
'Finished building: Radar_sense2GoL.siz'

'Invoking: ARM-GCC Create Flash Image'
"C:/DAVEv4/DAVE-4.3.2/eclipse/ARM-GCC-49/bin/arm-none-eabi-objcopy" -O ihex "Radar_sense2GoL.elf" "Radar_sense2GoL.hex"
'Finished building: Radar_sense2GoL.hex'

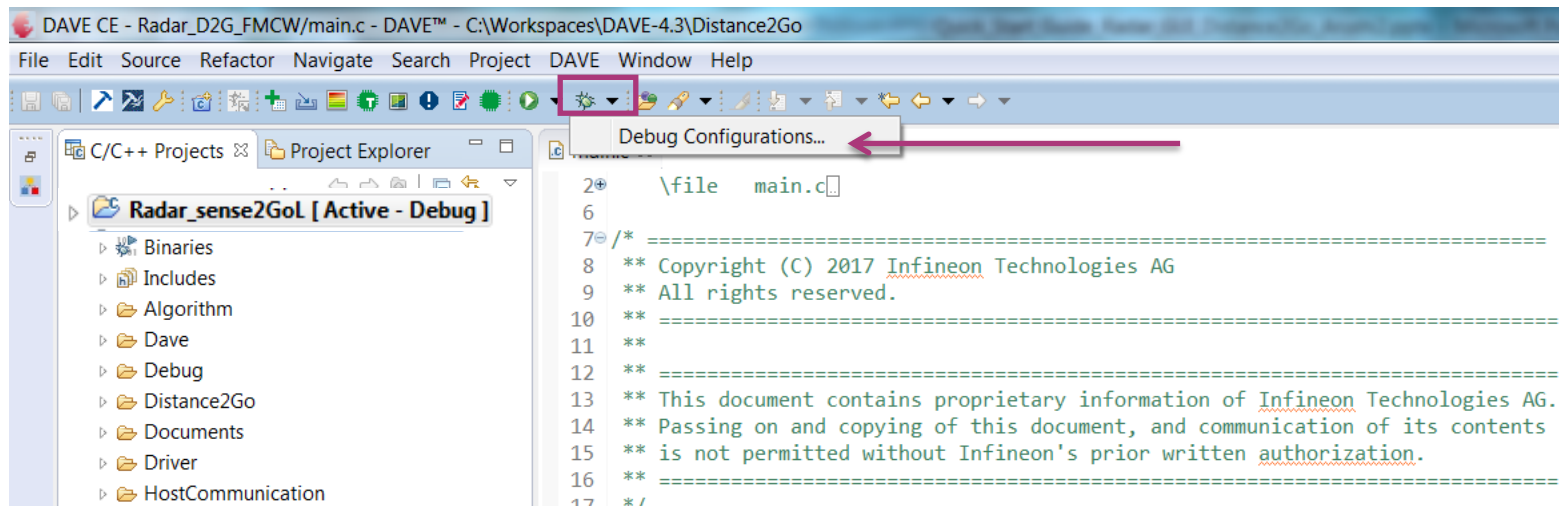
'Invoking: ARM-GCC Create Listing'
"C:/DAVEv4/DAVE-4.3.2/eclipse/ARM-GCC-49/bin/arm-none-eabi-objdump" -h -S "Radar_sense2GoL.elf" > "Radar_sense2GoL.lst"
'Finished building: Radar_sense2GoL.lst'

10:10:56 Build Finished (took 11s.819ms)
```

Building, Flashing and Debugging DAVE: Create debug configuration

In order to flash and debug the firmware in DAVE, need to follow these step.

1. Select the debug configurations by clicking on the drop down menu of Debug button as shown in Figure below, i.e. 'Debug' → 'Debug Configurations'

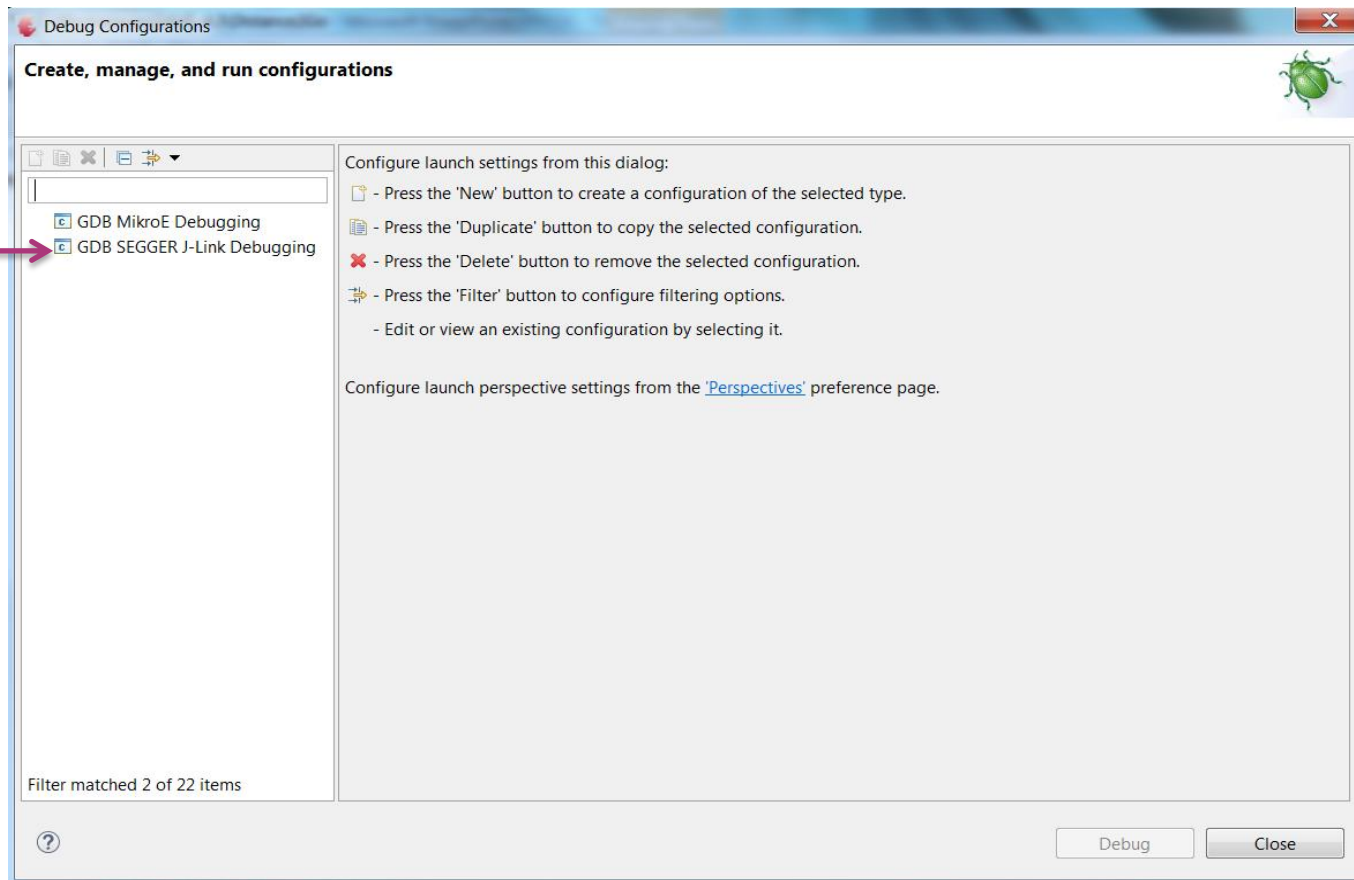


Building, Flashing and Debugging

DAVE: Create debug configuration cont'd

Following debug configurations are opened.

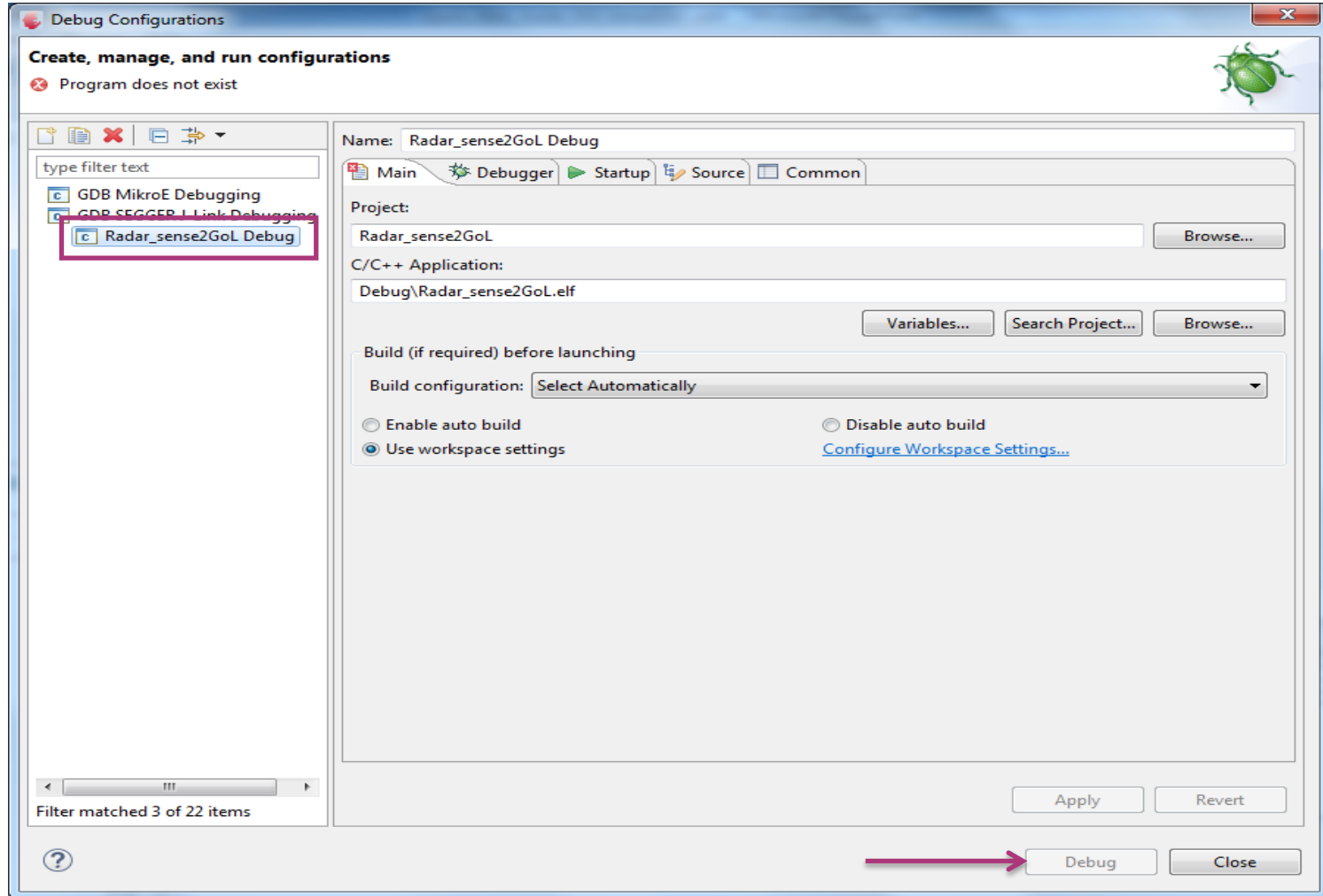
2. Double click on the 'GDB SEGGER J-Link Debugging' to create debug configurations.



Building, Flashing and Debugging

DAVE: Create debug configuration cont'd

Click on the 'Debug' button to flash and debug the DAVE project.



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- › The Sense2GoL project can be customized by setting parameters in the config.h file
- › On each change of the config.h file the project has to be re-build and flashed again

Configuration/Customization

Config.h File

- › Following can be configured;
 - Sampling freq in Hz ($F_s/2$ will be the maximum doppler frequency captured)
 - Detection threshold to filter out weak targets
 - FFT_SIZE (Caution: need to update the FFT size on Micrium GUI else it will crash)
 - Enable / Disable UART from code (also done by GUI)
 - For further UART configurations, please refer to the "Quick start guide for UART on LTR11.pdf "
 - Minimum/Maximum velocity to be detected

```
config.h  main.c
36 //
37 /*
38 =====
39 2. DEFINITIONS
40 =====
41 */
42
43 #define SAMPLING_FREQ_HZ (3000)    /**< sampling frequency in Hz.
44                                     PLEASE CHANGE ACCORDING TO YOUR
45                                     REQUIREMENTS!!! */
46 #define DETECTION_THRESHOLD (200) /**< threshold of fft magnitude. all
47                                     magnitudes below this value will be
48                                     ignored.
49                                     PLEASE CHANGE ACCORDING TO YOUR
50                                     REQUIREMENTS!!! */
51 #define FFT_SIZE (256)             /**< number of fft points */
52 #define UART_RAW_DATA (0)          /**< control for execution of UART feature to
53                                     transmit raw IQ from ADC. BE CAREFUL: WHEN
54                                     SENDING RAW DATA VIA UART INTERFACE GUI
55                                     WILL BE VERY SLOW AND NOT USABLE. TURN OFF
56                                     WHEN USING GUI */
57 #define MOTION_MIN_VELOCITY (0.5) /**< min velocity to detect motion */
58 #define MOTION_MAX_VELOCITY (20)  /**< max velocity to detect motion */
59
60 /*
61 =====
62 3. TYPES
63 =====
64 */
```


Configuration/Customization

Changing FFT_SIZE

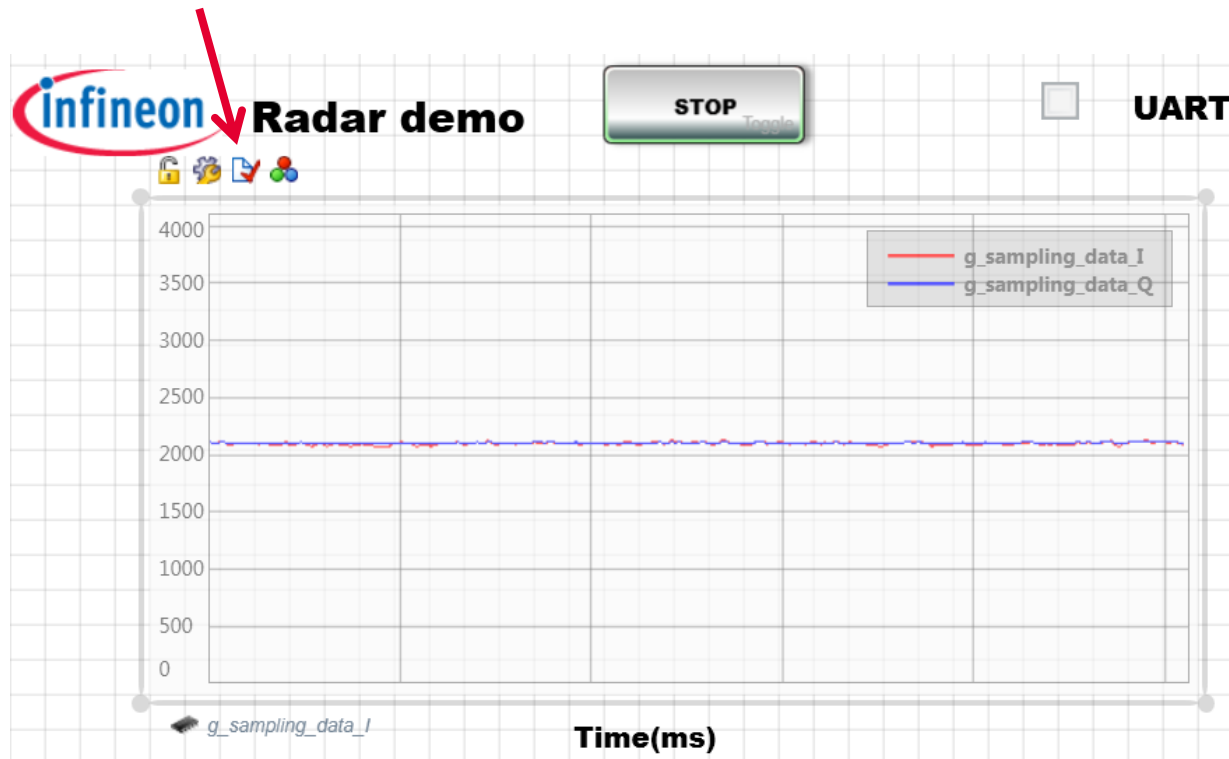


- After changing the FFT_SIZE in config.h file, one need to change the X-axis maximum samples in Micrium GUI, otherwise GUI will crash.
- For that, next sections will explain how to change the X-axis maximum sample count for;
 - Time Graph
 - Frequency Graph

Configuration/Customization

Change Max. samples count in Time Graph

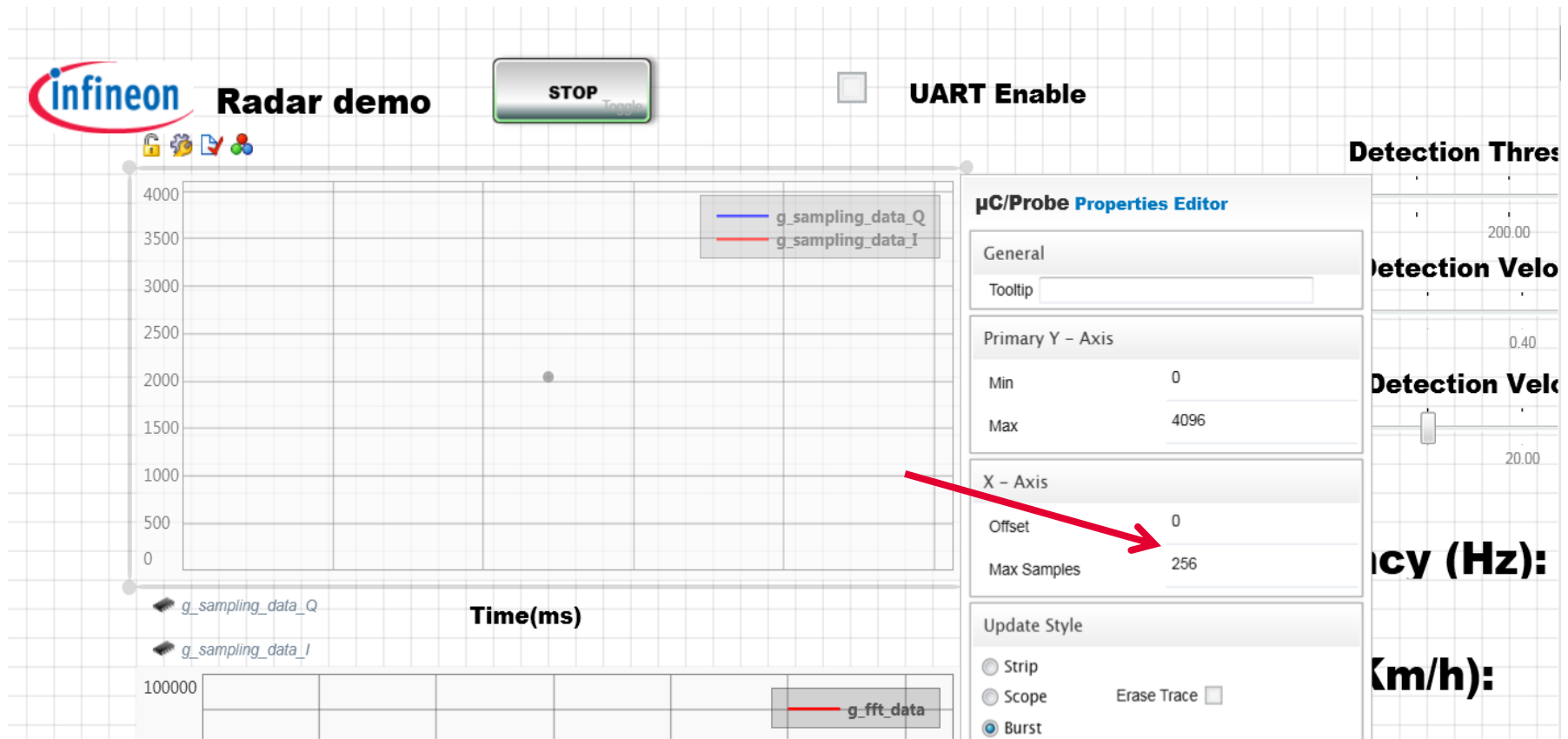
- When user click on the Time graph, four control icons appear at the top-left of the graph.
- Here, click on the Properties Editor of Time graph as shown below.



Configuration/Customization

Change Max. samples count in Time Graph

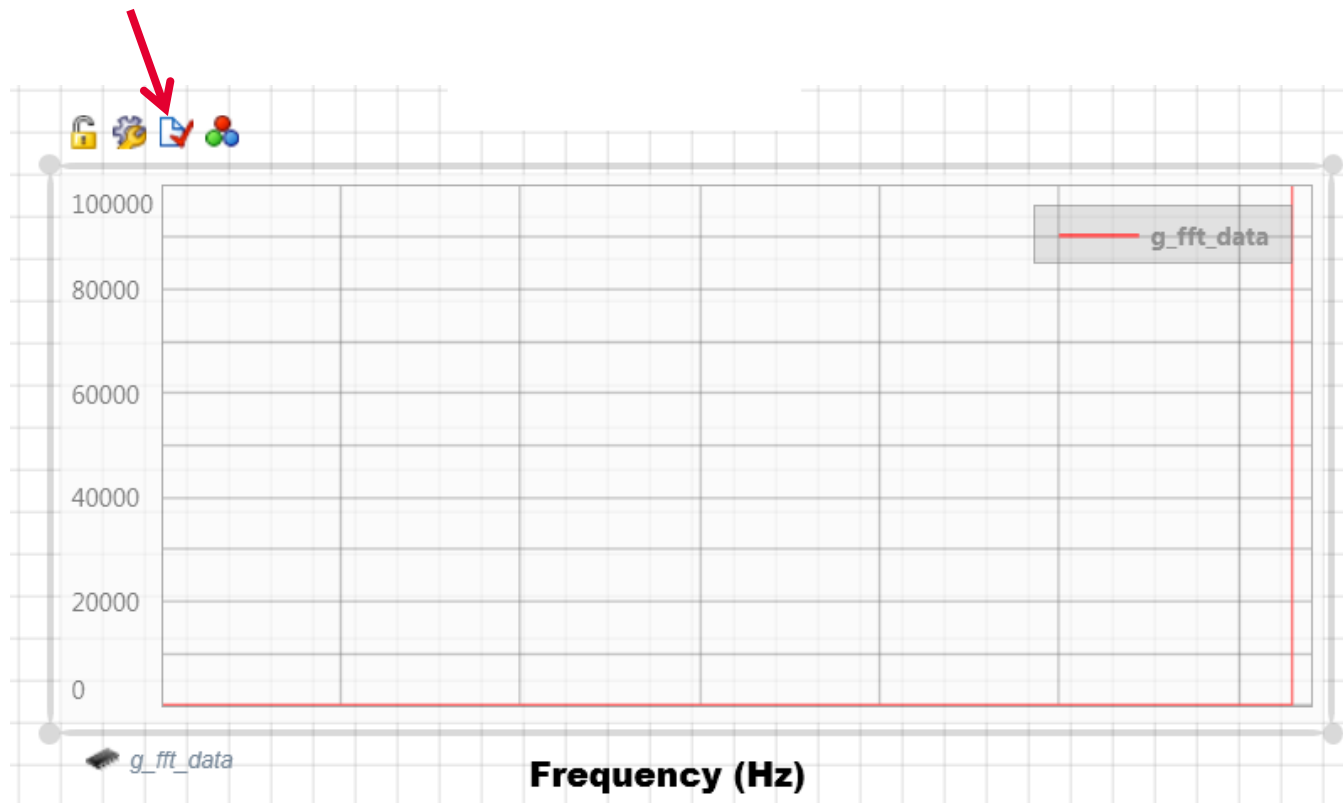
- Select Maximum samples on X-Axis equal to the FFT_SIZE value e.g. 256



Configuration/Customization

Change Max. samples count in Freq. Graph

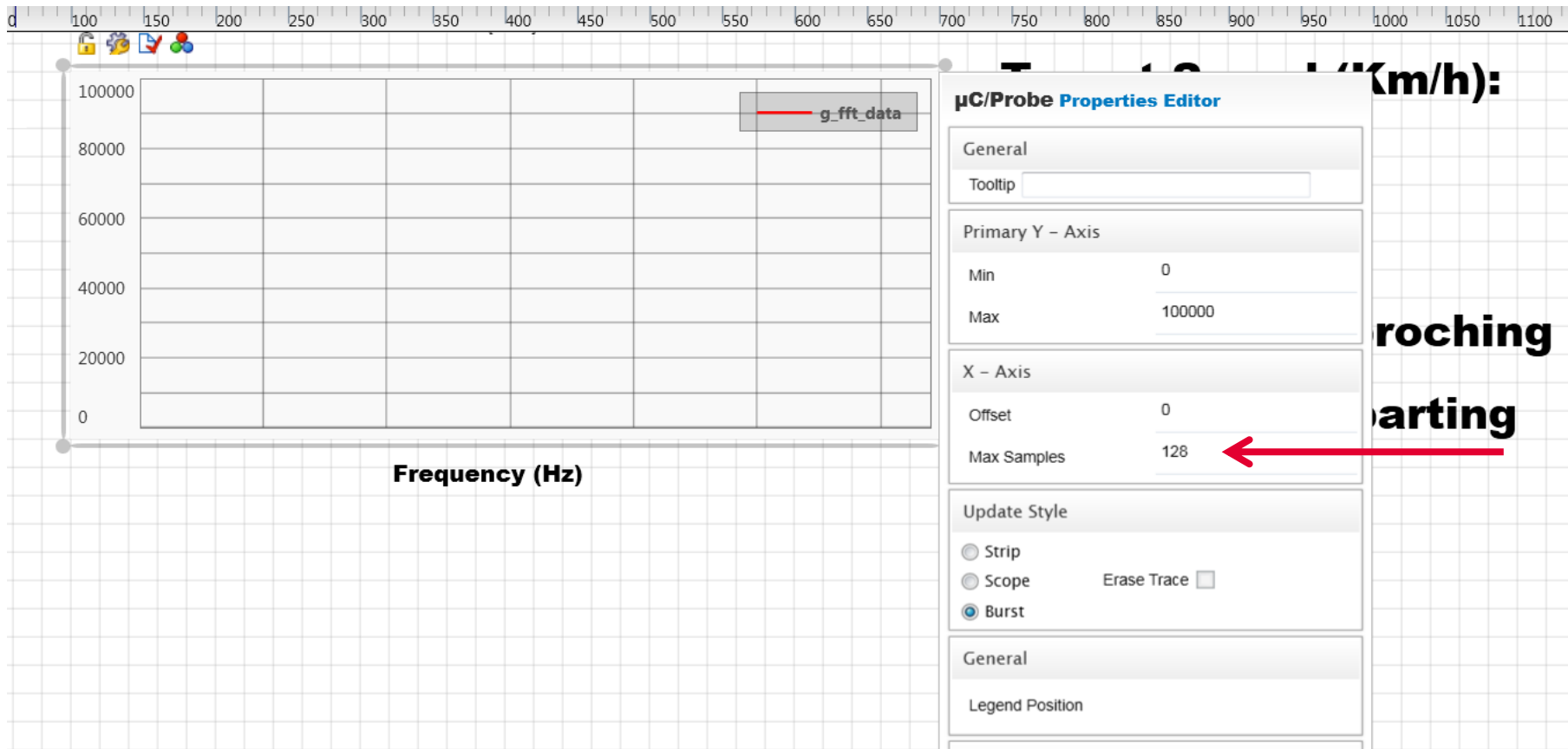
- When user click on the Frequency graph, four control icons appear at the top-left of the graph.
- Here, click on the Properties Editor of Frequency graph as shown below.



Configuration/Customization

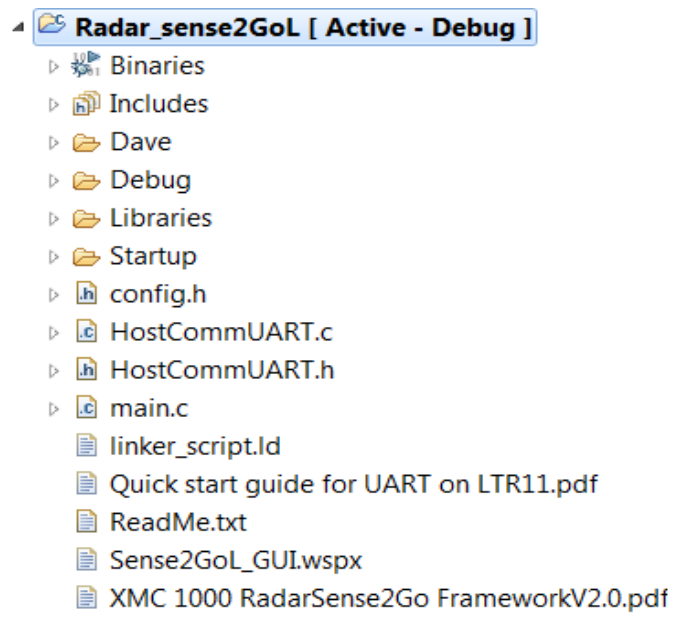
Change Max. samples count in Freq Graph

- Select Max samples on X-axis equal to the $\text{FFT_SIZE}/2$ value
 - e.g. if $\text{FFT_SIZE} = 256$, then the value in Max. samples on X-Axis property should be set to $\text{FFT_SIZE}/2 = 256/2 = 128$



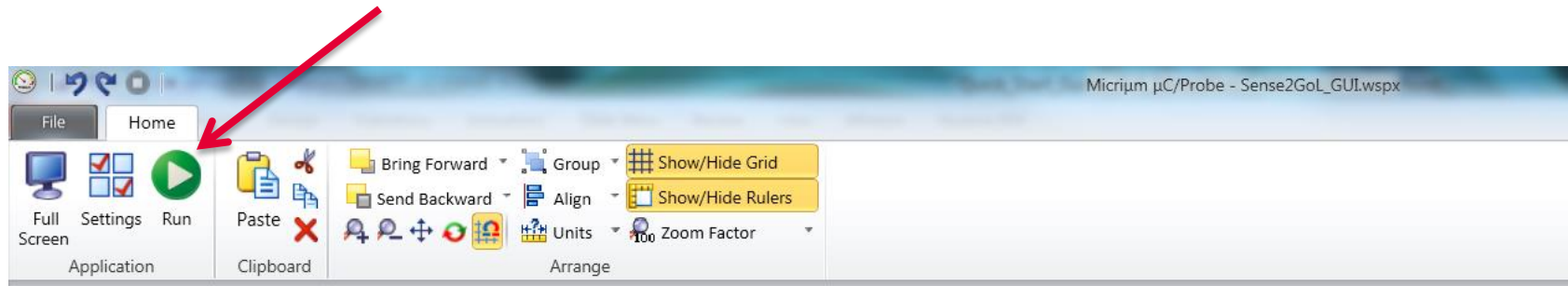
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- › 1. Open GUI by opening uC/Probe project inside FW
 - Sense2GoL_GUI.wspix
 - Can be done
 - In DAVE™ by double clicking file
 - In file explorer by double clicking file



GUI Overview (cont'd)

- › 2. Connect Sense2GoL kit via USB
 - Please ensure USB port on debugger board is connected
- › 3. Start GUI by clicking **Run** button

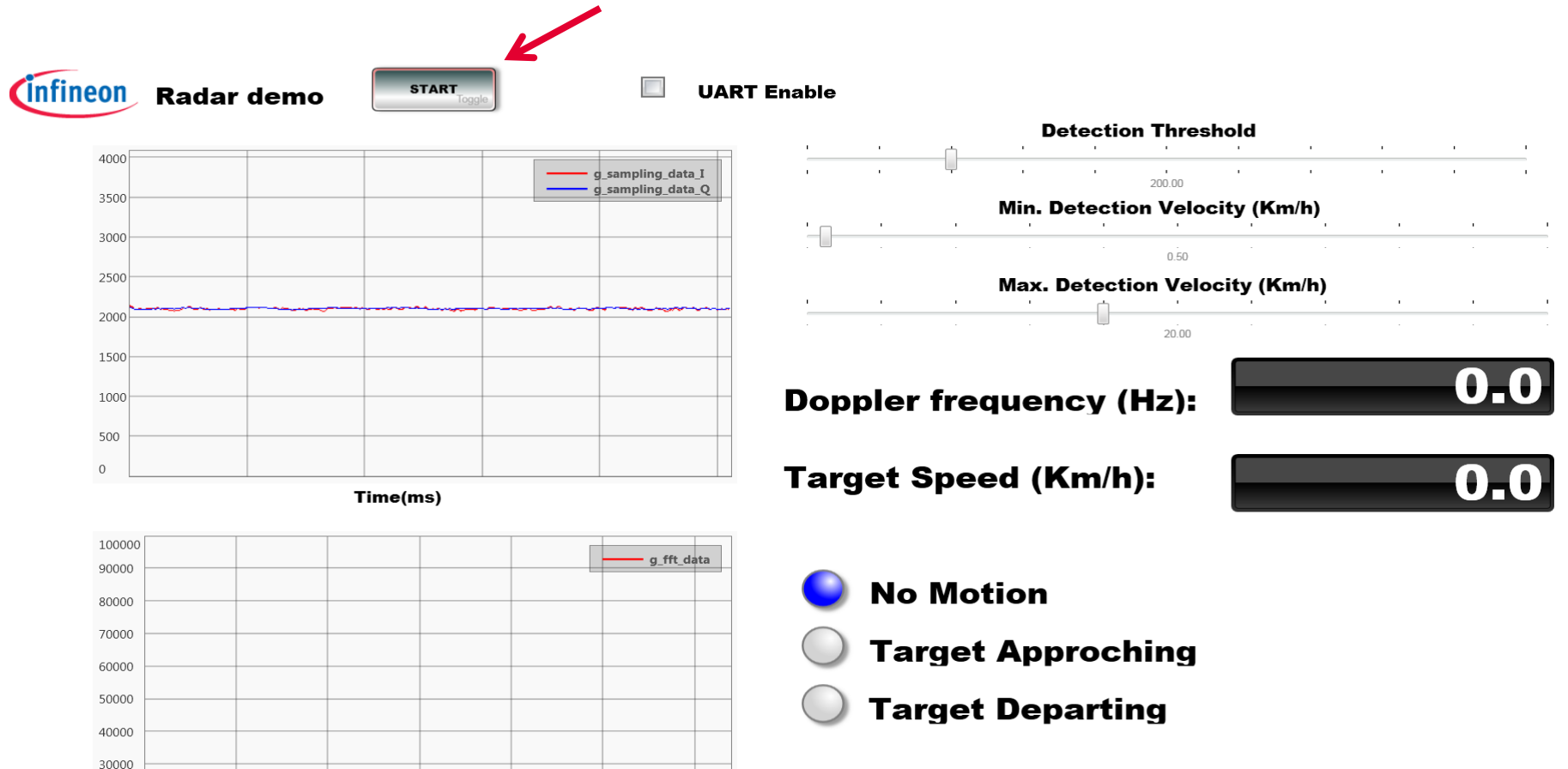


GUI

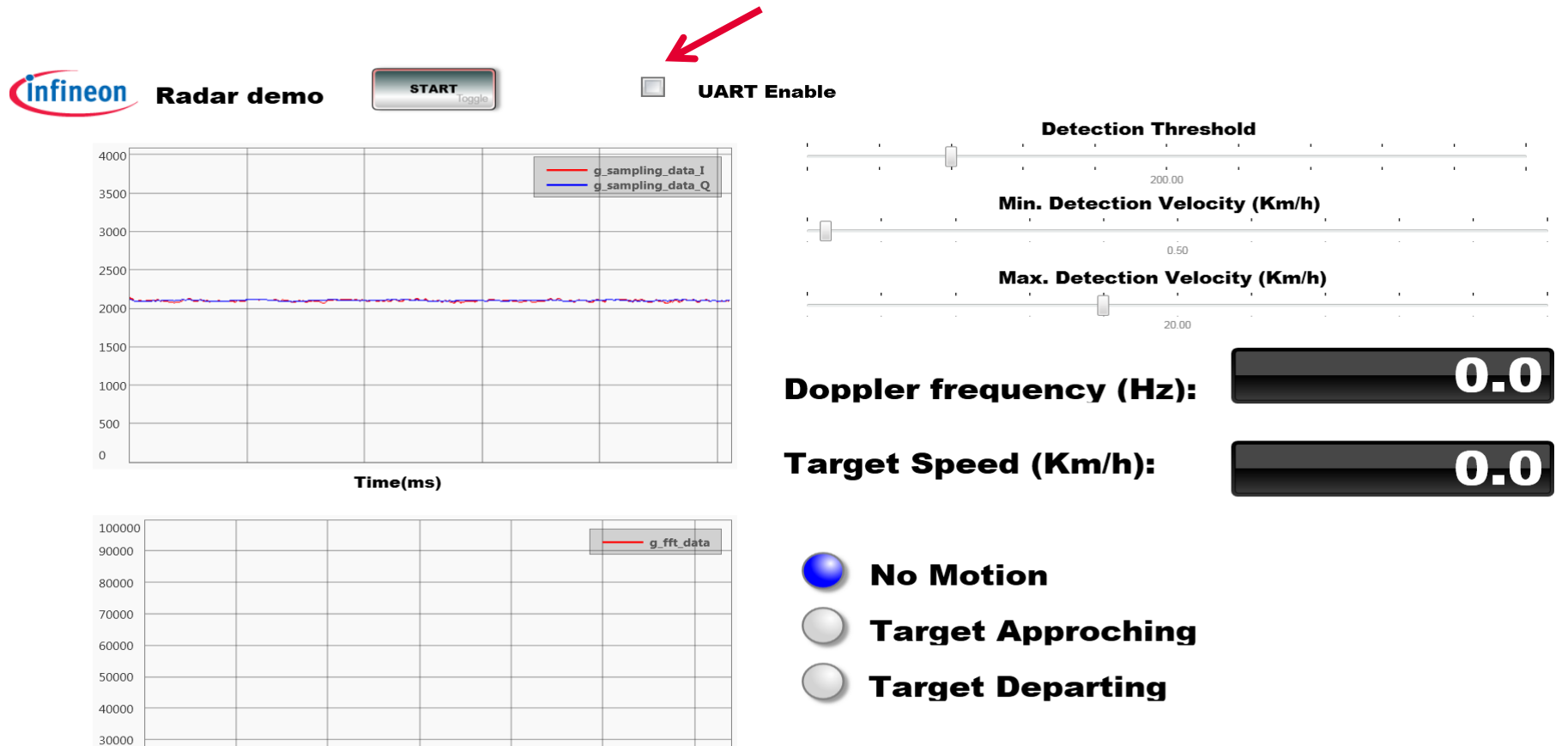
Starting GUI

> The following GUI should appear... size appropriately to fit screen

– **PRESS START TO BEGIN DATA COLLECTION**



- › In order to capture the raw ADC samples via UART, click on the UART Enable check-box



GUI Observations

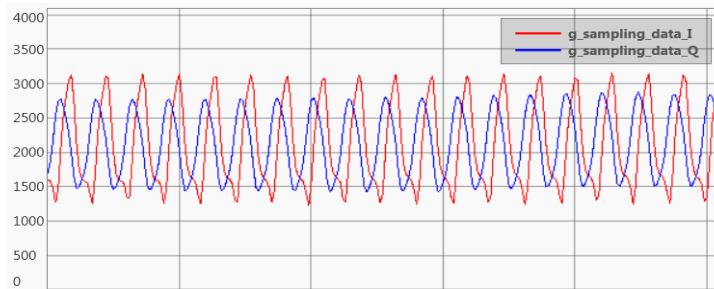
- › The radar should now detect movement and display data on GUI
 - Time & Frequency plots
 - Threshold can also be set, default 200
 - Minimum velocity (default 0.40km/h) and Maximum velocity (default 20km/h)
 - Max Doppler Frequency & Target Speed
 - Direction of Movement



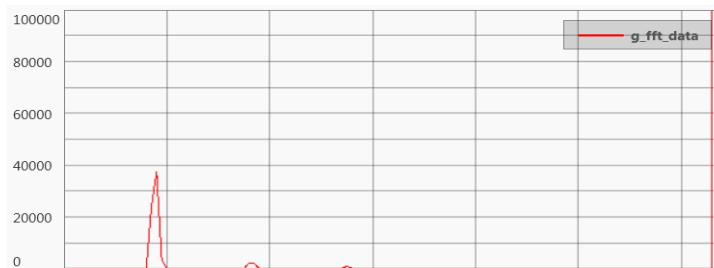
Radar demo



UART Enable

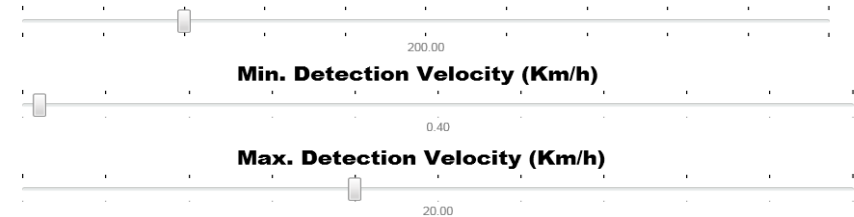


Time(ms)



Frequency (Hz)

Detection Threshold



Doppler frequency (Hz):

222.7

Target Speed (Km/h):

5.0



No Motion



Target Approaching



Target Departing

GUI Reference



Radar demo

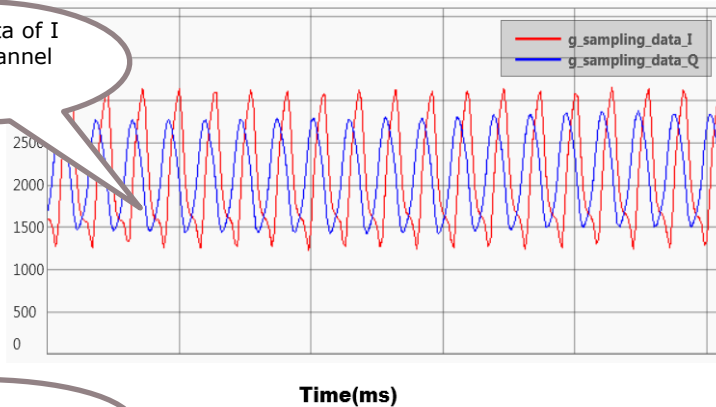


Start/Stop Data acquisition & detection

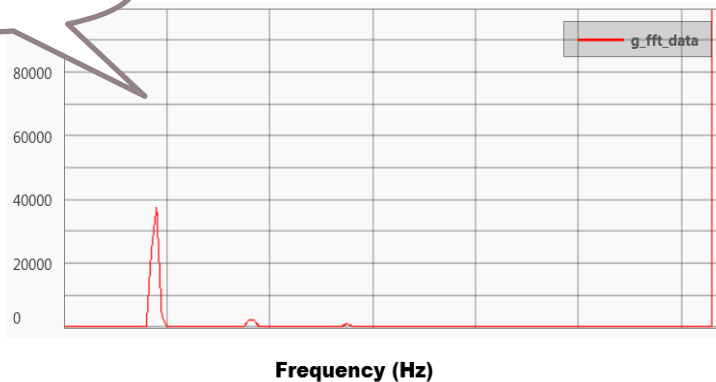


UART Enable

IF raw data of I and Q channel



Spectrum



Threshold for target detection

Detection Threshold

Min. Detection Velocity (Km/h)

Max. Detection Velocity (Km/h)

Doppler frequency (Hz):

222.7

Target Speed (Km/h):

5.0



No Motion



Target Approaching



Target Departing

Target Approaching or Moving Away Indicator

- 1 Overview
- 2 Development Tools Installation
- 3 Flashing and Debugging
- 4 Configuration/Customization
- 5 GUI
- 6 UART data streaming

UART data streaming Overview



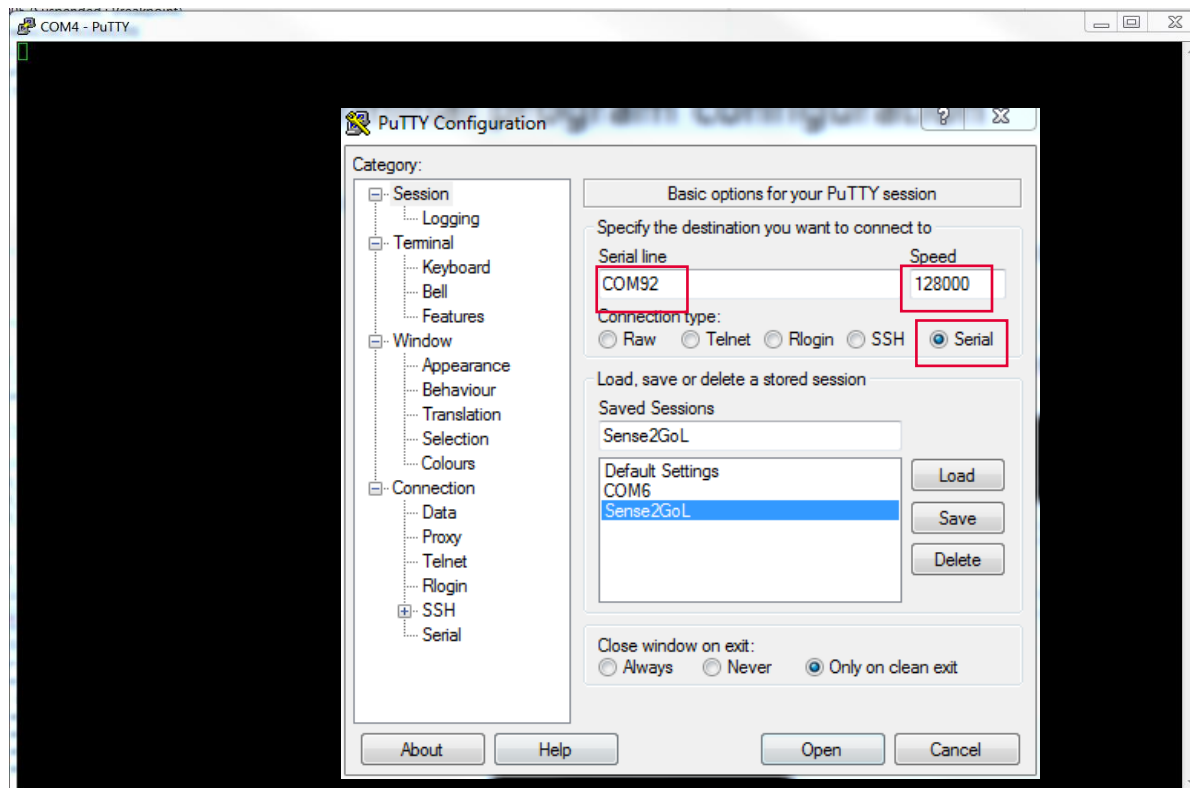
- › Sampled ADC data is streamed by default via UART connection
- › Via the transferred data it is possible to
 - View and export ADC data via Terminal program
 - Transfer data to MATLAB for processing

UART data streaming

Terminal program configuration

› Configure PuTTY

- UART Configurations: Full-duplex, Direct mode, 128000 baud rate, 8 data-bits, 1 stop-bit, no parity
- COM port number depends upon the HOST PC, look into the device manager for the COM port number your Sense2GoL connected, in this example it is COM92



UART data streaming

Terminal program output

- › Output a the PuTTY shell for the I and Q raw samples look like:

```
COM4 - PuTTY
2103 2103 2096 2105 2104 2102 2101 2107 2105 2098 2107 2102 2096 2096 2099 2100
2103 2101 2096 2100 2103 2099 2104 2102 2105 2102 2102 2097 2100 2102 2096 2095
2100 2104 2100 2104 2105 2104 2105 2107 2104 2103 2104 2103 2102 2103 2096 2100
2100 2102 2100 2105 2103 2105 2106 2096 2100 2100 2100 2100 2096 2102 2107 2104

----- I raw samples -----
2113 2099 2123 2098 2102 2105 2120 2077 2108 2094 2093 2114 2101 2093 2108 2089
2084 2088 2086 2087 2093 2096 2102 2110 2080 2108 2085 2097 2079 2118 2101 2107
2107 2092 2093 2099 2094 2087 2103 2102 2104 2096 2104 2100 2123 2115 2106 2104
2107 2093 2092 2094 2108 2109 2100 2093 2099 2105 2087 2090 2103 2091 2101 2125
2090 2078 2076 2089 2088 2110 2098 2107 2095 2099 2117 2108 2085 2121 2106 2124
2115 2100 2079 2102 2111 2087 2104 2074 2091 2111 2106 2116 2106 2112 2105 2112
2061 2101 2124 2095 2087 2095 2085 2102 2107 2124 2123 2098 2104 2108 2113 2102
2087 2112 2095 2082 2099 2105 2103 2074 2093 2102 2089 2091 2108 2101 2091 2098
2087 2104 2110 2106 2101 2095 2095 2083 2094 2106 2107 2104 2093 2107 2115 2087
2102 2075 2094 2109 2110 2103 2088 2110 2098 2097 2105 2113 2126 2100 2106 2116
2102 2094 2083 2080 2095 2127 2118 2104 2091 2085 2104 2103 2101 2099 2113 2111
2110 2083 2106 2117 2097 2100 2088 2098 2090 2096 2102 2099 2106 2085 2103 2105
2102 2102 2105 2095 2104 2081 2103 2125 2103 2112 2094 2090 2112 2072 2104 2083
2088 2082 2084 2135 2104 2092 2077 2111 2080 2083 2108 2104 2108 2101 2108 2081
2086 2085 2107 2115 2099 2105 2097 2119 2092 2100 2086 2134 2136 2116 2098 2115
2082 2100 2106 2103 2091 2092 2101 2104 2113 2100 2096 2088 2093 2085 2081 2116

----- Q raw samples -----
2103 2102 2106 2100 2103 2101 2104 2096 2107 2101 2103 2103 2104 2100 2107 2099
2105 2100 2103 2105 2097 2102 2105 2107 2103 2105 2097 2104 2101 2109 2104 2102
2105 2102 2102 2101 2104 2101 2105 2104 2105 2104 2101 2102 2109 2104 2104 2098
2104 2097 2095 2100 2101 2106 2102 2101 2102 2105 2100 2100 2108 2103 2101 2108
2104 2101 2100 2101 2109 2108 2102 2104 2106 2105 2110 2109 2100 2108 2107 2109
2108 2102 2096 2098 2104 2098 2101 2095 2099 2101 2102 2101 2098 2105 2100 2104
2095 2104 2106 2098 2097 2102 2095 2103 2101 2104 2104 2098 2097 2102 2101 2102
2094 2102 2104 2099 2100 2110 2102 2101 2101 2101 2100 2098 2104 2097 2100 2101
2102 2102 2105 2100 2101 2103 2103 2103 2104 2106 2108 2105 2101 2108 2106 2105
2104 2100 2100 2104 2105 2097 2104 2104
```


UART data streaming

Micrium GUI UART Setting

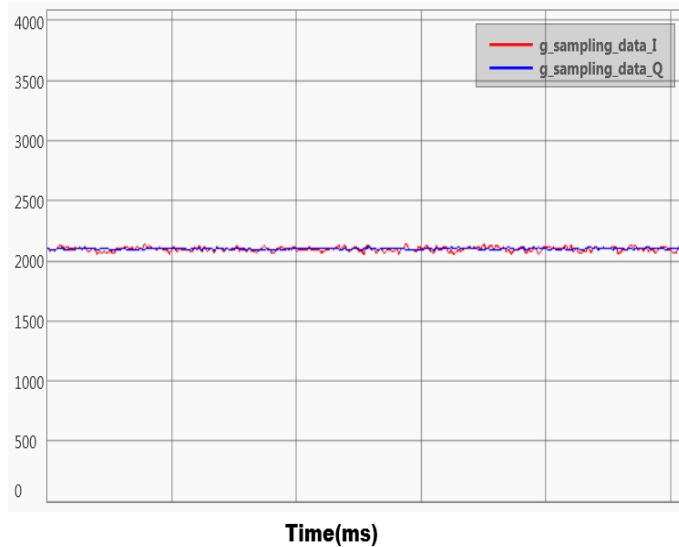
- › Please ensure that UART streaming is enabled. By default it is but can be changed in Micrium GUI by disabling checkbox.



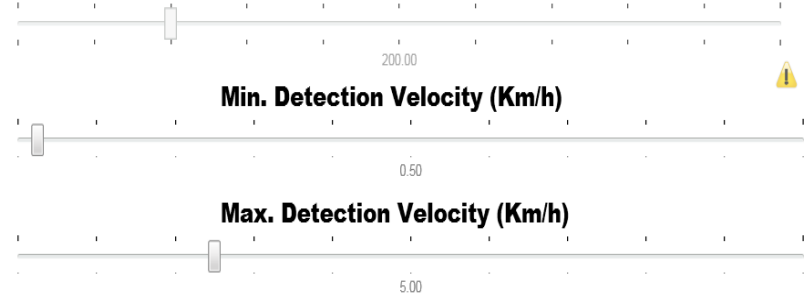
Radar demo



UART Enable



Detection Threshold



Doppler frequency (Hz):

0.0

Target Speed (Km/h):

UART data streaming

Features of UART Library



- › This UART Sense2GoL library supports the following data to be dumped at the HOST:
 1. Send raw ADC data to Host
 - I and Q (first 128 samples of I , followed by next 128 samples of Q)
 - Only I (128 samples)
 - Only Q (128 samples)
 2. Doppler measurements and FFT spectrum to Host
 3. Signed 16-bit, unsigned 16-bit and 32-bit are supported
 4. Any processing on the result needs to be done in **radarsense2gol_result()**

UART data streaming

Methods supported by UART Library



- 1. dumpRawIQ_int16**
- 2. dumpRawIQ_uint16**
- 3. dumpRawIQ_uint32**
- 4. dump_val_int16**
- 5. dump_arr_int16**
- 6. dump_val_uint16**
- 7. dump_arr_uint16**
- 8. dump_val_uint32**
- 9. dump_arr_uint32**
- 10. dump_val_float**



Part of your life. Part of tomorrow.

