

Wi-Fi®/Bluetooth® (NXP) Solution for i.MX

FreeRTOS Quick Start Guide - Rev. 2.0

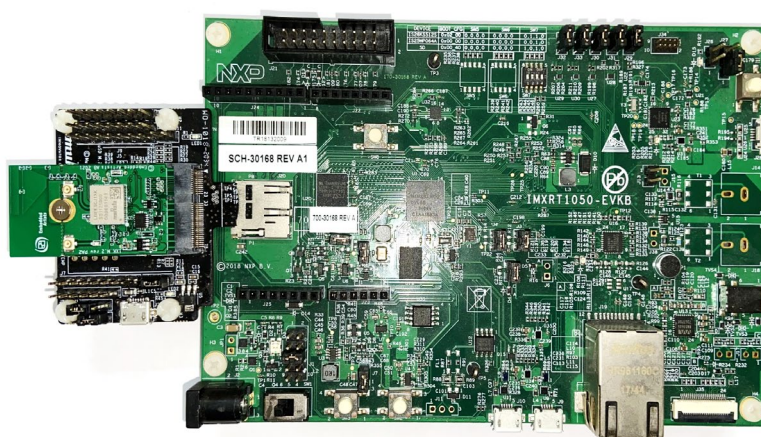


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About This Guide

This document guides the user on enabling a popular subset of [Murata's Wi-Fi/Bluetooth modules](#) (1XK, 1ZM and 2DS) on NXP [i.MX RT Evaluation Kits](#). All Murata Wi-Fi/Bluetooth modules are designed into [Embedded Artists' M.2 modules](#).









Audience & Purpose

This document is intended as an introduction for end users to start evaluating Murata Wi-Fi/Bluetooth solutions for FreeRTOS on NXP i.MX platforms.

Document Conventions

Table 1 describes the document conventions used in this guide.

Table 1: Document Conventions

Conventions	Description
	Warning Note Indicates very important note. Users are strongly recommended to review.
	Info Note Intended for informational purposes. Users should review.
	Menu Reference Indicates menu navigation instructions. Example: Insert → Tables → Quick Tables → Save Selection to Gallery 
	External Hyperlink This symbol indicates a hyperlink to an external document or website. Example: Embedded Artists AB  Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. Example: Introduction  Click on the text to open the link.
<code>Console input/output or code snippet</code>	Console I/O or Code Snippet This text Style denotes console input/output or a code snippet.
<code># Console I/O comment // Code snippet comment</code>	Console I/O or Code Snippet Comment This text Style denotes a console input/output or code snippet comment. <ul style="list-style-type: none"> Console I/O comment (preceded by "#") is for informational purposes only and does not denote actual console input/output. Code Snippet comment (preceded by "//") may exist in the original code.

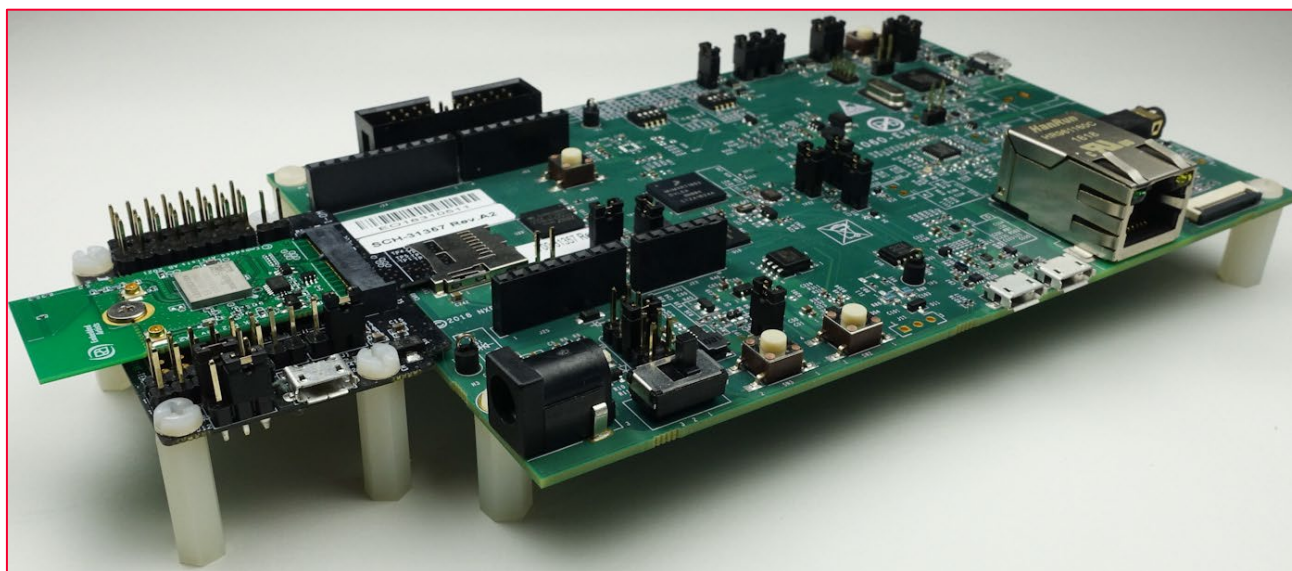
1 Introduction

This Quick Start Guide details enabling a selection of NXP based [Murata's Wi-Fi/Bluetooth modules](#) on the [NXP i.MX RT Evaluation Kits](#) (running FreeRTOS). The Embedded Artists' M.2 modules in this document covers:

- Type 1XK (IW416)
- Type 1ZM (88W8987)
- Type 2DS (88W8801)

Murata supports several NXP i.MX RT EVKs and Wi-Fi/Bluetooth M.2 modules. This Quick Start documents only one hardware/software configuration to introduce users to the Murata solution. For more details on different configurations supported, please refer to the [Murata Wi-Fi/BT \(NXP\) Solution for i.MX FreeRTOS User Guide](#). **Figure 1** below shows the setup used in this document – NXP i.MX RT1060 EVK with Type 1XK module (enabled by Murata's uSD-M.2 Adapter and Embedded Artists' 1XK M.2 module).

Figure 1: NXP i.MX RT1060 with Type 1XK (WLAN-only configuration)



The [NXP](#) and [Embedded Artists](#) platforms currently supported are based on i.MX RT microprocessors. Wireless connection is provided by either the Embedded Artists' Wi-Fi/BT M.2 EVBs directly, or by combining with [Murata's uSD-M.2 Adapter](#).

The example setup used to illustrate the various steps is NXP [i.MX RT1060 EVK](#) with Murata [Type 1XK](#) module (Embedded Artists' M.2 module with uSD-M.2 Adapter interconnect), connected to a host PC running Windows®.



Wi-Fi/Bluetooth M.2 EVB (Evaluation Board) is equivalent to Wi-Fi/Bluetooth M.2 module. We use "EVB" sometimes to better distinguish the M.2 form factor from the actual Murata module.

The following parts are used in this quick start guide:

- NXP IMXRT1060-EVK
- Embedded Artists EAR00385
- Murata LBEE0ZZ1WE-uSD-M2 (LBEE0ZZ1WE-TEMP)

2 Example Setup

2.1 Hardware


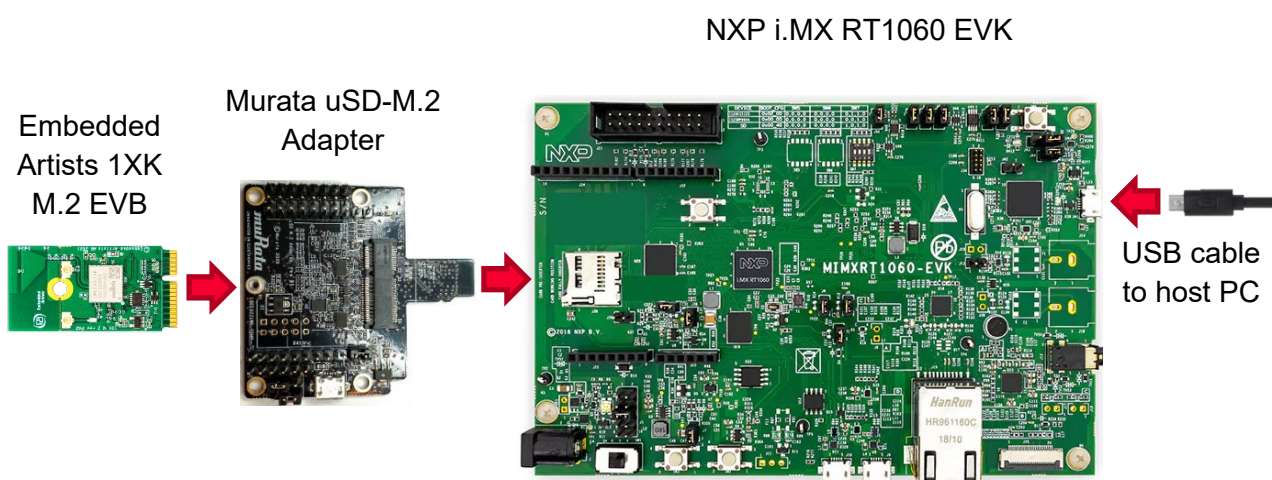





Figure 2 below provides a high-level overview of the hardware interconnect. Embedded Artists' 1XK M.2 module is connected to NXP's i.MX RT1060 EVK via Murata's uSD-M.2 Adapter. Note that this configuration only enables the Wi-Fi interface. For Bluetooth operation, additional connections using jumper cables must be made. For details, refer to the [Murata User Guide](#) .

Figure 2: Connecting the Wi-Fi/BT M.2 module to the i.MX RT EVK




2.2 Software

While multiple IDEs can be used to develop on the i.MX RT 1060 EVK, this example uses NXP's MCUXpresso IDE.

1. Download and install the following software.
 - [MCUXpresso IDE \(version 11.6.0\)](#) 
 - [Mbed Virtual COM Port Driver](#)  (The EVK must be plugged in before installing this)
 - A terminal application ([Tera Term](#) , [PuTTY](#) , etc.).
 - [iPerf](#) 

Refer to the [NXP i.MX RT 1060 EVK getting started page](#)  for more details.

2. Download the latest 2.11.0 SDK for i.MX RT1060 EVK using the MCUXpresso SDK Builder on NXP website.
 - Go to SDK Builder [homepage](#) .
 - Click on "Select Development Board" and sign in with your NXP login credentials.
 - On the "Select Development" page, enter "EVK-IMXRT1060" under "Search by Name". This will correctly highlight/select the i.MX RT1060 EVK we are using.
 - On the right side of the page, click on "Build MCUXpresso SDK v2.11.0".

- You will now transition to “Build SDK for EVK-IMXRT1060” page. Click the “Select All” button followed by the “Download SDK” button. Click on “I Agree” to the EULA.
 - The i.MX RT1060 SDK is now being downloaded.
 - Once downloaded, hit the “Close button” on pop-up window.
 - Examine your “Downloads” folder directory – it should now list “SDK_2_11_0_EVK-MIMXRT1060.zip”.
3. Launch the installed MCUXpresso IDE 11.6 and select the IDE view.
 4. Open “Installed SDKs” tab (bottom middle of IDE). Drag and drop the new SDK file into this region. You should then see the SDK zip file being copied over and appear on the “Installed SDK” list.

3 Import Example

Various sample applications are provided by the SDK. The wifi_iperf example, which is a performance test for the 1XK module, will be used in this document.

1. Click on **Import SDK example(s)...** in the “Quickstart” Panel, as shown in **Figure 3**.
2. Select **evkmimxrt1060** board and click the **Next** button, as shown in **Figure 4**.
3. Expand **wifi_examples** and select **wifi_iperf**. Click **Finish**. Ensure SDK Debug Console is set as **UART** in Project Options. See **Figure 5** for reference.
4. Open evkmimxrt1060_wifi_iperf/source/app_config.h file and change the enabled compiler flag as per the module name. In this example (using Murata 1XK module), the **WIFI_IW416_BOARD_MURATA_1XK_USD** flag needs to be set. See **Figure 6** for reference.



It is possible to build the example for modules 2DS and 1ZM as well using the same files. Just replace the compiler flag **WIFI_IW416_BOARD_MURATA_1XK_USD** in file source/app_config.h to **WIFI_88W8801_BOARD_MURATA_2DS_USD** or **WIFI_88W8987_BOARD_MURATA_1ZM_USD** respectively.

5. Optionally, change the country/region specific TX power setting by editing the same file source/app_config.h and enabling the required header file under the **WIFI_IW416_BOARD_MURATA_1XK_USD** compiler flag), as shown in **Figure 7**.
6. Open evkmimxrt1060_wifi_iperf/source/main.c file and modify the **EXT_AP_SSID**, **EXT_AP_PASSPHRASE** and **IPERF_SERVER_ADDRESS** macros as per your setup. See **Figure 8** for reference.
7. Save the changes.

Figure 3: Import SDK

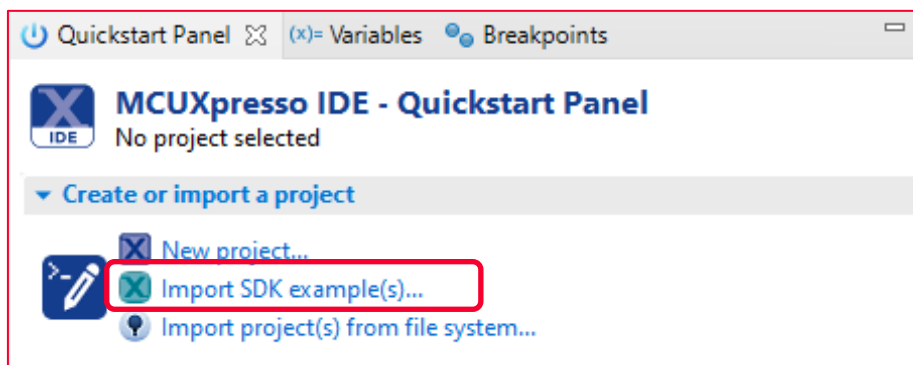


Figure 4: Select EVK to Use

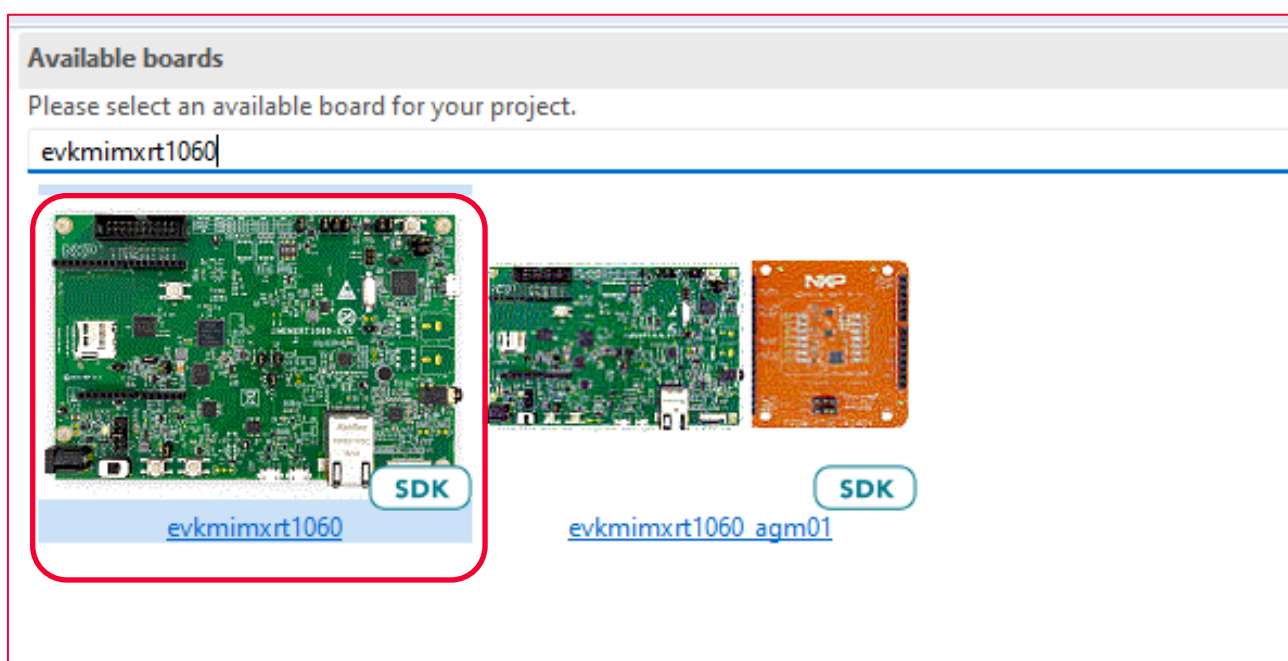


Figure 5: Import Example

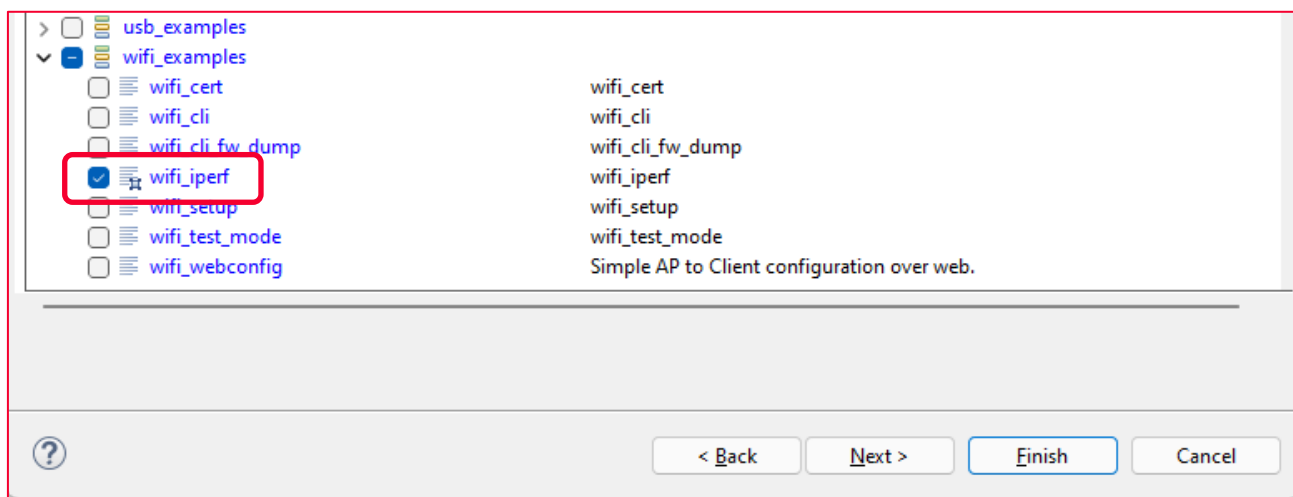


Figure 6: Enable Murata Module

```

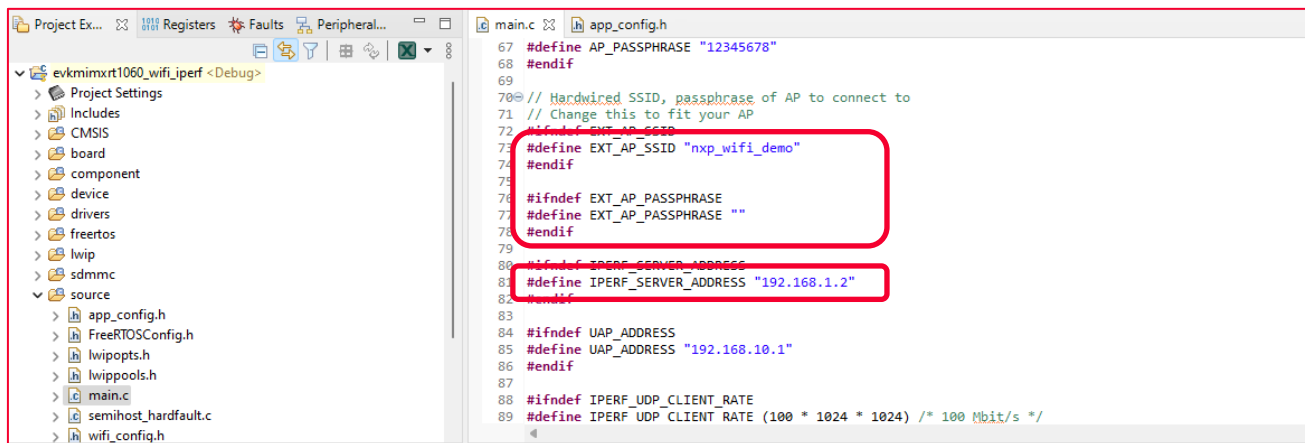
main.c | app_config.h
1  /*
2  * Copyright 2021 NXP
3  * All rights reserved.
4  *
5  * SPDX-License-Identifier: BSD-3-Clause
6  */
7
8  /*
9  * Supported Wi-Fi boards (modules):
10 *   WIFI_88W8977_BOARD_PAN9026_SDIO
11 *   WIFI_88W8977_BOARD_AW_AM281_USD
12 *   WIFI_88W8801_BOARD_AW_NM191_USD
13 *   WIFI_IW416_BOARD_AW_AM457_USD
14 *   WIFI_IW416_BOARD_AW_AM510_USD
15 *   WIFI_88W8987_BOARD_AW_CM358_USD
16 *   WIFI_88W8801_BOARD_MURATA_2DS_USD
17 *   WIFI_IW416_BOARD_MURATA_1XK_USD
18 *   WIFI_88W8987_BOARD_MURATA_1ZM_USD
19 */
20 /* @TES_ANCHOR */
21 #define WIFI_IW416_BOARD_MURATA_1XK_USD
22 /* @END_TEST_ANCHOR */
23
24 /* Wi-Fi boards configuration list */
25
26 /* Panasonic PAN9026 SDIO ADAPTER */
27 #if defined(WIFI_88W8977_BOARD_PAN9026_SDIO)
28 #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_WW.h"
29 #define SD8977
30 #define SDRAMCHOST_OPERATION_VOLTAGE_3V3
31 #define SD_CLOCK_MAX (25000000U)
32 #define WIFI_BT_USE_USD_INTERFACE
33 #define WLAN_ED_MAC_CTRL
  
```

Figure 7: Select Region

```

main.c | app_config.h
163 #define SD8801
164 #define SDRAMCHOST_OPERATION_VOLTAGE_1V8
165 #define SD_TIMING_MAX kSD_TimingSDR25HighSpeedMode
166 #define WIFI_BT_USE_M2_INTERFACE
167 #define WLAN_ED_MAC_CTRL \
168 { \
169     .ed_ctrl_2g = 0x1, .ed_offset_2g = 0x1E \
170 }
171
172 /* Murata 1XK + Murata USD-M 2 adapter */
173 #elif defined(WIFI_IW416_BOARD_MURATA_1XK_USD)
174 // #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_murata_1XK_CA.h"
175 // #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_murata_1XK_EU.h"
176 // #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_murata_1XK_JP.h"
177 // #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_murata_1XK_US.h"
178 #define WIFI_BT_TX_PWR_LIMITS "wlan_txpwrlimit_cfg_murata_1XK_WW.h"
179 #define SD8978
180 #define SDRAMCHOST_OPERATION_VOLTAGE_1V8
181 #define SD_TIMING_MAX kSD_TimingDDR50Mode
182 #define WIFI_BT_USE_USD_INTERFACE
183 #define WLAN_ED_MAC_CTRL
  
```


Figure 8: Customize Example



4 Build and Run

The steps to build and run the example are given below.

1. By default, debug mode is selected for build. While the example will work correctly in debug mode, for better performance, it is suggested to build in release mode. To select release mode build, right-click on the example and select Build Configurations → Set Active → Release (Release build). See **Figure 9** for reference.
2. Click Debug in the QuickStart Panel as shown in **Figure 10**. This will start the build and once completed start the deployment automatically.
3. A probe selection window may show, if this is the first time this example is being run. Select the correct probe (there should only be one if just one EVK is connected) and click **OK** as shown in **Figure 11**.
4. Once the build completes, open the terminal application (e.g., Tera Term) on the appropriate COM port (you can check the port number in Windows Device Manager, under **Ports (COM & LPT)**). Configure port for 115200 bps, 8 bits data, no parity, and 1 stop bit (115200/8/N/1).
5. Click resume button in MCUXpresso as shown in **Figure 12**.
6. You should see output as shown in **Figure 13** on the terminal.
7. Enter mode 'c' to run to connect to the AP. See **Figure 14** for reference.
8. Connect the host PC to the same Wi-Fi network as the EVK (**nxp_wifi_demo** in this example).
9. Run iPerf on the host PC in server mode.

```
iperf -s -i 1
```

10. On the EVK terminal, enter mode number '4' to select TCP client tradeoff mode (TX and RX sequentially). The test will start. A 10 second TX test will be followed by a 10 second RX test and the results will be printed as shown in **Figure 15**.

Figure 9: Set Build Configuration

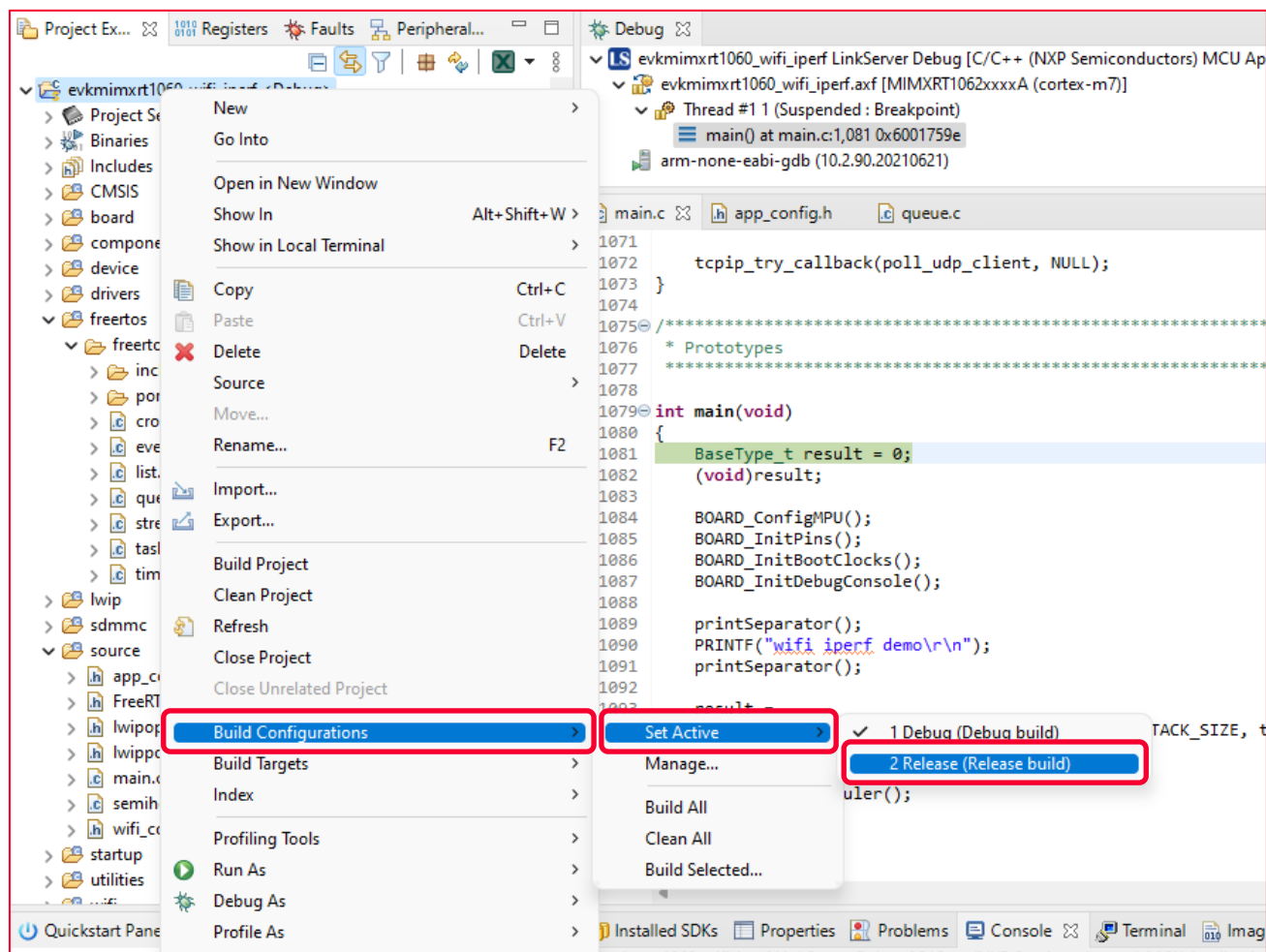


Figure 10: Build Example

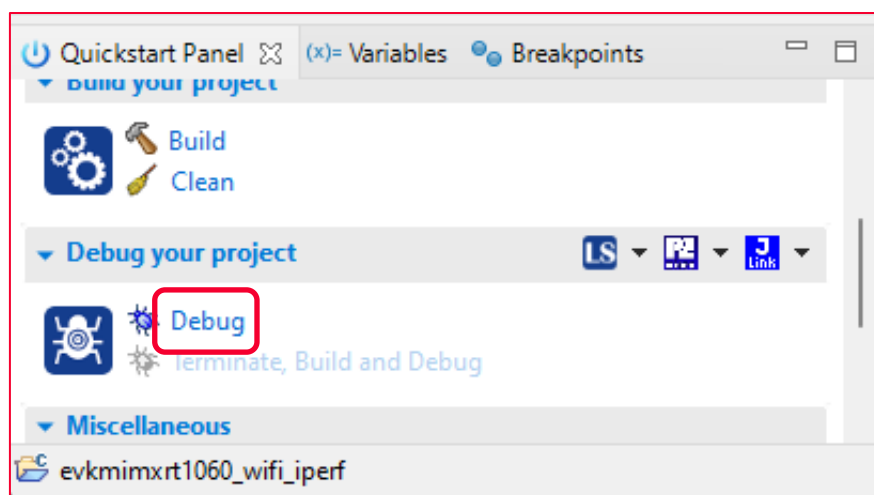


Figure 11: Probe Discovered Window

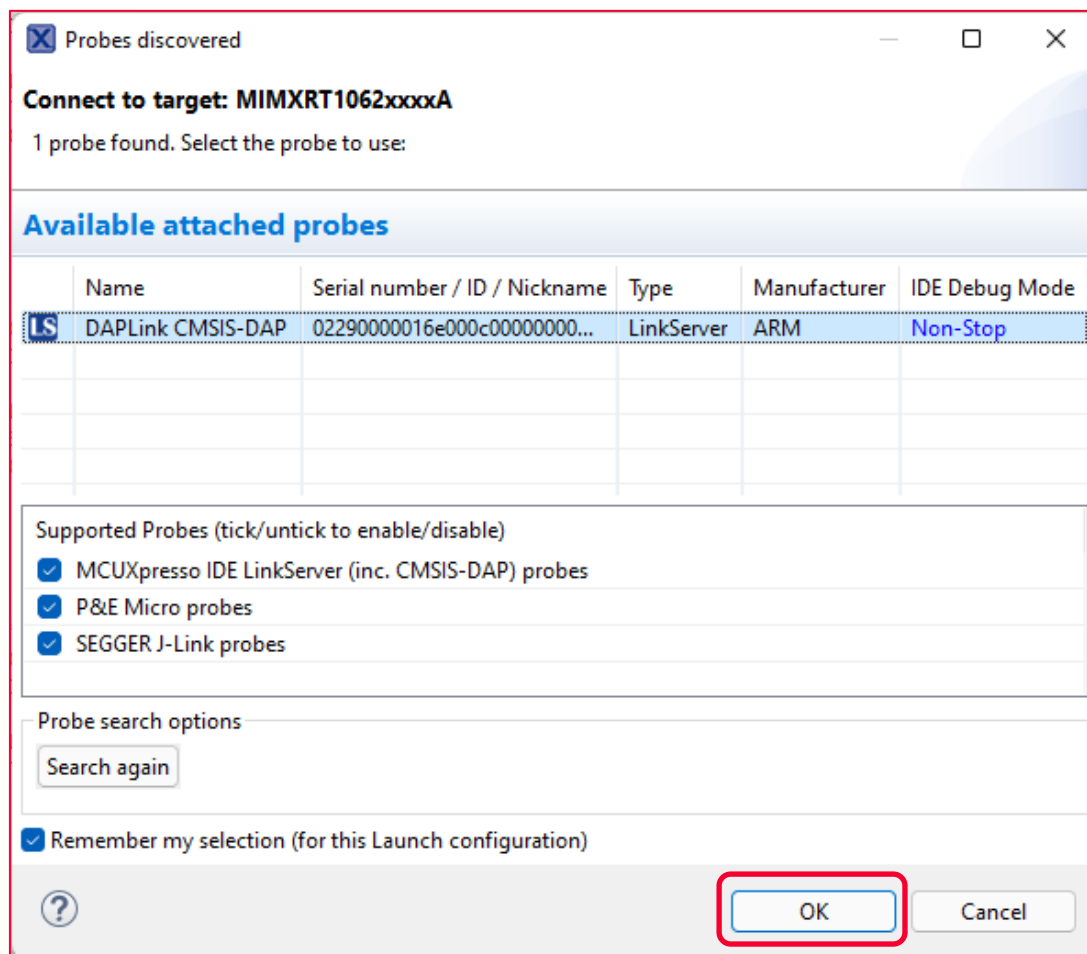


Figure 12: Run Example

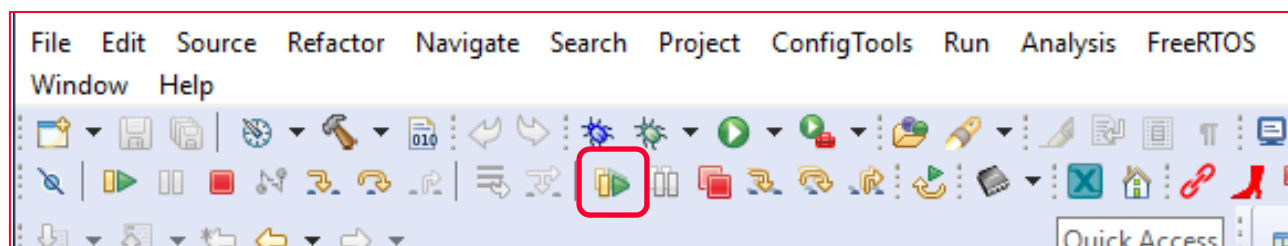


Figure 13: Output on EVK Terminal

```

COM6 - Tera Term VT
File Edit Setup Control Window Help
=====
wifi iperf demo
=====
Initialize WLAN Driver
MAC Address: 2C:4C:C6:F4:D4:40
=====
For Soft AP demonstration
Start a Soft AP using option "A" in WPA2 security mode from menu
This also starts DHCP Server with IP 192.168.10.1, NETMASK 255.255.255.0
=====
For Station demonstration
Start an External AP with SSID as "nxp_wifi_demo" in Open mode
Start DHCP Server on External AP
Station network is configured with Dynamic address assignment
Application provides IPerf support
Set IPERF_SERVER_ADDRESS while using as IPerf Client
=====
A Start Soft AP
S Stop Soft AP
s Start Scan for external APs
c Connect to External AP (SSID='nxp_wifi_demo')
D Disconnect from External AP
I Enable IEEE PS on Station
i Disable IEEE PS on Station
d Enable Deep sleep on Station
e Disable Deep sleep on Station
p Print All Network info
P Print DHCP Server info
1 TCP server mode (RX only test)
2 TCP client mode (TX only test)
3 TCP client dual mode (TX and RX in parallel)
4 TCP client tradeoff mode (TX and RX sequentially)
5 UDP server mode (RX only test)
6 UDP client mode (TX only test)
7 UDP client dual mode (TX and RX in parallel)
8 UDP client tradeoff mode (TX and RX sequentially)
h Help (print this menu)
H Print extended help
[net] Initialized TCP/IP networking stack
=====
app_cb: WLAN: received event 10
=====
app_cb: WLAN initialized
=====
WLAN Driver Version : v1.3.r37.p3
WLAN Firmware Version : IW416-V0, RF878X, FP91, 16.91.21.p11.3, WPA2_CVE_FIX 1, PVE_FIX 1
=====

```

Figure 14: Connection Output on EVK Terminal

```

=====
Key 'c': Connect to External AP (SSID='nxp_wifi_demo')
Connecting to nxp_wifi_demo .....=====
app_cb: WLAN: received event 0
=====
app_cb: WLAN: connected to network
Connected to following BSS:
SSID = [nxp_wifi_demo], IP = [192.168.1.44]
=====

```

Figure 15: Test Output on EVK Terminal















```
=====
Key '4': TCP client tradeoff mode (TX and RX sequentially)
-----
TCP_DONE_CLIENT (TX)
Local address : 192.168.1.142 Port 49153
Remote address : 192.168.1.147 Port 5001
Bytes Transferred 45443984
Duration (ms) 10000
Bandwidth (Mbitpsec) 36
New TCP client (settings flags 0x30313233)
-----
TCP_DONE_SERVER (RX)
Local address : 192.168.1.142 Port 5001
Remote address : 192.168.1.147 Port 44840
Bytes Transferred 57014884
Duration (ms) 10013
Bandwidth (Mbitpsec) 45
```

TX throughput

RX throughput

5 References







Table 2: References

Links	Description
Forum Pages	
Murata Community Forum Landing Page 	Main Forum landing page.
Registration Page for new users 	Future FAEs and other Future employees need to use their Future corporate email address to register. Once they have registered and been approved, we will add them to Future's private group on the Forum which is used to exchange sensitive IP – board schematics, etc.
Community Forum Help 	Landing page providing help to users. Links to necessary documents.
Troubleshooting Login and Registration 	Specific post which details how to troubleshoot any login or registration issues. Normally we don't see any registration issues.
Wi-Fi/Bluetooth section 	Starting point for any questions on Wi-Fi/Bluetooth module documents.
NXP-based Module section 	NXP-based modules: 1XK, 1ZM, 1XL, and 1YM. Also included are ABR, and 2DS.
Website Pages	
Murata's Wi-Fi/BT Module Landing Page 	Lists all of Murata Wi-Fi/Bluetooth modules. Provides quick links to each module webpage.
Murata's NXP-based Modules 	Lists all NXP-based Murata Wi-Fi/Bluetooth modules. Provides quick links to each module webpage.
Murata's i.MX Solution Landing Page 	Murata's i.MX solution landing page. Details Murata Wi-Fi/Bluetooth module solutions for various i.MX processor platforms. Comprehensive documentation posted here.
Embedded Artists' M.2 Landing Page 	Embedded Artists' landing page for Murata-based Wi-Fi/Bluetooth M.2 modules.
Murata's uSD-M.2 Adapter Landing Page 	Provides latest/comprehensive information on Murata's adapter including links to where it can be purchased.
Murata Wi-Fi/BT (NXP) Solution for i.MX FreeRTOS User Guide 	Details steps to get Murata (NXP-based) Wi-Fi/Bluetooth solution up and running quickly on NXP i.MX RT EVKs.
Murata uSD-M.2 Adapter Datasheet (Rev B1) 	Documents the current version of the Murata's uSD-M.2 adapter hardware and its interfacing options.
Murata Wi-Fi/BT Solution for i.MX Hardware User Manual 	Describes the Murata uSD-M.2 Adapter hardware. All interface signals to the NXP i.MX RT EVKs are described. Specifics on interfacing each i.MX EVK to Murata uSD-M.2 Adapter are provided.

6 Embedded Artists Wi-Fi/Bluetooth M.2 Modules

The following table lists the Embedded Artists' Wi-Fi/Bluetooth modules.

Table 3: Embedded Artists' Wi-Fi/Bluetooth M.2 modules

Interface	Embedded Artists M.2 EVB	Murata Module
WLAN-SDIO	Type 1XK M.2 	Type 1XK 
WLAN-SDIO	Type 1ZM M.2 	Type 1ZM 
WLAN-SDIO	Type 2DS M.2 	Type 2DS 

Revision History

Revision	Date	Author	Change Description
1.0	Aug 30, 2021	TF	Initial Release
1.1	Sep 03, 2021	TF	Fixed Murata MCUXpresso 2.10.0 SDK patch link.
1.2	Feb 15, 2022	TF	Updated for MCUXpresso 2.11.0 SDK. Updated example to use RT1060 EVK.
2.0	Aug 11, 2022	TF	Migrated to new template.



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