

Murata Wi-Fi/BT (NXP) Solution for i.MX

FreeRTOS Quick Start Guide



Revision History

Revision	Date	Author	Change Description
1.0	August 30, 2021	TF	Initial Release
1.1	Sept 3, 2021	TF	Fix Murata MCUXpresso 2.10.0 SDK patch link.

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1 Introduction

This document details enabling <u>Murata's (NXP-based) Wi-Fi/Bluetooth modules</u> on <u>NXP i.MX RT</u> <u>Evaluation Kits</u> (running FreeRTOS), using <u>Embedded Artists' Wi-Fi/BT M.2 modules</u>. Murata supports several NXP i.MX RT EVK's and Wi-Fi/Bluetooth M.2 modules with a newly <u>released patch</u> for MCUXpresso 2.10.0 SDK. 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 <u>Murata Wi-Fi/BT (NXP) Solution for i.MX FreeRTOS User Guide</u>. **Figure 1** below shows one such example – 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)

The <u>NXP</u> and <u>Embedded Artists</u> 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 <u>Murata's uSD-M.2 Adapter</u>.

The example setup used to illustrate the various steps is NXP <u>i.MX RT1050 EVK</u> with Murata <u>Type</u> <u>1XK</u> module (on Embedded Artists' M.2 module with uSD-M.2 Adapter interconnect), connected to a host PC running Windows[®].

Note that the following parts are used in this quick start guide:

- NXP IMXRT1050-EVKB
- Embedded Artists EAR00385
- Murata LBEE0ZZ1WE-TEMP (LBEE0ZZ1WE-uSD-M2)

2 References

2.1 Murata's uSD-M.2 Adapter Landing Page

This <u>website landing page</u> provides latest/comprehensive information on Murata's adapter including links to where it can be purchased.

2.2 Embedded Artists' M.2 Modules Landing Page

This <u>website landing page</u> provides latest/comprehensive information on Embedded Artists' M.2 modules which enable Murata Wi-Fi/BT modules for easy evaluation.

2.3 Murata's i.MX Wireless Solutions Landing Page

This <u>website landing page</u> provides latest/comprehensive information on Murata's i.MX Wireless solutions which use the uSD-M.2 Adapter as a key enabler so customers can easily evaluate Murata's modules on i.MX processors.

2.4 Murata's Community Forum Support

Murata's Community provides online support for all of Murata's i.MX Wireless solutions. Refer to <u>this</u> <u>link</u> for existing support threads.

2.5 Murata Wi-Fi/BT (NXP) Solution for i.MX FreeRTOS User Guide

This <u>User Guide</u> details steps to get Murata (NXP-based) Wi-Fi/Bluetooth solution up and running quickly on NXP i.MX RT EVK's.

2.6 Murata Patching Solution

<u>This archive file</u> contains the files necessary to enable the Murata module for the wifi_iperf example on i.MX RT 1050 EVK. It also patches any other i.MX RT SDK's present with Murata enhancements. The user is prompted to allow overwrite of MCUXpresso SDK source folders.

2.7 Murata uSD-M.2 Adapter Datasheet (Rev B1)

This <u>datasheet</u> documents the current version of the Murata's uSD-M.2 adapter hardware and its interfacing options.

2.8 Murata Wi-Fi/BT Solution for i.MX Hardware User Manual

This <u>manual</u> describes the Murata uSD-M.2 Adapter hardware. All interface signals to the NXP i.MX RT EVK's are described. Specifics on interfacing each i.MX EVK to Murata uSD-M.2 Adapter are provided.

3 Example Setup

3.1 Hardware

Figure 2 below provides a high-level overview of the hardware interconnect. Embedded Artists' 1XK M2 module is connected to NXP's i.MX RT1050 EVK via Murata's uSD-M2 Adapter. To enable an optional "radio enable" line (see **Figure 3**, J22/Pin3 on RT1050 EVK can be connected to J9/Pin3 of the uSD-M.2 Adapter using the included jumper cable in Murata's kit.



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3.2 Software

While multiple IDEs can be used to develop on the i.MX RT 1050 EVK, this example uses NXP's MCUXpresso IDE.

- 1. Download and install the following software.
 - a. MCUXpresso IDE (version 11.4.0)
 - b. mbed Virtual COM Port Driver (The EVK must be plugged in before installing this)
 - c. A terminal application (<u>Tera Term</u>, <u>PuTTY</u>, etc.).
 - d. <u>iPerf</u>

Refer to the NXP i.MX RT 1050 EVK getting started page for more details.

- 2. Download the latest 2.10 SDK for i.MX RT1050 EVK using the MCUXpresso SDK Builder on NXP website.
 - a. Go to SDK Builder homepage here: https://mcuxpresso.nxp.com/en/welcome
 - b. Click on "Select Development Board" and sign in with your NXP login credentials.
 - c. On the "Select Development" page, enter "EVKB-IMXRT1050" under "Search by Name". This will correctly highlight/select the i.MX RT1050 EVK we are using.
 - d. On the right side of the page, click on "Build MCUXpresso SDK v2.10.0".
 - e. You will now transition to "Build SDK for EVKB-IMXRT1050" page. Click the "Select All" button followed by the "Download SDK" button. Click on "I Agree" to the EULA.
 - f. The i.MX RT1050 SDK is now being downloaded.
 - g. Once downloaded, hit the "Close button" on pop-up window.
 - h. Examine your "Downloads" folder directory it should now list "SDK_2_10_0_EVKB-IMXRT1050.zip".
- 3. Launch the installed MCUXpresso IDE 11.4 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.

4 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.

Figure 4: Import SDK



2. Select evkbimxrt1050 board and click the Next button.



Figure 5: Select EVK to use

3. Expand **wifi_examples** and select **wifi_iperf**. Click **Finish**. Ensure **SDK Debug Console** is set as **UART** in **Project Options**.

Figure 6: Import example

> _ = usb_examples	
□ ≡ wifi_cli	wifi_cli
🗹 🛼 wifi_iperf	wifi_iperf
🔲 🧮 wifi_setup	wifi_setup
🔲 🧮 wifi_test_mode	wifi_test_mode
🔲 🧮 wifi_webconfig	Simple AP to Client configuration over web.
<	>
?	< <u>B</u> ack <u>N</u> ext > <u>F</u> inish Cancel

4. Right click on the imported project in the Project Explorer and select **Utilities -> Open directory browser here**.

Project Explorer	1010	Registers 🌟 Faults 🖵 Perioberals			Π	R main c 🕅
- rioject explorer 23	0101		· · · · · · · · · · · · · · · · · · ·		- 8	1⊖/** @file main.c
✓ [™] evkbimyrt1050 wi	<i>.</i> .		🗰ঌ 🔽	9	ŏ	2 *
 Project Setting Includes CMSIS 		New Go Into	>			3 * @brief main file 4 * 5 * Copyright 2020 NXP 6 * All rights reserved.
> 🔑 board		Open in New Window		L		7 *
> 😕 component		Show In	Alt+Shift+W >	L		8 * SPDX-License-Identifier
> 😕 device		Show in Local Terminal	>	L		10
> 📴 drivers		Сору	Ctrl+C			110///////////////////////////////////
> 😝 freertos	ŵ	Paste	Ctrl+V	L		13 ////////////////////////////////////
> 🔑 sdmmc	×	Delete	Delete	L		
🗸 🚰 source		Source	>	L		16 #include "pin mux.h"
> h app_config		Move		L		17 #include "clock_config.h"
> h FreeRTOSCo		Rename	F2	L		18 #include "board.h" 19 #include "fsl debug console
> h lwipopts.h						20
> 底 main.c	è	Import		L		21 #if defined(SD8801) 22 #include "sd8801 wlap b"
> 🖻 semihost_h	4	Export				23 #elif defined(SD8977)
> h wifi_config.		Build Project		L		24 #include "sduart8977_wlan_b
> 🐸 startup		Clean Project		L		25 #eiif defined(SD8978) 26 #include "sduartIW416 wlan
> 📴 utilities	8	Refresh	F5	L		27 #elif defined(SD8987)
> 🕮 xip		Close Project		L		<pre>28 #include "sduart8987_wlan_b 29 #elif defined(SD8997)</pre>
> 🗁 doc		Close Unrelated Project		L		30 #include "sduart8997_wlan_b
		Build Configurations	```			31 #elif defined(SD9097) 32 #include "pyt_sd9097 wlan b
		Puild Targets	ĺ.	L		33 #elif defined(SD9098)
		Index	(L		34 #include "pvt_sd9098_wlan.h
		index				<
🕛 Quickstart Panel 🔀		Profiling Tools	>	Þ		🎁 Installed SD 🔲 Properties 🖹 Proble
	0	Run As	>	Г	^	
MCUXpres	*	Debug As	>	L		<terminated> evkbimxrt1050_wifi_iperf LinkS</terminated>
Project evebin		Profile As	>	L		[MCUXpresso Semihosting Telnet con
 Create or import a 		Restore from Local History		J.		
👝 🔀 New projec		Launch Configurations	>	J.		
🎷 🕅 Import SDA		Utilities	>		0	pen command prompt
🦰 🕐 Import pro	X	SDK Management	>	C	0	pen directory browser here
 Build your project 		Tools	>	C	0	pen command prompt here
Build	\checkmark	Validate		Г		
Clean	X	MCUXpresso Config Tools	>			
	*	Run C/C++ Code Analysis				
 Debug your project 		Team	>	1		
🔽 🕸 Debug		Compare With	>			
😤 🔅 Terminate,		Configure	>			
- Miccollananus		Source	>			
Wiscenarieous		Properties	Alt+Enter	T	~	<
evkhimyrt1050 wifi i	nerf			-		

Figure 7: Access project source

5. The project source folder will open. Go to the parent folder (one level up). This is the workspace folder used by MCUXpresso. Download the Murata <u>released patch</u> for SDK 2.10.

Figure 8: Get the patched files

↑ 📑 → This PC → Documents → MCUXpressolDE_11.4.0_6224 → workspace	✓ Č		
Name	Date modified	Туре	Size
.mcuxpressoide_packages_support	11-08-2021 06:29 PM	File folder	
.metadata	11-08-2021 06:29 PM	File folder	
AzureRTOS_TAD_logs	18-08-2021 06:10 PM	File folder	
bluetooth_rf_test_mode.zip_expanded	27-07-2021 05:56 PM	File folder	
evkbimxrt1050_wifi_iperf	24-08-2021 06:10 PM	File folder	
FreeRTOS_TAD_logs	18-08-2021 06:10 PM	File folder	
Murata_MCUXpresso_SDK_v2.10.0_patch.zip	26-08-2021 07:55 PM		4,076 KB

6. Extract the downloaded file. Double click on the Murata_patch_examples.bat file. This will replace all the example files necessary to enable Murata modules.

	This PC > Documents > MCUXpressolDE_11.4.0_6224 > workspace >	🖌 🖸 🔎 s	→ Ö 🔎 Search workspace			
Name		Date modified	Туре	Size		
📑 .m	cuxpressoide_packages_support	11-08-2021 06:29 PM	File folder			
📑 .m	etadata	11-08-2021 06:29 PM	File folder			
📑 Az	ureRTOS_TAD_logs	18-08-2021 06:10 PM	File folder			
📑 blu	uetooth_rf_test_mode.zip_expanded	27-07-2021 05:56 PM	File folder			
📑 ev	kbimxrt1050_wifi_iperf	24-08-2021 06:10 PM	File folder			
📑 Fre	eeRTOS_TAD_logs	18-08-2021 06:10 PM	File folder			
2_	10_SDK_Examples.zip	26-08-2021 02:07 PM	Compressed (zipp	4,740 KB		
📲 Mi	urata_MCUXpresso_SDK_v2.10.0_patch.zip	26-08-2021 07:55 PM	Compressed (zipp	4,076 KB		
📑 M	urata_patch_examples.bat	26-08-2021 02:03 PM	Windows Batch File	1 KB		

Figure 9: Run the script

<u>Note:</u> This will patch all the valid examples in the workspace, including ones that may be present other than the wifi iperf example referred here.

 Open evkbimxrt1050_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_BOARD_MURATA_1XK flag needs to be set.

<u>Note:</u> It is possible to build the example for modules 2DS and 1ZM as well using the same files. Just replace the compiler flag WIFI_BOARD_MURATA_1XK in file source/app_config.h to WIFI_BOARD_MURATA_2DS or WIFI_BOARD_MURATA_1ZM respectively.



Figure 10: Enable Murata module

 Optionally, change the country/region specific TX power setting by editing the file source/wifi_config.h and select the required macro from the selection (MURATA_US, MURATA_EU, MURATA_CA, MURATA_JP, MURATA_WW).

.h w	ifi_config.h 🛛
46	
47	<pre>#if d_fined(WIFI_BOARD_MURATA_2DS) defined(WIFI_BOARD_MURATA_1XK) defined(WIFI_BOARD_MURATA_1ZM)</pre>
48	#define MURATA_US
490	7/#detine HUKATA_CA
50	//#define MURATA_EU
51	//#define MURATA_JP
52	//#define MURATA_WW
53	#endif
54	<pre>#define CONFIG_WIFI_MAX_PRIO (configMAX_PRIORITIES - 1)</pre>
55	
56	#define CONFIG_MAX_AP_ENTRIES 10
57	
58	#if defined(SD8977) defined(SD8978) defined(SD8987)
59	#define CONFIG_5GHz_SUPPORT 1
60	#endif
61	

Figure 11: Select region

9. Open evkbimxrt1050_wifi_iperf/source/main.c file and modify the EXT_AP_SSID, EXT_AP_PASSPHRASE and IPERF_SERVER_ADDRESS macros as per your setup.

Figure 12: Customize example

🍋 Project Explorer 🙁 🗰 Registers 💠 Faults 🚼 Peripherals+ 👘 🗖	🖻 main.c 🔀
E 🔄 🏹 🖶 🗞 🕅 🕶 🖇	67 TimerHandle_t timer;
✓ 🚰 evkbimxrt1050_wifi_iperf <debug></debug>	68 60 statis woid timen nell ude slight/TimesMandle t timen).
> 🍥 Project Settings	70
> 🎇 Binaries	71 // Hardwired SSID, passphrase of Soft AP to star
> 🔊 Includes	72 #define AP_SSID "NXP_Soft_AP"
> 😂 CMSIS	73 #define AP_PASSPHRASE "12345678"
> 😕 board	74 75⊖ // Hardwired SSTD, passphrase of AP to connect to
> 😕 component	76 // Change this to fit your AP
> 🔑 device	77 #define EX _AP_SSID "Mucata_5"
> 🔑 drivers	78 #define EX_AP_PASSPHRASE ""
> 🔑 freertos	80 #ifndeft pros Staven Humess
> 😂 lwip	81 #define IPERF SERVER ADDRESS "192.168.1.147"
> 🤗 sdmmc	82 #endif
✓ ²⁹ source	83
> h app_config.h	84 #itndet IPERF_UDP_CLIENT_RATE
> h FreeRTOSConfig.h	86 #endif
> h lwipopts.h	87
> h lwippools.h	88 #ifodef TPERE CLIENT AMOUNT

10. Save the changes.

5 Build and Run

1. Click Debug in the QuickStart Panel. This will start the build and once completed start the deployment automatically.

Figure 13: Build example



2. A probe selection window may show, if this is the first time an example is being run. Select the correct probe (there should only be one if just one EVK is connected) and click **OK**.

X	Probes discovered									
Coi	Connect to target: MIMXRT1052xxxxB									
1 p	1 probe found. Select the probe to use:									
Av	ailable attached pro	obes								
	Name	Serial number	Туре	Manufactur	IDE Debug Mo					
LS	DAPLink CMSIS-DAP	022700004021	Link	ARM	Non-Stop					
Su	pported Probes (tick/untick	to enable/disable)								
	MCUXpresso IDE LinkServe	er (inc. CMSIS-DAP) probes							
	P&E Micro probes									
	SEGGER J-Link probes									
Probe search options										
Search again										
Search again										
Remember my selection (for this Launch configuration)										
C	2)			ОК	Cancel					

Figure 14: Probe discovered windows

- 3. 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).
- 4. Click resume button in MCUXpresso.

Figure 15: Run example

		File	Edit	Source	Refactor	Navigate	Search	Project	ConfigTools	Run	Analysis	FreeRTOS
i 🔪 🖿 III 🔲 N 3. 39 IR 🗟 IX 🚺 🚺 🖷 3. 39 IR 🕹 i 🌮 🧾 🖞 🔗 🦨			- 🛛		• 🔨 •	B : 4	> <mark>*</mark>	🎋 • 🚺	• 💁 • 🍅	1	/ _/ R/	П Т 📃
	1	Ø			4 J Q	.e 🗟	र 🕩	ü 🖷 3	8 R 8	5	- 🛛	1 8 J.

5. You should see this output on the terminal.

🔟 COM18 - Tera Term VT	-	\times
<u>Eile E</u> dit <u>S</u> etup C <u>o</u> ntrol <u>W</u> indow <u>H</u> elp		
wifi iperf demo		1
Initialize WLAN Driver		
MAC Address: 2C:4C:C6:F4:D4:40		
En 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 starton demonstration		
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 IPert Client		
S Stop Soft AP		
s Start Scan for external APs		
c Connect to External AP (SSID='Murata_5')		
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 into		
P Print UHLP Server into		
2 TCP scient mode (TX scients)		
3 TCP client dual mode (TX and RX in narallel)		
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.r33.p2		
WLAN Firmware Version : IW416-V0, RF878X, FP91, 16.91.10.p214, WPA2_CVE_FIX 1, PVE_FIX 1		
		×

Figure 16: Output on EVK terminal

6. Enter mode 'c' to run to connect to the AP.

Figure 17: Connection output on EVK terminal

- 7. Connect the host PC to the same Wi-Fi network as the EVK (Murata_5 in this example).
- 8. Run iperf on the host PC in server mode.

iperf -s -i 1

9. 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 TX test and the results will be printed.



E=====================================
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

6 Murata Community Forum

For more support, please go to Murata's Wireless Community Forum at <u>https://community.murata.com/</u>.

Special announcements and deep dives are hosted on our Community Blog pages here: <u>https://community.murata.com/s/community-blog</u>.

For MCUXpresso/FreeRTOS-specific examples, please refer to this section of the Forum.

Find out more about our Wi-Fi / BT hardware solutions





Type 1ZM

uSD-M.2 Adapter

