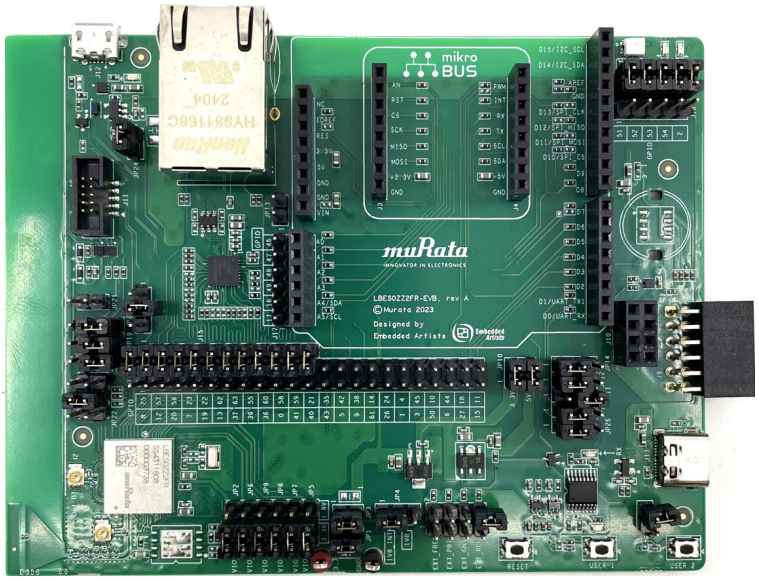
Application Note

Type 2FR/2FP EVK

NXP RW612 Chipset for 802.11 a/b/g/n/ac/ax + Bluetooth LE 5.4 / IEEE 802.15.4

Software Application Note - Rev. 1.4



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About This Document

Murata's Type 2FR/2FP is a small and very high-performance module based on NXP RW612 combo chipset, supporting IEEE 802.11 a/b/g/n/ac/ax Wi-Fi™ + Bluetooth LE 5.4 / 802.15.4. This document provides details on various app development guidelines.

Audience & Purpose

This document is intended for software/firmware, hardware, and systems engineers to evaluate and develop applications with Murata's Type 2FR/2FP module.

Document Conventions

Table 1 describes the document conventions.

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**: Murata Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. **Example**: Murata Community Forum Click on the text to open the link.
`Console input/output or code snippet`	**Console I/O or Code Snippet** This text ***Style*** denotes console input/output or a code snippet.
`# Console I/O comment` `// Code snippet comment`	**Console I/O or Code Snippet Comment** This text ***Style*** denotes a console input/output or code snippet comment. • 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 Murata Community Forum

Murata has introduced the Murata Community Forum for technical support to our customers. The Forum can be accessed via this link.

The forum content is freely accessible to the public. However, users must log in to post questions or answers. Registration is free.

1.1 Registering

To participate in the forum, you must first register. Follow these steps to complete the registration process:

1. From the forum homepage, click on the **Login** button to navigate to the Login page.
2. Select the **Sign up** option to begin the registration process.
3. Scroll to the end of the Terms of Use, tick the checkboxes, and click on the **I Agree** button.
4. Provide your email and password, ensuring you use your company email address, then click on **Next**.
5. Click the **Send me an email** button to initiate email verification.
6. Verify your email by either clicking the verification link sent to your email or entering the confirmation code in the **Enter confirmation code** link and clicking **Verify**.
7. Fill in the required information, confirm the details, and click **Submit**.
8. Wait for the forum moderators to review and approve your application. You will receive an email notification once approved.

1.2 Logging In

Once registered, you can log in to the forum as follows:

1. From the forum homepage, click on the **Login** button to navigate to the Login page.
2. Enter your Username (the email address you used for registration) and your Password, then click **Verify**.
3. Agree to the Terms of Use by clicking on the **I Agree** button. (This step is required only during your first login)
4. After successful login, you will gain full access to the forum's features.

1.3 Using the Public Forum

To create a new post or ask a question, follow these steps:

1. Navigate to the appropriate category or subcategory that best matches the scope of your post using the forum menu or navigation options.
2. Click on the **Ask a Question** button to open the post composition page.
3. Provide the following details for your post:
4. Enter a clear and descriptive title in the **Question** field.
5. Add detailed information in the **Details** field.
6. Attach relevant files, if needed.

7. Add relevant tags (topics) for proper post classification and enhanced searchability. Suggestions will appear as you type.
8. Click the **Ask** button to publish your question. The button will only activate once you have filled in the **Question** field.

1.4 Using Private Groups

Private forum groups play a vital role in ensuring confidentiality and secure collaboration for the following purposes:

- **Sharing sensitive information:** Enables restricted sharing of critical details within a controlled environment.
- **Schematics review:** Facilitates technical reviews of design schematics.
- **Logs and file sharing:** Supports sharing of files such as manufacturing firmware required for regulatory testing.

Private forum groups are designed for secure and restricted discussions. To access a private forum group:

1. Click on your Username on the top right to open the User menu, then click **My Profile** to go to your Profile page.
2. Locate the Groups block on the right and click on the name of the group you wish to access. If the group isn't visible, click **View All** to see the full list of groups you are a member of. Select the desired group. If you still cannot see your group, you are likely not a member yet. Please request access in any public post you have created, and a moderator will add you to the group (and create the private group if it does not exist).

1.5 Additional Resources

Please refer to the following additional resources for more information.

- Murata Community Forum Quick Start Guide
- Murata Community Forum User Guide

2 OTP Patch for Shared Antenna Use Case

2.1 Introduction

Current Type 2FR/2FP EVKs are configured as single (shared) antenna in hardware. But the calibration data in the OTP is for dual antenna. So, two changes in OTP are needed to be compatible with single antenna use case. Firstly, add Annex 100 for BLE; secondly, change a value to ANT_ISO_INFO_ANT_SHARING_INFO to support multi-radio coex functions. Without this patch, BLE only application will have very short range. The following section has details about the patch.

This patch is exclusively for Type 2FR/2FP EVK. Production modules will be configured with a single antenna in the OTP, making this patch unnecessary.

2.2 Updating OTP

The advantage of updating the OTP is that the data will be saved, and it will work with any app with single antenna configuration.

Updating the OTP can be done only once and cannot be reverted.

Updating OTP can only be done with MFG FW in module and LabTool on a PC.

1. Download the LabTool from Wireless MCU with Integrated Tri-radio: 1x1 Wi-Fi 6 + Bluetooth Low Energy 5.4 / 802.15.4 (**Figure 1**). The version we are using is **MFG-RW61X-MF-BRG-U16-WIN-X86-2.0.0.10.1-18.80.6.p7.1 (from Secure files)**.

Figure 1: Download LabTool Page

2. **For 2FR**:

   Flash with *rdrw612bga_uart_wifi_bridge.bin* app at address 0x08000000.

   For 2FP:

   Flash with *rdrw612bga_uart_wifi_bridge_2fp.bin* app at address 0x08000000.

3. Flash MFG WIFI FW (MFG-RW61X-MF-BRG-U16-WIN-X86-2.0.0.10.1-18.80.6.p7.1\FwImage\A2\rw61xw_sb_mfg_fw_cpu1_a2.bin) into the 2FR/2FP, address 0x08400000.

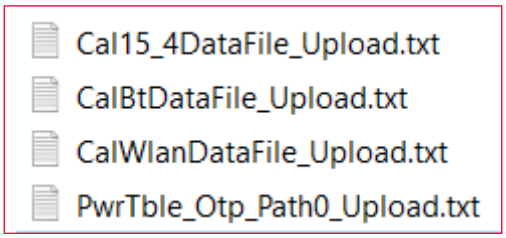
4. Connect 2FR/2FP UART to PC.
5. Goto MFG-RW61X-MF-BRG-U16-WIN-X86-2.0.0.10.1-18.80.6.p7.1\labtool. Modify SetUp.ini to have the correct “ComNo”.
6. Double click on DutApiSisoApApp_RW610.exe (LabTool). First read out OTP. Follow the log below (the red text denotes the command to enter):

```
Name: Dut labtool
Version: 2.0.0.10.1
Date: Apr 15 2024 (23:55:34)

Note:

1. =========WiFi tool=============
2. =========BT   tool=============
3. =========15_4   tool=============

Enter CMD 99 to Exit.

Enter option: 1

Name: DutApiClass
Interface: EtherNet
Version: 2.0.0.10.1
Date: Apr 15 2024 (23:55:16)

Note:

DutIf_InitConnection: 0
------------------------------------------------------
               RW610 (802.11a/g/b/n/ac/ax) TEST MENU
------------------------------------------------------
Enter option: 44 2

Dut_Shared_SetStorageType():0
Set Storage Type to: 2
Enter option: 54

..
86 0..88 0..
9194 0..
97 0..
WritePwrTableFile to File "PwrTble_Otp_Path0_Upload.txt"
96 0..
89 0 0..
92 0 0..
83105
102
103
107 0..
Annex 75 Dev0 Path098 0 0..
106
108
BT1 55
BT1 100
104
..
86 0..88 0..
9194 0..
97 0..
WritePwrTableFile to File "PwrTble_Otp_Path0_Upload.txt"
```

```
96 0..
89 0 0..
92 0 0..
83105
102
103
107 0..
Annex 75 Dev0 Path098 0 0..
106
108
BT1 55
BT1 100
104
 DUTAPI_UpLoadSaveCalData: 0x00000000           CsC:1
Enter option: 99

Exiting

 DutIf_Disconnection: 0
1. =========WiFi tool=============
2. =========BT   tool=============
3. =========15_4   tool=============

Enter CMD 99 to Exit.

Enter option: 99

Exiting
```

7. If step 6 is successful, some files will be generated in the LabTool folder.

Figure 2: Generated Files in LabTool Folder



8. Rename the files so that the **"_Upload**" is removed.
9. Open CalBtDataFile.txt and append the following to the end. Save the file.

```
[BT_HW_INFO]
BT_HW_INFO_EPA_Present=1
BT_HW_INFO_EPA_Gain=0x00
BT_HW_INFO_EPA_FEM_Mask=0x0000
BT_HW_INFO_ELNA_Present=1
BT_HW_INFO_ELNA_Gain=0x00
BT_HW_INFO_ELNA_FEM_Mask=0x0000
BT_HW_INFO_EANT_Present=0
BT_HW_INFO_EANT_Gain=0x00
```

The Final CalBtDataFile.txt file looks like this.

```
[BT_Config]
ANNEX56_EXIST=0
Version=0x1
Xtal=0x79
```

```
InitPwrIndBm_Pwr=4
FELoss=0x2
ForceClass2Op=0
Class1OpSupport=1
DisablePwrControl=0
MiscFlag=0
UsedInternalSleepClock=1
AOALocaltionSupport=0
AOANumberOfAntennas=0x0
RssiGoldenRangeLow=0x0
RssiGoldenRangeHigh=0x0
UartBaudRate=3000000
BdAddress=10.32.2C.68.02.E9
MinEncrKeyLen=0x0
MaxEncrKeyLen=0xf
RegionCode=0xa
[BT_HW_INFO]
BT_HW_INFO_EPA_Present=1
BT_HW_INFO_EPA_Gain=0x00
BT_HW_INFO_EPA_FEM_Mask=0x0000
BT_HW_INFO_ELNA_Present=1
BT_HW_INFO_ELNA_Gain=0x00
BT_HW_INFO_ELNA_FEM_Mask=0x0000
BT_HW_INFO_EANT_Present=0
BT_HW_INFO_EANT_Gain=0x00
```

10. Open CalWlanDataFile.txt and update the value of ANT_ISO_INFO_ANT_SHARING_INFO from 0x00000808 to 0x00000D08. Save the file.
11. Run labtool again.
12. Use similar commands as in Step 6, but instead of running command **54**, run command **53** which programs the new data into OTP.
13. Power cycle the EVK for the changes to take effect.

3 Integrating Murata Tx Power Settings

3.1 Introduction

This section provides guidance on incorporating the WLAN Tx power settings for Type 2FR/2FP EVK into Wi-Fi applications.

The Tx power settings should be configured after completing regulatory compliance and RF performance testing. The purpose of applying the power table is to ensure the application would not exceed max TX power that violates certifications.

3.2 Supported Devices

- Type 2FR (NXP RW612 based)
- Type 2FP (NXP RW610 based)

3.3 Prerequisite Components

Before getting started, you will need the following:

- Murata Type 2FR/2FP EVK Tx Power Tables from Murata GitHub
- The latest version of MCUXpresso IDE and RW61x SDK

This application note is based on SDK_25.03.00_RD-RW612-BGA.

3.4 Building App with Murata Tx Power Tables

Follow the example instructions below to integrate the TX power into the wifi_cli application.

1. Import the wifi_cli sample application using MCUXpresso IDE. Refer to the Type 2FR/2FP EVK Quick Start Guide for getting started quickly, or the Type 2FR/2FP EVK User Guide for detailed steps.
2. Navigate to the following file:
…\workspace\rdrw612bga_wifi_cli\component\wifi_bt_module\AzureWave\tx_pwr_limits\wlan_txpwrlimit_cfg_WW_rw610.h
3. Copy the region_power_cfg_raw_file_bin[] array block from region_power_cfg_raw_file_XX.h file downloaded from Murata GitHub into the wlan_txpwrlimit_cfg_WW_rw610.h file's rg_rw610_XX[] array, where XX is the region code, as shown in **Figure 3**. **Table 2** shows the region descriptions for supported region codes.

Table 2: SU TX Power Parameters

Parameter	Region Description
[rg_rw610_EU]	Europe
[rg_rw610_JP]	Japan, Australia, Korea
[rg_rw610_bga]	US

Parameter	Region Description
[rg_rw610_CA]	Canada
[rg_rw610_WW]	World-wide

Figure 3: SU Region Power Configuration Values

```
#if CONFIG_COMPRESS_TX_PWTBL
static const t_u8 rg_rw610_bga[] = {
    0x01, 0x00, 0xee, 0x01, 0x06, 0x00, 0x55, 0x53,0x20, 0x10, 0x00, 0x01, 0x06, 0x02, 0xc4, 0x00,
    0x88, 0x88, 0x03, 0x01, 0x0b, 0x00, 0x00, 0x00,0x00, 0x00, 0x55, 0x53, 0x20, 0x10, 0x23, 0x0b,
    0x01, 0x02, 0x0c, 0x05, 0xab, 0x00, 0x61, 0x00,0x08, 0x44, 0x04, 0x12, 0x03, 0x41, 0x01, 0xe0,
    0x10, 0x00, 0x0c, 0x18, 0x01, 0x07, 0x00, 0x41,0xe0, 0x28, 0x20, 0x4a, 0x25, 0x0e, 0x00, 0x82,
    0xa1, 0x91, 0x88, 0x8c, 0x4e, 0x2b, 0x17, 0x87,0xc6, 0xa1, 0xb0, 0xf8, 0xec, 0x52, 0x0b, 0x20,
    0x8c, 0xc6, 0xe1, 0xe0, 0xd8, 0x90, 0x04, 0x24,0x04, 0x08, 0xcb, 0x65, 0x92, 0x28, 0xc4, 0xb2,
    0x16, 0x11, 0x02, 0xc2, 0xe6, 0x72, 0xa0, 0x0c,0xd8, 0x02, 0x10, 0x9c, 0xcf, 0x65, 0x20, 0x03,
    0xf8, 0x00, 0x04, 0x0b, 0x89, 0x02, 0x69, 0x00,0x01, 0xd8, 0x30, 0x08, 0x0f, 0x07, 0x83, 0x01,
    0x08, 0xc0, 0x74, 0x2c, 0x00, 0x2a, 0x96, 0x04,0x00, 0xd5, 0x90, 0x98, 0x02, 0xab, 0x42, 0xad,
    0x57, 0x2b, 0xd3, 0xa9, 0xfd, 0x6e, 0x7f, 0x5d,0xaf, 0xd6, 0x40, 0x61, 0x20, 0x1c, 0xf8, 0x24,
    0x09, 0x88, 0x84, 0x81, 0x15, 0xe8, 0xb5, 0xa8,0x23, 0x6d, 0x96, 0x84, 0x6e, 0x10, 0x5b, 0x98,
    0x3a, 0x63, 0x59, 0xb3, 0x42, 0xc2, 0x17, 0xb0,0x85, 0xf6, 0x08, 0x00, 0x3f, 0x03, 0x43, 0x75,
    0xe9, 0x60, 0x00, 0xd3, 0x8e, 0x06, 0x81, 0xe4,0x33, 0xd0, 0x4c, 0xac, 0x0f, 0x22, 0x07, 0x63,
    0x4a, 0x80, 0x02, 0xa0};
```

4. Copy the subband_ru_power_cfg[] array block from array block from region_power_cfg_raw_file_XX.h file downloaded from Murata GitHub into the wlan_txpwrlimit_cfg_WW_rw610.h file's rutxpowerlimit_bga_cfg_set[] array, where XX is the region code, as shown in **Figure 4**. **Table 3** shows the region description of RU Tx power limit arrays.

Figure 4: RU Region Power Configuration Values

```
const static uint8_t rutxpowerlimit_cfg_set_WW[] = {
    0x6d, 0x02, 0x6c, 0x00, 0x00, 0x00, 0x00, 0x00, 0x01, 0x00, 0x18, 0x01, 0x04, 0x06, 0x0a, 0x0e,
    0x00, 0x00, 0x00, 0x04, 0x06, 0x0a, 0x0e, 0x00, 0x00, 0x00, 0x04, 0x06, 0x0a, 0x0e, 0x00, 0x00,
    0x00, 0x06, 0x08, 0x0b, 0x0f, 0x00, 0x00, 0x00, 0x02, 0x05, 0x08, 0x0c, 0x00, 0x00, 0x00, 0x02,
    0x05, 0x08, 0x0c, 0x00, 0x00, 0x00, 0x06, 0x0b, 0x0e, 0x11, 0x00, 0x00, 0x00, 0x06, 0x0b, 0x0e,
    0x11, 0x00, 0x00, 0x00, 0x06, 0x09, 0x09, 0x09, 0x00, 0x00, 0x00, 0x09, 0x0c, 0x0f, 0x11, 0x00,
    0x00, 0x00, 0x09, 0x0c, 0x0f, 0x11, 0x00, 0x00, 0x00, 0x08, 0x0b, 0x0e, 0x11, 0x00, 0x00, 0x00,
    0x0e, 0x0e, 0x0e, 0x0e, 0x00, 0x64, 0x02, 0x03, 0x00, 0x88, 0x88, 0x00};

const static uint8_t rutxpowerlimit_cfg_set_US[] = {
    0x6d, 0x02, 0x6c, 0x00, 0x00, 0x00, 0x00, 0x00, 0x01, 0x00, 0x18, 0x01, 0x11, 0x12, 0x12, 0x12,
    0x00, 0x00, 0x00, 0x11, 0x12, 0x12, 0x11, 0x00, 0x00, 0x00, 0x0f, 0x12, 0x11, 0x10, 0x00, 0x00,
    0x00, 0x0d, 0x0f, 0x11, 0x11, 0x00, 0x00, 0x00, 0x0d, 0x0f, 0x11, 0x11, 0x00, 0x00, 0x00, 0x0d,
    0x0f, 0x11, 0x11, 0x00, 0x00, 0x00, 0x0d, 0x0f, 0x11, 0x11, 0x00, 0x00, 0x00, 0x0d, 0x0f, 0x11,
    0x11, 0x00, 0x00, 0x00, 0x09, 0x09, 0x09, 0x09, 0x00, 0x00, 0x00, 0x11, 0x11, 0x11, 0x11, 0x00,
    0x00, 0x00, 0x11, 0x11, 0x11, 0x11, 0x00, 0x00, 0x00, 0x08, 0x0b, 0x0e, 0x11, 0x00, 0x00, 0x00,
    0x13, 0x13, 0x12, 0x10, 0x00, 0x64, 0x02, 0x03, 0x00, 0x88, 0x88, 0x00};
```

Table 3: RU TX Power Parameters

Parameter	Region Description
[rutxpowerlimit_cfg_set_EU]	RU Tx power for Europe
[rutxpowerlimit_cfg_set_JP]	RU Tx power for Japan
[rutxpowerlimit_cfg_set_US]	RU Tx power for US
[rutxpowerlimit_cfg_set_WW]	RU Tx power for World-wide

To set the RU power for Canada, you can create an array block and add in the code under "[rutxpowerlimit_cfg_set_US]".

5. Build the wifi_cli application image and flash the RW61x evaluation board.

3.5 Enabling Tx Power Limits

Follow the instructions below to enable the Tx power limits with the wifi_cli application

1. Set the region code with the following command:

```
wlan-set-regioncode <regioncode>
```

Refer to **Table 4** for region code values.

Table 4: Region Code Values

Regioncode Value	Region Description
0x00	World-wide Safe
0x10	US FCC, Singapore
0x20	IC Canda
0x30	ETSI, Australia, Republic of Korea
0xFF	Japan

2. Readback the SU Tx power level with the following command:

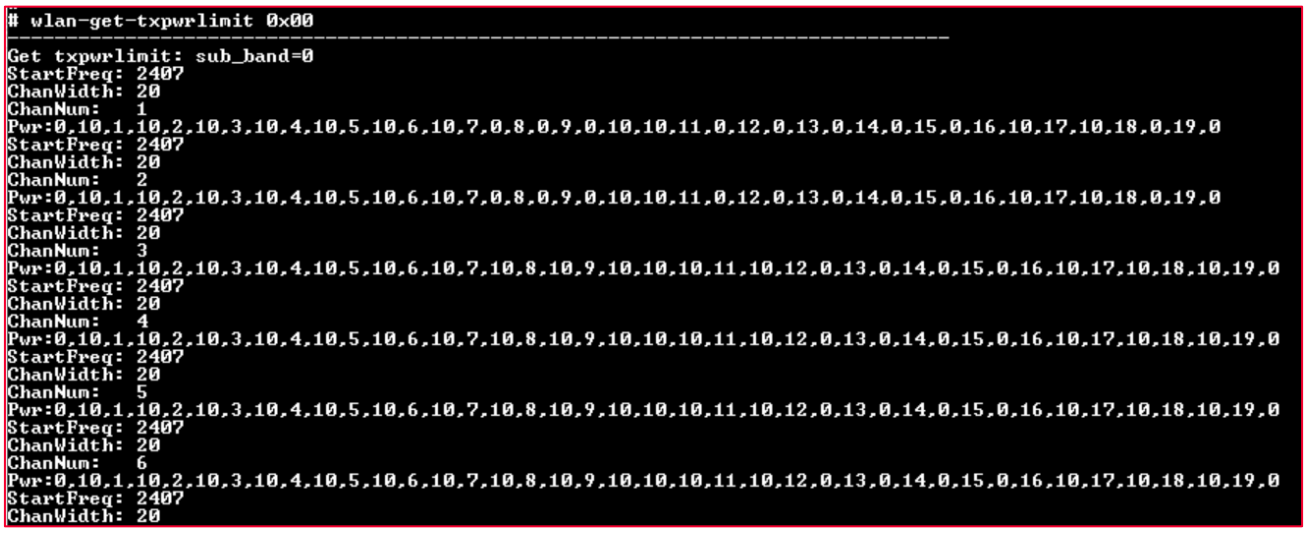
```
wlan-get-txpwrlimit <subband>
```

Refer to **Table 5** for sub band values. **Figure 5** shows an example readback of the Tx power limit for 2.4 GHz.

Table 5: Sub Band Values

Sub band Value	Sub band Description
0x00	2.4 GHz sub band (2.4 GHz: channel 1-14)
0x10	5 GHz sub band0 (5 GHz: channel 36,40,44,48,52,56,60,64)
0x11	5 GHz sub band1 (5 GHz: channel 100,104,108,112,116,120,124,128,132,136,140,144)
0x12	5 GHz sub band2 (5 GHz: channel 149,153,157,161,165,172)
0x13	5 GHz sub band3 (5 GHz: channel 183,184,185,187,188,189, 192,196; 5G: channel 7,8,11,12,16,34)

Figure 5: 2.4 GHz Tx power limit readback in wifi_cli



3. Enable RU UL-OFDMA Tx power limits with the following command:

```
wlan-set-rutxpwrlimit
```

This command must be executed before connecting to an AP.

3.6 Customization of Transmit Power Using Command-Line Interface

1. Edit the file <sdk_root>/wifi/wlcmgr/wlan_enhanced_tests.c in the SDK and add the following line in "static struct cli_command wlan_enhanced_commands".

```
{"wlan-set-txpwrlimit", NULL, test_wlan_set_txpwrlimit},
```

2. Define the handler for the CLI command “wlan-set-txpwrlimit” to set TX power table in “wlan_enhanced_tests.c” file.

```
static void test_wlan_set_txpwrlimit(int argc, char **argv)
{
    int rv = wlan_set_txpwrlimit(&tx_pwrlimit_2g_cfg);
    if (rv != WM_SUCCESS)
        PRINTF("Unable to set 2G TX PWR Limit configuration\r\n");
    else
        PRINTF("Successfully configured 2G TX PWR Limit\r\n");
#ifdef CONFIG_5GHz_SUPPORT
    rv = wlan_set_txpwrlimit(&tx_pwrlimit_5g_cfg);
    if (rv != WM_SUCCESS)
        PRINTF("Unable to set 5G TX PWR Limit configuration\r\n");
    else
        PRINTF("Successfully configured 5G TX PWR Limit\r\n");
#endif
}
```

3. Run "wlan-set-txpwrlimit" command from the command-line interface and check that the output is as shown below:

```
# wlan-set-txpwrlimit
Successfully configured 2G TX PWR Limit
Successfully configured 5G TX PWR Limit
```

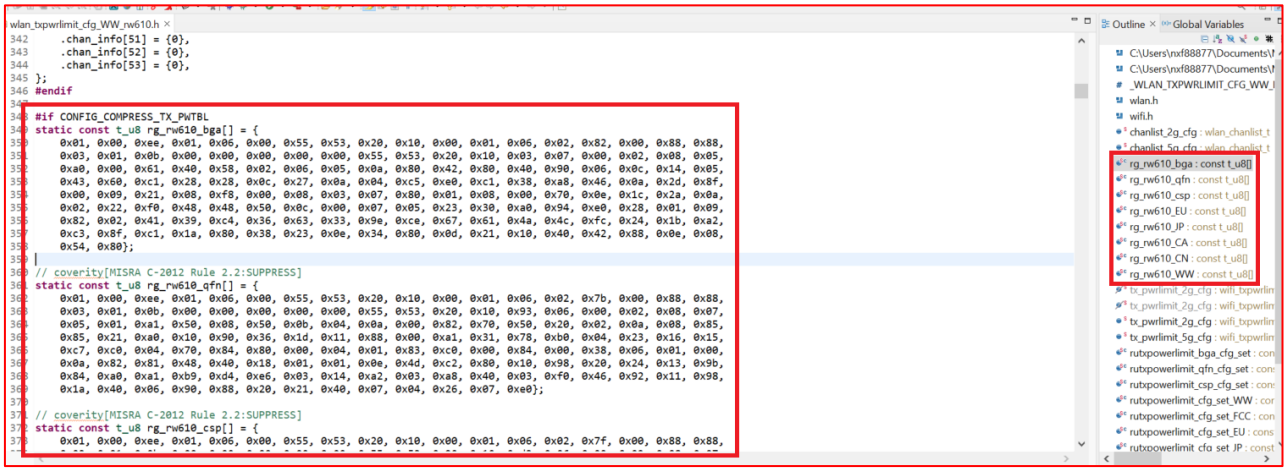
4. Run the "wlan-get-txpwrlimit <subband>" command, you will now be able to see the transmit power values that is set in "wlan_txpwrlimit_cfg_WW_rw610.h" file. Also, if you change transmit power values in the "wlan_txpwrlimit_cfg_WW_rw610.h" file and flash the example again to the EVK, you will be able to see the changed transmit power.

Always run the "wlan-set-txpwrlimit" command after flashing the EVK to see the changed transmit power values.

3.7 Customization of Transmit Power Using Spreadsheet

There are a few arrays in the wlan_txpwrlimit_cfg_WW_rw610.h which holds the TX power settings as hex data for different regions.

Figure 6: Hex Data in Header File



To modify the TX power, you will have to fill out TX power table spreadsheet. After the sheet is filled out, you can convert the spreadsheet file to a header file using the conversion utility which can be downloaded here. The resulting header file can essentially be copied (with one minor modification) into the array for the associated region.

Upon changing the country code in the application, or associating to an AP with broadcasting country IE, the TX power will be updated.

4 Patching for BLE Only Applications

If the application is BLE only, and is using single shared antenna configuration (as in our EVK), Section 1 and Section 2 can be skipped and an easier option is available. User just needs to add one line of code in the BLE project and rebuild the app.

Please refer to the Type 2FR/2FP EVK User Guide for detailed instructions on how to build and flash the Bluetooth example applications.

This patch is exclusively for Type 2FR/2FP EVK. Production modules will be configured with a single antenna (including Annex 100) in the OTP, making this patch unnecessary.

As an example, if we want to patch for peripheral_ht BLE app, do the following.

1. Open MCUXpressoIDE_11.9.0_2144\workspace-2.16.0\rdrw612bga_peripheral_ht\framework\Platform\configs\fwk_config.h.
2. Locate the first appearance of the macro gPlatformDisableSetBtCalDataAnnex100_d.
3. Add “#define gPlatformDisableSetBtCalDataAnnex100_d 0” before the first appearance. This will trigger the app to add Annex 100 to RAM while initialization of BLE.

```
"#define gPlatformDisableSetBtCalDataAnnex100_d 0"
```

4. Rebuild the app.

The Annex 100 will not be saved in flash or OTP using this method. So, for all other BLE only apps, this needs to be done.

Revision History

Revision	Date	Author	Change Description
1.0	Oct 15, 2024	TF	Initial release
1.1	Nov 04, 2024	TF	Added Murata Tx power setting integration section
1.2	Dec 05, 2024	TF	Updated Single antenna setup sections. Added Section 3.
1.3	Dec 12, 2024	TF	Updated as per new NXP documentation. Added Murata Community Forum section.
1.4	Mar 4, 2026	TF	Updated document to reflect the first 8 byte removal change from the transmit power hex data.

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