

FCC Regulatory Certification (ABR)

Test Guide - Rev. 2.0

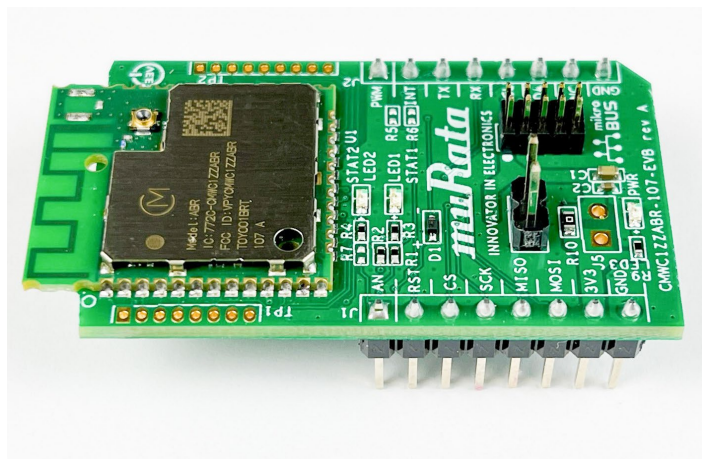


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About This Document

This document provides some lab test procedures for Federal Communications Commission (FCC) Part 15C regulatory certification for Murata Type ABR module based on NXP MW320 chipset. This document does not cover other regulatory certification tests required for FCC such as unintentional radiation or RF exposure test. Details for complete regulatory certification tests are available from regulatory test lab.









Audience & Purpose

This document is targeted towards Regulatory Certification test engineers of NXP i.MX application processor-based solutions, running Linux operating system.

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: Embedded Artists AB  Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. Example: References  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 Murata RF Test Resources




The following table lists the resources provided by Murata for easier certification tests. These resources are referred to at various places in this document.

Table 2: Murata RF Test Resources

Item	Description
lpcpresso55s69_murata_abr_bridge_uart.zip 	BT UART passthrough example project
Murata_ABR_RF_Test_Tool.py 	Murata RF Test Script for Type ABR module
Murata_ABR_RF_Test_Helper_Tool.exp 	Murata RF Test Script helper file used by Murata RF Test Tool.

2 Flashing Manufacturing Firmware

A manufacturing firmware needs to be flashed on the Murata Type ABR module before regulatory tests can be performed.

Please refer to the [Murata Type ABR mikroBUS Flashing Guide](#)  document for the instructions. The procedure requires a Windows® 10 host machine, NXP [LPC-Link2](#)  debug probe and NXP [LPCXpresso55S69 Development Board](#) .

3 Hardware Setup




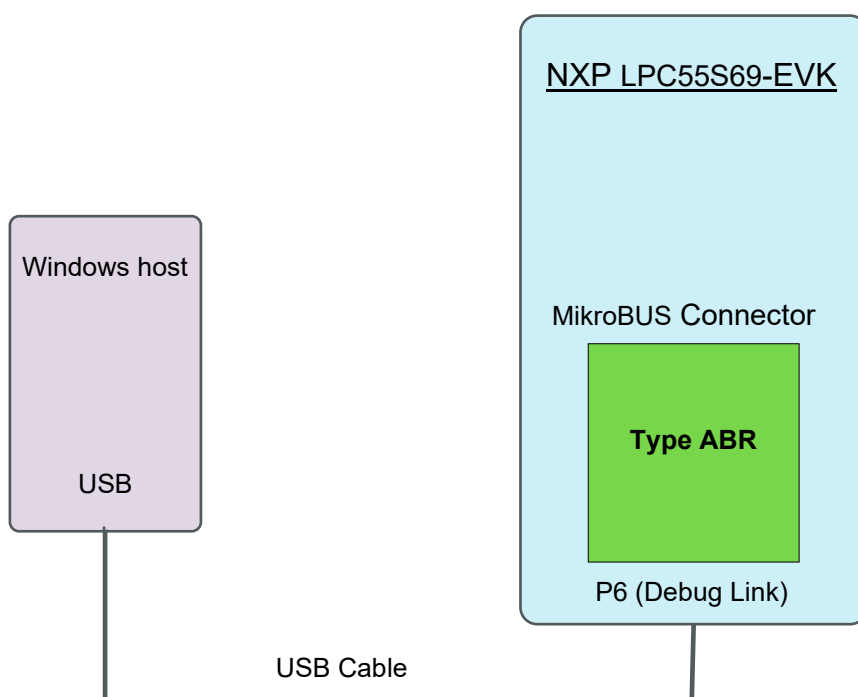
Refer to the **Figure 1** to connect the Type ABR module to the Windows host machine as well as the NXP [LPCXpresso55S69 Development Board](#) . The [LPCXpresso55S28](#)  and [LPCXpresso55S16](#)  development boards are also supported.

Figure 1: Hardware Setup Block Diagram

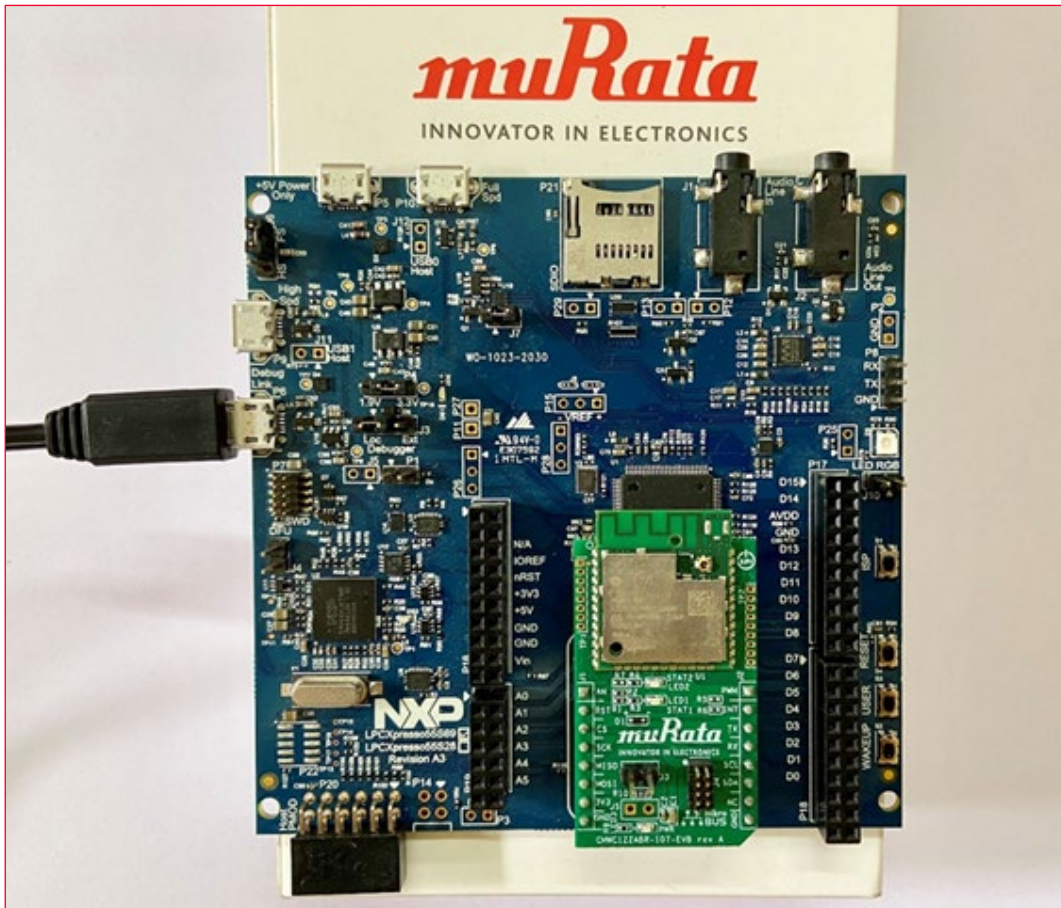


The steps are as given below.

- Connect the Type ABR MikroBUS EVB on the LPC55S69-EVK board on the MikroBUS connector.
- Connect the NXP LPC55S69-EVK (Port P6 marked “Debug Link”) to the Windows host via a USB port.

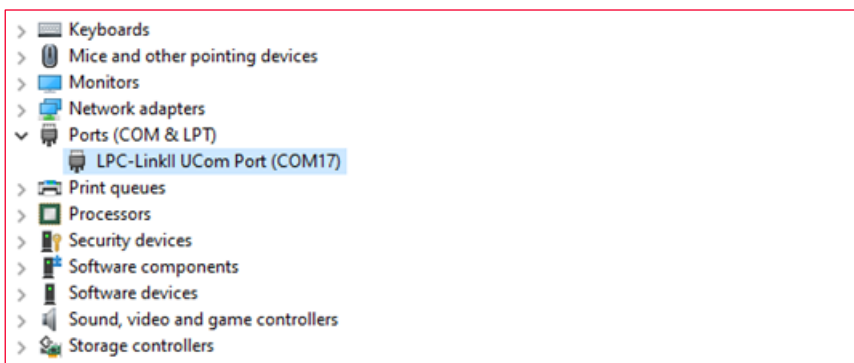
The full setup is shown in **Figure 2**.

Figure 2: Complete Hardware Setup



- Check in the device manager for confirmation and note the COM port number (COM17 in **Figure 3**).

Figure 3: Device Manager Window



4 Software Setup

In this section the software setup process is explained. All related screens are listed at the end of the section. Please click on the links for the figures to refer.




1. Download and install MCUXpresso IDE 11.4.0 or later from [this link](#) .
2. Obtain the LPC55S69 MCUXpresso SDK 2.10.0 or later from [this link](#) . Make sure to click **Select All** (marked in **Figure 4**) to select all components while configuring the SDK.
3. Download the Murata [BT UART passthrough example project](#)  and extract.
4. Run MCUXpresso. Drag and drop the downloaded SDK in the IDE to install as shown in **Figure 5**.
5. Import the downloaded example `lpcxpresso55s69_murata_abr_bridge_uart` from file system as shown in **Figure 6**.
6. Run debug in the IDE as marked in **Figure 7**.
7. Once Debug is selected, the debug process starts and then stops after a second or two. Once the debug is halted click **Resume Debug** icon as shown in **Figure 8**.
8. At this point, the Type ABR module is ready for RF testing.
9. Once the RF testing is complete, click Stop Debug on the MCUXpresso IDE to terminate the example application as marked in **Figure 9**.

Figure 4: Device Manager Window

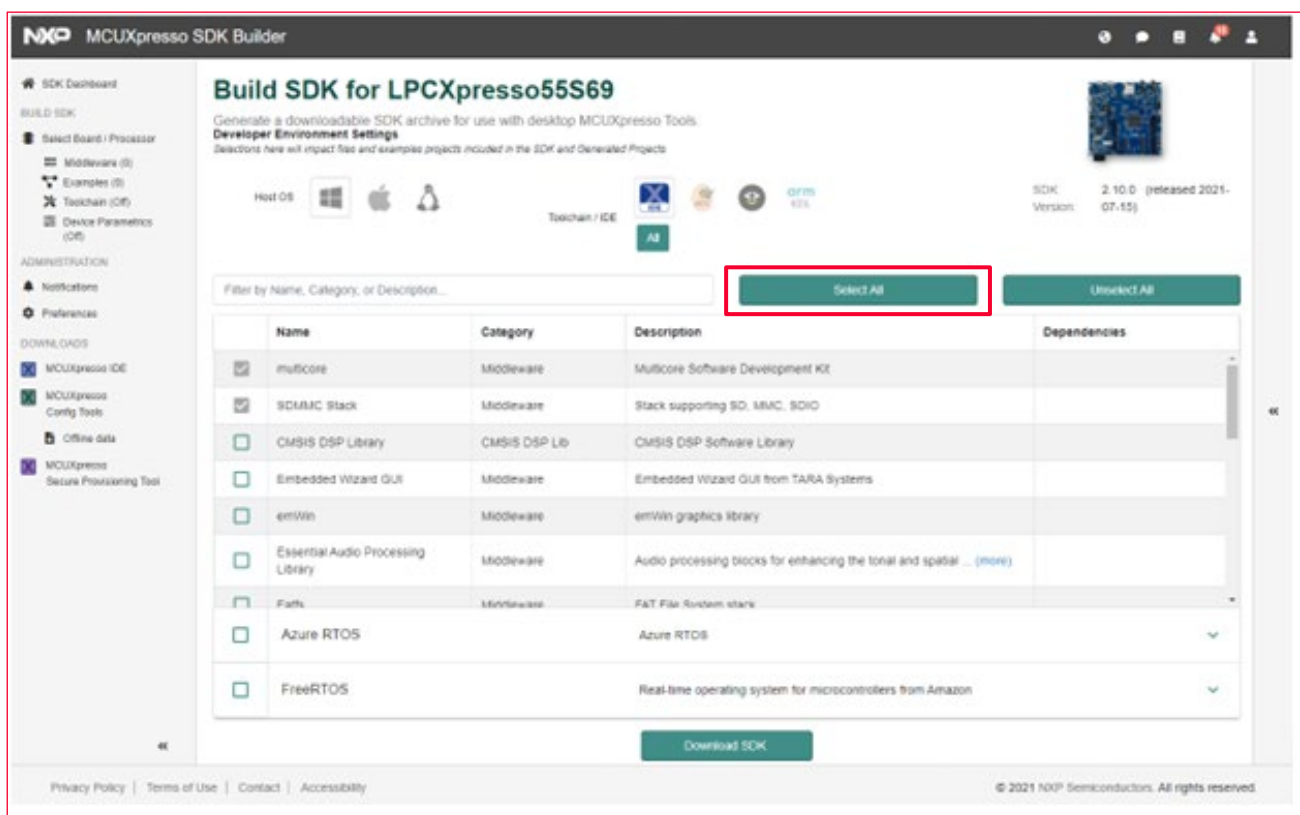


Figure 5: Install SDK

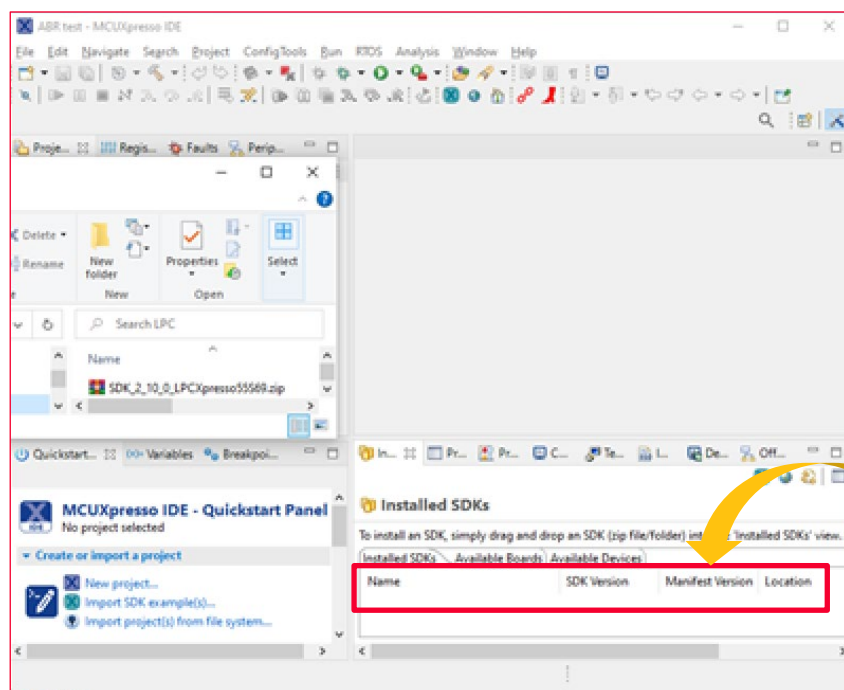


Figure 6: Import Example

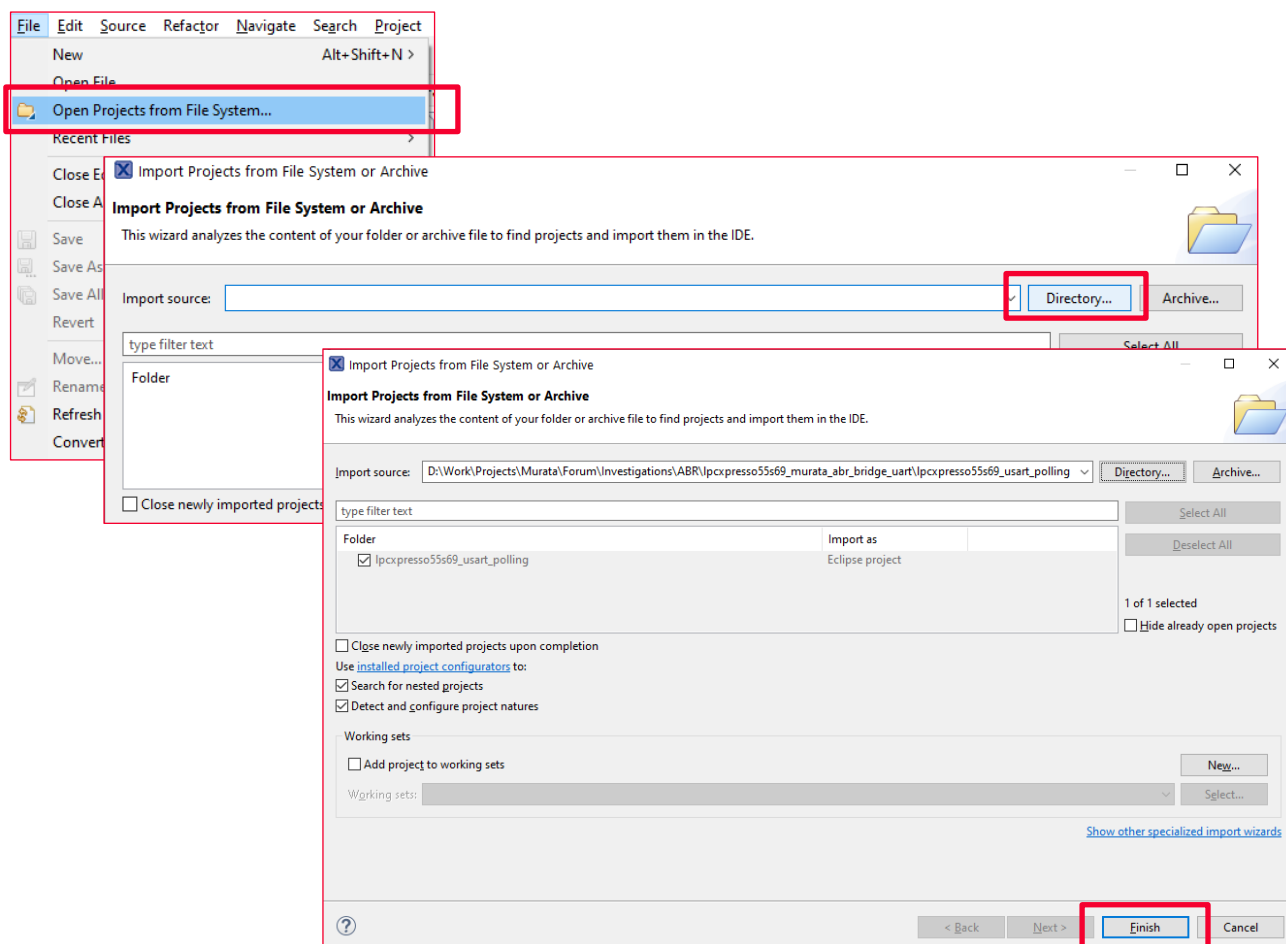


Figure 7: Run Example Application

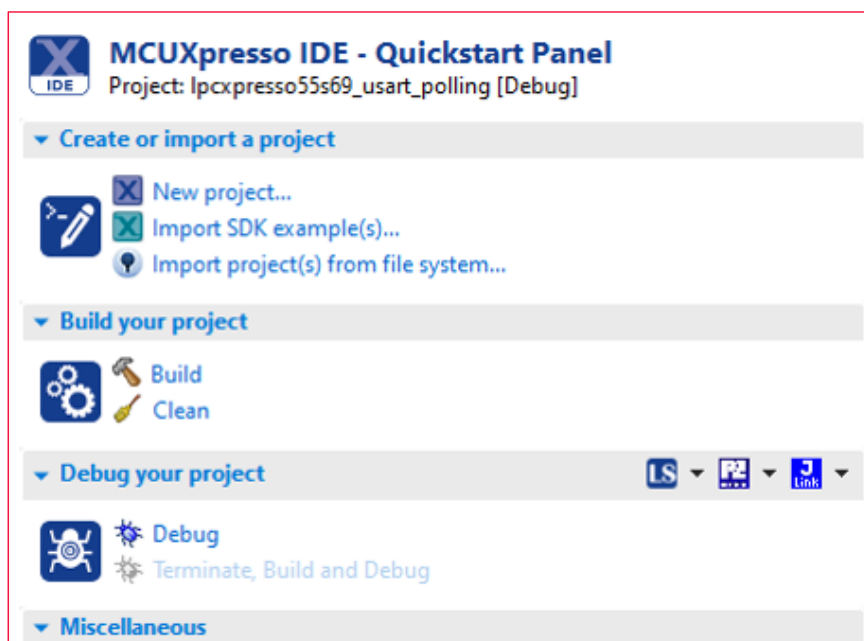


Figure 8: Resume Debug

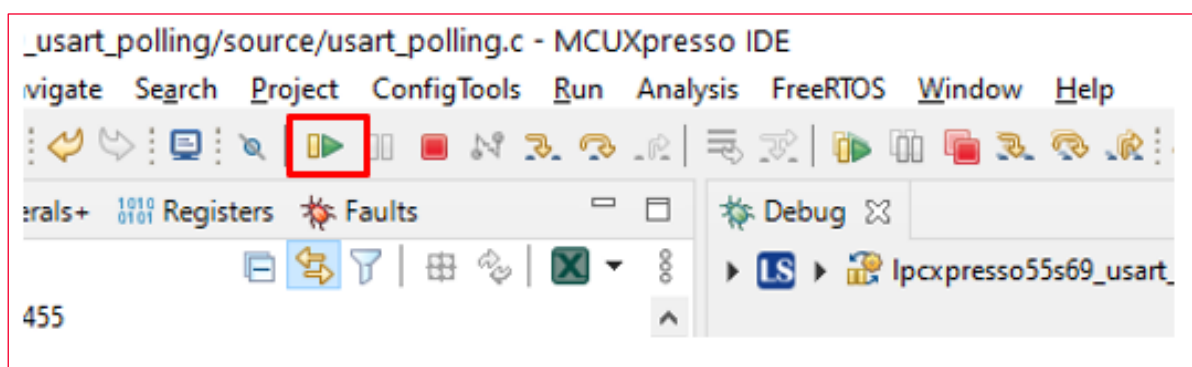
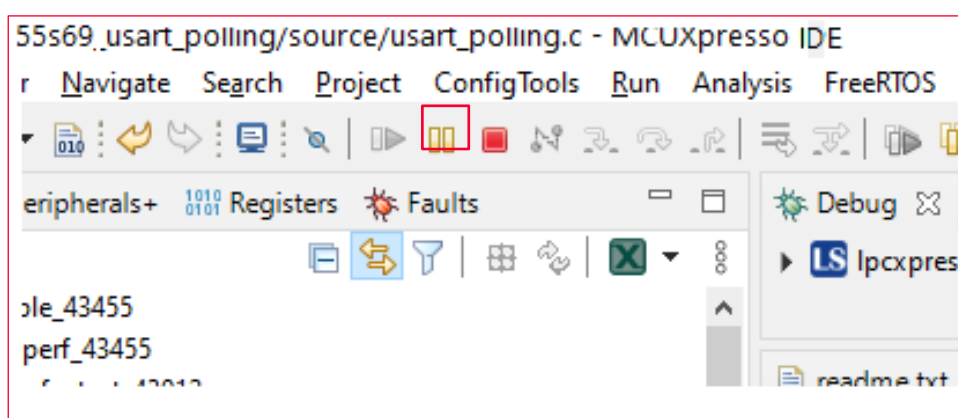


Figure 9: Stop Example Application

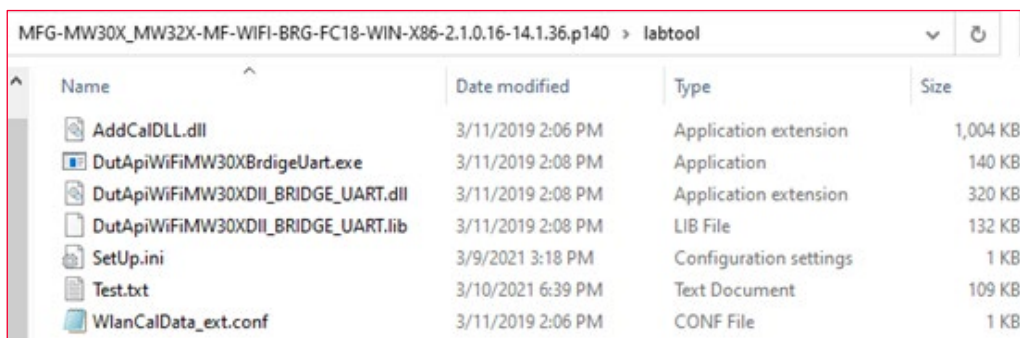


5 Wi-Fi RF Test

The LabTool software from NXP is used to configure the Type ABR module in manufacturing mode to run RF tests. The steps to follow are given below.

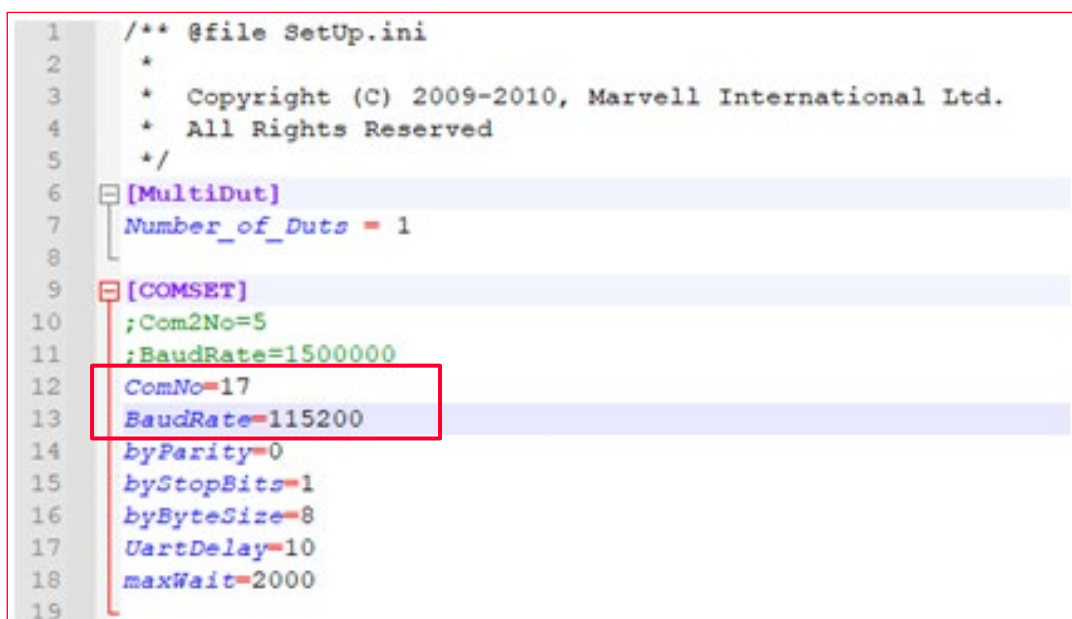
1. Download the LabTool application (contact NXP for access).
2. Unzip the downloaded package and navigate to the **LabTool** folder. The unzipped folder contents are shown in **Figure 10**.
3. Open the SetUp.ini file and edit the COM port number of the LPC55S69-EVK. Also change the baud rate to 115200 as shown in **Figure 11**.
4. Open the LabTool. Click on “DutApiWiFIMW30XBrdigeUart.exe” file. Issue command 88 (Get FW version) and 11 (Get channel) to check if the LabTool is working properly. A successful command execution is indicated by a status value with all 0s. An unsuccessful command execution will have nonzero status value (0x00000001 to 0xFFFFFFFF) and will return invalid data. This could indicate a problem with communication with the DUT, incorrect firmware, no firmware download, wrong version of labtool/firmware etc. Refer to **Figure 12** for command line information.
5. Terminate the LabTool session by executing command 99.

Figure 10: LabTool Folder



Name	Date modified	Type	Size
AddCalDLL.dll	3/11/2019 2:06 PM	Application extension	1,004 KB
DutApiWiFIMW30XBrdigeUart.exe	3/11/2019 2:08 PM	Application	140 KB
DutApiWiFIMW30XDII_BRIDGE_UART.dll	3/11/2019 2:08 PM	Application extension	320 KB
DutApiWiFIMW30XDII_BRIDGE_UART.lib	3/11/2019 2:08 PM	LIB File	132 KB
SetUp.ini	3/9/2021 3:18 PM	Configuration settings	1 KB
Test.txt	3/10/2021 6:39 PM	Text Document	109 KB
WlanCalData_ext.conf	3/11/2019 2:06 PM	CONF File	1 KB

Figure 11: Configure LabTool



```

1  /** @file SetUp.ini
2  *
3  * Copyright (C) 2009-2010, Marvell International Ltd.
4  * All Rights Reserved
5  */
6  [MultiDut]
7  Number_of_Duts = 1
8
9  [COMSET]
10 ;Com2No=5
11 ;BaudRate=1500000
12 ComNo=17
13 BaudRate=115200
14 byParity=0
15 byStopBits=1
16 byByteSize=8
17 UartDelay=10
18 maxWait=2000
19

```

Figure 12: Test LabTool Command Execution

```

Version:      2.1.0.14
Date:        Mar 11 2019 (12:08:15)

Note:

Name:        DutApiClient
Interface:    EtherNet
Version:      2.1.0.14
Date:        Mar 11 2019 (12:07:36)

Note:

\\.\COM17
DutIf_InitConnection: 0
-----
                        W87xx (802.11a/g/b/n) TEST MENU
-----
Enter option: 88
DLL Version : 2.1.0.14
LabTool Version: 2.1.0.14
FW Version:  14.1.36.115      Mfg Version: 2.0.0.31
SOC:    0001    11
BBP:    9F      00
RF:     48      10
OR Version: 0.3      Customer ID: 0
Enter option: 11
DutIf_GetRfChannel: 0x00000000
RF Channel: 6 (2437.0 MHz)
Enter option:

```

5.1 Continuous Transmit Test

The following LabTool commands listed in **Table 3** must be executed to perform the Continuous Transmit Test.

Table 3: Continuous Transmit Test Commands

#	Command	Description
1	35	Stop previous test (if any)
2	12 <channel>	Set channel.
3	22 <channel> <TX power> <data modulation>	Set channel (repeat) and TX power. The last argument indicates data modulation type: <ul style="list-style-type: none"> 0 = CCK 1 = OFDM
4	35 1 <data rate>	Start test.
5	35	For valid values of data rate, please refer to Table 4
#	Command	Stop test

Table 4: Supported Data Rates

Wi-Fi standard	Data Rate	ID
11b	1 Mbps	1
	2 Mbps	2
	5.5 Mbps	3
	11 Mbps	4
11g	6 Mbps	6
	9 Mbps	7
	12 Mbps	8
	18 Mbps	9
	24 Mbps	10
	36 Mbps	11
	48 Mbps	12
	54 Mbps	13
11n	HT_MCS0	15
	HT_MCS1	16
	HT_MCS2	17
	HT_MCS3	18
	HT_MCS4	19
	HT_MCS5	20
	HT_MCS6	21
	HT_MCS7	22

Given below is a sample output of running Continuous Transmit Test for channel = 6, TX power = 17 dBm and data rate = 11 Mbps.

```

-----
                        W87xx (802.11a/g/b/n) TEST MENU
-----
Enter option: 35
  DutIf_AdjustPcktSifs: 0x00000000
Enter option: 12 6
  DutIf_SetRfChannel: 0x00000000
  RF Channel: 6 (2437.0 MHz)
Enter option: 22 6 17 0
  DutIf_SetRfChannel: 0x0
  DutIf_SetRfPowerCal: 0x0
Enter option: 35 1 4
  DutIf_AdjustPcktSifs: 0x00000000
  TRPC ID: 1
Enter option: 35
  DutIf_AdjustPcktSifs: 0x00000000

```

5.2 Carrier Wave Test

The following LabTool commands must be executed to perform the Carrier Wave Test.

Table 5: Carrier Wave Test Commands

#	Command	Description
1	35	Stop previous test (if any)
2	12 <channel>	Set channel.

3	22 <channel> <TX power> <data modulation>	Set channel (repeat) and TX power. The last argument indicates data modulation type: <ul style="list-style-type: none"> • 0 = CCK • 1 = OFDM
4	18 1	Start test.
5	18	Stop test

Given below is a sample output of running Carrier Wave Test for channel = 11 and TX power = 15 dBm.

```

-----
                        W87xx (802.11a/g/b/n) TEST MENU
-----
Enter option: 18
  DutIf_SetTxContMode: 0x00000000
Enter option: 12 11
  DutIf_SetRfChannel: 0x00000000
  RF Channel: 11 (2462.0 MHz)
Enter option: 22 11 15 0
  DutIf_SetRfChannel: 0x0
  DutIf_SetRfPowerCal: 0x0
Enter option: 18 1
  DutIf_SetTxContMode: 0x00000000
Enter option: 18
  DutIf_SetTxContMode: 0x00000000
  
```

5.3 Receive Test

The following LabTool commands must be executed to perform the Receive Test. The first number is the command ID, the remaining are parameters.

Table 6: Receive Test Commands

#	Command	Description
1	35	Stop previous test (if any)
2	12 <channel>	Set channel.
3	31	Start test by clearing received packets.
4	32	Stop test. Get and clear Rx packet count.

Given below is a sample output of running Receive Test for channel = 6.



```
-----  
W87xx (802.11a/g/b/n) TEST MENU  
-----  
Enter option: 35  
  DutIf_AdjustPcktSifs: 0x00000000  
Enter option: 12 6  
  DutIf_SetRfChannel: 0x00000000  
  RF Channel: 6 (2437.0 MHz)  
Enter option: 31  
  DutIf_ClearRxPckts: 0x00000000  
Enter option: 32  
  DutIf_GetRxPckt: 0x00000000  
GetRxPckt:  
  Rx Packet 288  
  Multi Cast 288  
  Err Count 785
```

5.4 Murata ABR RF Test Script

Murata has simplified the RF testing steps by providing an easy-to-use python script that can be run on the Windows host (via Cygwin). Steps for downloading and invoking the script are detailed here.

5.4.1 Install Dependencies

The Murata ABR RF Test Script uses python and expect software to automate the tests. These can be installed on Windows using the Cygwin platform.


1. Download Cygwin for [x86 32-bit system](#)  or [64-bit system](#)  and execute.
2. Select the option **Install from Internet**.
3. Select the option **Direct Connection**.
4. Select any mirror you want to use (E.g., <https://mirror.clarkson.edu>).
5. Do not select any package for first install.
6. Complete the install.
7. Open Cygwin terminal and add the following line at the end of the /etc/fstab file.

```
none /cygdrive binary,noacl,posix=0,user 0 0
```



You can also add it manually by opening the file (c:\cygwin\etc\fstab) assuming Cygwin has been installed at C:\cygwin location.

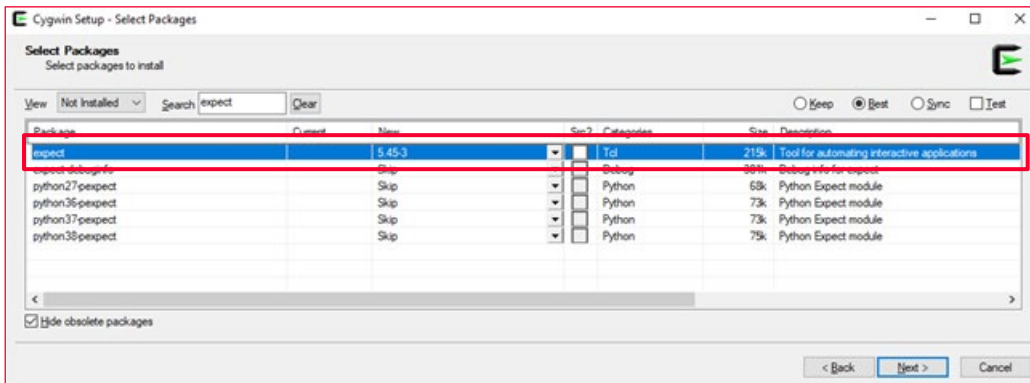
5.4.2 Install Python 2.7

Download and install Python 2.7 [from here](#) . This document assumes Python 2.7.18 is being used.

5.4.3 Install Expect

Run the Cygwin installation program again (as downloaded in [Section 5.4.1](#)) and add the expect package.

Figure 13: Expect Installation in Cygwin



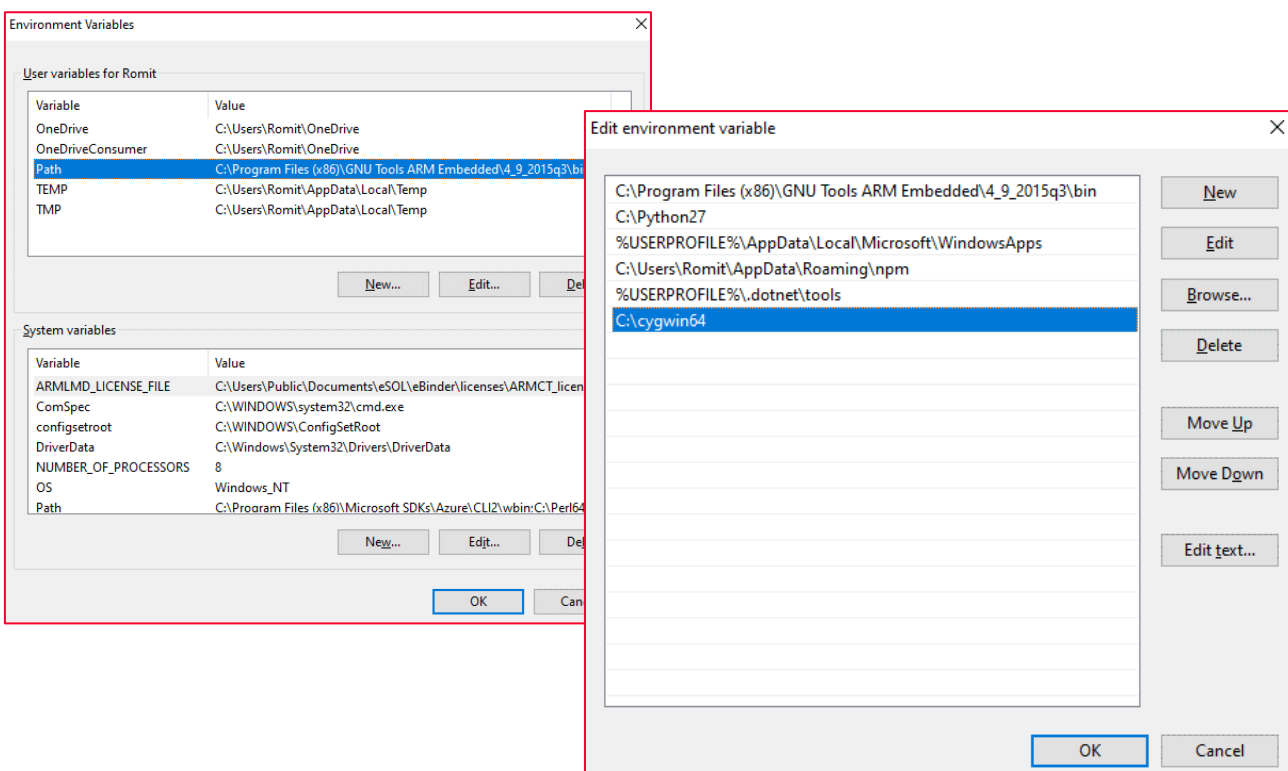
5.4.4 Update Environment Variables

After installations are complete, please go to Start → View Advanced System Settings → Environment Variables → User Variables → PATH. Double click on the PATH and add the following paths:

- Cygwin bin folder
- Python installation folder

Example: C:\cygwin64\bin;C:\Python27

Figure 14: Update Environment



5.4.5 Download Murata ABR RF Test Script Files

Download the [Murata ABR RF Test Script Files](#) – Murata ABR RF Test Tool and Murata ABR RF Test Tool Helper.

Place the downloaded Murata scripts (both Murata_ABR_RF_Test_Tool.py and Murata_ABR_RF_Test_Helper_Tool.exp) in the same folder where the LabTool application (DutApiWiFiMW30XBrdigeUart.exe) is located.

5.4.6 Run the script

Murata ABR RF test script performs the following tasks:

- Prompts the user to select the RF test to conduct.
- Depending on the selected test, prompts the user to select/enter the relevant parameters:
 - Channel
 - Data rate
 - TX Power
- Prompts the user to enter the test run time (in seconds).
- Provides the selected configuration for the user to review and accept.
- Executes LabTool commands on behalf of the user.

Running the script file is straightforward. Simply invoke the following command from the folder on the test platform where the scripts are located (both Murata_ABR_RF_Test_Tool.py and Murata_ABR_RF_Test_Helper_Tool.exp):

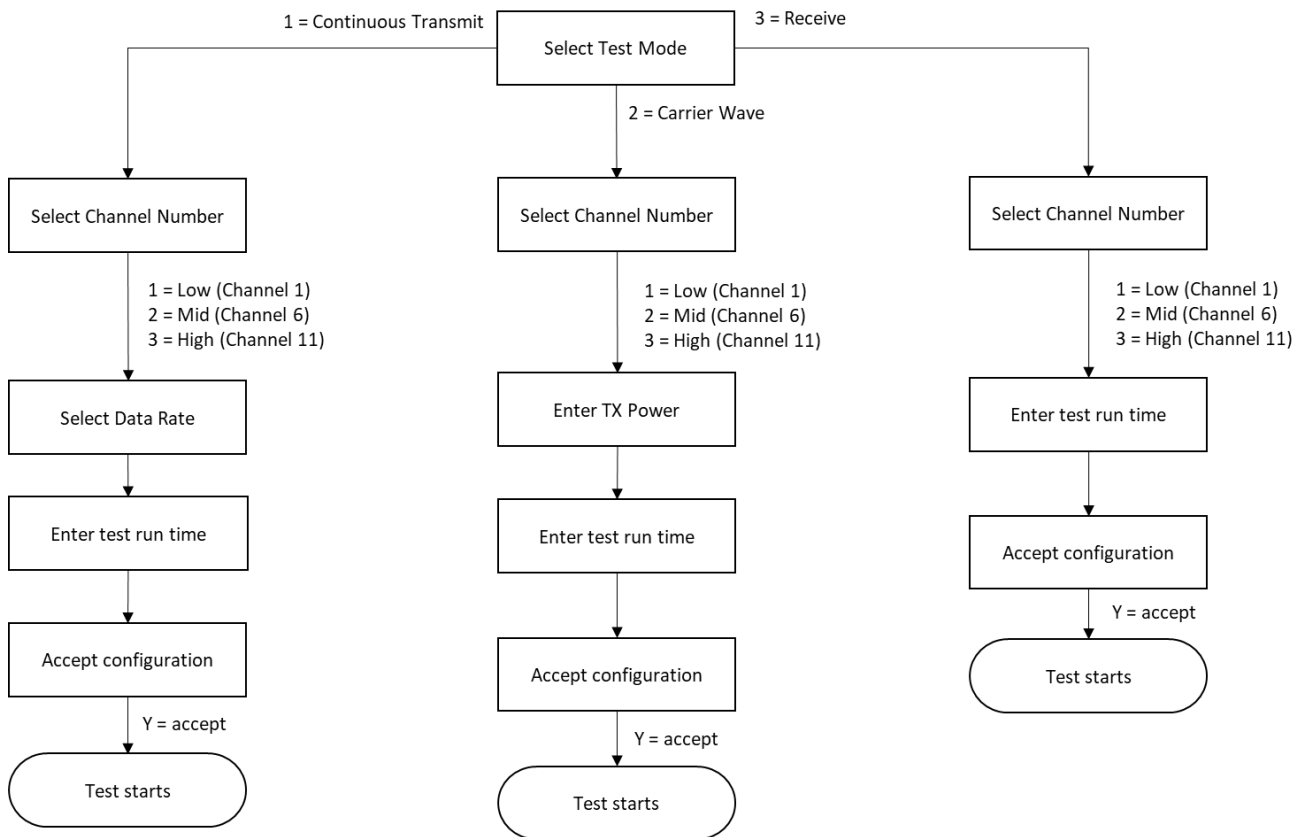
```
python Murata_ABR_RF_Test_Tool.py
```

For an example input/output sequence, refer to [Appendix A: Sample output of Murata ABR RF Test Script](#)

5.4.7 Script flow

Figure 15 describes the user interaction flow of the script for Type ABR module.

Figure 15: Murata RF Test Script Flow for Type ABR



5.4.8 Automation option in the script

User can provide a configuration file to the script to automate a test partly or fully. Invoke the script with '-c' switch and provide the config file name.

```
python Murata_ABR_RF_Test_Tool.py -c config.txt
```

A demo config file is given below – the parameters are self-explanatory. Supported values are same as that of the script inputs. In case a required parameter is not provided, or the value provided is not supported, the script will request the user to select/enter the parameter as per normal script operation. This allows the user to automate a test fully (by providing all required parameters), or partly (by providing parameters that will not change between tests). One additional parameter used by the config file is 'TIME' which indicates the time (in seconds) the test should run.

```
# This config file will execute a Continuous Transmission test on Murata Type
# ABR module for 2.4 GHz band on channel 6 and data rate 11 Mbps. Transmission
# parameters are kept at default (packet interval = 20, packet length = 1024).
```

```
# Test selection option
# 1 = Continuous Transmit, 2 = Carrier Wave, 3 = Receive
```

```
TEST=1
```

```
# Channel selection option
```

```
CHANNEL=2
```

```
# Data rate selection option
```

```
RATE=11
```

```
# Time to run test (in seconds)
```

```
TIME=10
```

6 Appendix A: Sample output of Murata ABR RF Test Script

The following shows a sample output of Murata ABR RF Test Script for running Continuous Transmission test on Murata Type ABR module for channel 6 and data rate 11 Mbps. Transmission parameters are kept at default (packet interval = 20, packet length = 1024). The test is set up to run for 10 seconds.

```
$ python Murata_ABR_RF_Test_Tool.py
Murata Type ABR Regulatory Script Version 1.4
Select Test Mode
-----
```

```
-----
| Entry | Test Mode |
|-----|-----|
| 1     | Continuous Transmit |
| 2     | Carrier Wave       |
| 3     | Receive            |
|-----|-----|
```

```
Select your entry for Test Mode: 1
```

```
Running Continuous Transmit test for ABR
```

```
Select Channel Number
-----
```

```
-----
| Entry | Channel Number | Description |
|-----|-----|-----|
| 1     | LOW            | Channel 1  |
| 2     | MID            | Channel 6  |
| 3     | HIGH           | Channel 11 |
|-----|-----|-----|
```

```
Select your entry for Channel Number: 2
```

```
Select data rate
[1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, 54, 6.5, 13, 19.5, 26, 39, 52, 58.5,
65]

Enter data rate: 11

Enter test run time (seconds): 10

Please verify your selection
-----

-----
| Module                | ABR                |
| Test                  | Continuous Transmit test |
| Channel Number        | 6                  |
| Data Rate              | 11 Mbps            |
| Transmit Power         | 17 dBm             |
| Runtime                | 10 seconds         |
|-----|-----|

Do you accept selected configurations? (Y/N): Y

Beginning...
spawn ./DutApiWiFiMW30XBrdigeUart.exe

Setting up ...
....

Starting test now ...

Waiting for 10 seconds
.....

Transmission stopped
Test complete. Test log available in Test.txt
```

7 Acronyms

Table 7 describes the acronyms in this document.


Table 7: Acronyms

Acronyms	Meaning
AP	Access Point
EVB	Evaluation Board
EVK	Evaluation Kit
FCC	Federal Communications Commission
FTDI	Future Technology Devices International Limited
FW	Firmware
NXP	NXP Semiconductors
OS	Operation System
PC	Personal Computer
RF	Radio Frequency
Wi-Fi	Wireless LAN: "Wi-Fi" is a registered trademark of Wi-Fi Alliance
WLAN	Wireless Local Area Network


8 References

This section reviews all the key reference documents that the user may like to refer to.



8.1 Murata Type ABR Module Landing Page

[This landing page](#)  provides a high-level description of the module and includes all the necessary support documents.


8.2 Murata Type ABR mikroBUS™ Flashing Guide

[This document](#)  provides detailed steps of building and flashing the Murata Type ABR mikroBUS EVB with production and manufacturing firmware.


8.3 Murata Type ABR mikroBUS™ EVB Quick Start Guide

[This guide](#)  details the process of running an example program for the Murata Type ABR module, available with MCUXpresso SDK, using the [LPCXpresso55S69 Development Board](#) .

8.4 FCC Regulatory Certification Guide

[This document](#)  provides general information on FCC Regulatory Certification with respect to Murata Wi-Fi/Bluetooth modules.

8.5 Murata's Community Forum Support

Murata's Community provides online support for the Murata Wi-Fi/Bluetooth modules on various i.MX platforms. Refer to [this link](#)  for existing support threads.

Revision History

Revision	Date	Author	Change Description
1.0	Oct 28, 2020	TF	Initial Release
2.0	May 20, 2022	TF	Converted to new template



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