

Laird Regulatory Utility Guide for Windows

Version 1.0

REVISION HISTORY

Version	Date	Notes	Approver
1.0	14 Sept 2015	Initial Release: Combined guide for PC and Mobile versions of Windows.	Jonathan Kaye

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LAIRD WI-FI RADIOS

Table 1 describes all of the current Microsoft Windows-based Laird Wi-Fi products.

Table 1: Laird Windows Wi-Fi products

802.11g radios (support 802.11b and 802.11g)	
MCF10G	Miniature CF module with antenna connectors
MSD10G	Miniature SDIO module with antenna connectors
802.11a/g radios (support 802.11a, 802.11b, and 802.11g)	
MCF10AG	Miniature CF module with antenna connectors
MSD10AG and MSD30AG	Miniature SDIO module with antenna connectors
SSD30AG	Miniature SDIO module
802.11n radios (support 802.11a, 802.11b, 802.11g, and 802.11n)	
PE15N	PCIe (Express) mini card with antenna connectors
EC25N	ExpressCard (EC) with integrated antennas
SSD45N	Miniature SDIO module
MSD45N	Miniature SDIO module with antenna connectors
802.11n Wi-Fi and Wi-Fi/BT radios (Supports 802.11a, 802.11g, and 802.11n)	
MSD40NBT	Enterprise-grade dual-band 802.11n and Bluetooth in a pluggable module
SSD40NBT	Enterprise-grade dual-band 802.11n and Bluetooth in a SiP module

Each Laird radio enables a computing device to communicate to a computing network using either the IEEE 802.11a, 802.11b, 802.11g, or 802.11n protocols. The hardware components and software for all related Laird radios are the same. For example:

- The 25N version is a 15N version with integrated antennas.
- The miniature SD version is essentially the SSD version with a different layout and a different (Molex) connector.

For an overview of all Laird products, see <http://www.lairdtech.com/product-categories/embedded-wireless>.

LAIRD SOFTWARE

Overview

Laird software is a set of integrated components that includes:

- A device driver which controls the operation of the radio on the device
- An 802.1X security supplicant which handles authentication and encryption key management
- Utilities, such as the administrative applications called the Summit Client Utility (SCU) and Laird Connection Manager (LCM)
- A software developer's kit (SDK) for these utilities

Laird develops and supports its software on the following Microsoft operating systems:

- Windows Embedded CE 6.0 (R1, R2, and R3), and 5.0
- Windows Mobile 6.5, 6.1, 6, and 5.0
- Windows Embedded Compact 2013 and 7
- Windows 8, 7, and XP Professional and Embedded

Note: The SDC-PE15N, and the SDC-EC25N radios are for use with Windows XP, Windows 7, and Windows 8 operating systems. All other radios are for use on one or more flavours of Windows CE.

About LCM and SCU

LCM and SCU are designed for end users and administrators of mobile devices that use a Laird radio module. They may be used to create a per network configuration profile containing Wi-Fi settings such as the SSID, or to create global settings which apply to all profiles. For a complete list of configuration settings, see the Laird Connection Manager Administrators Guide. It can be accessed from the Software Download page of any applicable product.

Although SCU and LCM provide a GUI for access to all of their functions, access to these functions is also available through a Wi-Fi SDK. A Laird customer can use the SDK to manage the radio from another utility, such as one that the customer provides with its mobile devices.

About LRU and SCU

The Laird Regulatory Utility (LRU), the successor to the Summit Regulatory Utility (SRU), enables you to conduct regulatory domain tests that require continuous receive, continuous transmit, and continuous wave (CW) frequency, by placing the Laird radio into a special test mode.

Laird offers LRU only to its direct customers:

- Device manufacturers that use embedded Laird radios in their devices or offer Laird radios as device options.
- Value-added distributors that must configure Laird radios for resellers and end-customers.

About LMU and SMU

The Laird Manufacturing Utility (LMU), the successor to the Summit Manufacturing Utility (SMU), enables device manufacturers to set certain permanent manufacturing time settings.

Note: The Laird Manufacturing Utility will be required for regulatory testing if it is necessary to adjust the radio's maximum transmit power levels.

LAIRD REGULATORY UTILITY

Overview

This guide is for LRU running on all supported Microsoft Windows platforms. To use LRU in a computing device, you must first verify that the following steps have been performed:

1. The Laird software is installed on a mobile computing device that runs a supported operating system.
2. The Laird radio is installed and properly connected.
3. The LRU application is installed on the device.

We recommend that you verify the steps above were done in the order shown, otherwise you may be unable to perform the regulatory tests. The order of these steps is important for all devices but especially important on Windows XP and 7.

For example, on Windows XP or 7, if you insert the radio in your device before you install the software, then the operating system may flag the radio as *unknown* and displays the “Found New Hardware Wizard” screen, or it may install a default device driver in place of the Laird device driver; if this should happen you must click **Cancel** to cancel the Hardware Wizard, or uninstall the default driver using Windows device manager.

Compatible Driver Versions

Laird strives to make all of its software backwards compatible, but sometimes it’s not possible. Laird has attempted to ensure that the following driver versions and newer have been tested and are compatible with LRU v47.3.2.8.

- 15 Series NDIS 5: 3.4.0.33 and newer
- 15 Series NDIS 6: 3.4.0.46 and newer
- 30 Series: 3.5.0.8 and newer
- 40 Series: 36.3.5.26 and newer
- 45 Series: 3.5.2.26 and newer

Regulatory Compliance

To comply with FCC RF exposure compliance requirements, each antenna used with a Laird radio module must be installed with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

The User Guide for the device that embeds or otherwise uses a Laird radio should **not** provide information on how to install a radio module within a device or remove an installed radio module from a device.

Each device is labeled with all applicable regulatory information in a manner that’s compliant with all regulatory standards. Regulatory operational requirements are included with this document and are to be incorporated into the operating manual of any device into which the Laird radio is installed. For complete regulatory information, see the Hardware Integration Guide for the applicable radio, available from the Documentation tab of each product page at lairdtech.com.

Installing Laird Software

Windows CE, Windows Mobile, or Windows Compact Embedded

In most cases, the device manufacturer builds the Laird software into the OS image for Windows CE, Windows Mobile, or Windows Compact Embedded. Therefore, the software installation and update process is decided by the manufacturer. Some manufacturers may flash a new OS images, while others may use custom built *.cab* files to install or update the software in question. Since each manufacture’s process is unique, if you find yourself in the position where the Laird software is not installed, contact the device manufacturer for the steps to install or update the Laird software.

Windows XP, 7 and 8

On Windows XP, 7, and 8, if the manufacturer has not pre-installed the Laird software and they have not locked down the system, it may be possible to install the Laird software using Microsoft’s Windows Installer. The

Windows Installer uses a special database package, called an MSI package, to install and configure Windows drivers and applications. An MSI package contains all the software components, including the device driver and other utilities such as SCU or LCM.

Note: Prior to installing the radio, use Windows Device Manager to uninstall any Laird, Summit, Atheros, or Broadcom radio drivers currently installed on your computer.

To install the Laird software, perform the following tasks:

- Download the appropriate MSI package for the operating system of your device.
- Double click on the installation package to launch the installation wizard.
- Click **Next** on the initial welcome screen.
- Specify the folder in which Laird software is installed and click **Next**.
- Click **Install** to complete the installation process.

You can use the same setup wizard to uninstall or upgrade Laird software.

Installing the Radio

Once you have installed the Laird software, you must verify that the Laird radio card or module is installed and connected properly. The process to do this varies with the module being installed. For example, to install an EC25 Series radio card, you simply insert the card in an external card slot. To install all other radio modules, you must complete two types of connections:

- **Module to device** – Mate a connector on the end of the module to a connector on the device.
- **Antenna(s) to module** – Use an antenna cable that mates with the antenna on one end and with the radio module’s U.FL connector on the other end.

The standard approach is to first install the module in the device and then connect the antenna(s). However, if the antenna connectors on the radio are not visible when the radio is installed, then you must connect the antenna(s) before installing the radio.

To install the radio, insert the card into the device until the CF, PCMCIA, SD, PCIe, or Molex connector mates with a connector on the device.

To connect one or more antennas, attach the antenna cable (fitted with a Hirose U.FL connector) to the radio module by mating the U.FL connector with a U.FL connector on the radio module.

Detailed instructions are available in each device’s Hardware Integration Guide. For convenience, the following sections summarize the installation process for each of Laird’s currently supported radios.

Summit 30AG Radio Module

For a Summit 30AG radio module, connect the primary (or only) antenna to the **Main** connector (**J3**) which is located nearer to the edge of the card. If there is a second antenna, connect it to the auxiliary antenna connector (**J2**) which is located nearer to the center of the card.



Summit 40NBT Radio Module

The Summit 40NBT radio module provides two unique U.FL type antenna connectors to allow for diversity support when operating in 802.11a, 802.11b and 802.11g modes, and 2 x 2 MIMO support when operating in 802.11n mode. Connect the primary (or only) antenna to the **Main** connector (**J3**), which is located nearer the edge of the card. If there is a second antenna located nearer to the center of the card, connect it to the **Auxiliary** antenna connector (**J2**).



Summit 45N Radio Module

For a Summit 45N radio module, connect the primary (and only) antenna to the **Main** connector (**J1**) which is located nearer to the middle of the card.



Summit PE15N Radio Module

The Summit PE15N provides two unique U.FL type antenna connectors to allow for diversity support when operating in 802.11a, 802.11b and 802.11g modes, and 2 x 2 MIMO support when operating in 802.11n mode. Connect the primary antenna to the **Main** connector (**J1**) which is located near the right edge of the card. Connect the secondary antenna to the **Auxiliary** connector (**J2**) which is located near the left edge of the card.



USING THE LAIRD REGULATORY UTILITY

Installing LRU to the device

Identify the appropriate *lru.exe* file for the operating system and processor of your device. Download the file and copy it to your device using a supported file transfer mechanism.

Note: Once you have finished using LRU, you **must** remove LRU from the device. LRU is only for use by manufacturers who embed Laird radios in their devices. Manufacturers may **not** redistribute LRU.

Removing LRU from the device

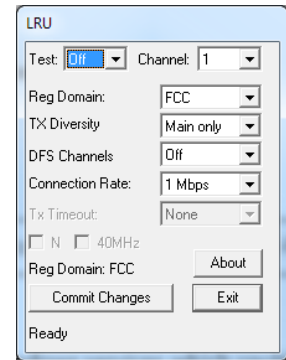
LRU is designed exclusively for OEM manufacturers who embed Laird radios in their products and not for device end-users or administrators. Once you have used LRU to complete regulatory testing, you **must** remove LRU from the device. To do so, simply erase the file *lru.exe*.

Operating the LRU

When LRU runs, it puts the radio into a special mode in order to perform tests for regulatory domain exercises. These regulatory tests require continuous transmit, continuous receive, and continuous wave (CW) frequency.

To run LRU, use File Explorer or Windows Explorer to locate the *LRU.exe* file. Tap or double click the file to execute it. When LRU is ready to run regulatory tests, the screen shown on the right will show the status 'Ready' at the bottom as shown. Use the Test drop-down menu to select the applicable test:

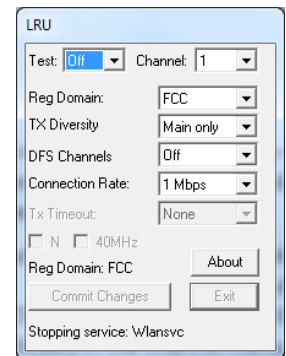
- Tx – Continuous transmit test
- Rx – Continuous receive test
- Freq – Continuous wave frequency test
- Off – Device is out of testing mode



Note: Continuous wave (CW) frequency is not available for the SDC-PE15N *NDIS5* driver.

During start-up, LRU may stop certain Windows services which could interfere with the regulatory tests. If LRU does so, it will restore them to their original running state when LRU exits. The status at the bottom of LRU will display which services are being stopped, as shown, and may include all or a subset of the following:

- Summit 802.11 Supplicant
- Laird 802.11 Supplicant
- Laird Auto Connection Services
- Windows Connect Now
- Windows Defender
- Windows Firewall
- WLAN Auto Config
- Wireless Zero Config



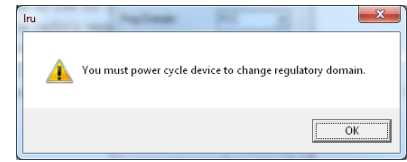
Depending on the radio being tested, there may be one or more drop-down menus available in addition to the Test drop-down menu. You may use these menus to **temporarily** override the manufacturer's settings. LRU will restore these settings to their initial values when LRU exits.

Which drop-down menus are enabled and the set of parameters selectable in each drop-down depends on the radio under test and the configuration parameters set. For example, if the radio does not support 'N' rates, the Connect Rates drop-down menu will not include the MCS entries and the 40MHz check box will be disabled. If DFS channels are disabled, these channels will not be included in the channel drop-down menu.

Use the drop-down menus to modify the following settings:

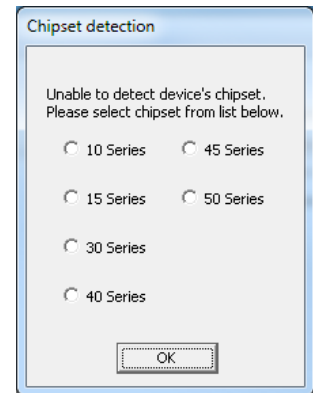
- Channel – Selects the 802.11 channel to run the regulatory test on
- Connection Rate – Select the data rate to use for the continuous transmit test
- Reg Domain – Temporarily changes the radio's regulatory domain
- TX Diversity – Temporarily changes the TX antenna configuration
- DFS Channels – Temporarily changes the DFS channel set
- 40 MHz – When a .11N connection rate is selected, this check box requests that the channel used is a 40 MHz wide channel

Note: For certain radios, changing some of the configuration settings, such as DFS channels or regulatory domain, may result in LRU prompting to “Power Cycle the Device”. If this should occur during testing, tap OK and then power cycle the device so the driver is reloaded. During this time LRU will pause the test and display the status message ‘Waiting on device reload’.



Chipset Detection

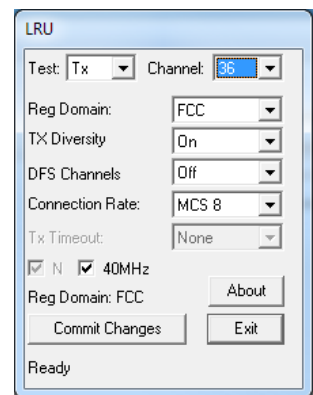
When starting, LRU attempts to automatically detect the radio’s chipset. If LRU is unable to do so it will display the dialog to the right. If this dialog appears, select the chipset series for the radio under test and tap **Ok**.



Running Your First Test

When you configure your first test and tap **Commit Changes**, LRU may display the following message: “Power Cycle Device to put it into test mode”. Cycling the power is required because the Laird driver checks if it should run in test mode at device power-up. When prompted to power cycle the device, tap **Ok** to continue, then power-cycle the device. LRU will automatically pause the test and wait for the driver to reload and confirm the device is in test mode before beginning the test.

Your first test will continue running until you start a new test or take the device out of test mode. You may start a new test by configuring the test on the SRU window and tapping **Commit Changes**.



Running Subsequent Tests

Once LRU is running a test, the most reliable way to start a new test is to do the following:

1. Take the device out of test mode by selecting **Off** for the test and tapping **Commit Changes**.
2. Configure the new test parameters.
3. Tap **Commit Changes**.

Performing these steps allows LRU, the driver, and radio firmware to ‘resync’ in between tests.

Notes on LRU

This section includes helpful information on using LRU.

- If prompted to “Power Cycle the Device”, it is best to hit “OK” **before** you initiate the power cycle, otherwise LRU may not properly detect that the driver has reloaded. If you find yourself in the situation where LRU failed to detect that the driver reloaded, you may hit exit to stop the current test and exit LRU. After exiting you should power cycle the radio before relaunching LRU.
- SCU or LCM will display a status of “FCC Test Mode” while LRU is running tests.
- LRU displays the currently active regulatory domain, which may be a temporary domain set by LRU to override the manufacturing domain for testing purposes. This domain setting will not ‘stick’ once LRU exits. The only way to permanently set the regulatory domain is by using the Laird Manufacturing Utility (LMU).
- LRU does not provide a mechanism to adjust the maximum power settings. This can only be adjusted using the Laird Manufacturing Utility (LMU).
- During transmit tests, LRU assumes that the card is capable of operating on all channels regardless of the regulatory domain. If for any reason the radio is unable to transmit on the requested channel, the radio may choose to use default values or ignore the request and do nothing. For example, if you select channel 12 but your radio is configured for the FCC domain, then the test won’t work; your radio must be configured for ETSI or TELEC to use channel 12.
- 802.11N rates MCS 8-15 require two antennas in order to achieve the correct data rates. Therefore these rates will not be selectable if the radio does not support two antennas or if TX diversity is set to main or auxiliary.
- On some devices, there isn’t a way to suspend/resume the device and cause the radio device driver to power cycle (i.e. reload the radio driver); instead the user must actually power down the entire device. In this scenario the full power down will cause LRU to exit and the user will need to relaunch LRU upon boot-up. This exiting and relaunching of LRU can cause LRU to get confused about its current state. To overcome this, add the registry key HKLM\Software\Laird\LRU\HardReset; set it to a value of 1 before launching LRU.
- It is not necessary to select **Off** between tests; the test, channel, rate, or any other parameter may be changed at any time (click **Commit Changes** to apply the settings and run the test). However the most reliable way to run the test is to turn off the current test by selecting **Off** (click **Commit Changes**) before running a subsequent test. This allows LRU, the driver, and radio firmware to ‘resync’ in between tests.