WLAN AND BLUETOOTH RADIO TOOLS USER GUIDE

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1 Introduction

1.1 Purpose & Scope

The purpose of this document is to describe the software tools available to test the WLAN and Bluetooth radios that are embedded within certain LSR modules. Also described in this document is what hardware requirements are necessary in the TiWi-R2, TiWi-BLE, TiWi5, TiWi-SL, TiWi-uB2, and TiWi-uB1 host boards to use these tools. Note that not all sections pertain to all modules.

1.2 Applicable Documents

- TiWi-R2 Datasheet 330-0045
- TiWi-BLE Datasheet 330-0087
- TiWi5 Datasheet 330-0042
- TiWi-SL Datasheet 330-0085
- TiWi-uB2 Datasheet 330-0100
- TiWi-uB2 EM Board User Guide 330-0104
- TiWi-uB1 Datasheet 330-0132
- TiWi-uB1 EM Board User Guide 330-0134

1.3 Revision History

Date	ECN	Change Description	Revision
9/26/2011	-	Initial release	1.0
6/8/2012	-	Updated information for new tools. Added hardware info.	2.0
8/14/2013	87-2013	Added TiWi-uB1 info	3.0

Table 1 Revision History

2 Using TiWi Test Modes with Host Processor

Note that this section only applies to TiWi-R2, TiWi-BLE, and TiWi5.

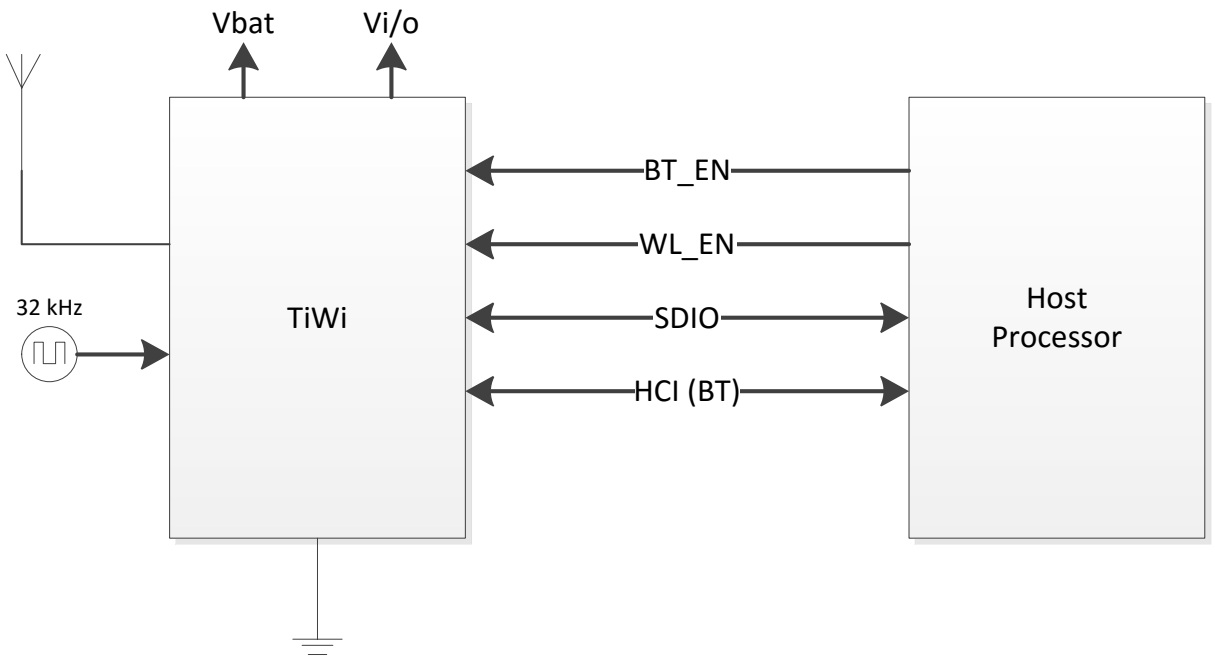

Figure 1 TiWi to Host Processor Connections

2.1 WLAN

The current TI Wiki page is dated October 2010 – TI will be updating this page to include additional information on APIs to invoke WLAN Test Modes.

http://processors.wiki.ti.com/index.php/OMAP35x_Wireless_Connectivity_PLT_Recommendations

WLAN Continuous Transmit http://processors.wiki.ti.com/index.php/WL127x_TX_Testing

WLAN Constant Receive http://processors.wiki.ti.com/index.php/WL127x_RX_Testing

2.2 Bluetooth

Bluetooth FCC Modes
http://processors.wiki.ti.com/index.php/Bluetooth_FCC_Mode

Bluetooth RF SIG Mode http://processors.wiki.ti.com/index.php/Bluetooth_RF_SIG_Mode

3 Hardware Requirements for LSR Tools

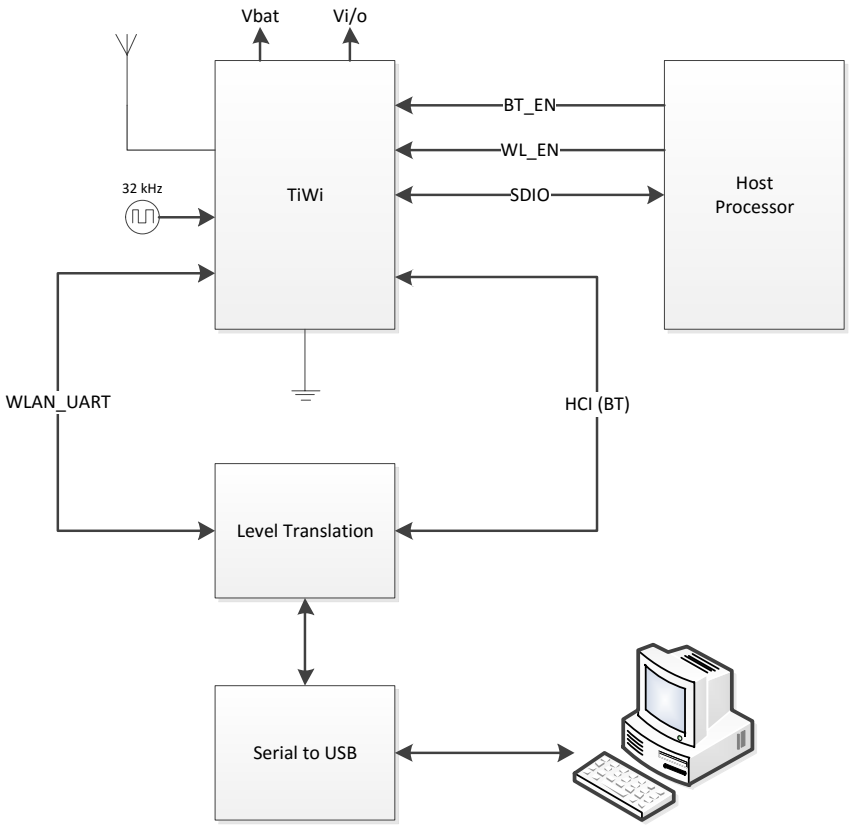

Figure 2 General Connection Diagram

3.1 USB to Serial Conversion

A UART connection to the module is needed to put both the WLAN and Bluetooth radios into test modes. The most common way to do this is with a USB to serial converter such as offered by FTDI (http://www.ftdichip.com/).

3.2 Level Translation

The UART I/O on the module operates at 1.8V DC, but the USB-to-Serial converters commonly run at 3.3V DC, therefore level translation is needed. LS Research has used a Fairchild 74VCX164245MTD for voltage translation on past designs successfully.

A 1.8V FTDI USB-to-Serial cable can be used in order to eliminate the need for level shifter circuitry.

FTDI 1.8V TTL USB-to-Serial cable (TTL-232RG-VREG1V8-WE):
http://www.ftdichip.com/Products/Cables/USBTTLSerial.htm

3.3 TiWi-R2 / TiWi-BLE / TiWi5

The TiWI-R2, TiWi-BLE, and TiWi5 modules have a pin for pin compatible footprint.

3.3.1 TiWi-R2, TiWi-BLE, and TiWi5 Power and Clock Connections

Pin Number	Pin Description	Connect To
1	VBAT	3.3V DC
11	VIO	1.8V DC
19	SLOW_CLK	32.768 kHz clock
12,30,44-47,49-56	GND	GND

Table 2 TiWi-R2, TiWi-BLE, and TiWi5 Power and Clock Connections

The power-up sequence diagram in the corresponding module datasheet must be followed.

3.3.2 TiWi-R2, TiWi-BLE, and TiWi5 WLAN Connections

Pin Number	Pin Description
7	WL_RS232_RX
8	WL_RS232_TX
10	WL_EN

Table 3 TiWi-R2, TiWi-BLE, and TiWi5 WLAN Connections

The WLAN Enable pin (WL_EN) must be properly asserted per the power-up sequence diagram in the corresponding TiWi datasheet.

3.3.3 TiWi-R2, TiWi-BLE, and TiWi5 Bluetooth Connections

Pin Number	Pin Description
34	HCI_RX
35	HCI_RTS (Optional)
36	HCI_TX
39	HCI_CTS (Optional)
5	BT_EN

Table 4 TiWi-R2, TiWi-BLE, and TiWi5 Bluetooth Connections

The Bluetooth Enable pin (BT_EN) must be properly asserted per the power-up sequence diagram in the corresponding TiWi datasheet.

3.3.4 Sharing the HCI Port for Bluetooth

The Bluetooth HCI port needs to be shared between the host processor or microcontroller, and the Bluetooth Eval Tool (PC). Provisions need to be in place on the printed circuit board to prevent contention between the PC's UART and the host's UART. There are various ways this could be implemented; a simple method that may work in some applications is to use resistor population options to disconnect the unused port.

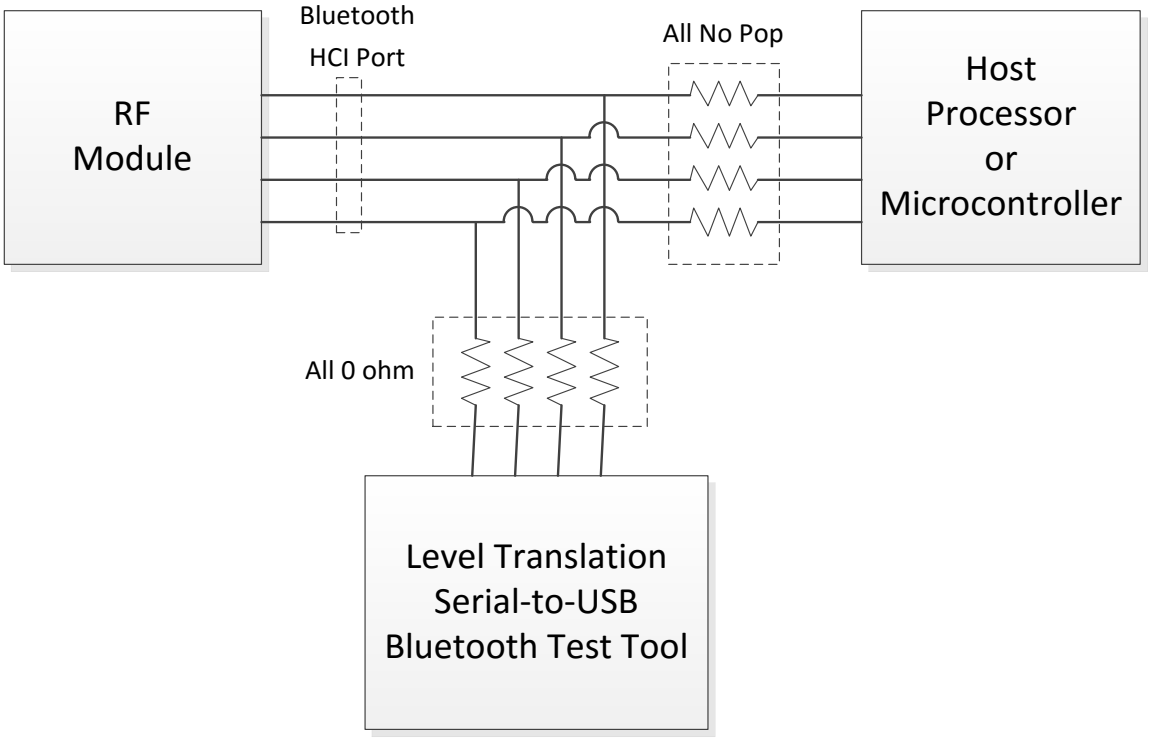

Figure 3 Sharing HCI Port for Bluetooth

3.4 TiWi-SL

The TiWi-SL module is an 802.11b/g capable module; therefore there is no Bluetooth interface.

3.4.1 TiWi-SL Power Connections

Pin Number	Pin Description	Connect To
15	VCC	2.9 - 3.6 VDC
1,11,12,14,16,17,23,24,27,32-35,37-44	GND	GND

Table 5 TiWi-SL Power and Clock Connections

3.4.2 TiWi-SL WLAN Connections

Pin Number	Pin Description
9	UART_RX
7	UART_TX
5	MODE1
8	MODE2
13	PWR_EN

Table 6 TiWi-SL WLAN Connections

See the TiWi-SL datasheet for details on how to connect the MODE1 and MODE2 pins for test mode or normal operation.

3.5 TiWi-uB2

The TiWi-uB2 module is a Bluetooth Smart Ready (Bluetooth 4.0 + EDR) module; therefore it has no WLAN interface.

3.5.1 TiWi-uB2 Power and Clock Connections

Pin Number	Pin Description	Connect To
12	VBAT	3.0 – 4.8V DC
18	VDD_IO	1.8V DC
8	SLOW_CLK_IN	32.768 kHz clock
5-7,9,13,15,17,25-33	GND	GND

Table 7 TiWi-uB2 Power and Clock Connections

3.5.2 TiWi-uB2 Bluetooth Connections

Pin Number	Pin Description
3	HCI_RX
4	HCI_RTS (Optional)
2	HCI_TX
1	HCI_CTS (Optional)
16	nSHUTD

Table 8 TiWi-uB2 Bluetooth Connections

The Bluetooth enable pin (nSHUTD) must be properly asserted per the power-up sequence diagram in the TiWi-uB2 datasheet.

NOTE: See section 3.3.4 for sharing the HCI interface port.

3.6 TiWi-uB1

The TiWi-uB1 module is a Bluetooth Smart (Bluetooth 4.0 BLE) module; therefore it has no WLAN interface.

In order to use the HCI interface the TI HostTestRelease App must be flashed into the TiWi-uB1 module. See the TI BLE Stack for more information.

3.6.1 TiWi-uB1 Power and Clock Connections

Pin Number	Pin Description	Connect To
11	AVCC	2.0 – 3.6V DC
12	DVCC	2.0 – 3.6V DC
4,5	XOSC32K	32.768 kHz clock
2,3,22,33-39	GND	GND

Table 9 TiWi-uB1 Power and Clock Connections

3.6.2 TiWi-uB1 Bluetooth Connections

Pin Number	Pin Description
30	HCI_RX
27	HCI_RTS
29	HCI_TX
28	HCI_CTS
6	Reset

Table 10 TiWi-uB1 Bluetooth Connections

NOTE: See section 3.3.4 for sharing the HCI interface port.

4 Using LSR Tools to Invoke Test Modes

4.1 Obtaining the LSR Software

4.1.1 TiWi Bluetooth Evaluation Tool (LSR Part Number 930-0030)

The TiWi Bluetooth Evaluation Tool can be obtained from the TiWi Page on the LSR wiki. Note that this tool is used for not only the TiWi modules, but also the TiWi-uB2 and TiWi-uB1 Bluetooth modules.

4.1.2 TiWi WLAN Evaluation Tool (LSR Part Number 930-0019)

The TiWi WLAN Evaluation Tool can be obtained from the TiWi Page on the LSR wiki.

4.2 Using the Software

4.2.1 TiWi Bluetooth Evaluation Tool

To use the TiWi Bluetooth Eval Tool effectively, the user must use the tool in this order:

1. Connect to the module on the specified COM port
2. Load the appropriate patch file into the module
3. Evaluate constant transmit or constant receive

4.2.1.1 Connecting to the Module Bluetooth Port

Open the tool, select the desired COM port, and press the connect button. Upon connecting to the Bluetooth device successfully, an appropriate message will be displayed.

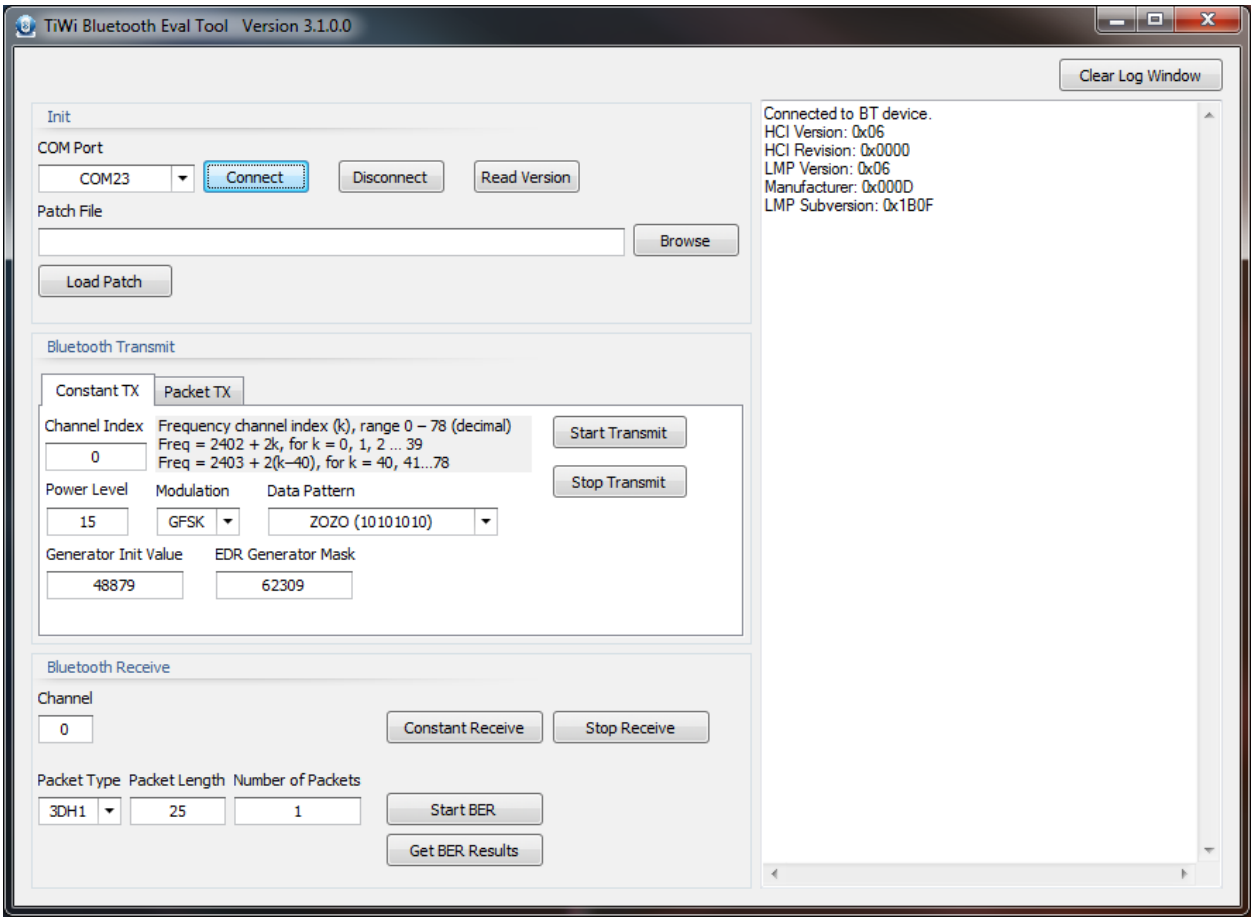

Figure 4 Bluetooth Device Connected Successfully

NOTE: The serial communication between the PC tool and the module runs at 115,200 baud.

4.2.1.2 Loading the Bluetooth Patch

NOTE: The TiWi-uB1 module does not need a patch

To load the Bluetooth patch into the module, the user can type the patch file path in or use the browse button to select the patch file. An appropriate patch file will have an .hci extension. Once the patch file is selected, the user can click the "Load Patch" button and the patch will be loaded into the module. Depending on the size of the patch, this can take several seconds.

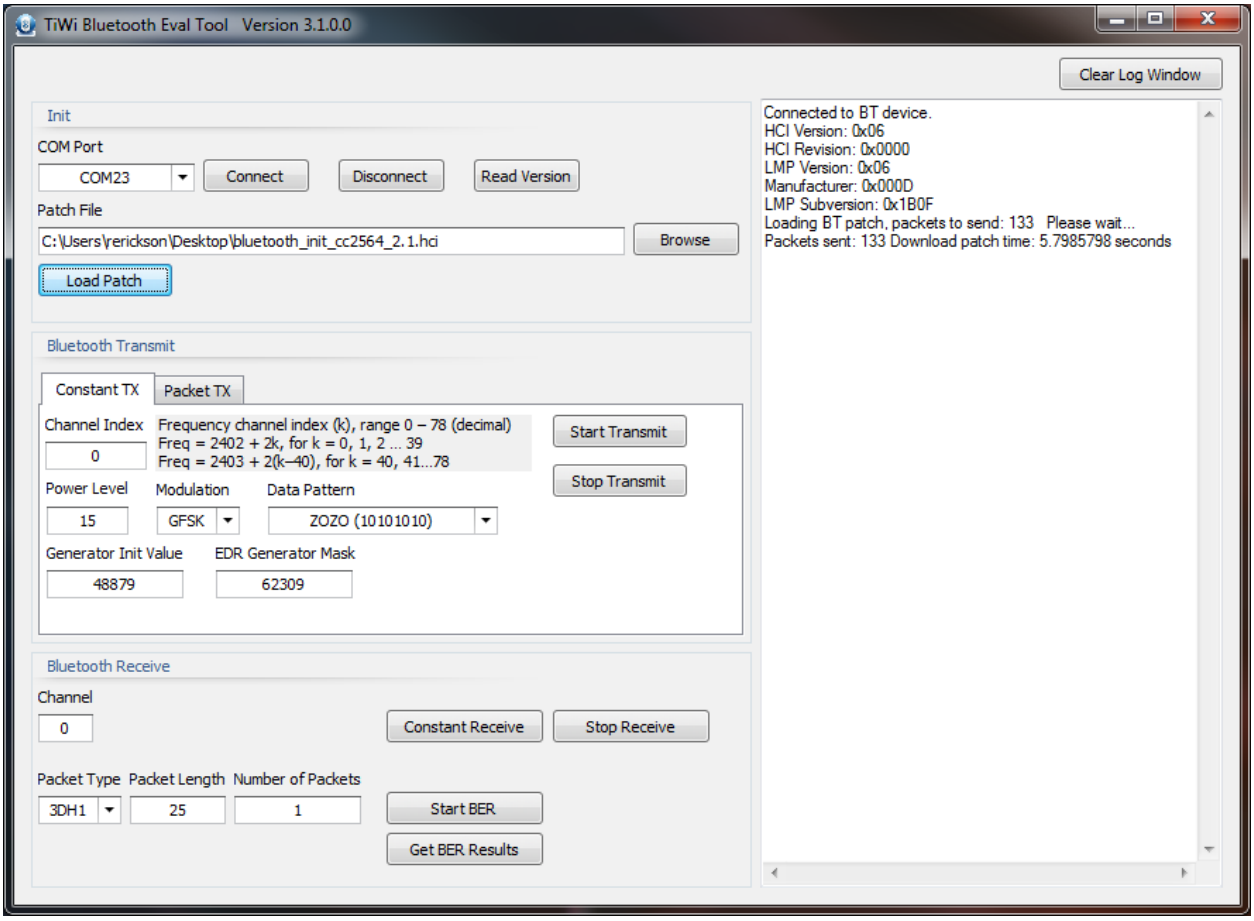

Figure 5 Bluetooth Patch Loaded Successfully

Once the patch is loaded, the tool can be used to evaluate the constant transmit or receive characteristics of the module.

4.2.1.3 BLE Packet TX Tab

This tab only applies to the TiWi-BLE, TiWi5, and TiWi-uB2 modules. It allows the user to control BLE transmit modes.

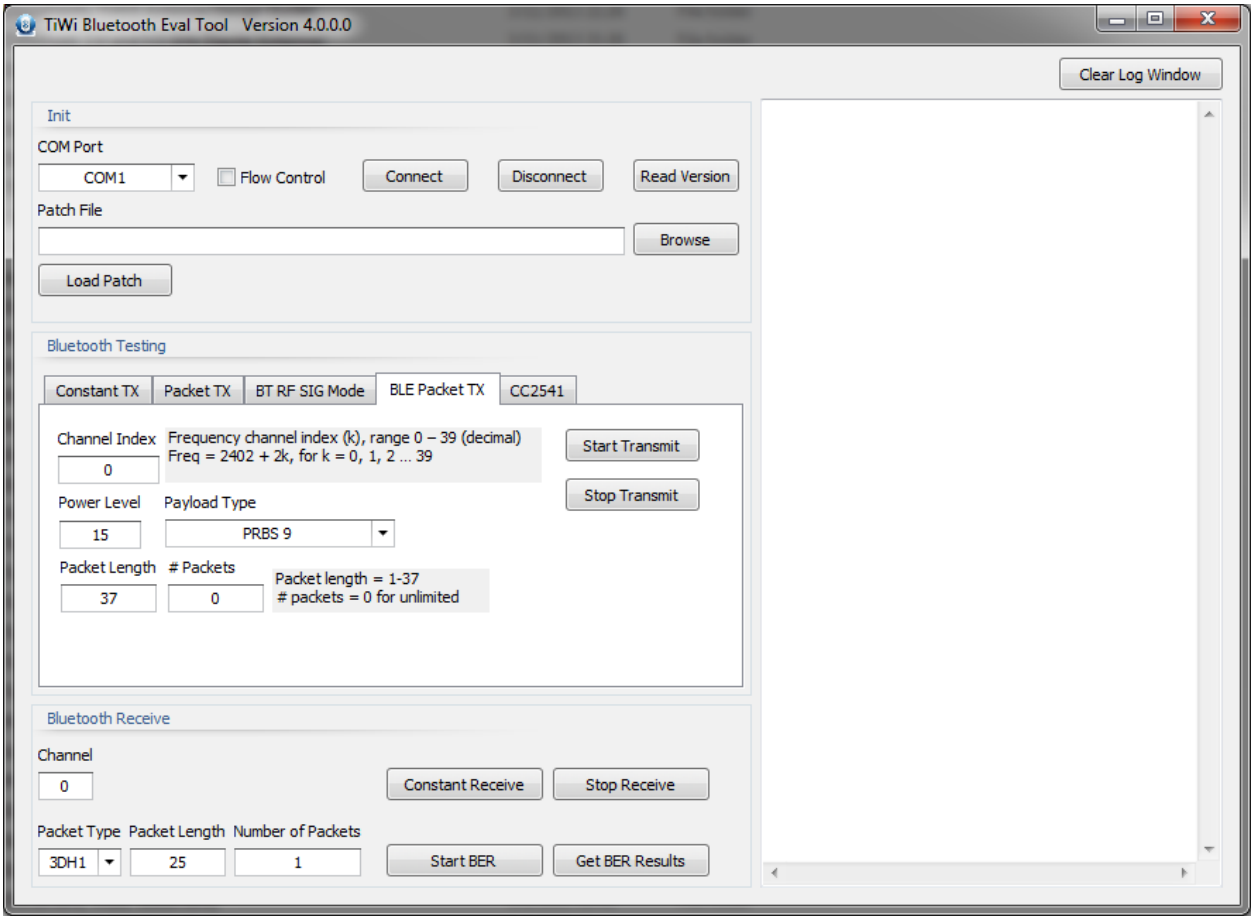

Figure 6 BLE Packet TX Tab

4.2.1.4 TiWi-uB1 Control

After connecting to the TiWi-uB1 there is a CC2541 tab in the Bluetooth Eval Tool that will allow the user to control the TiWi-uB1 test modes. This is the only tab used to control the TiWi-uB1.

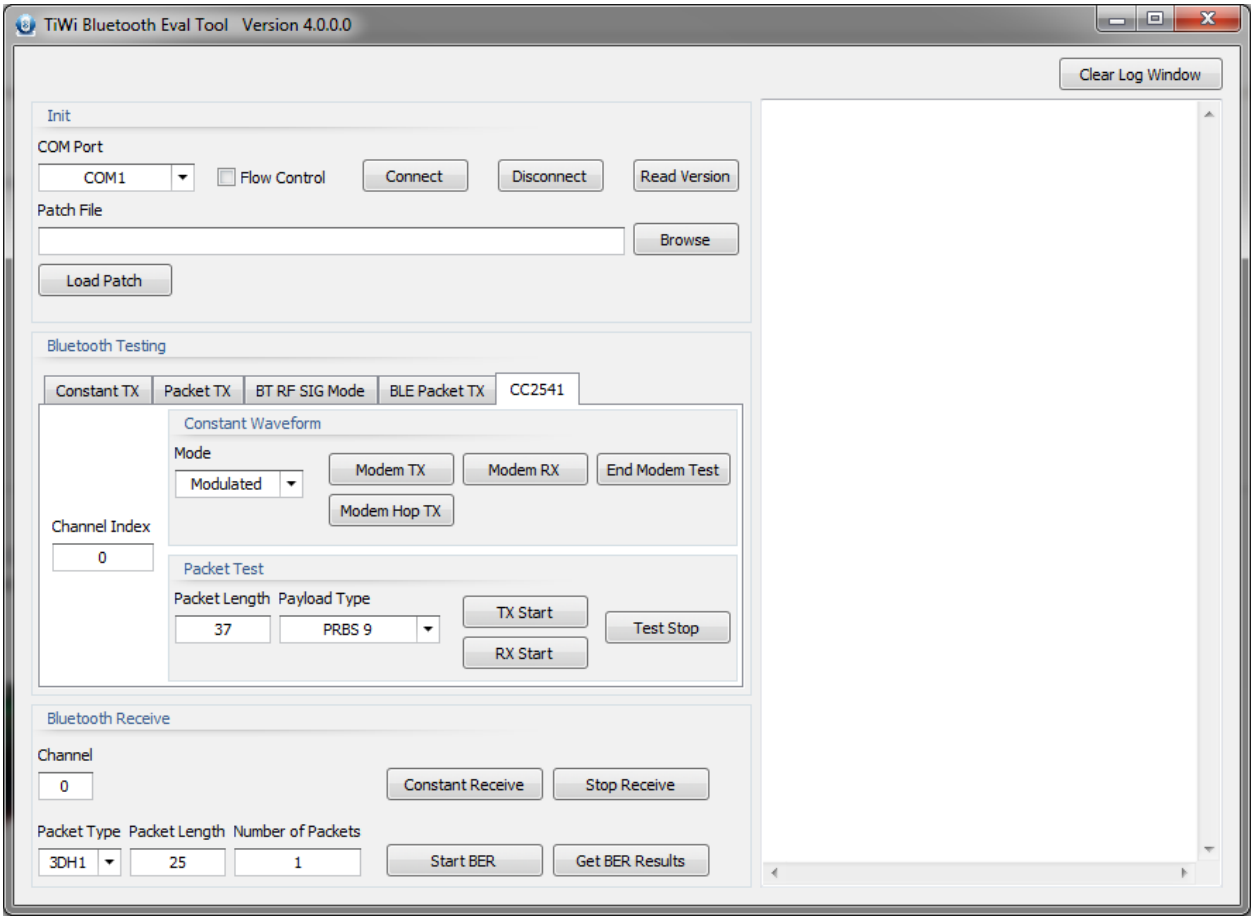

Figure 7 TiWi-uB1 RF test modes

4.2.2 TiWi WLAN Evaluation Tool

To use the TiWi WLAN Eval Tool effectively, the user must use the tool in this order:

1. Connect to the module on the specified COM port
2. Load the appropriate firmware into the module
3. Run a transmit BIP calibration so accurate transmit levels are reached
4. Evaluate constant transmit or constant receive

4.2.2.1 Connecting to the TiWi WLAN Port

Open the tool and select the desired COM port and baud rate. A valid INI file must be chosen before attempting to connect. Once an INI file is selected, the "Connect" button can be clicked.

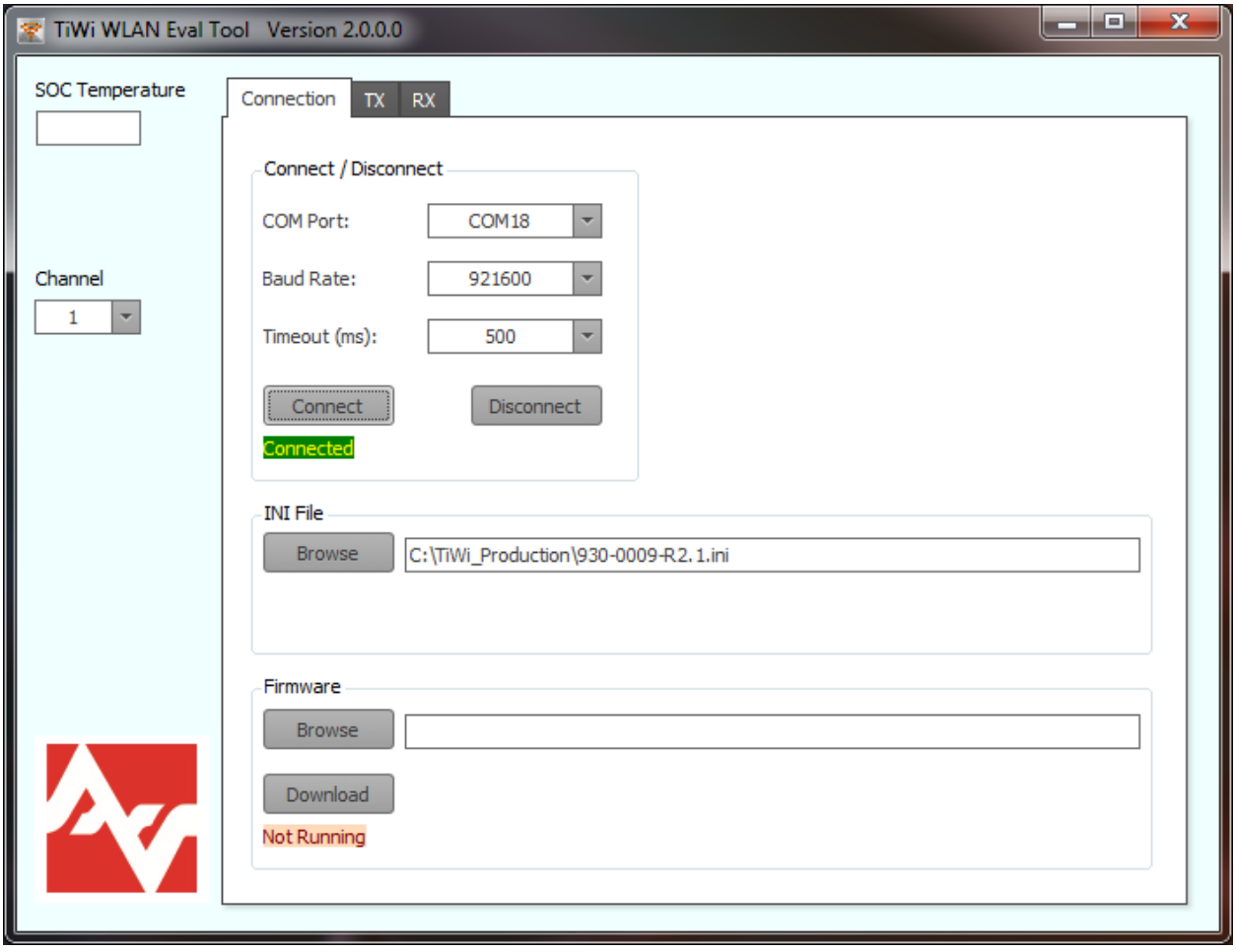

Figure 8 Connected to WLAN Successfully

4.2.2.2 Loading the WLAN firmware

The user must select the desired firmware file and then click the “Download” button.

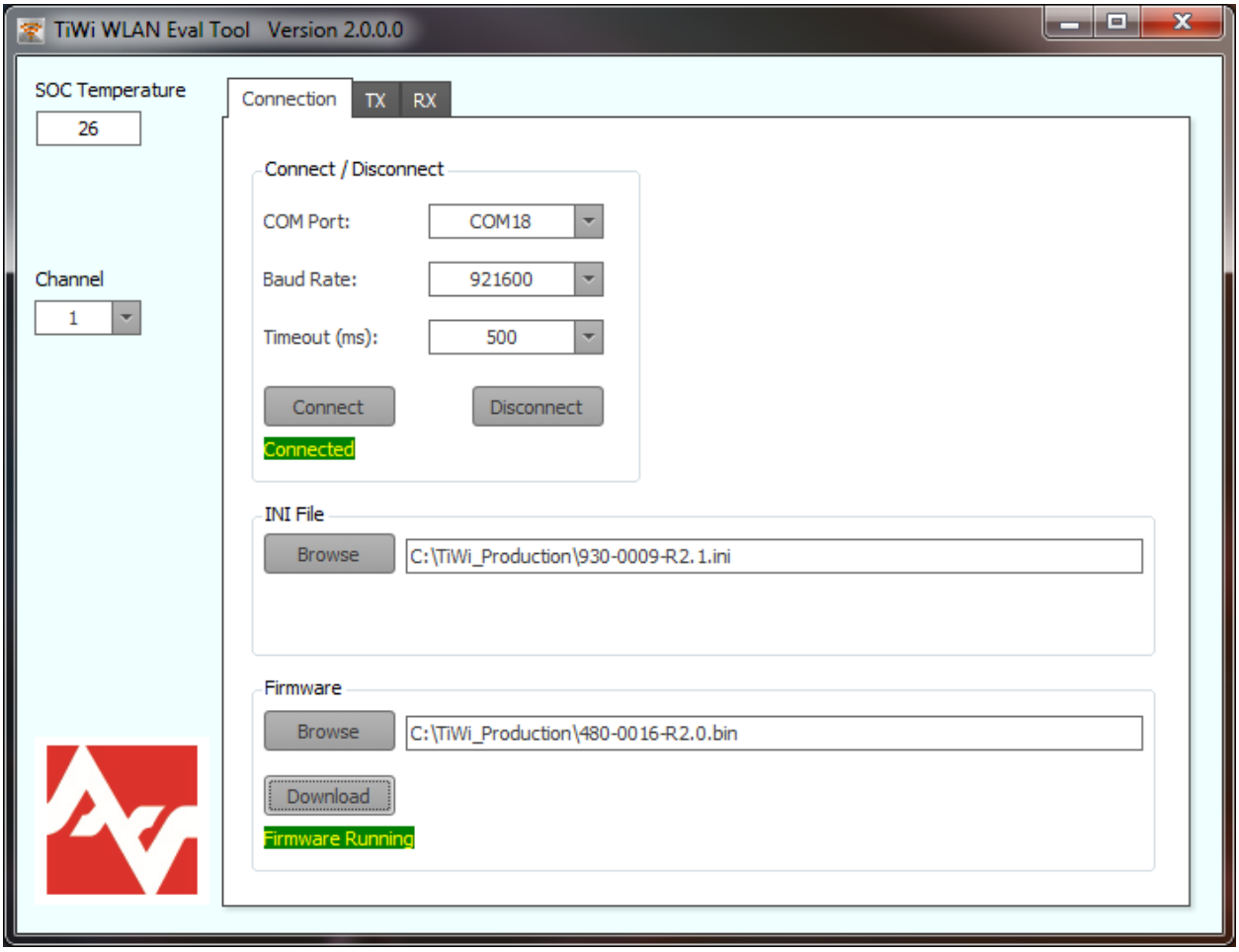

Figure 9 WLAN Firmware Loaded Successfully

4.2.2.3 Running TX BIP (Transmit calibration)

To run the TX BIP, the user must navigate to the TX tab of the tool and click the “Run TX BIP” button. The calibration will complete in a second or two and if no error is displayed the calibration has completed successfully.

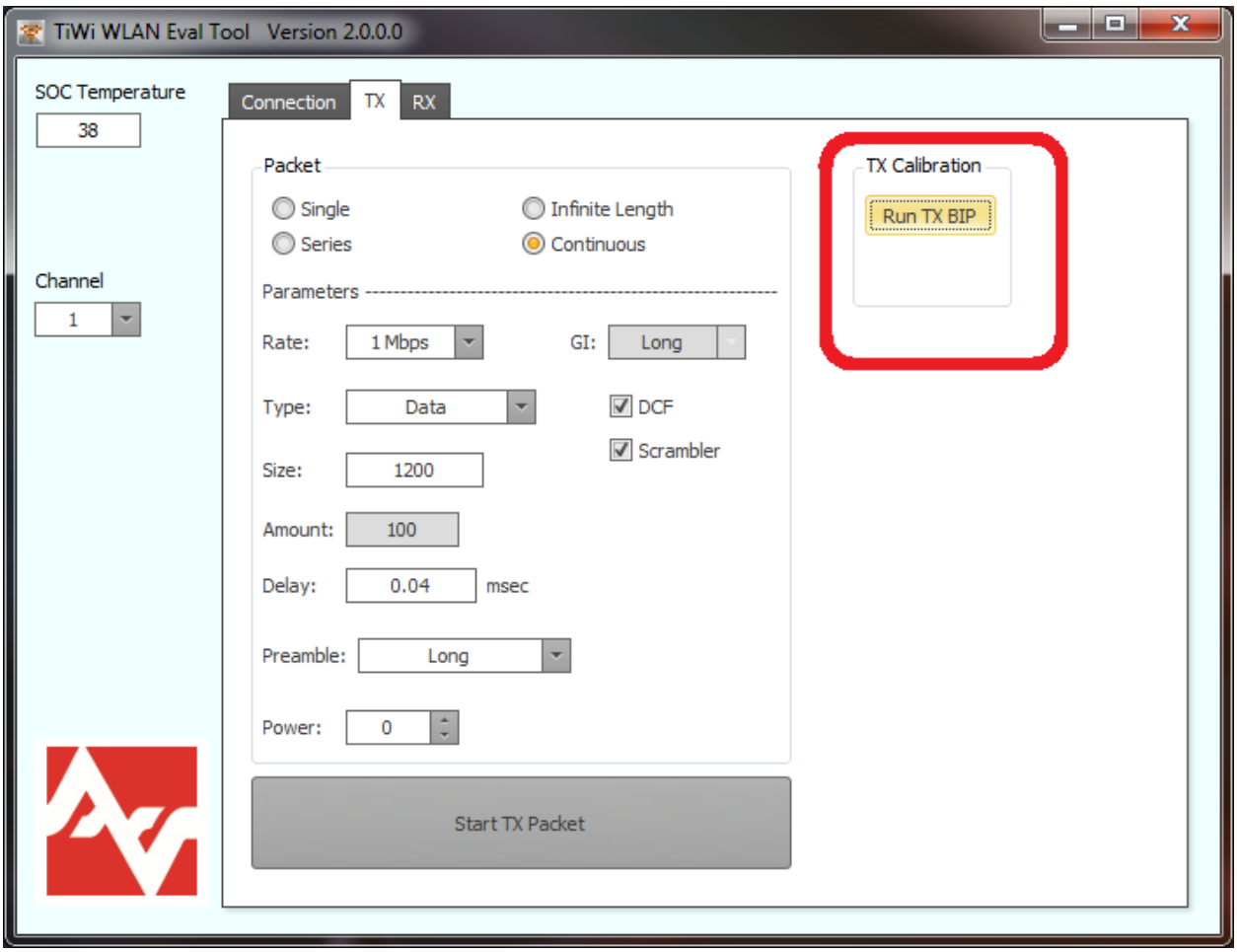

Figure 10 TX BIP Button

4.2.2.4 Evaluating WLAN TX and RX

The Transmit and Receive characteristics of the module can be evaluated using the TX and RX tabs respective.

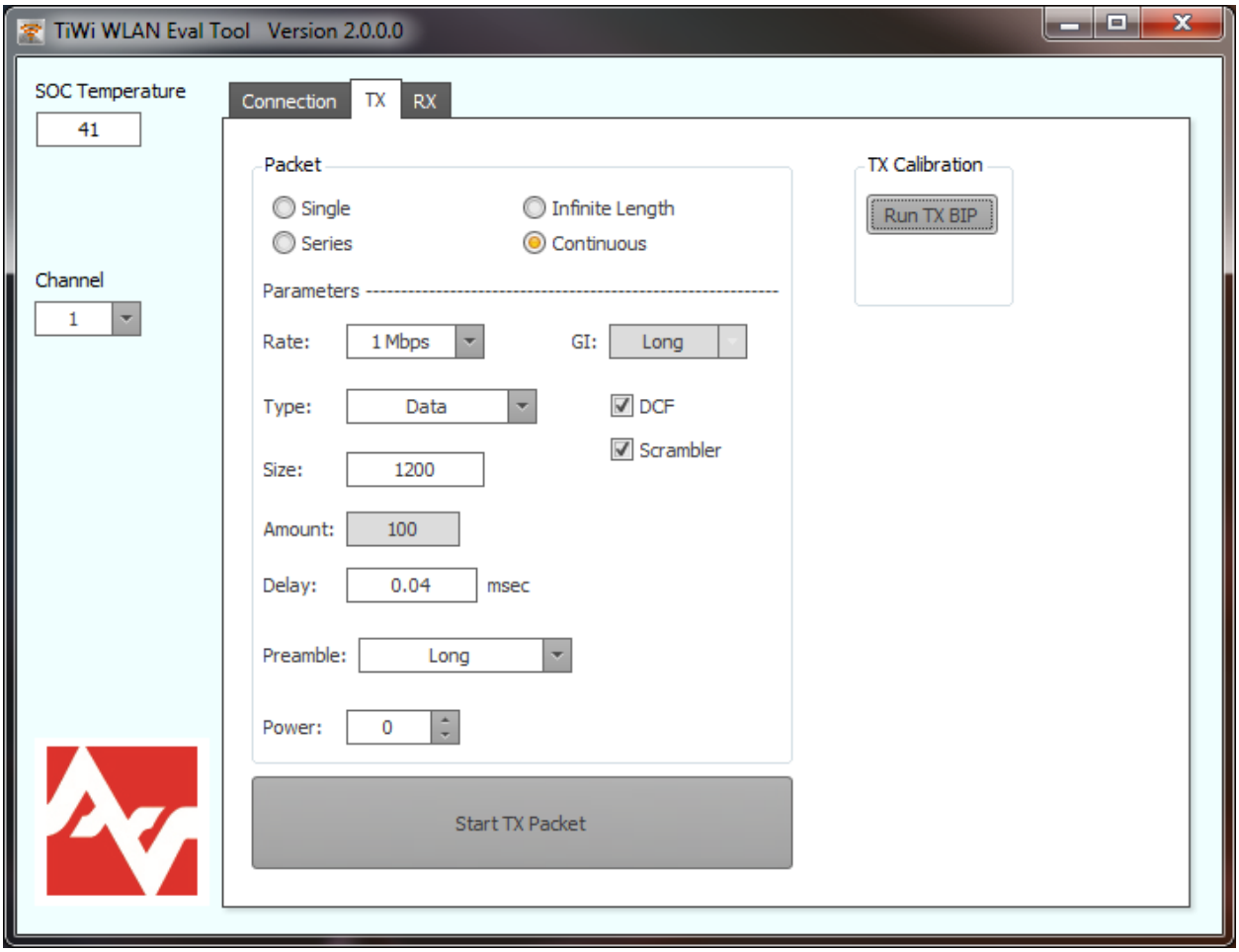

Figure 11 TiWi WLAN TX Tab

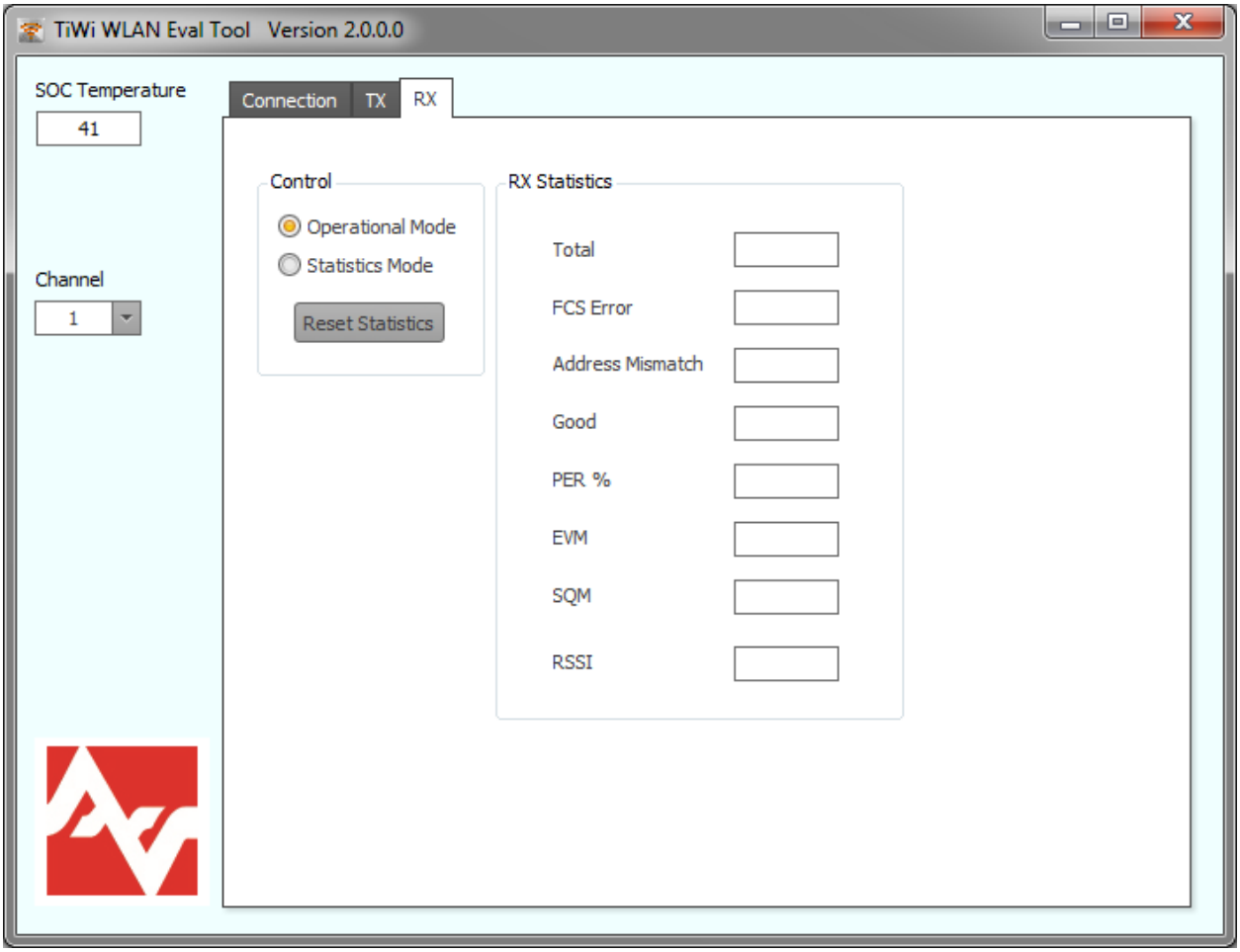

Figure 12 TiWi WLAN RX Tab

5 Contacting LS Research

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