RE40 DKRE Development Kit Radio Engine





User Guide

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About This Document

Introduction

This guide provides information about using the Zebra RE40 Development Kit Radio Engine (DKRE) for development and testing.



IMPORTANT: If you have a problem with your equipment, contact Zebra Global Customer Support for your region. Contact information is available at: <u>www.zebra.com/support</u>.

Configurations

This guide covers the following configuration:

Configuration	Description
DKRE-4000-00WW	RE40 Standard Development Kit

Chapter Descriptions

Topics covered in this guide are as follows:

- Getting Started provides an overview of the development kit including the kit contents and block diagram.
- DKRE Setup provides information on installing and configuring the development kit hardware.
- Software Overview provides an overview of software applications, software installation and usage, APIs, and interface information.
- Appendix A: Regulatory for Third Party Integration provides regulatory and compliance information for third party integration.
- Appendix B: Troubleshooting provides troubleshooting solutions for potential problems.
- Appendix C: Environmental Considerations provides information and recommendations on environmental concerns that can potentially affect performance.

Notational Conventions

The following conventions are used in this document:

• "DKRE" refers to the Zebra Development Kit Radio Engine; "Device" or "RFID Module" refers to the RE40 RFID Module.

- Bold text is used to highlight the following:
 - Dialog box, window and screen names
 - Drop-down list and list box names
 - Check box and radio button names
 - · Icons on a screen
 - Key names on a keypad
 - Button names on a screen.
- Bullets (•) indicate:
 - Action items
 - · Lists of alternatives
 - Lists of required steps that are not necessarily sequential.
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.

Icon Conventions

The documentation set is designed to give the reader more visual clues. The following graphic icons are used throughout the documentation set. These icons and their associated meanings are described below.



NOTE: The text here indicates information that is supplemental for the user to know and that is not required to complete a task.



IMPORTANT: The text here indicates information that is important for the user to know.



CAUTION: If the precaution is not heeded, the user could receive minor or moderate injury.



CAUTION—ESD: Observe proper electrostatic safety precautions.



CAUTION—ELECTRIC SHOCK: Disconnect the printer power before performing certain procedures to avoid the risk of electric shock.



WARNING: If danger is not avoided, the user CAN be seriously injured or killed.



DANGER! If danger is not avoided, the user WILL be seriously injured or killed.



NOTE: This is an icon for wired networking notes.



NOTE: This is an icon for wireless networking notes.

Related Documents and Software

The following documents provide more information about the RE40 RFID Module:

- RE40 Integration Guide
- Carrier Board Integration Guide
- DKRE Quick Start Guide
- RFID Demo Application User Guide
- API Programmer's Guide.

For the latest version of this guide and all guides, go to www.zebra.com/support.

Service Information

If you have a problem with your equipment, contact Zebra Global Customer Support for your region. Contact information is available at <u>www.zebra.com/support</u>.

When contacting support, please have the following information available:

- Serial number of the unit
- Model number or product name
- · Software/firmware type or version number

Zebra responds to calls by email, telephone or fax within the time limits set forth in support agreements.

If your problem cannot be solved by Zebra Customer Support, you may need to return your equipment for servicing and will be given specific directions. Zebra is not responsible for any damages incurred during shipment if the approved shipping container is not used. Shipping the units improperly can possibly void the warranty.

If you purchased your Zebra business product from a Zebra business partner, contact that business partner for support.

Getting Started

Introduction

The Development Kit Radio Engine (DKRE) is a composite test system comprising of a development board, two RE40 RFID modules, and accessories which provide the tools needed to design and test an embedded RE40 RFID module before integration into a host device.

Unpacking

Remove the material from its packing and inspect for damage. If the material was damaged in transit, contact Zebra Support. See Service Information on page 8 for information. KEEP THE PACKING. It is the approved shipping container; use this to return the equipment for servicing.

DKRE Contents

This DKRE contents consists the following:

Table 1	DKRE Contents
---------	---------------

Item	Part Number	Quantity
RE40 Development Board	DKRE-4000-00WW	1
5V Power Supply	PWR-WUA5V12W0WW	1
Development Kit Quick Start Guide	N/A	1
USB Drive with Software Tools and Documentation	N/A	1
Antennas:		
US antenna, 3.5 dBiL (902-928MHz)	S9025PR	1
EU antenna, 3.0 dBiL (865-870MHz)	S8655PL	1
Universal Dipole antenna, (860-960MHz)	9000984-XLPDNB	1
RF Cable: SMA to SMA	N/A	1
RE40 Modules	RE4000-MR01000-WW	2
Micro USB Cables: USB Power 6 ft, USB Data 4.5 ft	N/A	2
RFID Tag Sample Kit	N/A	1

DKRE Board Overview

The DKRE is designed to allow for easy development of RE40 applications using a Windows PC or other hosts capable of utilizing UART. Components and connections on the PCB are displayed in Figure 1.





Figure 2 DKRE Interface Connections

Connector	Description
Micro USB	Data, UART0 and UART1 through FTDI
Micro USB Client	Data, USB
GPIO Header	USER GPIO connection
Micro USB	Power, 5V/1.5A USB charger
DC Jack	Power 5V regulated power supply
JTAG Connector	For Debug
Data UART Header	UART 0
Debug UART Header	UART 1
Aux Header	Miscellaneous debug connections
ZIF Connector	Connects to carrier board to bring out debug pins to DKRE
SMA Connector	Two SMA when carrier board is present
Board to Wire Connector	Connects to carrier board

DKRE Setup

Introduction

This chapter provides instructions for installing and configuring the DKRE hardware.

DKRE Hardware

The Development Kit Radio Engine hosts the carrier board with 2 RF ports (SMA) and support for UART and USB. The DKRE is intended for development and testing purposes only.

The Development Board components and connections are shown in Figure 3. The DKRE main connections are power, RF, and UART communication. The power for the RE40 RFID Module default configuration comes from the micro USB for power or 5V DC power adaptor. The RF signal is connected to the antenna using the SMA connectors. The RE40 communication with UART is connected with the micro USB.



NOTE: There are two RE40 carrier configurations: 2 port RE40 (RE4000- CP02000-WW) shown in Figure 3 and a 4 port RE40 (RE4000-CP04000-WW).



Figure 3 DKRE Board Components and Connections

6 Micro USB - UART Communication

7 UART, ADC, JTAG_EN Header

DKRE Accessories





- 3 Carrier Board PCB
- 4 Board to Wire Connector
- Micro USB UART Communication 5
- Micro USB Power-in 6

- USB Type A to Micro USB Cable 9
- 10 USB Wall Power Adaptor
- 11 **RFID Tags**
- RFID Antenna with SMA Connector 12

Installing DKRE Hardware

Install the RE40 DKRE as follows:

1. Restore the default configuration if the connectors have been reconfigured since opening the kit (see DKRE Default Configuration on page 15).





- 2. Connect the development board to your Windows PC using the Micro USB USB Communication or Micro USB UART Communication.
- **3.** Connect the 5V power supply to an AC outlet and use the Power USB cable to connect power to the development board at the Micro USB Power in Port.
- 4. Observe the green Power LED on the DKRE to indicate that the module is powered on.

Figure 6 Connecting Power Supply to Development Board



DKRE Power LED Green	Status LED Red	Status LED Yellow	Definition
Off	Off	Off	Power is off; RFID module is in sleep mode.
On	Off	On	Normal operation.
On	On	On	Error condition exists (check error log); RFID module may or may not be fully operational.
On	Flashing	Off	Firmware download is in progress.
On	On	Off	RFID module is in boot mode (may be on briefly after power up or reset).

- **5.** Based on the country of operation, select the appropriate antenna provided in the DKRE kit (US antenna p/n: S9025PR; EU antenna p/n: S8655PL; Universal antenna p/n: 9000984-XLPDNB).
- 6. Connect the antenna to one of the J201 or J204 SMA antenna connectors (see Figure 15 on page 22) using the SMA RF Cable.

For instructions on software installation, connecting readers, and reading RFID tags, see Software Overview on page 27.

Carrier Board PCB

The Carrier Board PCB has a mounted module, 2 or 4 RF ports (MMCX), and other communication connectors. The Carrier Board is FCC Class B certified and regulatory approved.

For detailed information, refer to the Carrier Board Integration Guide, located at: www.zebra.com/support.



Figure 7 2 Port Carrier Board PCB

DKRE Default Configuration

The default configuration of the DKRE development board allows communication with the RE40 over the USB-UART interface with a host PC, and power 5V regulated power supply. To restore the default configuration, perform the following steps:

1. Set the switches on the DKRE to the default settings as shown in Figure 8.





JZ TSM-105-01-S-DV-P-TR



- 2. Discover the COM port for the DKRE board in Windows 10.
- 3. Click Windows > Device Manager.
- 4. Select Ports.



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🗢 🔶 🔟 🔟 📖 💭		
✓		
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> 🗃 Batteries		
> Biometric devices		
> 3 Bluetooth		
> 🤜 Computer		
> 👝 Disk drives		
> 🔙 Display adapters		
> 🙀 Human Interface Devices		
> 📷 IDE ATA/ATAPI controllers		
> 💦 Imaging devices		
> 🛄 Keyboards		
> 🔛 Memory technology devices		
Mice and other pointing devices		
> 🥅 Monitors		
> 💭 Network adapters		
V 🙀 Ports (COM & LPT)		
Intel(R) Active Management Technology - SOL (COM3)		
USB Serial Port (COM6)		
USB Serial Port (COM7)		
> 🛱 Print queues		- 1
> 🛱 Printers		
> Processors		
> By Security devices		
> 🛄 Sensors		
Software devices		- 8

- 5. The DKRE UART ports are enumerated as USB Serial Ports. Use the lowest port number for communication. For example, select COM6 in Figure 9.
- 6. Run the RE40Config tool from the command line (example: RE40Config.exe COM6 921600) to set the factory defaults as follows:
 - a. Set the Protocol to Binary Interface.
 - b. Set the Num of Antennas to 3 (for DKRE board).
 - c. Erase the Region Configuration.
 - d. Set Baud Rate.

For additional information on options, see RE40Config on page 50.

Integration with Raspberry Pi

Raspberry Pi 4B Setup and Raspbian OS Installation

To setup the 4B board and install the operating system, go to: https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started

RE40 DKRE Setup with Raspberry Pi Board

To setup the RE40 DKRE with the Raspberry Pi Board:

 Connect the Micro USB Communication Cable from the Raspberry Pi board to the DKRE Debug USB port.

DKRE Setup

Figure 10 Raspberry Pi and DKRE Board Connection



- 2. Connect to the Raspberry Pi module using the SSH login.
- 3. Execute the following command to list RE40 RFID module as two UART ports: /dev/ttyUSB0 and /dev/ttyUSB1 (as shown in Figure 11).



NOTE: The port device /dev/ttyUSB0 is used for RFID operations such as Tag Inventory, Tag Access, etc.

Figure 11

Raspberry Pi Execute Command



RE40 DKRE GPIO Connections

There are a total of 10 pins available in GPIO header on the RE40 DKRE board.

- Pins 1-2: Input DC Voltage Jumper
- Pins 3-4: Ground
- Pin 5: GPIO 0 (General Purpose Input Output)
- Pin 6: GPIO 1 (General Purpose Input Output)
- Pin 7: GPIO 2 (General Purpose Input Output)
- Pin 8: GPIO 3 (General Purpose Input Output)

- Pin 9: GPIO 4 (General Purpose Output Only)
- Pin 10: GPIO 5 (General Purpose Output Only)
- GPIO
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 2
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 GND
 PIN

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 5
 3
 1

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 7
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- Figure 12 DKRE GPIO Connections

Antennas

The RE40 RFID module supports one monostatic bidirectional RF antenna port through castellated pad, which may be connected to a 50 ohm controlled impedance connector for the antenna. The module also provides two control lines for the external RF switch.



NOTE: The RE40 RFID module does not support bistatic operation.

Using a Multi-port RF Switch

The module supports using an RF switch, allowing up to four total logical antenna ports. RF switching is controlled using one or two of the GPIO lines. The number of antenna ports must be programmed into the module to allow for RF switching.

Antenna Requirements

Antennas that provide a suitable 50 ohm match at the operating frequency band produce best results. The level of performance specified is achieved with antennas providing an 18 dB return loss (VSWR of 1.3) or better across the operating band.

DKRE Setup

While a short period of exposure to 5dB or less is not expected to significantly harm the module, the module should never transmit in an open port. Damage may occur if an antenna is disconnected during operation or if the module observes a short circuit at the antenna port.



NOTE: The RE40 RFID module does not support automatic antenna detection.

Authorized Antennas

The RE40 RFID module supports the use of any 50 ohm commercial antenna with a maximum gain of 6 dBiL that meets VSWR 1.8:1 and meets all applicable regulatory requirements (gain, beam width, return loss, etc). Antennas that have a gain greater than 6 dBiL may not be used in some regions without additional regulatory approval.

The module has been certified to operate with the antennas listed in Figure 3.



NOTE: The performance of the RE40 RFID module is dependent upon the detailed specifications of the third-party antenna being used.

WOUEI	Polarization	Frequency Range	Maximum Linear Gain	VSWR
AN440	1 x Left-hand Circular 1 x Right-hand Circular	EU: 865-868 MHz US: 902-928 MHz*	US/Canada: 6.0 dBiL	1.22:1
AN480	Left-hand Circular or Right-hand Circular	EU: 865-868 MHz US: 902-928 MHz	6.0 dBiL	1.3:1
AN610	Left-hand Circular	EU: 865-868 MHz US: 902-928 MHz	5.0 dBic	1.4:1
AN620	Left-hand Circular	EU: 865-868 MHz US: 902-928 MHz	7.0 dBic	1.4:1
AN710	Left-hand Circular	EU: 865-868 MHz US: 902-928 MHz	3.0 dBic	2:1
AN720	Left-hand Circular	EU: 865-868 MHz US: 902-928 MHz	US/Canada: 3.0 dBiL EU: 3.5 dBiL	1.5:1
AN510	Right-hand Circular	EU: 865-868 MHz US: 902-928 MHz	8.5 dBic	1.3:1
Laird	S9025PL S9025PR	US: 902-928 MHz	5.5 dBiC	1.5:1
Laird	S8655PL S8655PB	EU: 865-870 MHz	5.0 dBiC	1.5:1

Table 3Approved Antennas

Third Party Antenna Support

The RE40 may be used with third party antennas provided they meet VSWR 1.8:1 and meet all applicable regulatory requirements (see Antenna Requirements on page 55).



NOTE: Depending on the detailed specifications of the third party antenna (for example: gain, efficiency, beam width, return loss, axial ratio), the performance of the module may vary.

Connecting the Mini RFID Panel Antennas

To connect the Mini RFID Panel antennas:

- 1. Connect the one end of the RF cable to the antenna.
- 2. Connect the other end of the RF cable to the RF SMA Connector port (see Figure 3) on the development board.

Figure 13 Mini RFID Panel Antennas



Connecting the SMA-Male Rubber Duck Antenna

To connect the SMA-Male Rubber Duck antenna, connect the cable directly into the RF SMA Connector port (see Figure 3) on the development board.



Figure 14 SMA-Male Rubber Duck Antenna

DKRE Connectors and Switches



DKRE Board Reference	Description
J205	DC jack which connects to 5V/2A external power adapter. Caution: Do not use at the same time as the J202 USB Wall adapter.
J202	Micro USB connector for connection to USB 5V wall adapter. Caution: Do not use at the same time as the J205 USB Wall adapter.
J216	Dual row pin header (Berg stick) 10 pins 0.1 inch for AUX UART, ADC and JTAG_DBGPWR_EN. Image: start of the s
S203	Module enable switch used to activate the RFID Module or Carrier Board.

Table 4 DKRE Connector and Switch Descriptions



Table 4 DKRE Connector and Switch Descriptions (Continued)



 Table 4
 DKRE Connector and Switch Descriptions (Continued)





Software Overview

Introduction

This chapter provides an overview of software applications, software installation and usage, APIs, and interface information.

API

Where API utilization is not feasible or convenient, the RE40 can also be configured in RCI mode to enable the use of RAIN RCI-based applications.



NOTE: The RFID SDK for C is supported in any host that supports POSIX threads.

Table 5 Available SDKs

SDK	Programming Languages	Sample App
RFID SDK for Windows	С	RFIDHostSample1 (GUI)
(Windows 10 64-bit)	C# .NET Framework 4.5.2	CS_RFID_Host_Sample2 (GUI)
	C# .NET Core 3.0	CS_RFIDSample4
	Java (JDK 1.8)	J_RFIDHostSample1 (GUI)
RFID SDK for Linux	С	RFIDSample4
(Ubuntu 18.04 64-bit / Raspberry Pi 32-bit)	C# .NET Core 3.0	CS_RFIDSample4
	Java (JDK 1.8)	J_RFIDSample4
RFID SDK for Android (Android 10)	Android Java	Hello RFID Application (GUI)
RAIN RCI (Any OS which supports UART/USB CDC)	Python 3.0	rcisample.py

Interfaces

Serial UART driver support at the host with a baud rate of 921600 is required.

Demo Application Overview

Zebra offers demo applications for both Windows and non-Window based hosts as outlined in Table 6.

 Table 6
 Demo Application Tools

Tools	Operating System	Description
123RFID Desktop	Windows 10 64 bit	A GUI-based Windows application used to configure and update module firmware. See 123RFID Desktop on page 29 for detailed instructions.
RFID Demo Application for .NET Core 3.0	Operating System Supporting .NET Core 3.0	A console-based application used to demonstrate reader configuration and file-based firmware updates. Intended for non-Windows based hosts that are unable to use 123RFID Desktop. See RFID Demo Application for Linux/Raspbian on page 42 detailed instructions.

123RFID Desktop Application

123RFID Desktop is a software tool that simplifies reader setup and is intuitive enough for first time users. It finds and connects to a reader with three simple clicks.

123RFID Desktop features include:

- Find, connect reader, and start reading tags with three simple mouse clicks.
- Update firmware.
- Streamline the optimization process using the intuitive configuration wizard.
 - Save optimized settings to a file for later use.
 - Load an already saved configuration file to the connected reader.
 - Print a report of optimized settings.
- Analyze tag data using filtering tools.
 - Use the Asset Tag List file to filter by known tags.
 - Filter by EPC or RSSI values.
- Check reader performance using charts.
 - Charts that represent tag read counts by antennas.
 - Check RSSI signal on individual tags during an inventory.
 - Program the GPIO accessory (for example: have a photo-eye sensor activate an inventory session).
 - Built-in screen-by-screen help and How-To-Videos link to guide users through the tool.

For more information go to <u>www.zebra.com/123rfid</u>.

RFID Demo Application

RFID demo application is provided in all supported SDKs. The RFID demo applications come with development project and source code. They showcase RFID module configuration and various RFID operations.

A console-based demo tool is also provided. The console-based demo tool for .NET core 3.0 demonstrates a reader configuration and a firmware update for non-Windows based hosts.

For detailed information, refer to the RFID Demo Application User Guide located at: www.zebra.com/support.

123RFID Desktop

Installing 123RFID Desktop

To install and open 123RFID Desktop:

- 1. Install the 123RFID Desktop software on your PC. Choose one of the following options.
 - Copy the 123RFID Desktop file from the USB drive if provided.
 - Download the software from: www.zebra.com/us/en/support-downloads/software/utilities/123rfid.html.
- Open the 123RFID Desktop software by double-clicking on the 123RFID Desktop icon on your desktop. The 123RFID loading window displays.

Figure 16 123RFID Desktop Loading Window

123RFID Desktop Setup Utility for RFID Fixed Readers				
Loading 123RFID Desktop				
्रीन् JEBRA	©2019 Zebra Technologies LLC.All rights reserved.			

 Read the 123RFID Desktop Overview screen that appears on startup to familiarize yourself with the application features.



🗱 123 RFID Desktop	— X ((❶)) 0 Readers Connected.
Somet Somet	<form><text><text><section-header><section-header></section-header></section-header></text></text></form>

Connecting Reader with 123RFID Desktop

The DKRE can be connected with 123RFID Desktop in one of the following ways:

- Locate the DKRE on the local subnet or USB port using Reader Discovery.
- Enter the COM port.

Once connected, you can begin reading RFID tags and performing inventory.

Connecting via Reader Discovery

To connect to the RE40 RFID module using the Reader Discovery feature:

1. Open the 123RFID Desktop software by double-clicking on the **123RFID Desktop** icon on your desktop. The **Welcome** Screen displays.



Q. 12	23RFID Desktop	— D X
(O) Connect P) Read Configure Eirmware	State List on the reader (a) on local subnet or USB port. Inter reader (a) on local subnet or USB port. Connect or Recently Def Deformation or COOM port below. Connect to Accently Used Reader Connect or Accently Used Reader Image: Connect or Coom of	<section-header><section-header><text><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header><section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></section-header></text></section-header></section-header>
About		

- 2. Click Find Readers to initiate Reader Discovery.
- 3. For initial use only, you must configure the region of operation.
 - **a.** After selecting **Find Readers** and **Connect** (next to the desired reader to connect to) for the first time, the Region Configuration Prompt window displays.

Figure 19 Region Configuration Prompt Window



- b. Click Continue. The RE Module Admin Login window displays.
- c. Enter a Username and Password of your choosing.

Figure 20 RE Module Admin Login

RE MODU	JLE Admin Login X
A	To set the region, you'll need to login into the admin system on the reader.
	Usemame: admin Password: I CANCEL LOGIN

d. Click Login.

Figure 21 123RFID Region Configuration Window

RE MODULE Region Configuration				
Warning- Selecting a Region different from the country of use is illegall				
Region of Operation:	United States	•		
Communication Standard:	United States			
I Understand implications of setting an illegal region.				
Help with Region Setup		SI	ET	

e. Click on the Region of Operation drop-down menu and select your region of operation.



- f. Click on the **Communication Standard** drop-down menu and select the standard for your region if applicable.
- g. Click on the I understand implications of setting an illegal region check box.
- h. Click SET.

Figure 22 Region Configuration Successful Window

RE MODULE0 Region Configuration	-	Ж
Reader has been successfuly updated. You can now CONNECT the reader.		
	ок	1

- 4. A successful update message window displays. Click OK.
- Once Reader Discovery is complete, the readers display in the Available Readers section of the screen. Click Connect next to the desired reader to connect to.

颜. 12	3RFID Desktop	ļ	(♥)) 0 Readers Conr	nected. 📕 He	ow to Videos	i Help with D	iscovery	Ж			
((O)) Connect	Reader Discovery	/									
)) Read	Rea	nder Name N	lodel IP/COM Por	t Reader ID	Firmware	Serial Number	Mfg. Date	Ant			
¢ Configure	No readers connected. 1. Click FIND READERS below to discover readers. 2. Click CONNECT.										
Firmware											
Tiniware	Available Readers (5)										
	PING CONNEC	Reader Name RE MODULE RE MODULE	RE40	IP/COM Port	Firmware	Serial Number	-	9			
								Ε			
	<	m					•	*			
		Enter IP or hos	tname or COM port	PING	CONNECT	FIN	D READERS				
About											

Figure 23 123RFID Desktop Reader Discovery Screen

6. Once connected, the reader displays in the **Connected Readers** section of the screen as shown in Figure 28.

Connecting via COM Port

To connect to the RE40 RFID module by entering the COM port:

- Open the 123RFID Desktop software by double-clicking on the 123RFID Desktop icon on your desktop.
- 2. Enter the reader COM port in the field provided (see Figure 18). Once connected, the reader displays in the **Available Readers** section of the screen.
- 3. Click **Connect**. For initial use only, you must configure the region of operation as follows:
 - **a.** After selecting **Connect** for the first time, the Region Configuration Prompt window displays.

Figure 24 Region Configuration Prompt Window



b. Click Continue. The RE Module Admin Login window displays.

c. Enter a Username and Password of your choosing.

Figure 25 RE Module Admin Login

RE MODULE Admin Login										
▲	To set the re system on t	agion, you'll need to login into the admin he reader.								
	Username:	admin								
	Password:	Ι								
		CANCEL LOGIN								

- d. Click Login.
- e. Click on the Region of Operation drop-down menu and select your region of operation.



WARNING: Selecting a Region different from the country of use is illegal.

- f. Click on the **Communication Standard** drop-down menu and select the standard for your region if applicable.
- g. Click on the I understand implications of setting an illegal region check box.

Figure 26 123RFID Region Configuration Window



h. Click SET.

Figure 27 Region Configuration Successful Window



- 4. A successful update message window displays. Click OK.
- 5. Once connected, the reader displays in the **Connected Readers** section of the screen.

0. 12	23RFID	Deskto	p	<u>((Q))</u>						
((O)) Connect		er Discove Readers	ery							
)) Read	READ	DISCONNECT ALL	Reader Name RE MODULE RE MODULE	Model RE40	IP/COM Port	Reader ID 123456789	Firmware 3.0.3.0	Serial Number	Mfg. Date	Ant
Configure										
Firmware	<	aders (4)		m						Þ
			Reader Name	,	Model	IP/COM Port	Firmware	Serial Number	М	fg. D
	*			ш						•
About			Ent	er IP or hostname	e or COM port	PING		FI	ND READERS	



Reading RFID Tags

Once the device is connected, begin reading RFID tags as follows:

- 1. Select the **Read** tab to display the **Data View** screen.
- 2. Place the tags within a few inches of the antenna field of view.
- 3. Click Start to begin reading tags.

(12	23RFID Desktop	(()) 1 Reader Connected (How to Videos () Help with Reading	X
((Q))	Data View	O TAGS O READS O READS/ START	
Connect		Clear Export Running Time: 00:00:00:00	
)e	Filters		
Read	TagID	Count RSSI First Seen Last Seen	
Configure			
Eirmwara		Antennas GPIO	
riiliware			
	1 RE MODULE	ags Reads Read Rate (%) Ant 1 (%) Ant 2 (%) Ant 3 (%) 0 0 0 0 0	
About	<		

Figure 29 123RFID Desktop Start Tag Reading

4. Monitor the **Data View** screen.



NOTE: Depending on the detailed specifications of the third party antenna (for example: gain, efficiency, beam width, return loss, axial ratio), the performance of the module may vary.

美 . 12	23RFID Desktor	C				<u>((♥)</u> 1 R	eader Conne	ected	How to Videos () Help with Reading	
((O)) Connect	Data View		86 • • •	TAGS 6	, 877	READS	66 READS	S/ STOP Running Time: 00:00:01:42		
))e	Filters									
Read	TagID	Count	RSSI	First Seen		Last See	1		(COM4)	0
	8DF0000000000000007E027C	22	-68	1/25/2020	3:37:37 AM	1/25/202	0 3:39:17 AN	1 4	Ant 1	
0	AD852200484BA18512000000	96	-61	1/25/2020	3:37:37 AM	1/25/202	0 3:39:18 AN	Λ	((()))	
Configure	8DF000000000000007E02F5	127	-63	1/25/2020	3:37:37 AM	1/25/202	0 3:39:19 AN	A =		
lonngure	8DF000000000000007C6D50	211	-38	1/25/2020	3:37:37 AM	1/25/202	0 3:39:20 AN	Λ		
J.	8DF000000000000007E0282	195	-55	1/25/2020	3:37:37 AM	1/25/202	0 3:39:19 AN	Λ		
¥.	30304035A880C800001235AC	67	-58	1/25/2020	3:37:37 AM	1/25/202	0 3:39:18 AN	Λ	Antennas GPIO	
Firmware	30304035A880C800001235CA	103	-63	1/25/2020	3:37:37 AM	1/25/202	0 3:39:19 AN	Λ		
	AD852200484B317E030000F3	56	-59	1/25/2020	3:37:37 AM	1/25/202	0 3:39:19 AN	Λ		
	ABCD	108	-63	1/25/2020	3:37:37 AM	1/25/202	0 3:39:19 AN	Λ		
	30304035A880C800001235C4	45	-65	1/25/2020	3:37:37 AM	1/25/202	0 3:39:18 AN	Λ		
	555522004867BF91180000C8	245	-54	1/25/2020	3:37:38 AM	1/25/202	0 3:39:20 AN	Λ		
	777719001BA4C583160000C/	119	-59	1/25/2020	3:37:38 AM	1/25/202	0 3:39:18 AN	Λ		
	30304035A880C800001235C8	65	-66	1/25/2020	3:37:38 AM	1/25/202	0 3:39:15 AN	Λ		
	30304035A880C800001235B9	43	-67	1/25/2020	3:37:38 AM	1/25/202	0 3:39:18 AN	Λ		
	777719001BA4C581170000C8	54	-66	1/25/2020	3:37:38 AM	1/25/202	0 3:39:14 AN	Λ		
	30304035A880C800001235BE	78	-64	1/25/2020	3:37:38 AM	1/25/202	0 3:39:18 AN	Λ		
	686920686F7720722075	72	-62	1/25/2020	3:37:38 AM	1/25/202	0 3:39:17 AN	1	•	
	Reader	Tags	Reads	Read Rate	() Ant 1	(4))) Ant 2	(🖤) Ant 3	(¶))) Ant 4	(
	1. RE MODULE	86	6882	66	6882					
About	٠							÷		



123RFID Data View Options





1	Read	Select the Read tab to access the Data View screen.
2	Filters	Select Filters to apply an asset tag list and select reader(s) to display.
3	Tag Alert	Select the Tag Alert icon to highlight a row if an RFID tag has not been seen in a specified amount of seconds.
4	Charts	Select Charts to see tag reads and RSSI signal per tag across antennas.
5	Tag Focus	Select Tag Focus to minimize redundant reads of strong tags to allow the reader to focus on tags that are typically the last to be read.
6	Clear	Select Clear to clear all of the RFID tags currently displayed in Data View.
7	Tag Fields	Select the Tag Fields icon to select the desired columns to display.
8	Export	Select Export to export summary or history data to Excel (.csv file format).
9	Start	Select Start to begin reading RFID tags.

Changing Region Configuration



IMPORTANT: Selecting a Region different from the country of use is illegal.

To change the region configuration:

1. Under Available Readers, click Connect next to the desired RE40 module. The module displays under Connected Readers.

Figure 32 123RFID Desktop Connected Readers

SAFIL	D Deskt	ор				Reader Co	onnected 📑 How	to Videos 👔) Help with Discovery
Read	ler Disco	overy							
Connecte	d Readers	,							
READ	DISCONNECT A	LL Reader	Name M	odel IP/COM Po	rt Reader ID	Firmware	Serial Number	Mfg. Date	Antennas
	DISCONNECT	<mark>с</mark> Ф ^в	E MODULE COM5	40 COM5		PAAFBS00-00	1-N13	-	••
					m				
Available	Readers (6)								
Available	Readers (6)		Reader Name	Model	IP/COM Port	Firmware	Serial Number	Mfg. Date	
Available	Readers (6) PING	CONNECT	Reader Name FX7500ED6938 FX7500 RF FX7500ED6938	Model 1D Rez FX7500-4	IP/COM Port 10.17.131.50	Firmware 3.7.12	Serial Number 17130010505188	Mfg. Date 2017-05-10	
Available	Readers (6) PING PING	CONNECT	Reader Name FX7500ED6938 FX7500 RF FX7500ED6938 FX9600E5734 FX9600E5734 FX9600E5734	Model ^{1D Rev} FX7500-4 FX9600-8	IP/COM Port 10.17.131.50 10.17.131.203	Firmware 3.7.12 3.7.13	Serial Number 17130010505188 17204010506520	Mfg. Date 2017-05-10 2017-07-23	
Available	Readers (6) PING PING PING PING	CONNECT CONNECT CONNECT	Reader Name FX7500ED6938 FX7500 RF FX7500ED6938 FX9600EE5734 FX9600E5734 FX75008036E9 FX7500 RF FX75008036E9	Model ID Rei FX7500-4 FX9600-8 FX9600-8 ID Rei FX7500-4	//////////////////////////////////////	Firmware 3.7.12 3.7.13 3.1.11	Serial Number 17130010505188 17204010506520 17032010507157	Mfg. Date 2017-05-10 2017-07-23 2017-02-01	
Available	Readers (6) PING PING PING PING PING	CONNECT CONNECT CONNECT CONNECT	Reader Name FX7500ED6938 FX7500 RF FX7500ED6938 FX9600EE5734 FX9600EE5734 FX75008036E9 FX7500 RFI FX75008036E9 FX7500ED6AE5 FX7500EAE5	Model ID Rev FX7500-4 FX9600-8 FX7500-4 FX7500-8	m IP/COM Port 10.17.131.50 10.17.131.203 10.17.131.165 10.17.131.232	Firmware 3.7.12 3.7.13 3.1.11 3.7.4	Serial Number 17130010505188 17204010506520 17032010507157 17117010504568	Mfg. Date 2017-05-10 2017-07-23 2017-02-01 2017-04-27	

- 2. Under Connected Readers, select the RE40 module check box under the Read column.
- 3. Click on the **Configure** tab.



St. 14		-				
10.0 1		((O)) 1 Reader Connected	How to Videos	 Help with Configuration 		
((O)) Connect	Reader Configuration Click picture below to edit reader settings					
*)) Read Configure	RE MODULE COMS					

a. Click on the RE40 module.



美 。1:	23RFID Des	ktop	((Q)) 1 Reader Connected	How to Videos	() Help with Configuration
((O)) Connect	← BACK	What do you want to do? Please select an action from below to continue.			
))) Read	RE MODULE COM5	Load a "Saved Config" File to Reader			
Configure		Edit Configuration on Reader			
Firmware					

- b. Click on Edit Configuration on Reader.
- Figure 35 Region Config Screen

(. 1:	23RFID Des	ktop		(() 1 Reader Connected	How to Videos	Help with Configuration
((Q)) Connect	← BACK	Region Configuration				Help with Region Setup
))e		Region of Operation:	India 👻			ŀ
Read	RE MODULE COM7	Communication Standarad:	India			
Configure	Name Antenna	Frequency Hopping: Selected Channels:	▼ ♥ 865.70 ♥ 866.30 ♥ 866.90			
V	Trigger	Warning- Selecting a Reg	ion different from the country of use is illegal!			
Firmware	GPO		I Understand implications of setting an illegal region.			
	Advanced		SET			
	Region Config					
	Save Config					

- c. Click on **Region Config** from the Configure menu. The current configured region displays.
- d. Enter the required region configuration parameters: Region of Operation, Communication Standard, Frequency Hopping, Selected Channels.
- e. Select the region compliance check box I understand implications of setting an illegal region.
- f. Click SET.



Figure 36 Region Configuration Update Confirmation Window

g. When the region configuration is complete, the RE40 disconnects and a successful update message window displays. Click **OK**.

Figure 37 Connect Tab Screen

领• 12	3RFID	Deskto	р							(Q)	1 Reader Connected	I low to Videos	Help with Discovery
((Q)) Connect	Reade Connected R	er Discov	very										
9)@			Keader N	lame Mode	IP/COM Po	rt Reader ID	Firmware	Serial Number	Mtg. Date Ante	ennas	Country Code		
Read													
¢ Configure						No readers 1. Click FIN 2. Click CO	connected. D READERS b NNEC1.	elow to discover readers.					
E Firmware													
	Available Rea	aders (8)											
		. ,		Reader Name	Model	IP/COM Port	Firmware	Serial Number	Mfg. Date				A.
		PING	ONNECT	FX7500ED6938 FX7500 RFID F FX7500ED6938	ei FX7500-4	10.17.131.50	3.7.12	17130010505188	2017-05-10				
		PING	ONNECT	FX9600EE5734 FX9600EE5734	FX9600-8	10.17.131.203	3.7.13	17204010506520	2017-07-23				
		PING	ONNECT	FX75008036E9 FX7500 RFID R FX75008036E9	FX7500 4	10.17.131.165	3.1.11	17032010507157	2017 02 01				=
		PING	ONNECT	FX7500ED6AE5	FX7500-8	10.17.131.232	3.7.4	17117010504568	2017-04-27				
		PING	ONNECT	ATR7000F41AD6 ATR RFID Re ATR7000F41AD6	d ATR7000-4	10.17.131.119	2.16.7	-					
		PING	ONNECT	FX7500800324 FX7500 RFID R FX7500800324	FX7500-4	10.17.131.141	3.7.11	15294010504730	2015-10-21				
		PU10		t RE MODULE COM5									*
About									10.17.	.130.134	Р	ING CONNECT	FIND READERS

h. The Connect screen displays.

Updating Firmware with 123RFID

To update the reader firmware with 123RFID:

- 1. Select the Firmware tab.
- 2. Select the check box next to the desired reader.



nril	Desk	top								((o)) 1 Reader Connected	How to Videos	1 Help with Firmware U	pdate
Upda	ate Read Readers (1)	der F	=irm	ware						1	device selected for updat	e 👤 UPDATE FIRMW	ARE
v	Reader Name	Model	IP	Reader ID	Firmware	Serial Number	Mfg. Date	Locale	Update Status				
X	RE MODULE1 com7	RE40	com7	123456789	3.0.6.0	D7718111911911							
	Jpda vailable V	Jpdate Readers (1)	Update Readers (1) Image: square sq	Jpdate Reader Firm vallable Readers (1) Reader Name Model IP REMODULE1 RE40 com7	Update Reader Firmware vallable Readers (1) Reader Name Model IP Reader ID RE MODULE1 RE40 com7 123456789	Update Reader Firmware valiable Readers (1) Reader Name Model IP Reader ID Firmware RE MODULE1 RE40 com7 123456789 3.0.6.0	Vallable Readers (1) Image: Constraint of the state sta	Vallable Readers (1) Image: Constraint of the state sta	Valiable Readers (1) Reader ID Firmware Serial Number Mrg. Date Locale RE MODULE1 RE40 com7 123456789 3.0.6.0 07718111911911 - -	Valiable Reader Firmware Valiable Readers (1) Image: Colspan="4">Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Reader Name Reader Name Reader Nam Reader Name Re	Valiable Reader Firmware Mrg. Date Locale Update Status Image: Model Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: RE MODULE1 RE40 com7 123456789 30.6.0 D7718111911911 - -	Update Reader Firmware 1 device selected for update vallable Readers (1) Image: Constraint of the selected for update Image: Constraint of the selected for upda	Update Reader Firmware 1 device selected for update valiable Readers (1) Image: Reader Name Model IP Reader ID Firmware Serial Number Mfg. Date Locale Update Status Image: Com 7 Image: Com 7 1 23456789 30.6.0 D7718111911911 -

- 3. Click Update Firmware. A Reader Firmware Update window displays.
- 4. Click **Browse** and navigate to the firmware version you want to install on the selected device.

Figure 39 Reader Firmware Update Window

Update Firmware	Х
File Based FTP Ba	
Reader Firmware Update	
Update To: Select a directory	
Select the firmware version you would like install on the selected device.	
d:\3.0.6\3.0.6\ Browse	
Search the 123RFID Desktop support site for new firmware versions.	
CANCEL CONTI	NUE

5. Click Continue.

Figure 40 Update Status Progress Bar

A. 12	123 RFID Desktop									(()) 1 Reader Connected	How to Videos	() H	elp with Firmware	Update		
((O)) Connect	Update Reader Firmware Available Readers (1)									0/1 de	vices updated success	sfully	上 UPDATE FIRM	WARE		
n)e		Reader Name	Model	IP	Reader ID	Firmware	Serial Number	Mfg. Date	Locale	Update Status						
Read		RE MODULE0 Com7	RE40	Com7	123456789	3.0.6.0	D7718111911910	-	-	Updating (20%)						
Configure																
Firmware																

6. The Update Status column provides a progress status bar indicating the percentage complete. Once the firmware update is complete, a successful update window displays.

Figure 41 Firmware Update Successful Window



7. Click OK.

RFID Demo Application for Linux/Raspbian

Install SDK

To install SDK .net Core 3.0:

- **1.** Download .net core RunTime (3.0).
 - For Raspberry Pi, go to: https://dotnet.microsoft.com/download/dotnet-core/thank-you/sdk-3.0.100-linux-arm32-binaries
 - For Linux X64, go to: https://dotnet.microsoft.com/download/dotnet-core/thank-you/sdk-3.0.100-linux-x64-binaries
- 2. When the download completes, open a terminal and go to the path where you downloaded the .net core SDK.
- 3. Run the following commands to extract the SDK and make the commands available at the terminal: mkdir -p \$HOME/dotnet && tar zxf dotnet-sdk-3.0.100-linux-arm.tar.gz -C \$HOME/dotnet export DOTNET_ROOT=\$HOME/dotnet export PATH=\$PATH: \$HOME/dotnet
- 4. Run the dotnet --info command in your terminal to verify that .NET is correctly installed and ready to use.

```
Figure 42 .NET Installation Verification Screen
```

```
pi@raspberrypi:~/Pramod $ dotnet --info
.NET Core SDK (reflecting any global.json):
Version: 3.0.100
Commit:
           04339c3a26
Runtime Environment:
OS Name:
           raspbian
OS Version: 10
OS Platform: Linux
           linux-arm
RID:
Base Path: /home/pi/dotnet/sdk/3.0.100/
Host (useful for support):
 Version: 3.0.0
 Commit: 7d57652f33
.NET Core SDKs installed:
 3.0.100 [/home/pi/dotnet/sdk]
.NET Core runtimes installed:
 Microsoft.AspNetCore.App 3.0.0 [/home/pi/dotnet/shared/Microsoft.AspNetCore.App]
 Microsoft.NETCore.App 3.0.0 [/home/pi/dotnet/shared/Microsoft.NETCore.App]
To install additional .NET Core runtimes or SDKs:
 https://aka.ms/dotnet-download
pi@raspberrypi:~/Pramod $
```

- 5. The DKRE board can be connected to Raspberry Pi/Linux System with USB UART and USB CDC port.
 - For USB UART
 - Runls/dev/ttyUSB*
 - For data communication, use the port /dev/ttyUSB0

Figure 43 USB UART Connection Screen

```
pl@raspberryp1:~ $ lsusb
Bus 003 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub
Bus 001 Device 007: ID 0403:6010 Future Technology Devices International, Ltd FT
2232C/D/H Dual UART/FIFO IC
Bus 001 Device 002: ID 2109:3431 VIA Labs, Inc. Hub
Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub
pi@raspberrypi:~ $ ls /dev/ttyUSB*
/dev/ttyUSB0 /dev/ttyUSB1
pi@raspberrypi:~ $
```

- For USB CDC
 - Runls/dev/ttyACM*
 - For data communication, use the port /dev/ttyACMO
- 6. To run the sample application:
 - a. Go to the path CS_RFI DSampl e4. dl I where the sample application is present.
 - **b.** Run the following command from the terminal using the USB port where the DKRE board is connected: dotnet CS_RFIDSampl e4. dI I /dev/ttyUSB0 921600



<pre>pi@raspberrypi:~/Pramod \$ dotnet CS_RFID4Sample4Core.dll</pre>	/dev/ttyUSB0	921600
Welcome to RFID API4 .NET Standard Sample Application		
Courses of Marson		
Command Menu		
I. Capability		
2. Configuration		
3. Inventory		
Access		
5. Region Configuration		
6. Firmware Update		
/. Exit		
Reader Capabilities		
FirwareVersion=3 0 6 0		
ModelName=RF40		
NumAntenna Supported=1		
NumCDIDort s=2		
NumCDODort e=4		
IsuTCClockSupported= True		
IsBlockFraseSupported=True		
IsBlockWriteSupported=True		
Isbiooxwiicesuppoied iide IsTagInventoryStateAwareSingulationSupported=True		
/avNumOnerationsTnlocegeSeguence=8		
MaxNumDreFiltere=32		
CommunicationStandard=US_ECC_DART_15		
CountryCode=40		
IsloppingEnabled=True		
IshoppingEnabled-Ifde		

7. The DKRE is connected and the following **Command Menu** displays.

--Command Menu----

- 1. Capability
- 2. Configuration
- 3. Inventory
- 4. Access
- 5. Region Configuration
- 6. Firmware Update
- 7. Exit

Configuring the Region

For initial use, you must configure the region as follows:

- 1. From the Command Menu, enter 5 for Region Configuration.
- --Command Menu----
- 1. Capability
- 2. Configuration
- 3. Inventory
- 4. Access
- 5. Region Configuration
- 6. Firmware Update
- 7. Exit
- 5
- 2. From the Region Configuration Sub Menu, enter 1 for Get Supported Regions.

----Region Configuration Sub Menu----

- 1. Get Supported Regions
- 2. Get Region Standards
- 3. Get Active Region
- 4. Get Active Region Standard
- 5. Activate Region
- 6. Set Region Frequency
- 7. Back to Main Menu
- 1
- 3. The regions display.

Successfully logged into /dev/ttyUSB0

Total number of Regions 43 Region 1 UAE Region 2 Al bania Region 3 Argentina Region 4 Australia Region 5 Bangladesh Region 6 Bolivia Region 7 Bosnia Region 8 Brazil Region 9 Canada Region 10 Chile Region 11 China Region 12 Colombia Region 13 Costa Rica Region 14 Dominican republic Region 15 Ecuador Region 16 El salvador Region 17 European Union Region 18 Georgia Region 19 Guatemala Region 20 Hongkong Region 21 Honduras

Region 22 India Region 23 Indonesia Region 24 Japan Region 25 Korea Region 26 Mexico Region 27 Malaysia Region 28 Nicaragua Region 29 New Zeal and Region 30 Peru Region 31 Philippines Region 32 Puerto Rico Region 33 Russia Region 34 Saudi Arabia Region 35 Singapore Region 36 Thail and Region 37 Turkey Region 38 Taiwan Region 39 United States Region 40 Uruguay Region 41 Venezuel a Region 42 Vietnam Region 43 South Africa _____

4. From the Region Configuration Sub Menu, enter 2 for Get Region Standard.

----Region Configuration Sub Menu----1. Get Supported Regions 2. Get Region Standards 3. Get Active Region 4. Get Active Region Standard 5. Activate Region 6. Set Region Frequency 7. Back to Main Menu 2 Successfully logged into /dev/ttyUSBO Enter Region Name Indi a _____ Standard name INDIA Is Hopping Configurable True Number of channels 3 Channel index 1 value 865700 Channel index 2 value 866300 Channel index 3 value 866900 -----

5. From the Region Configuration Sub Menu, enter 3 for Get Active Region.

----Region Configuration Sub Menu----

1. Get Supported Regions

2. Get Region Standards 3. Get Active Region 4. Get Active Region Standard 5. Activate Region 6. Set Region Frequency 7. Back to Main Menu 3 Successfully logged into /dev/ttyUSBO Region Name: United States Region Standard Name: United States Active Channel index(s): _____ 6. From the Region Configuration Sub Menu, enter 5 for Activate Region. ----Region Configuration Sub Menu----1. Get Supported Regions 2. Get Region Standards 3. Get Active Region 4. Get Active Region Standard 5. Activate Region 6. Set Region Frequency 7. Back to Main Menu 5 Successfully logged into /dev/ttyUSBO Enter Region Name India Enter Communication Standrad Name INDIA Region activated successful. Setting Channel (s). _____ 7. From the Region Configuration Sub Menu, enter 6 for Set Region Frequency. ----Region Configuration Sub Menu----1. Get Supported Regions 2. Get Region Standards 3. Get Active Region 4. Get Active Region Standard

- 5. Activate Region
- 6. Set Region Frequency
- 7. Back to Main Menu

6 Successfully logged into /dev/ttyUSB0 Enter Region Name India

Standard name INDIA Is Hopping Configurable True Number of channels 3

```
Channel index 1 value 865700
Channel index 2 value 866300
Channel index 3 value 866900
Enter Communication Standrad Name
INDIA
Index
          Channel
1
          865700
2
          866300
3
          866900
Please select Channel index(s) to set (use, to input more then one index)
For example: 1,2,3
1,3
Selected Channel index(s)
1,3
Do you want to set selected Channel (s)? (y/n)
У
Region activated successful. Setting Channel (s).
Region Channel (s) Setting successful.
-----
8. A success log in message displays.
----Region Configuration Sub Menu----
1. Get Supported Regions
2. Get Region Standards
3. Get Active Region
4. Get Active Region Standard
5. Activate Region
6. Set Region Frequency
7. Back to Main Menu
3
Successfully logged into /dev/ttyUSBO
Region Name: India
Region Standard Name: INDIA
Active Channel index(s):
1
3
_____
9. To return to the Main Menu, enter 7.
```

Reading Tags

To begin reading tags to perform inventory:

1. From the Command Menu, enter 3 for Inventory.

--Command Menu----

- 1. Capability
- 2. Configuration
- 3. Inventory

- 4. Access
- 5. Region Configuration
- 6. Firmware Update
- 7. Exit
- 3

2. From the Inventory Sub Menu, enter 1 for Simple inventory.

- --Inventory Sub Menu----
- 1. Simple
- 2. Periodic Inventory
- 3. Pre-filter
- 4. Back to Main Menu

1

The inventory displays.

Firmware Update

To update the reader firmware with 123RFID:

- 1. From the Command Menu, enter 6 for Firmware update.
- ----Command Menu----
- 1. Capability
- 2. Configuration
- 3. Inventory
- 4. Access
- 5. Region Configuration
- 6. Firmware Update
- 7. Exit

6

2. At the Enter firmware file: prompt, enter the path to the firmware file in the remote machine. Enter firmware file:

d:\3.0.6\3.0.6 Successfully logged into COM7 Update: : 0 Stopping packet formater thread Update: : 0 Update: : 0 Update: : 0 Sending FLASH PROGRAM Update: : 0

Update:	: 0	
Update:	: 0	
Update:	: 0	
Update:	: 0	
Update:	Negotiating Baudrate : O	
Update:	Negotiate Baudrate Successful,	Changing system Baudrate to 921600 : 0
Update:	Negotiate Baudrate Successful,	Changing system Baudrate to 921600 : 0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	0
Update:	Updating BAAFBS00-001-R03 :	5
Update:	Updating BAAFBS00-001-R03 :	5

RE40Config

The RE40Config tool may be used to change the initial RE40 RFID Module default settings such as the protocol, baud rate, number of antenna ports, and erase the region configuration.

The default configuration of RE40 RFID is shown in Table 7.

Table 7 RE40 RFID Default Settings

Setting	Default
Protocol	Binary
Baud Rate	921600
Number of Antenna Ports	3 (DKRE with 1 and 4 Antenna Ports)

The RE40Config tool runs on the Windows 10 operating system. To download the tool, go to: <u>www.zebra.com/support</u>.

Running RE40Config

To run the RE40Config, go to the Windows menu and execute the following command at the prompt: RE40Config <com port> <baud rate>

(For example, RE40Config COM6 921600)

When connected, enter one of the following operations at a time:

- 1: Set Mode
- 2: Set No of Antennas
- 3: Erase Region Config
- 4: Set Baud Rate

Press Enter after each input to complete the operation.

Configuring Protocol Mode

To change the protocol to interface with RE40 RFID Module, first enter **1** to select Set Mode and then enter **1** for **Binary** mode or **2** for **RCI** mode. See example as follows:

Choose operation 1: Set Mode, 2: Set No of Antennas, 3: Erase Region Config, 4: Set Baud Rate

Choose Mode 1: Binary, 2: RCI

Configuring Number for Antennas

To change the maximum number of antenna ports supported by the RE40 RFID Module, first enter **2** to select **Set No of Antennas** and then enter the option number that corresponds to the desired antenna ports (as shown in Table 8).

The following table lists the antenna options as they relate to the antenna(s) ports enabled.

 Table 8
 Antenna Port Options

Option	Antenna Port Enabled
1	1
2	1 and 2
3	1 and 4 (DKRE Board)
4	1, 2, 3, 4

In following example, by entering the number 2 under **Choose Number of Antennas 1 - 4**, antenna ports 1 and 2 are enabled (as shown in Table 8.)

Choose operation 1: Set Mode, 2: Set No of Antennas, 3: Erase Region Config, 4: Set Baud Rate 2

Choose Number of Antennas 1 - 4

Erasing Region Config

The 123RFID Desktop tool or RFID API can be used to configure the region depending on the country that it is deployed. There is also an option to remove the region configuration setting. To erase Region Config permanently, enter **3** to select **Erase Region Config** and then enter **y** to confirm your selection as follows:

Choose operation 1: Set Mode, 2: Set No of Antennas, 3: Erase Region Config, 4: Set Baud Rate 3 Permanently Erase Region Config Confirm y/n: y

Setting Baud Rate

Depending on the baud rate of the host supported, you may change the baud rate by entering **4** for **Set Baud Rate** and then the option number that corresponds to the desired Baud Rate (as shown in Table 9).

The RE40 supports the baud rates in Table 9 to be configured.

Table 9	Baud Rate	Options
---------	-----------	---------

Option	Baud Rate
1	115200
2	230400
3	460800
4	921600

In following example, by entering the number **3** under Choose Baud Rate, the Baud Rate default is changed to 460800 (as shown in Table 9).

Choose operation 1: Set Mode, 2: Set No of Antennas, 3: Erase Region Config, 4: Set Baud Rate

```
4
```

```
RE40 supports the following baud rates to be configured
Choose Baud rate 1: 115200 2: 230400 3: 460800 4: 921600
3
```

Success

Appendix A: Regulatory for Third Party Integration

Third Party Integration Overview

The RE40 is pending approval for modular certification by FCC and Industry Canada under the following ID numbers:

FCC ID - UZ7RE40 IC ID - 109AN-RE40

Modular approval allows installation in different end-use products by an OEM with limited or no additional testing or equipment authorization for the transmitter function provided by the RE40:

- No additional transmitter compliance testing is required if the module is operated with an approved antenna.
- No additional transmitter compliance testing is required if the module is operated with the same general type of antenna listed as approved in the RE40 documentation.
 - Acceptable antennas must be of equal or less far field gain than the antenna previously authorized under the same FCC ID and must have similar in band and out of band characteristics.

The end-product must comply with all applicable FCC equipment authorizations, regulations, requirements and equipment functions not associated with the RE40.

• Compliance must be demonstrated to regulations for other transmitter components within the host product, to requirements for unintentional radiators (Part 15B), and to additional authorization requirements for the non-transmitter functions.

The OEM applying the RE40 is required to include all FCC and/or IC statements and warnings detailed in the following sections to the end-product labeling and in the finished product manual.

Product Labeling

A statement must be included on the exterior of the final OEM product which communicates that the device identified by the FCC and Industry Canada ID numbers are contained within the product. Include the statements:

- Contains FCC ID: UZ7RE40
- Contains IC: 109AN-RE40

Additionally, the OEM must include the following statements on the exterior of the finished product:

• This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including any interference that may cause undesired operation.

User Manuals

Any user documentation that accompanies the end-product must include the following information in a location that is easily read:

- To comply with EU RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20 cm is maintained between the reader (antenna) and user's/nearby people's body at all times and must not be co-located or operating in conjunction with another antenna or transmitter.
- To comply with FCC/ISED's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 25 cm is maintained between the reader (antenna) and user's/nearby people's body at all times and must not be co-located or operating in conjunction with another antenna or transmitter.

US Requirements

The finished product manual must contain the following statement:

 WARNING: The Federal Communications Commission warns that changes or modifications of the radio module within this device not expressly approved by Zebra Technologies, Inc. could void the user's authority to operate the equipment.

In the case where an OEM seeks class B (residential) limits for the host product, the finished product manual must contain the following statement:

- Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
 - Reorient or relocate the receiving antenna.
 - Increase the separation between the equipment and receiver.
 - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
 - Consult the dealer or an experienced radio/TV technician for help.

In the case where an OEM seeks the lesser category of a Class A digital device for their finished product, the following statement must be included in the manual of the finished product:

 Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his expense.

Canadian Requirements

The OEM must include the following regulatory statements in both the English and the French product manual and/or on the finished product:

• This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

 Cet appareil contient des émetteurs / récepteurs exemptés de licence qui sont conformes aux RSS exempts de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

(1) Cet appareil ne doit pas provoquer d'interférences.

(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil.

Antenna Requirements

Although the RE40 is compatible with many different antennas, the device's modular certification with the FCC and IC was tested with Zebra tested antennas enlisted for RE40. As a result, the following instructions allow end users to certify with the FCC and IC using their own antenna.

- To operate the RE40 under the FCC ID or IC, the following guidelines must be followed:
 - The OEM may operate:
 - With the following antenna or antennas of the same type (patch) with maximum gain (6 dBi) according to Zebra UHF RFID Antenna spec, examples: AN510, AN610, AN620, AN720, AN440, AN480, AN710
 - Laird Technologies Model S9025PL, S9025PR, S8655PL, S8655PR.
 - RF I/O interface to the antenna connector on the PCB shall be accomplished via a microstrip or stripline transmission line with characteristic impedance of 50 oHms +/- 10%. A custom coaxial pigtail may also be utilized to connect to the antenna in lieu of a connector.
 - The FCC and IC modular certification testing was performed using Zebra's RE40 Carrier Board PCB, detailed documentation of which can be downloaded from the Zebra support site at www.zebra.com/support.
 - The connector on the OEM's PCB which interfaces to the antenna must be of a unique type to disable connection to a non-permissible antenna in compliance with FCC section 15.203. The following connectors are allowed:
 - Right angle Reverse-Polarity SMA (RP-SMA) Jack: Amphenol p/n 132136RP or equivalent
 - Ultra-Miniature Coaxial Connector (UMCC) Jack: Molex p/n 0734120110 or equivalent
 - Custom 50 Ohm coaxial pigtail from PCB to antenna
 - The OEM must professionally install the RE40 into its final environment to ensure that the conditions are met.

Statement of Compliance

Zebra Technologies, Inc. hereby declares that this radio equipment is in compliance with Directives, 2014/53/EU and 2011/65/EU.

The full text of the EU Declaration of Conformity is available at the following Internet address: www.zebra.com/doc.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the RED before it can be placed on the EU market. This includes reassessing the transmitter module for compliance with the Radio and EMF essential requirements of the RED. This module must not be incorporated into any other device or system without retesting for compliance as multi-radio and combined equipment.

In all cases assessment of the final product must be met against the Essential requirements of the RE Directive Articles 3.1(a) and (b), safety and EMC respectively, as well as any relevant Article 3.3 requirements.

- 1. The patch antenna (gain: 6 dBi) AN480 was verified in the conformity testing, and for compliance; the antenna shall not be modified.
- **2.** A separate approval is required for all other operating configurations, including different antenna configurations (antenna gain increase or different antenna type).
- **3.** If any other simultaneous transmission radio is installed in the host platform together with this module, or above restrictions cannot be kept, a separate RF exposure assessment and CE equipment certification is required.

Appendix B: Troubleshooting

Troubleshooting

The following table provides potential problems that may arise and the solution for correcting the problem.

Table 10 Troubleshooting

Problem	Cause	Solutions
No Tag Reads.	Antenna is not connected.	Connect the correct antenna specific to your region (see DKRE Contents on page 9 for antenna options).
		Region must be configured (For 123RFID, see Connecting via Reader Discovery on page 30, Connecting via COM Port on page 33; for RFID Demo Application, see Configuring the Region on page 45).
	Antenna cable is not correct.	Connect the correct antenna specific to region (see DKRE Contents on page 9 and Antennas on page 19 for antenna information).
	Antenna is not connected correctly to the development board.	Connect the antenna to the development board SMA port (see Installing DKRE Hardware on page 14).
	Power is not connected properly.	Connect the power to the correct Micro USB port using the Micro USB - Power Cable (see Installing DKRE Hardware on page 14).
	Tags are not close enough to the antenna.	Move the tags closer so that they are within a few inches of the antenna.
	Antenna configuration is not set accurately.	Ensure transmit power is set.
	Module temperature is above the operational threshold.	Improve air circulation; wait for the ambient temp to reduce; reduce the transmit power.

Module not connecting.	Region is not configured.	Configure the region using 123RFID Desktop Demo tool ¹ (see Connecting via Reader Discovery on page 30, Connecting via COM Port on page 33).			
	No COM ports enumerated in OS.	Ensure the proper driver is installed for UART/USB CDC ¹ . For USB CDC protocol, the Zebra CDC driver is recommended. Go to: <u>https://www.zebra.com/us/en/support- downloads/software/drivers/usb-cdc-d</u> <u>river.html</u> .			
	Invalid COM port used for connection.	Ensure that the right COM port is used ¹ . For Windows, find the assigned COM ports for RE40 in the Device Manager under Ports . For Linux, use /dev/tty*.			
	Improper power supply.	Ensure that a Zebra provided power adapter is used ¹ .			
	Module configured to RCI protocol.	Use the RE40Config tool to set back to the binary interface protocol ¹ .			
123RFID is not launching.	.NET framework version for 4.5.2 is not installed.	Install the .NET framework 4.5.2.			
¹ After implementing, power cycle the DKRE development board.					

Appendix C: Environmental Considerations

Introduction

This chapter provides information and recommendations on environmental concerns that can that potentially affect performance or damage equipment.

ESD Considerations



CAUTION—ESD: The RFID antenna port may be susceptible to damage from Electrostatic Discharge (ESD). Equipment failure can result if the antenna or communication ports are subjected to ESD. Standard ESD precautions should be taken during installation to avoid static discharge when handling or making connections to the RFID reader antenna or communication ports. Environmental analysis should also be performed to ensure static is not building up on and around the antennas, possibly causing discharges during operation.

ESD Damage

For DKRE installations that fail without a known cause, ESD (ElectroStatic Discharge) may potentially be the cause. Failures due to ESD commonly appear in the software interface as follows:

- RF operations such as reading or writing respond with errors which could be due to RF front end damage or deterioration due to ESD discharge.
- RF operations respond with **No Antenna Connected or Detected** although it is confirmed that a good antenna is installed.
- **Invalid Command errors** appears signaling that a command is not supported although the command previously worked properly. To prevent further damage, a command may become unsupported and return to the bootloader.

Identifying ESD Damage

Determining if ESD is the cause of a failure is challenging. Confirmation is only possible if failed components are isolated and examined under high power microscopy. Concluding that ESD is the cause of a failure is inferred if conditions that could produce ESD are present, anti-ESD precautions have not been taken, and other potential causes are eliminated.

Suggested methods for identifying ESD as the cause for an RFID reader damage are as follows:

- Return failed units for analysis.
- Measure ambient static levels with a static meter. High static levels that change are highly characteristic of discharges.

- Touch some things around the antenna and operating area to feel for static discharges.
- Use the mean operating time statistic before and after one or more of the changes listed below to determine if the change has resulted in an improvement. Be sure to restart your statistic after the change.

Installation Best Practices

To ensure an RFID reader is not unnecessarily exposed to ESD, apply the following guidelines to all installations including full power, partial power, with or without ESD:

- Ensure that RFID module, reader housing, and antenna ground connection are all grounded to a common low inductance ground.
- Verify R-TNC knurled threaded nuts are tight. Do not use a thread locking compound that would compromise the grounding connection of the thread to thread mate. If there is any indication that field vibration might cause the R-TNC to loosen, apply RTV or other adhesive externally.
- Use antenna cables with double shield outer conductors, or full metallic shield semi rigid cables. Zebra specified cables are double shielded and adequate for most applications. ESD discharge currents flowing on the outer surface of a single shield coaxial cable have coupled to the inside of coaxial cables, causing ESD failure.
- Minimize ground loops in coaxial cable runs to antennas. Tying both the RFID module and antenna to
 ground could lead to the possibility of ground currents flowing along antenna cables. The tendency of
 these currents to flow is related to the area of the conceptual surface marked out by the antenna cable
 and the nearest continuous ground surface. When this conceptual surface has minimal area, these
 ground loop currents are minimized. Routing antenna cables against grounded metallic chassis parts
 helps minimize ground loop currents.
- Keep the antenna radome in place to provide ESD protection for the antenna's metallic parts and to protect the antenna from performance changes due to environmental accumulation.
- Record serial numbers, operating lifetimes, and numbers of units operating to determine the mean
 operating lifetime. This number indicates if you have a failure problem, and indicates if improvements or
 failures are confined to one instance or across your population.

Variables Affecting Performance

Environmental

The RFID reader performance may be affected by the following environmental conditions:

- Metal surfaces such as desks, filing cabinets, and bookshelves, may enhance or degrade reader performance.
- Mount antennas away from metal surfaces that may adversely affect the system performance.
- Devices that operate at 900 MHz, such as cordless phones and wireless LANs, can degrade reader performance. Conversely, the RFID reader may affect the performance of these 900 MHz devices.
- Turn off moving machinery when testing as it many interfere with reader performance.
- Fluorescent lighting fixtures are a source of strong electromagnetic interference. Replace or keep the RFID reader cables and antennas away from them.
- Coaxial cables leading from the reader to antennas may be a strong source of electromagnetic radiation. Lay the cables flat and do not coil them.

Tag Considerations

There are variables associated with tags that can affect reader performance to be aware of:

- Some materials, metal, and moisture, interfere with tag performance.
- Most tags have folded dipole antennas. They read well when facing the antenna and when their long edge is oriented toward the antenna. Tags read poorly when the short edge is oriented toward the antenna.
- There are many tag models available and each have its own performance characteristics.

Antenna Considerations

- Use a circularly polarized antenna. Linear antennas can only be used if the tag orientation to the antenna is consistent, or if not in the ideal orientation the antenna or tag can be rotated for best reading.
- To reduce or eliminate ESD issues, use an antenna with a design that naturally presents a short to DC.
- Use an antenna with a return loss of 10 dB or greater (1.92 VSWR) in the transmission band of the region the module is using.
- Use an outdoor-rated antenna if there is a chance that water or dust could get into the antenna and change its RF characteristics.
- Ensure that the antenna is mounted so that personnel do not stand in the radiation beam of the antenna unless they are more than 21 cm away from the face of the antenna (to adhere to FCC limits for long term exposure). If the application calls for personnel to work in the antenna beam and they will be less than 21 cm from the face of the antenna, power should be reduced, or a lower gain antenna must be used (21 cm assumes a 27 dBm power level into an 8.15 dBi antenna).

Multiple Readers

- The RFID reader adversely affects performance of 900 MHz devices. These devices also may degrade performance of the reader.
- Antennas on other readers operating in close proximity may interfere with one another, thus degrading performance of the readers.
- Interference from other antennas may be eliminated or reduced by using either one or both of the following strategies:
 - Affected antennas may be synchronized with a separate user application using a time-multiplexing strategy.
 - Antenna power can be reduced by reconfiguring the RF Transmit Power setting for the reader.



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