

# SR100 USER GUIDE

VERSION 1.0



# CONTACT INFORMATION

SKYETEK, INC.

1525 Market St. Suite 200

Denver, CO 80202

<http://www.skyetek.com>

SALES:

[sales@skyetek.com](mailto:sales@skyetek.com)

TECHNICAL SUPPORT:

[techsupport@skyetek.com](mailto:techsupport@skyetek.com)

<http://support.skyetek.com>

# TABLE OF CONTENTS

- SR100 User Guide ..... 1
- Contact Information ..... 2
- Table of Contents ..... 3
- Chapter 1..... 6
  - SR100 Overview ..... 6
    - Features..... 6
    - SkyeReader Console..... 6
    - FCC Notice..... 6
    - Note Regarding RF Exposure ..... 6
- Chapter 2..... 8
  - Mechanical Specifications ..... 8
- Chapter 3..... 9
  - Environment Specifications..... 9
    - General Ratings and Operating Conditions ..... 9
- Chapter 4..... 10
  - Electrical Specifications ..... 10
    - Absolute Maximum Ratings ..... 10
- Chapter 5..... 11
  - Radio Specifications and Regional Compliance..... 11
    - RF Radio Power ..... 11
    - Frequency Range ..... 11
    - Tag Protocols..... 11
    - Regional Regulations..... 11
    - Radio Specifications..... 11
- Chapter 6..... 13
  - Host Interface Specification..... 13

- USB ..... 13
- TCP/IP..... 13
  - Discovery ..... 13
  - Opening a socket..... 14
- Chapter 7..... 15
  - Antenna Options..... 15
    - Internal Antenna..... 15
    - External Antenna ..... 15
- Chapter 8..... 16
  - Software Specifications ..... 16
    - Host Communication - SkyeTek Protocol v3 ..... 16
    - SkyeReader Console Software ..... 17
- Chapter 9..... 18
  - System Parameters ..... 18
    - Changing System Paramters ..... 18
    - System Parameter Descriptions ..... 18
      - Serial Number ..... 19
      - Firmware Version ..... 19
      - Hardware Version ..... 19
      - Product Code ..... 19
      - Reader ID..... 20
      - Reader Name ..... 20
      - User Port Direction ..... 20
      - User Port Value..... 20
      - MUX Control..... 21
      - Operating Mode ..... 21
      - Command Retry ..... 21
      - Power Level..... 22
      - Current Frequency..... 22

Start Frequency ..... 23

Stop Frequency..... 23

Hop Channel Spacing ..... 23

Frequency Hopping Sequence..... 24

Modulation Depth ..... 24

# CHAPTER 1

## SR100 OVERVIEW

The SR100 is RFID portal reader with an integrated antenna designed for use in North America and Europe. The SR100 can read and write to ISO 18000-6C (EPC Class 1 Gen 2) transponders with a maximum output power of 1W.

## FEATURES

- Common communications protocol - All Skyetek products use Skyetek Protocol v3 (STPv3) to drive low level communication. Skyetek's C and C# APIs are built on top of this protocol to give users methods for all reader and tag operations to use from custom software applications.
- The SR100 has an internal 5dBi Circular Polarized antenna as well as a 50Ohm output to connect and external antenna.
- Communicate via USB or TCP over Ethernet. Send STPv3 commands to the reader using these two interfaces allow easy integration into most modern systems. Users can access all reader functions over both interfaces, including firmware upgrades, security features and all tag commands.

## SKYEREADER CONSOLE

The SR100 ships with the SkyeReader Console software package. This software runs on Windows XP, Vista, and 7. SkyeReader Console includes the following features:

## FCC NOTICE

This equipment complies with Part 15 of the FCC rules. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept all interference received, including interference that may cause undesired operation.

## NOTE REGARDING RF EXPOSURE

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 25cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.



# CHAPTER 2

## MECHANICAL SPECIFICATIONS

(Insert Drawings)



# CHAPTER 3

## ENVIRONMENT SPECIFICATIONS

### GENERAL RATINGS AND OPERATING CONDITIONS

Specification	Rating
Temperature Range	
Operating	
Storage	
Humidity	
Operating, continuous storage	
Transient storage (<24 hours)	
ESP Protection	

# CHAPTER 4

## ELECTRICAL SPECIFICATIONS

This chapter discusses the electrical specifications of the SR100. Unless otherwise noted, the following assumptions apply to these specifications:

- Operating Temperature is 25° C.
- Frequency is 915MHz
- Supply voltage is 6V or 48V if using Power over Ethernet.

Specification	Min	Typical	Max	Units
<i>Logic Inputs</i>				
High State	2			V
Low State			0.8	V
Input Current		4	25	mA
<i>Logic Outputs</i>				
Output High	2.9	3.3		V
Output Low		0	0.4	V
Output Current		4	25	mA
<i>Power Supplies</i>				
DC Power Supply	5.0	6.0	6.5	V
Power over Ethernet	48	48	52	V
<i>Peak Transmit Current Consumption</i>				

## ABSOLUTE MAXIMUM RATINGS

Specification	Rating
Maximum Input Voltage, DC Jack	9V
Maximum Voltage, PoE	52V
Digital I/O Voltage	3.3V
Antenna VSWR	1.5:1 or better

# CHAPTER 5

## RADIO SPECIFICATIONS AND REGIONAL COMPLIANCE

### RF RADIO POWER

The output power of the SR100 is adjustable from 10-30dBm in steps of 0.1dBm with +/- 1dB accuracy. With this adjustable power, the user can configure the device to suit their needs of reading transponders at different ranges, or to reduce overall power consumption. See “Power Level” on page 22 for information on how to set the RF output power.

### FREQUENCY RANGE

The SR100 is a multi-frequency device that can operate anywhere in the 860-960MHz range, which covers the world’s major UHF RFID bands. The user can set a Start and Stop frequency so the reader may operate in a subset of this band. See “System Parameters” below for more information on adjusting the Current, Start and Stop frequency for the reader.

*SkyeTek will lock all pertinent system parameters for a given region (frequency, hop channel spacing, etc.) when the unit is sold in said region. This is to prevent the user from violated regional regulations.*

### TAG PROTOCOLS

The SR100 supports basic tag commands (identify, read and write) for the following tag protocols:

- EPC C1G2 (ISO 18000-6C)
- iPX EM

NOTE - For additional tag support information, see the Tag Support list included with the documentation for your SR100.

### REGIONAL REGULATIONS

The SR100 has been tested and approved for regional compliance in the following regions.

Region	Agency	Approvals	Publications/Regulations
North America	FCC	Part 15	
Europe	ETSI		

### RADIO SPECIFICATIONS

For the table below, assume an operating temperature of 25°C.

Specification	Min	Typical	Max	Units
<b>RF Characteristics</b>				
Frequency ranges (Direct Output)	860		960	MHz
Hop Channel Spacing	100	200	300	KHz
<b>Transmission Parameters</b>				
Transmit Power	10		30	dBm
Optimum PA Load Impedance		50		Ohms
<b>Receiver Parameters</b>				
Sensitivity at 50 kbps (30dBm output power)		60		dB
Sensitivity at 80 kbps (30dBm output power)		60		dB

# CHAPTER 6

## HOST INTERFACE SPECIFICATION

This chapter describes the host interface connections of the SR100.

The SR100 supports two host interfaces:

- USB
- TCP/IP over Ethernet

Each interface is active when the user makes the connection with either an Ethernet cable or a USB cable. If both cables are connected, USB has priority and the Ethernet connection will not be able to communicate with the reader. The SR100 receives and transmits STPv3 commands over both interfaces.

### USB

The SR100 supports a USB Full Speed connection. It uses a USB to serial converter internally to communicate with the reader which requires a driver to be installed on your host computer. This driver is included with the software CD, is installed automatically with the SkyReader Console software, or can be downloaded from [www.ftdichip.com/Drivers/VCP.htm](http://www.ftdichip.com/Drivers/VCP.htm).

### TCP/IP

The SR100 can use TCP sockets for communication as well. The C# API provides methods for device discovery and communication, but if you want to use a different programming environment, the information below describes how these methods work.

### DISCOVERY

The SR100 utilizes the .NET Micro Framework for network communication. This is very nice because a discovery function is built into the device. All that is required is to send the string "DOTNETMF" over a UDP Multicast on your network. The device will receive this string and send out a UDP Multicast that looks like this:


You can use the MAC Address and IP Address from this response to create a socket connection as described below. You can match the MAC Address from this response to the one printed on the label on the bottom of your SR100.

The SR100 uses DHCP to dynamically obtain an IP address. When you first apply power to the unit and then a network connection, it will take a few seconds for this process to complete. You can watch the LEDs on the Ethernet connector for an indicator; when the Green LED starts blinking, the device is communicating with the network and you may try the discovery process.

---

## OPENING A SOCKET

After you have discovered your device's IP Address, you can now open a TCP socket to your SR100. The SR100 is always listening for a new connection if it is not already connected. You must use the following parameters:

- Two way communication socket (stream)
- Use Port 2000

After the socket connection is established, you may stream data across this socket freely. The SR100 will receive and transmit STPv3 commands and responses. To close the socket, simply terminate the connection, and the SR100 will recognize the connection has been closed and listen for a new one.

# CHAPTER 7

## ANTENNA OPTIONS

The SR100 supports two antenna options: internal antenna and external antenna. The default is to use the internal antenna because it is always connected.

To change the active antenna, the user sends a Write System Parameter command to the reader with the following attributes:

Command	Address	Blocks	Data
Write System Parameter	0x0060	0001	0x01 for external 0x02 for internal (Default)

You can also issue a Store Default System Parameter with the same attributes to keep your settings after a power cycle.

## INTERNAL ANTENNA

The internal antenna is a 5dBi gain Circularly Polarized patch antenna. This high performance antenna will allow the user to read tags up to 5m from the reader in free space. Because it is circularly polarized, tag orientation does not play a major factor in read distance.

## EXTERNAL ANTENNA

The SR100 can use any external antenna with a 50Ω load. Keep the following items in mind when selecting an external antenna:

- Antenna Gain - The SR100 has 1W of output power, and the maximum EIRP allowed by the FCC is 4W. The highest gain antenna that can be used with the SR100 in North America is 5.35dBi. Check regional regulations for other restrictions.
  - Antenna gain is also directly related to beam width. The higher the gain, the more directional the antenna is, and the narrower the beam width.
- Cable - Different cables have different losses over distance. For example, standard RG58 coaxial cable losses approximately 0.49dB/meter. Over longer distances, this can cause significant loss of power.
- Polarization - A linearly polarized antenna will be very sensitive to tag orientation, where a circularly polarized antenna will not be as sensitive.

# CHAPTER 8

## SOFTWARE SPECIFICATIONS

### HOST COMMUNICATION - SKYETEK PROTOCOL V3

The SR100 uses SkyTek Protocol v3 for all communication. For more information about this protocol, including commands, flags, request and response formats, please see the *SkyTek Protocol v3 Reference Guide*.

The basic command and response format is illustrated below.

#### Request Format (bytes) ASCII Mode

Flags	Cmd.	RID	Tag Type	TID Length	TID	AFI	Addr.	# of Blocks	Data Length	Data	CRC
4	4	8	4	4	32 (max)	2	4	4	4	2K	4

#### Request Format (bytes) Binary Mode

Mes. Length	Flags	Cmd.	RID	Tag Type	TID Len.	TID	AFI	Addr	# of Blks.	Data Len.	Data	CRC
2	2	2	4	2	1	16 (max)	1	2	2	2	1K	2

#### Response Format (bytes) ASCII Mode

Response Code	RID	Tag Type	Data Length	Response Data	CRC
4	8	4	4	2K	4

#### Response Format (bytes) Binary Mode

Message Length	Response Code	RID	Tag Type	Data Length	Response Data	CRC
2	2	4	2	2	1K	2

#### Shading Information

	Required Fields
--	-----------------



	Optional Fields (depending on the command and flags)
	Required Fields, depending on the command

## SKYEREADER CONSOLE SOFTWARE

Information to follow.

# CHAPTER 9

## SYSTEM PARAMETERS

System parameters let you configure reader settings to customize them for your environment. You can temporarily alter parameters in memory or change the default values that are stored on the SR100 non-volatile memory. The following table summarizes the parameters for the SR100.

Parameter	Address	Length (bytes)	Default Value
Serial Number	0x0000	0x0004	0x00000000
Firmware Version	0x0001	0x0004	0xFFFFFFFF (depends on release)
Hardware Version	0x0002	0x0004	0xFFFFFFFF (depends on release)
Product Code	0x0003	0x0002	0x000A
Reader ID	0x0004	0x0004	0xFFFFFFFF
Reader Name	0x0005	0x0020	SR100 (in hexadecimal)
User Port Direction	0x0008	0x0001	0x00
User Port Value	0x0009	0x0001	0x00
MUX Control	0x000A	0x0001	0x00
Operating Mode	0x000C	0x0001	0x00
Command Retry	0x0011	0x0001	0x05
Power Level	0x0012	0x0001	0xFA
Current Frequency	0x0030	0x0004	0x3689CAC0 (915 MHz)
Start Frequency	0x0031	0x0004	0x35C80160 (902.3 MHz)
Stop Frequency	0x0032	0x0004	0x374B9420 (927.7 MHz)
Hop Channel Spacing	0x0034	0x0004	0x00030D40
Frequency Hopping Sequence	0x0035	0x0001	0x01 (random)
Modulation Depth	0x0036	0x0001	0x64 (100%)

## CHANGING SYSTEM PARAMETERS

You can read or write system parameters via the following commands:

- Read System Parameter—reads the current value of the system parameter at the memory address specified.
- Write System Parameter—writes a new value to the system parameter at the memory address specified.
- Store Default System Parameter—writes a new system parameter value to the EEPROM.
- Retrieve Default System Parameter—reads the system parameter value at the address specified out of EEPROM.

See the *SkyeTek Protocol v3 Reference Guide* for a complete list of commands.

## SYSTEM PARAMETER DESCRIPTIONS

This section describes each SR100 system parameter.

---

## SERIAL NUMBER

- Returns the serial number of the reader
- Parameter address: 0x0000
- Length (bytes): 1
- Default value: 0x00000000
- Read-only

---

## FIRMWARE VERSION

Returns the firmware version currently loaded on the reader. (Refer to the SkyeModule M10 Release Notes for more information about the specific firmware release.)

- Refer to the SkyeTek Development Kit User Guide for information about updating firmware.
- Parameter address: 0x0001
- Length (bytes): 4
- Default value: 0XXXXXXXX (depending on release)
- The firmware version uses this format:
  - a) Product type (1 Byte)
  - b) Major revision (1 Byte)
  - c) Minor revision/build number (2 bytes)
- Read-only

---

## HARDWARE VERSION

- Returns the current hardware version of the reader
- Parameter address: 0x0002
- Length (bytes): 4
- Default value: 0XXXXXXXX (depending on release)
- The hardware version uses the following format:
  - a) Product type (1 Byte)
  - b) Major revision (1 Byte)
  - c) Minor revision/build number (2 Bytes)
- Read-only

---

## PRODUCT CODE

- Returns the SkyeTek product code identifier. (Each SkyeTek product has a unique product code.)
- Parameter address: 0x0003
- Length (bytes): 2
- Default value: 0x000A
- Read-only

---

## READER ID

- Specifies the Reader ID, which is a reader-specific identifier. It lets the reader execute and respond only to those commands intended for it. The reader determines if the Reader ID in the request matches its internal Reader ID. If the ID does not match, the reader does not respond.
- Parameter address: 0x0004
- Length (bytes): 4
- Default value: 0xFFFFFFFF (depending on release)
- Select the Reader ID functionality by specifying the RID Flag in the request. This setting lets you use multiple readers on the same bus or networked together.
- Read/write

Note -Changing the reader ID from the factory default of FFFFFFFF to any other value disables Loop Mode, which is used for read range demonstrations. See “Selecting Any Supported Tag Continuously (Loop Mode)” for an example of using Loop Mode.

---

## READER NAME

- Identifies a reader with a 32-byte user-defined name.
- Parameter address: 0x0005
- Length (bytes): 32
- Default value: SkyeModule M10 (in hex)
- Read/write

---

## USER PORT DIRECTION

- Sets the direction of the GPIO pins of the reader.
- Parameter address: 0x0008
- Length (bytes): 1
- Default value: 0x00
- A one in the bit position indicates that the corresponding GPIO pin is an input.
- A zero in the bit position indicates that the corresponding GPIO pin is an output.
- Read/write
- Bits correspond to the pins as follows:
  - BIT0 - GPIO0
  - BIT1 - GPIO1
  - BIT2 - GPIO2
  - BIT3 - GPIO3
  - BIT4 - reserved for future use
  - BIT5 - reserved for future use
  - BIT6 - reserved for future use
  - BIT7 - reserved for future use

---

## USER PORT VALUE

- Sets the value of the GPIO pins of the reader.

- Parameter address: 0x0009
- Length (bytes): 1
- Default value: 0x00
- A one in the bit position indicates that the corresponding GPIO pin is a logic high.
- A zero in the bit position indicates that the corresponding GPIO pin is logic low.
- The enable bit (bit 7) must be set for the settings to take effect.
- Bits correspond to the pins as follows:
  - BIT0 - GPIO0
  - BIT1 - GPIO1
  - BIT2 - GPIO2
  - BIT3 - GPIO3
  - BIT4 - reserved for future use
  - BIT5 - reserved for future use
  - BIT6 - reserved for future use
  - BIT7 - enable
- Read/write

---

## MUX CONTROL

- Controls a SkyePlus multiplexer. See the SkyePlus Multiplexer Reference Guide for complete information about using this parameter.
- Parameter address: 0x000A
- Length (bytes): 1
- Default value: 0x00
- Read/write

---

## OPERATING MODE

- Puts the reader into sleep mode.
- Parameter address: 0x000C
- Length (bytes): 1
- Default value: 0x00
- Writing a value 0x01 to this parameter puts the reader into sleep mode.
- Sending any command on any interface wakes the reader from sleep mode.
- Read/write

---

## COMMAND RETRY

- One-byte value.
- Parameter address: 0x0011
- Length (bytes): 1
- Default value: 0x05
- Can be set by the host.
- Specifies the number of times a tag command is executed internally in the reader before responding with a failure response.
- Applies only to tag-specific SkyeTek Protocol commands.

- Valid range of values is 0-255 (0x00-0xFF).
- The command is repeated internally “n” number of times, where n is the value specified by the host, unless there is a successful response. When a successful response occurs, the reader stops repeating the command and sends a success response back to the host.
- Read/write

Note - Increasing the value of this parameter increases the time that the reader takes before it sends a failure message if a failure occurs. To avoid unnecessary delays, be sure to determine the optimal number of retries for your particular use.

---

## POWER LEVEL

- Configures the power level for the reader.
- Parameter address: 0x0012
- Length (bytes): 1
- Default value: 0xFA (30 dBm)
- Power level is set in steps of 0.1 dB from 10 dBm to 30 dBm.
- Power levels are written in hex corresponding to a decimal value between 50 and 250 (see Table 9-10).
- Use the following equation to calculate the value to be written for a desired power level:  
 $(\text{Desired power in dBm} - 5) / 0.1 = \text{decimal value to write to system parameter}$

### Common Power Levels

Power (dBm)	SkyeTek Decimal Value	Hex Equivalent
10	50	0x32
12	70	0x46
15	100	0x64
17	120	0x78
20	150	0x96
21	160	0xA0
24	190	0xBE
27	220	0xDC
30	250	0xFA

- Read/write

---

## CURRENT FREQUENCY

- Sets the current frequency with which the reader singulates a tag.
- Parameter address: 0x0030
- Length (bytes): 4
- Default value: 0x3689CAC0 (915 MHz)
- This parameter is a 4-byte hex equivalent of the frequency. Table 9-11 shows hex values for commonly used frequencies.
- Read/write

## START FREQUENCY

- Sets the low end of the frequency range under which the reader operates.
- Parameter address: 0x0031
- Length (bytes): 4
- Default value: 0x35C80160 (902.3 MHz)
- This parameter is written with a 4-byte hex equivalent of the frequency desired. See Table 9-11 for commonly used frequencies and their hex values.
- To enable frequency hopping, set a frequency range using the Start Frequency and Stop Frequency system parameters. Then use the Frequency Hopping Sequence parameter to set the frequency hopping mode (either sequential or pseudo-random). To disable frequency hopping, set the Start Frequency and Stop Frequency parameter to the same value.
- Read/write

## STOP FREQUENCY

- Sets the high end of the frequency range under which the reader operates.
- Parameter address: 0x0032
- Length (bytes): 4
- Default value: 0x374B9420 (927.7 MHz)
- This parameter is written with a 4-byte hex equivalent of the frequency desired. See Table 9-11 for commonly used frequencies and their hex values.
- To enable frequency hopping, set a frequency range using the Start Frequency and Stop Frequency system parameters. Then use the Frequency Hopping Sequence parameter to set the frequency hopping mode (either sequential or pseudo-random). To disable frequency hopping, set the Start Frequency and Stop Frequency parameter to the same value.
- Read/write

### Commonly Used Frequencies

Frequency (MHz)	Hex Equivalent	Description
865.7	0x339988A0	ETSI Start
866.7	0x33A8CAE0	ETSI Center
867.9	0x33BB1A60	ETSI Stop
902.3	0x35C80160	FCC Start
915.0	0x3689CAC0	FCC Center
927.7	0x374B9420	FCC Stop

## HOP CHANNEL SPACING

- Controls the hop channel spacing when frequency hopping is enabled.
- Parameter address: 0x0034
- Length (bytes): 4
- Default value: 0x00030D40 (200 KHz)
- To enable frequency hopping, set a frequency range using the Start Frequency and Stop Frequency system parameters. Then use the Frequency Hopping Sequence parameter to set the

frequency hopping mode (either sequential or pseudo-random). To disable frequency hopping, set the Start Frequency and Stop Frequency parameter to the same value.

- Read/write

---

## FREQUENCY HOPPING SEQUENCE

- Switches the hopping sequence between pseudo-random and sequential mode.
- Parameter address: 0x0035
- Length (bytes): 1
- Default value: 0x01 (pseudo-random)
- To set the reader to sequential hopping mode, write 0x00 to this parameter.
- To reset the reader to pseudo-random hopping sequence, write 0x01 to this parameter.
- To enable frequency hopping, set a frequency range using the Start Frequency and Stop Frequency system parameters. Then use the Frequency Hopping Sequence parameter to set the frequency hopping mode (either sequential or pseudo-random). To disable frequency hopping, set the Start Frequency and Stop Frequency parameter to the same value.
- Read/write

---

## MODULATION DEPTH

- Sets the modulation depth of the reader-to-tag transmissions, as calculated by the equation:  $(V_{max} - V_{min})/V_{max}$ .
- Parameter address: 0x0036
- Length (bytes): 1
- Default value: 100%
- The values for the modulation depths are in steps of 10, ranging from 10% to 100%.
- The values are the hex equivalent of the corresponding modulation depth.

### Common Modulation Depth Values

Modulation Depth (%)	Hex Equivalent
30	0x1E
80	0x50
90	0x5A
100	0x64

- The modulation depth is calculated by the reader using the equation:
  - $(V_{MAX} - V_{MIN})/V_{MAX}$  where  $V_{MAX}$  is the RF voltage when transmit power is maximum and  $V_{MIN}$  is the RF voltage when transmit power is minimum. (For 100% modulation depth,  $V_{MIN}$  equals zero.)
- See the manufacturer's tag data sheet for the modulation depth supported for the tags in your application.
- Read/write