

# OPERATIONS MANUAL



## INTELLIGUARD® IG-RS2000-1 RFID Reader Module

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## IntelliGuard® IG-RS2000-1 Overview

The IntelliGuard IG-RS2000-1 reader module comprises a fully integrated EPC Gen2-compliant RFID reader system for embedded systems. Based on the Indy R2000 reader chip from Impinj, this provides proven and reliable performance for IntelliGuard's Smart Cabinet Inventory Systems. The system-in-package design allows it to be attached to a PCB using standard printed circuit board (PCB) assembly methodologies, affording high performance with lower system costs. It is easily integrated into IntelliGuard's line of smart cabinets for automated inventory tracking and control, requiring only connections to a power source, digital communication with a host, and an antenna. In an embedded system, it allows a complete feature set for EPC Gen2 RFID capability.

This document includes interface, functional, performance, mechanical and environmental specifications.

Host communication specifications (e.g. firmware upgrade and host interface protocol) and the Impinj Radio Interface (IRI) documentation are used by IntelliGuard to implement the final system solution and are not provided to end users. All operational application development is done by IntelliGuard for IntelliGuard's products and utilizes Impinj's suites of development tools, including the Indy ITK Release. IG-RS2000 uses the IRI™ (Impinj Radio Interface) to communicate with host systems. The ITK (IRI Tool Kit) is used by IntelliGuard to build the host platform. Further information may be found at [www.impinj.com](http://www.impinj.com). IntelliGuard provides this link as reference only.

*Table 1. IG-RS2000-1 Key Attributes*

Air Interface	ISO 18000-63 (EPC Global C1G2)
Antenna Ports	Four total (2 surface mount, 2 u.fl connectors)
Transmit Power	Settable from 10 dBm to 29.86 dBm (maximum) at the antenna connector
Receive Sensitivity	Ideal -74 dBm (depends on antenna match)
Frequency	UHF 902.75-927.25 MHz for Operation in North America
Package	Metal can; 35 pin surface-mount
Power Supply	3.5 to 5.25 VDC
Dimensions	38 mm x 52 mm x 4 mm
Temperature	Operating: -20 to +60 degrees C
Regions	Capable for all major regions (when configured by IntelliGuard)
Compliance	Certified for FCC and Canada modular certification
RoHS	Yes, 2011/65/EU

### ***Restriction on Use***

***The IG-RS2000-1 is intended for use in IntelliGuard's lines of RFID-enabled inventory control cabinets and solutions. All calibrations and settings are performed by IntelliGuard personnel for compliance in the intended region of use. There are no end-user controls that alter the behavior and performance of this device.***

## IntelliGuard® IG-RS2000-1 Device Operation

IntelliGuard's lines of-RFID enabled Smart Cabinets utilize the IG-RS2000-1 in an embedded configuration, controlled by a host Raspberry Pi mini-computer. The software application on the Pi links to the IG-RS2000-1 via its serial UART to the Pi's USB. The control protocol is implemented using the Impinj Radio Interface (IRI™) in the final system solution. All operational applications are developed using Impinj's suites of development tools, including the Indy IRI Tool Kit (ITK). IG-RS2000-1 uses the IRI™ to communicate with the host system. The ITK (IRI Tool Kit) is used by IntelliGuard to build the host platform. Further information may be found at [www.impinj.com](http://www.impinj.com). IntelliGuard provides this link as reference only.

In operation, the embedded system interfaces to various sensors which provide input to the User Application to determine when an RFID inventory scan will occur. Specifically, sensors which indicate whether a cabinet door is open or closed, and whether it is locked or unlocked, are monitored by the Application. Following a sequence where access is granted (via a proximity badge reader), the cabinet door is opened and then closed and locked, the IG-RS2000-1 is activated for a brief time to read the RFID tags affixed to the products inside the cabinet. The tags' IDs are collected and associated with their specific products. The data are stored in a database for subsequent analysis and reports.

The IG-RS2000-1 is ISO18000-63-compliant, and is compliant with the EPC Global and RAIN standards. The complete air-interface protocols may be found on the GS1 website at <https://www.gs1.org>

IntelliGuard Smart Cabinets are available in a variety of sizes and configurations. In each case the IG-RS2000-1 may be set within regulatory constraints to optimize tag reading ability. Typically, the scanning times are adjusted depending upon the number or tagged items within the cabinet, and may range from 5 seconds to 15 seconds. From a User's perspective minimizing the scanning time is desirable. Secondly, the RF transmitted power and receiver sensitivity levels may be adjusted, depending on the type and size of the enclosure.

The embedded system takes inventory of the cabinet each time the cabinet is accessed. The frequency of access will vary depending on the customer's logistics and use, and will typically run between 2 and 5 times per day. Between RFID scans, the IG-RS2000-1 is idle.

## IntelliGuard® IG-RS2000-1 Device Description

The IntelliGuard RS-2000-1 module is a self-contained UHF EPC Gen 2 RFID reader. The System-in-Package (SiP) construction is surface-mountable and is designed to be assembled onto PCB to interface with a host processor, power and ground, and a set of antennas. Additional Inputs and Outputs consist of a serial interface (UART), Status, and Health indicators.

In addition to the two surface-mount RF antenna connection, two U.FL connectors are provided. The entire SiP is contained within a metal 'can' for EMI shielding.

*Figure 1. Module Picture and FCC Label*



Figure 2. Basic Connections

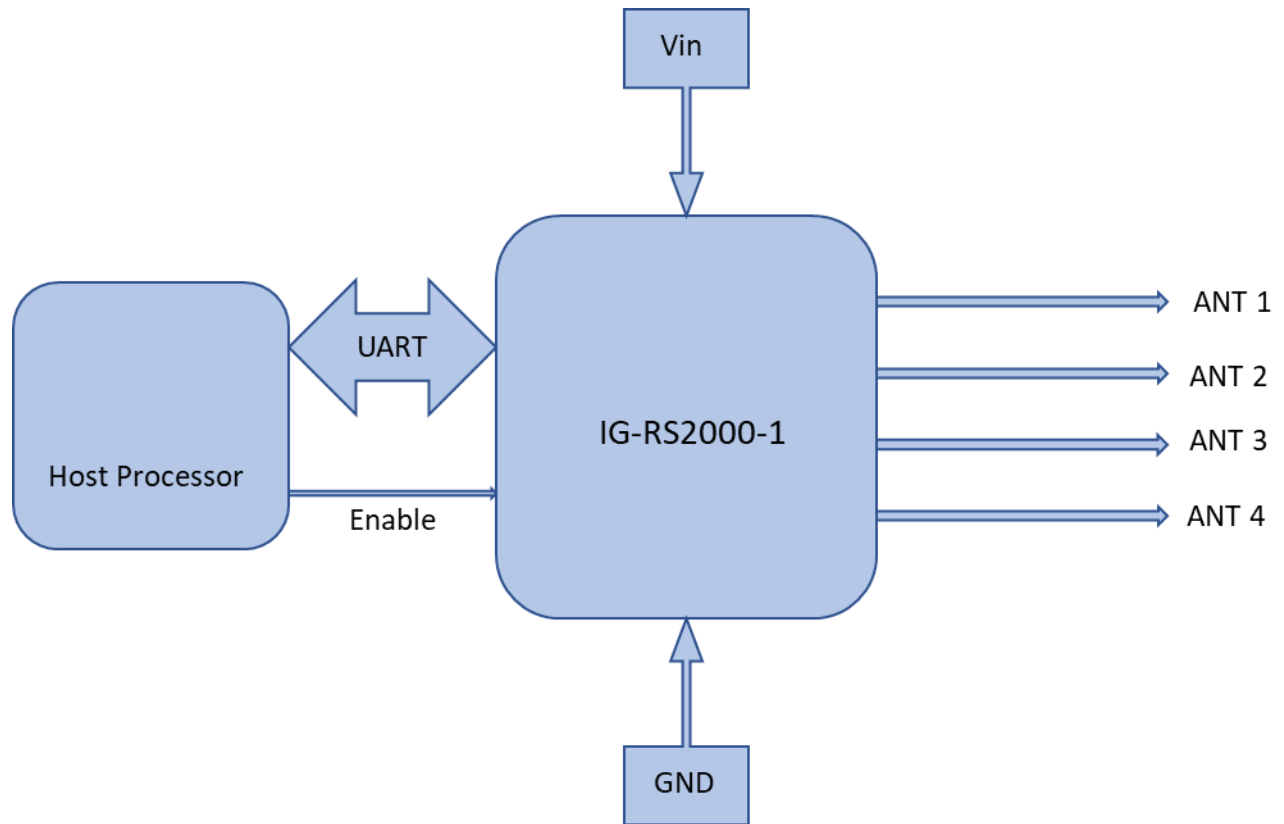


Figure 3. SiP Pin-Outs

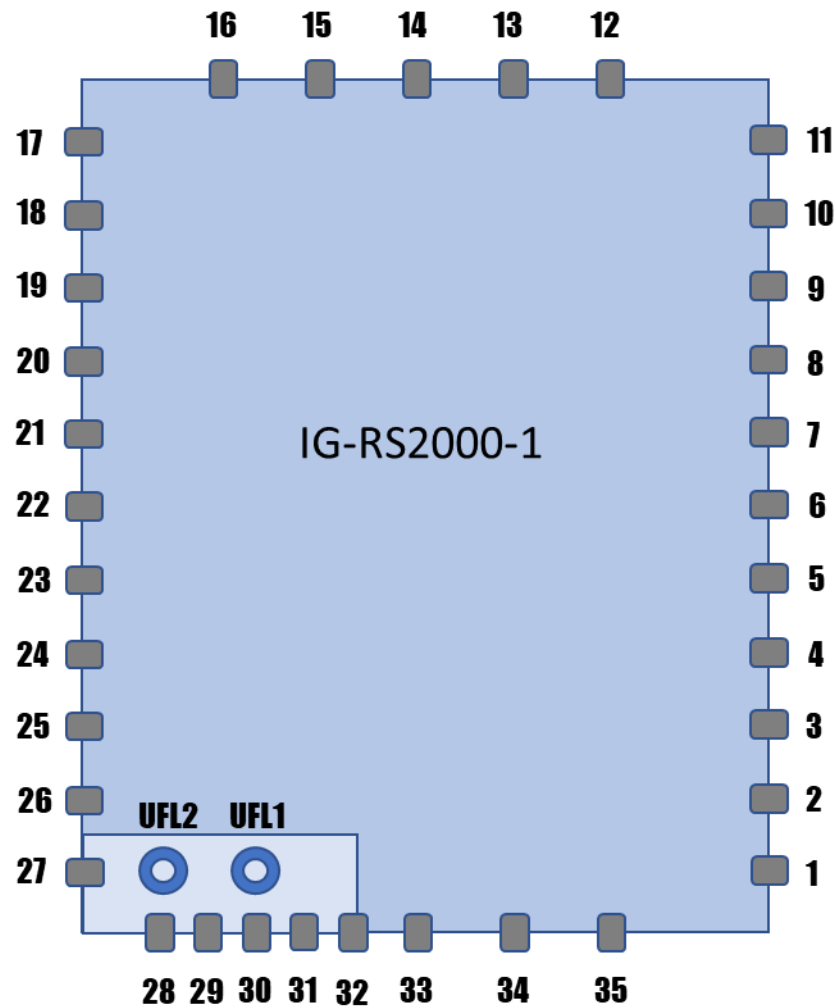


Table 2. Full Pin-Out List (note: not all pins are utilized)

Pin #	Pin Name	Pin Type	Description
1	VDC_IN	Power	Supply Voltage
2	GND	Ground	Ground
3	UART2-TX	Digital Output	Debug UART Tx to host
4	UART2-RX	Digital Input	Debug UART Rx from host
Pin #	Pin Name	Pin Type	Description
5	GND	Ground	Ground

7	UART1-RX	Digital Input	UART Rx from host
8	GND	Ground	Ground
9	ENABLE	Digital Input	Enable, Active High
10	GND	Ground	Ground
11	VDC_IN	Power	Supply Voltage
12	GND	Ground	Ground
13	GND	Ground	Ground
14	GND	Ground	Ground
15	GND	Ground	Ground
16	GND	Ground	Ground
17	WKUP	Digital Input	Wakeup from Sleep
18	GPIO1	Digital I/O	GPIO
19	GPIO2	Digital I/O	GPIO
20	GPIO3	Digital I/O	GPIO
21	GPIO4	Digital I/O	GPIO
22	STATUS	Digital Output	Status Indication
23	HEALTH	Digital Output	Health Indication
24	GND	Ground	Ground
25	CLK_OUT	No Connect	Test Pin
26	DTEST0	No Connect	Test Pin
27	DTEST1	No Connect	Test Pin
28	GND	Ground	Ground
29	ANT2	RF	Antenna Port 2
30	GND	Ground	Ground
31	ANT1	RF	Antenna Port 1
32	GND	Ground	Ground
33	GND	Ground	Ground
34	GND	Ground	Ground
35	GND	Ground	Ground
UFL1	UFL1	RF	UFL Port 1
UFL2	UFL2	RF	UFL Port 2

## IntelliGuard® IG-RS2000-1 Regulatory and Label

The IG-RS2000 has been certified for modular operation by FCC and Industry Canada in certain specific configurations using the following IDs. Use of these IDs requires specific text be added to product labeling and product Hardware User's Guides.

FCC ID: SOA-RS2000

IC ID: 22150-RS2000

## Federal Communications Commission (FCC) Part 15 Compliance

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 interference that may cause undesired operation.

This equipment has been tested to be sure it complies with the limits for 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 an 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.

- Re-orient 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.

### *Canada Operation*

*This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.*

*Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

*This radio transmitter 22150-RS2000 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

*“Le présent émetteur radio 22150-RS2000 a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.”*



## Antennas

The Reader has been tested and certified to operate with planar patch antennas and monopole antennas having a gain not exceeding 6 dBi. Use of other antenna types are not permitted.

**CAUTION: Changes to this product or modifications not expressly approved by the party responsible for compliance could void your authority to operate per FCC Part 15.**

**ATTENTION: Les modifications apportées à ce produit ou modifications pas expressément approuvés par la partie responsable de la conformité peuvent annuler votre droit à utiliser par FCC Part 15.**

## Maximum Permissible Exposure

FCC maximum permissible exposure (MPE) limits require that a minimum of 35 cm separation be maintained between the antennas and personnel working in the area. For additional information on maximum permissible exposure please refer to the following bulletins:

FCC OET Bulletin 65: Evaluating Compliance with FCC Guidelines for Maximum Permissible Exposure to Radiofrequency Electromagnetic Fields

FCC OET Bulletin 56: Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Electromagnetic Fields

*L'exposition maximale admissible d'IC (MPE) limite exige qu'un minimum de 35 cm de séparation soit maintenu entre les antennes et le personnel travaillant dans la région. Pour plus d'informations sur l'exposition maximale admissible veuillez consulter les bulletins suivants :*

*Cnr-102 - Radio Fréquence (RF) Conformité des appareils de radiocommunication aux limites d'exposition (pour toutes les bandes de fréquences)*

Table 3. FCC ID Label Example

