



Datasheet

# IMPINJ R700 SERIES RAIN RFID READERS

DATASHEET

## OVERVIEW

The Impinj R700 series of readers include the R700 and R720 RAIN RFID readers. These readers are designed to support enterprise RAIN deployments that need industry-leading performance, enterprise-grade reliability and security, and support for next-gen RAIN tags. IoT developers can easily build and deploy customized solutions with developer-friendly tools, increased processing power, and increased on-reader memory.

This document constitutes the electrical and mechanical specifications pertaining to the Impinj R700 and R720 RAIN RFID readers. It contains a functional overview, mechanical characteristics, and electrical specifications. For technical support, visit the Impinj Support Portal at [support.impinj.com](https://support.impinj.com).

**Table 1: Impinj R700 Series Key Specifications**

SPECIFICATION	R700	R720
<b>Physical Dimensions</b>	With mounting brackets 8.4 in. long x 7.4 in. wide x 1.2 in. deep (21.5 cm x 18.7 cm x 3.0 cm) Without brackets: 8.4 in. width x 5.9 in. depth x 1.2 in. height inch (21.4 x 14.9 x 3.0 cm)	
<b>Power Supply</b>	PoE (802.3af), PoE+ (802.3at) with LLDP for power negotiation	
<b>Air Interface Protocol</b>	EPCglobal UHF Gen2 v2 / ISO 18000-63 RFID	
<b>Antenna Ports</b>	4, Monostatic (RP-TNC)	
<b>Frequency Range</b>	IPJ-R700-241 ETSI Reader 865 – 868 MHz, 915 – 921 MHz IPJ-R700-341 Global Reader: 902 – 928 MHz IPJ-R700-441 Japan Reader 916.7 to 920.9 MHz	IPJ-R720-243 ETSI Reader 865 – 868 MHz, 915 – 921 MHz IPJ-R720-343 Global Reader: 902 – 928 MHz IPJ-R720-443 Japan Reader: 916.7 to 920.9 MHz
<b>Transmit Power</b>	PoE+: 10 - 33 dBm max PoE: 10 - 30 dBm max	PoE+: 10 - 33 dBm max PoE: 10 - 20 dBm max
<b>Typical Receive Sensitivity</b>	-93 dBm CISC 90% PSR	
<b>Processor</b>	Dual-Core 1 GHz ARM processor	Quad-Core 1.4 GHz ARM53 Processor
<b>Memory</b>	1 GB Flash, 1 GB RAM	
<b>Network Connectivity</b>	10/100/1000 BASE-T Ethernet	
<b>Device Connectivity</b>	3 USB Type-A, 1 micro USB	
<b>General Purpose I/O</b>	2 in / 3 out	

Figure 1: Impinj R700/R720 Top View



Figure 2: Impinj R700/R720 Bottom View



Figure 3: Impinj R700/R720 Front View



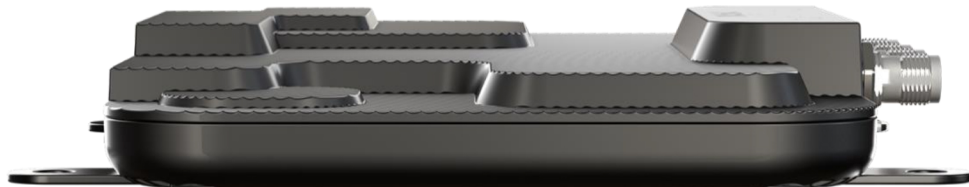
Figure 4: Impinj R700/R720 Back View



Figure 5: Impinj R700/R720 Left View



Figure 6: Impinj R700/R720 Right View



# TABLE OF CONTENTS

<b>1</b>	<b>Introduction .....</b>	<b>1</b>
1.1	Features .....	1
1.2	Block Diagram .....	1
<b>2</b>	<b>Specifications.....</b>	<b>2</b>
2.1	Mechanical .....	2
2.2	Environmental .....	2
2.3	RFID .....	3
2.3.1	Transmit Power .....	3
2.3.2	Gen 2 Reader Modes .....	4
2.3.3	Read Rate .....	4
2.3.4	Receive Sensitivity .....	4
2.4	Connectivity .....	4
2.4.1	Power .....	4
2.4.2	GPIO .....	5
2.5	Operating System .....	6
<b>3</b>	<b>Development Libraries .....</b>	<b>6</b>
<b>4</b>	<b>Regulatory Specifications.....</b>	<b>7</b>
<b>5</b>	<b>Ordering Information .....</b>	<b>7</b>
5.1	Reader.....	7
5.2	Accessories and Warranties .....	8
5.3	Antennas and Antenna Cables .....	8
<b>6</b>	<b>Impinj Fixed Reader Comparison.....</b>	<b>9</b>
<b>7</b>	<b>Additional User Documentation .....</b>	<b>9</b>
<b>8</b>	<b>Change Log .....</b>	<b>11</b>
8.1	June 2020.....	11
8.2	October 2020.....	11
8.3	February 2021 .....	11
<b>9</b>	<b>Notices .....</b>	<b>12</b>

# 1 INTRODUCTION

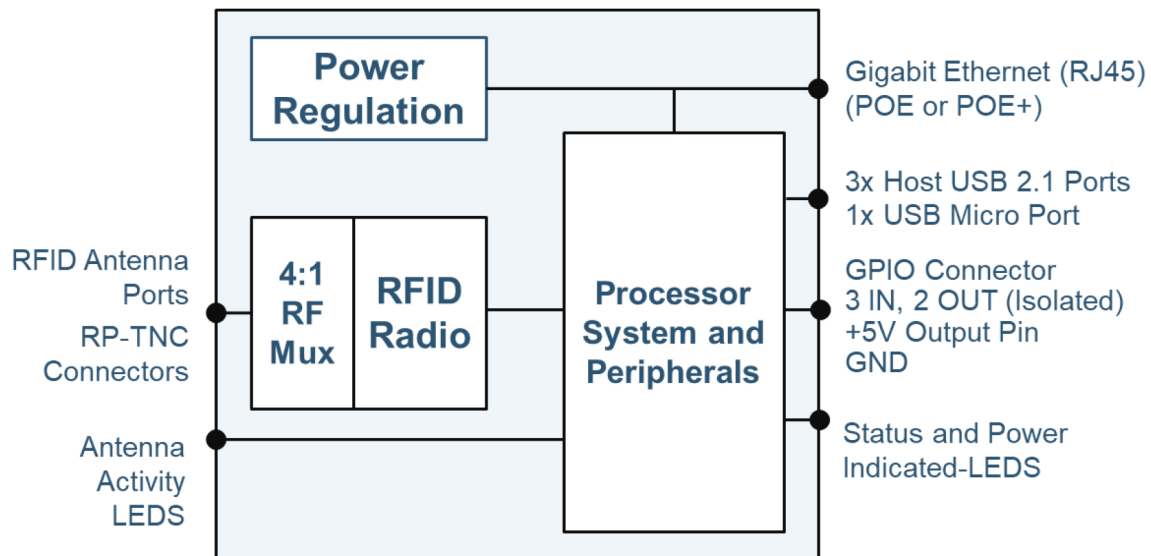
The Impinj R700 series are four-port RAIN RFID readers, compliant with the GS1 UHF Gen2v2 protocol which ISO/IEC standardizes as 18000-63. Impinj R700 and R720 are specifically designed to meet the increasing demands of next-generation IoT solutions and enterprise-grade RAIN deployments.

## 1.1 Features

- **Industry-leading sensitivity:** Empowers reading tags farther and faster, and future proofing of IoT solutions
- **Powerful edge processing:** Enables intelligent on-reader RAIN RFID tag-processing algorithms
- **Secure, upgradable Linux OS:** Delivers enterprise-grade security and reliability, and the flexibility to customize with on-reader applications
- **Simple IoT device interface:** Easily connects IoT applications to configure and control devices, and to consume RAIN data with native support for MQTT
- **Optimized design for inventory:** Increases read rate and improves read zone control at lower transmit power
- **Rich peripheral and accessory support:** Provides versatility with support for USB flash drives, Wi-Fi adapters, and up to 32 antennas via optional antenna hub

## 1.2 Block Diagram

Figure 7: Impinj R700 Series Block Diagram



## 2 SPECIFICATIONS

### 2.1 Mechanical

**Table 2: Impinj R700 Series Mechanical Specifications**

SPECIFICATION	DESCRIPTION
Physical Dimensions	With mounting brackets 8.4 in. long x 7.4 in. wide x 1.2 in. deep (21.5 cm x 18.7 cm x 3.0 cm) Without brackets: 8.4 in. width x 5.9 in. depth x 1.2 in. height inch (21.4 x 14.9 x 3.0 cm)
Mounting	<ul style="list-style-type: none"> <li>VESA 100 ×100 mm on bottom of the enclosure</li> <li>Two removable brackets compatible with Impinj Speedway mounting system</li> </ul>
Weight	2.12 lb., 0.96 kg
Housing Material	Die-cast Aluminum
Factory Reset Button	Restores reader to known factory state
LED Indicators	System status, inventory, firmware upgrade, antenna activity, network activity

### 2.2 Environmental

**Table 3: Impinj R700 Series Environmental Specifications**

SPECIFICATION	DESCRIPTION
Operating Temperature	-4° F to 122° F (-20° C to 50° C)
Storage Temperature	-4° F to 158° F (-20° C to 70° C)
Humidity	5% - 95% non-condensing
Sealing	Ingress Protection (IP) 50 rating
Shock and Vibration	MIL-STD-810G

## 2.3 RFID

**Table 4: Impinj R700 RFID Specifications**

SPECIFICATION	R700	R720
<b>Air Protocol</b>	EPCglobal UHF Class 1 Gen 2 / ISO 18000-63 RFID	
<b>Transmit Power</b>	10 – 30 dBm (PoE All Models, Japan) 10 – 31.5 dBm (PoE+, ETSI Lower Band) 10 – 33 dBm (PoE+, FCC / ETSI Upper Band)	10 – 20 dBm (PoE, All Models) 10 – 31.5 dBm (PoE+, ETSI Lower Band) 10 – 33 dBm (PoE+, FCC / ETSI Upper Band)
<b>Transmit Power Resolution</b>	0.25 dB	
<b>Transmit Power Accuracy</b>	0.5 dB	
<b>Frequency Range</b>	IPJ-R700-341 Global Reader: 902 – 928 MHz IPJ-R700-241 ETSI Reader 865 – 868 MHz, 915 – 921 MHz IPJ-R700-441 Japan Reader 916.7 to 920.9 MHz	IPJ-R720-343 Global Reader: 902 – 928 MHz IPJ-R720-243 ETSI Reader 865 – 868 MHz, 915 – 921 MHz IPJ-R720-443 Japan Reader 916.7 to 920.9 MHz
<b>Return Loss</b>	10 dB min	
<b>Read Rate</b>	Up to 1100 reads per second	
<b>Antenna Impedance</b>	50 ohms	
<b>Receive Sensitivity*</b>	Ideal: -94 dBm Typical: -93 dBm Challenging: -88 dBm	
<b>Gen 2 Reader Modes</b>	Static and Dynamic RF Modes various per region	

\*Data collected using CISC conducted sensitivity test, 90% PSR. Using RF mode FCC DRM M8 @ 30 dBm. Conditions described in Table 5:

### 2.3.1 Transmit Power

The user configures Impinj R700/R720 transmit power, the conducted power available at the RF port on the reader.

#### 2.3.1.1 R700

For Impinj R700 reader models, the reader will limit the maximum transmit power to 30 dBm while configured to use PoE power. When configured to use PoE+ power, the reader may allow for a higher maximum transmit if the region allows for it. The Impinj R700 will only present valid output powers for the region it is configured to operate in. For additional information on how to properly set transmit power to comply with regulatory rules, refer to the Impinj R700 series Installation and Operations Guide. For additional information on the differences between PoE and PoE+ power refer to section 2.4.1 of this datasheet.

#### 2.3.1.2 R720

For all Impinj R720 reader models, the reader will limit the maximum transmit power to 20 dBm while configured to use PoE power. When configured to use PoE+, the reader can transmit the full allowable transmit power range based on region. The Impinj R720 will only present valid output powers for the region it is configured to operate in. For additional information on how to properly set transmit power to comply with regulatory rules, refer to the Impinj R700 Series Installation and Operations Guide. For additional information on the differences between PoE and PoE+ power refer to section 2.4.1 of this datasheet.



### 2.3.2 Gen 2 Reader Modes

The Impinj R700 series readers include support for two types of reader modes: static and dynamic. The number of modes varies per region and comply with regulatory agencies. For additional detail on Reader Modes visit the [Impinj Support Portal](#).

### 2.3.3 Read Rate

The Impinj R700 series readers read rate varies depending on the reader configuration and number of tags in the field of view. The maximum read rate can only be achieved while using reader mode 0 in an FCC-like region.

### 2.3.4 Receive Sensitivity

Impinj follows the RAIN Alliance and ISO/IEC 18046-2:2020 recommended receive sensitivity methodology. This methodology uses the CISC Xplorer and its tag emulator for conducted receive sensitivity testing. The benchmark used is based on a Packet Success Rate (PSR) of 90%. Impinj has created three conditions using this methodology to showcase a gradation of performance based on adjacent equipment selection. The conditions are described in Table 5.

**Table 5: Receive Sensitivity Conditions**

CONDITION	TIME DELAY (ns)	RETURN LOSS (dB)
Ideal	4.5	22+
Typical	6.0	15
Challenging	38.2	12

The receive sensitivity of the Impinj R700 series readers vary depending on the RF mode chosen to perform Inventory. Applications that require the lowest (i.e., best) receive sensitivity should choose Dense Reader M8 mode. To learn more about reader modes and receive sensitivity, visit the [Impinj Support Portal](#).

## 2.4 Connectivity

**Table 6: Impinj R700 Series Connectivity Specifications**

SPECIFICATION	DESCRIPTION
Network	10/100/1000 Base-T Ethernet (RJ45)
Antenna Ports	4 monostatic ports (RP-TNC)
USB	3 Type A host, 1 micro device
Power	PoE (802.3af), PoE+ (802.3at) with LLDP for power negotiation
General Purpose I/O	2 in, 3 out optically isolated
General Purpose I/O Header	Phoenix Contact 9 pin 3.81 mm pitch

### 2.4.1 Power

The Impinj R700 series readers are powered exclusively through Power over Ethernet (PoE) or PoE+ via the ethernet port. For applications where the reader is not connected to a PoE capable switch, users can apply a midspan injector to add inline power to a network connection via a power supply. By default, the

Impinj R700 and R720 will attempt to negotiate power using Link Layer Discovery Protocol (LLDP). If the negotiation fails, the Impinj R700 and R720 will default to using PoE power.

Impinj recommends PoE+ power when using the Impinj R700 series readers to source power to external USB devices or through the general-purpose outputs.

## 2.4.2 GPIO

The Impinj R700 series readers utilizes a Phoenix Contact 9 position 3.81 mm pitch header to expose the GPIO signals. To connect external signals, a matching terminal block must be installed. Pin 1 is located nearest the push-pin factory reset button.

**Table 7: Impinj R700 Series GPIO Pin Assignments**

PIN	ASSIGNMENT
1	+5V (500 mA max current)
2	Chassis GND
3	IN 0
4	IN 1
5	OUT 0
6	OUT 1
7	OUT 2
8	V MINUS
9	V PLUS

**Figure 8: Impinj R700 Series GPIO Pin Locations**



**Table 8: Impinj R700 Series GPIO Electrical Specifications**

SPECIFICATION	DESCRIPTION
V PLUS	5 – 30 V (reference to V MINUS)
Input Logic 0	0 - 0.8 V
Input Logic 1	3 – 30 V
Output Logic 0	0 – 0.5 V (reference to V MINUS)

Output Logic 1	V PLUS – 0.5 V
GPO Current Draw	1.5 A Source or Sink
Isolation	Optical

## 2.5 Operating System

**Table 9: Impinj R700 Series Operating System Specifications**

SPECIFICATION	DESCRIPTION
Processor	R700: Dual-Core 1 GHz Cortex A7 R720: Quad-core 1.4 GHz ARM53
Memory	1 GB Flash, 1 GB RAM
Operating System	Linux, 5.10 kernel
Firmware	Impinj Octane Firmware
Firmware Upgrade	Web-based and remote capable
Network Stack	IPv4, IPv6
Network Services	SSH, HTTP, HTTPS, NTP, DHCP, SFTP, mDNS
Network Security	802.1x port security
Network Management	Event logs with syslog forwarding

## 3 DEVELOPMENT LIBRARIES

**Table 10: Impinj R700 Series Supported Development Libraries**

API	DESCRIPTION
Reader configuration REST API	OpenAPI compatible RESTful configuration API with support for over 80 languages.
Impinj Octane SDK	Host-based applications (.NET, Java)
Impinj Octane LLRP toolkit	Host-based applications (.NET, Java, C, C++) compatible with LLRP 1.0.1 with Impinj Extensions
Impinj R700 embedded toolkit	Compiler (C, C++) and precompiled Octane LLRP libraries to develop on-reader applications

## 4 REGULATORY SPECIFICATIONS

Table 11: Impinj R700 Series Regulatory Specifications

SPECIFICATION	R700	R720
RF	USA and Canada <ul style="list-style-type: none"> <li>Federal Communications Commission (FCC) Part 15.247 and 15.249</li> <li>Professional Installation required under FCC rules</li> </ul> ETSI <ul style="list-style-type: none"> <li>EN 302 208 v3.3.0</li> <li>EN 301 489-3 v2.2.1</li> <li>EN 300 489-1 v2.2.0</li> </ul> Japan <ul style="list-style-type: none"> <li>ARIB STD-T106</li> </ul>	USA and Canada <ul style="list-style-type: none"> <li>Federal Communications Commission (FCC) Part 15.247 and 15.249</li> <li>Professional Installation required under FCC rules</li> </ul> ETSI <ul style="list-style-type: none"> <li>EN 302 208 v3.3.0</li> <li>EN 301 489-3 v2.2.1</li> <li>EN 300 489-1 v2.2.0</li> </ul> Japan <ul style="list-style-type: none"> <li>ARIB STD-T106</li> </ul>
Safety	USA and Canada <ul style="list-style-type: none"> <li>UL listed</li> </ul> EU <ul style="list-style-type: none"> <li>CE mark</li> </ul>	
Hazardous Substances	RoHS3 2015/863 compliant	

The latest regional certifications are available on the Impinj Support Portal.

## 5 ORDERING INFORMATION

### 5.1 Reader

Table 12: Impinj R700 Part Number Information

PART NUMBER	DESCRIPTION
IPJ-R700-241	Impinj R700 RAIN RFID reader, 4-Port, ETSI
IPJ-R700-341	Impinj R700 RAIN RFID reader, 4-Port, FGX
IPJ-R700-441	Impinj R700 RAIN RFID reader, 4-Port, Japan

Table 13: Impinj R720 Part Number Information

PART NUMBER	DESCRIPTION
IPJ-R720-243	Impinj R720 RAIN RFID reader, 4-Port, ETSI
IPJ-R720-343	Impinj R720 RAIN RFID reader, 4-Port, FGX
IPJ-R720-443	Impinj R720 RAIN RFID reader, 4-Port, Japan

## 5.2 Accessories and Warranties

**Table 14: Impinj R700 Series Hardware Accessories and Services**

PART NUMBER	NAME	DESCRIPTION																												
IPJ-A6010	Impinj R700 antenna hub	The Impinj R700 antenna hub expands the number of antennas that can connect to an Impinj R700 reader by allowing eight antennas to connect to one antenna port for a total of 32 antennas per reader. The R700 antenna hub is compatible with all R700 Series Readers.																												
IPJ-A5100-000	Impinj R700 water-resistant case	IP54 water resistant case																												
IPJ-A2010	PoE+ Midspan Injector	PoE+ midspan power injector (without AC power cord)																												
IPJ-A2041-xxx	AC Power Cord for PoE+ injector	<table border="0"> <tr> <td>ARG</td> <td>Argentina</td> <td>RSA</td> <td>South Africa</td> </tr> <tr> <td>AUS</td> <td>Australia, New Zealand</td> <td>UK1</td> <td>UK, Singapore</td> </tr> <tr> <td>BRA</td> <td>Brazil</td> <td></td> <td>Malaysia, Hong Kong</td> </tr> <tr> <td>CHN</td> <td>China</td> <td>USA</td> <td>USA</td> </tr> <tr> <td>EU1</td> <td>Europe</td> <td></td> <td></td> </tr> <tr> <td>IND</td> <td>India</td> <td></td> <td></td> </tr> <tr> <td>JPN</td> <td>Japan</td> <td></td> <td></td> </tr> </table>	ARG	Argentina	RSA	South Africa	AUS	Australia, New Zealand	UK1	UK, Singapore	BRA	Brazil		Malaysia, Hong Kong	CHN	China	USA	USA	EU1	Europe			IND	India			JPN	Japan		
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IPJ-C205x	Warranty extension	<table border="0"> <tr> <td>1</td> <td>1-year</td> </tr> <tr> <td>2</td> <td>2-year</td> </tr> <tr> <td>3</td> <td>3-year</td> </tr> </table>	1	1-year	2	2-year	3	3-year																						
1	1-year																													
2	2-year																													
3	3-year																													
IPJ-C2001	Firmware Updates	Firmware Updates (1-year)																												

## 5.3 Antennas and Antenna Cables

**Table 15: Antenna and Antenna Cable Ordering Information**

PART NUMBER	PART NAME	DESCRIPTION
IPJ-A0303-000	Impinj Mini-Guardrail Antenna	Impinj Mini-Guardrail antennas are ideal for fixed spaces that need exceptional control in a small zone. The antenna is unobtrusive and optimal for monitoring items within cabinets or other small enclosures. Provides broadband support for optimal performance globally.
IPJ-A0404-000	Impinj Matchbox Antenna	The Impinj MatchBox antenna is ideal for tight-proximity spaces that need exceptional control in a small zone. The antenna is unobtrusive and can monitor items within cabinets or other small enclosures. Provides bi-directional, short-range coverage and broadband support for optimal performance globally.
IPJ-A300x-000	Antenna Cable 2 2 meters 4 4 meters 8 8 meters	RG58, SMA male to R-TNC male
IPJ-A311x-000	Antenna Cable 2 2.1 meters 4 4.6 meters	Low Loss/High Flex, SMA male to R-TNC male
IPJ-A312x-000	Antenna Cable 2 2.1 meters 4 4.6 meters	Low Loss/High Flex, SMA male to SMA male

## 6 IMPINJ FIXED READER COMPARISON

Table 16: Impinj Fixed Reader Comparison

FEATURE	IMPINJ R720	IMPINJ R700	IMPINJ R420	IMPINJ R220
Antenna Ports	4	4	4	2
Read Zones (max)	32	32	32	16
Read Rate (max per-second)	1100	1100	1100	200
Transmit Power (max, dBm)	33.0	33.0	32.5	32.5
Receive Sensitivity* (Typical, dBm)	-93	-93	-84	-84
Processor Speed	1.4 GHz (quad core)	1 GHz (dual core)	400 MHz (single core)	400 MHz (single core)
Random Access Memory (MB)	1024	1024	256	256
Custom Application Partition (MB)	256	256	32	32
Impinj IoT device interface	Yes	yes	no	no
USB Peripheral Slots	3	3	1	1
GPIO Connector	Integrated	Integrated	Accessory	Accessory
Ethernet Network Speed	10/100/1000	10/100/1000	10/100	10/100
Power Over Ethernet Support	PoE+ (PoE with reduced Tx Power)	PoE PoE+	PoE PoE+ EU2 model	PoE

\*Data collected using CISC conducted sensitivity test, 90% PSR. Using RF mode FCC DRM M8 @ 30 dBm. Ideal condition; 6.0ns time delay and 15dB return loss

## 7 ADDITIONAL USER DOCUMENTATION

The following table lists documents that may be helpful in operating the Impinj R700 Series Readers. These documents can be found on the Impinj Support Portal at [Impinj R700 Reader Documents](#).

**Table 17: Impinj R700 Series User Documentation**

DOCUMENT	DESCRIPTION
<b>Impinj R700 Series Quick Start Guide</b>	Simple guide to begin using Impinj R700 Series readers
<b>Impinj R700 Series Installation and Operations Guide</b>	Detailed instructions for installing, connecting, configuring, operating, upgrading, and troubleshooting the Impinj R700 Series Readers
<b>RShell Reference Manual</b>	Guide to using the Reader Shell (RShell) command line interface to configure, maintain, and query the status of Impinj RAIN RFID readers
<b>Impinj Octane LLRP Guide</b>	Describes the LLRP capabilities supported by Impinj RAIN RFID readers, which includes Impinj custom LLRP extensions
<b>Impinj R700 Series Embedded Development Quick Start Guide</b>	Guide to begin developing custom on-reader applications
<b>Impinj R700 Series Firmware Release Notes</b>	Details up to date features and known issues

## 8 CHANGE LOG

### 8.1 June 2020

- Updated to include Impinj R700 ETSI reader model information
- Updated to reflect features of Impinj R700 firmware version 7.1
- Minor formatting changes

### 8.2 October 2020

- Updated to include Impinj R700 FGX reader model information
- Removed Impinj R700 FCC reader model information
- Updated to reflect features of Impinj R700 firmware version 7.3
- Minor formatting changes

### 8.3 February 2021

- Updated to include Impinj R700 Japan reader model information
- Updated Accessory table to include Impinj R700 antenna hub and Impinj R700 water-resistant case
- Updated to reflect features of Impinj R700 firmware version 7.4
- Updated specification table to indicate Impinj Speedway R120 End-of-Life status
- Minor formatting changes

### 8.4 November 2023

- Updated to include R720 reader model information
- Updated receive sensitivity values to reflect new methodology
- Removed R120 reader model information
- Removed end-of-life accessories
- Minor formatting changes



## 9 NOTICES

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