



Datasheet

# IMPINJ R700 RAIN RFID READER

## DATASHEET

Version 3.0

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## DOCUMENT OVERVIEW

The Impinj R700 reader is 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.

- **Best Receive Sensitivity:** empowers faster, more accurate reads at lower transmit power to better control read zone
- **Powerful Edge Processing:** enables intelligent on-reader RAIN tag-processing algorithms
- **Secure, upgradable Linux OS:** delivers enterprise-grade security and reliability
- **Simple IoT device interface:** easily connects IoT applications to configure, control, and consume RAIN data, with native support for MQTT
- **Fast Gigabit Ethernet Connectivity:** brings fast network connectivity to IoT applications
- **Rich peripheral and accessory support:** Provides versatility, including support for up to 32 antennas, to seamlessly integrate the reader into customized IoT solutions

This document constitutes the electrical and mechanical specifications pertaining to the Impinj R700 RAIN RFID Reader. 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 Key Specifications**

| SPECIFICATION                 | DESCRIPTION                                                                                                                                                                                    |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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)<br>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-R700-341 Global Reader: 902 – 928 MHz<br>IPJ-R700-241 ETSI Reader 865 – 868 MHz, 915 – 921 MHz                                                                                             |
| <b>Transmit Power</b>         | PoE+: 33 dBm max<br>PoE: 30 dBm max                                                                                                                                                            |
| <b>Receive Sensitivity</b>    | -92 dBm max                                                                                                                                                                                    |
| <b>Processor</b>              | Dual-Core 1 GHz ARM 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>    | 3 out, 2 in                                                                                                                                                                                    |

Figure 1: Impinj R700 Top View



Figure 2: Impinj R700 Bottom View



Figure 3: Impinj R700 Front View



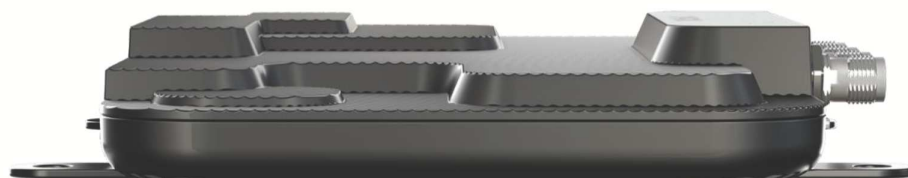
Figure 4: Impinj R700 Back View



Figure 5: Impinj R700 Left View



Figure 6: Impinj R700 Right View



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# 1 INTRODUCTION

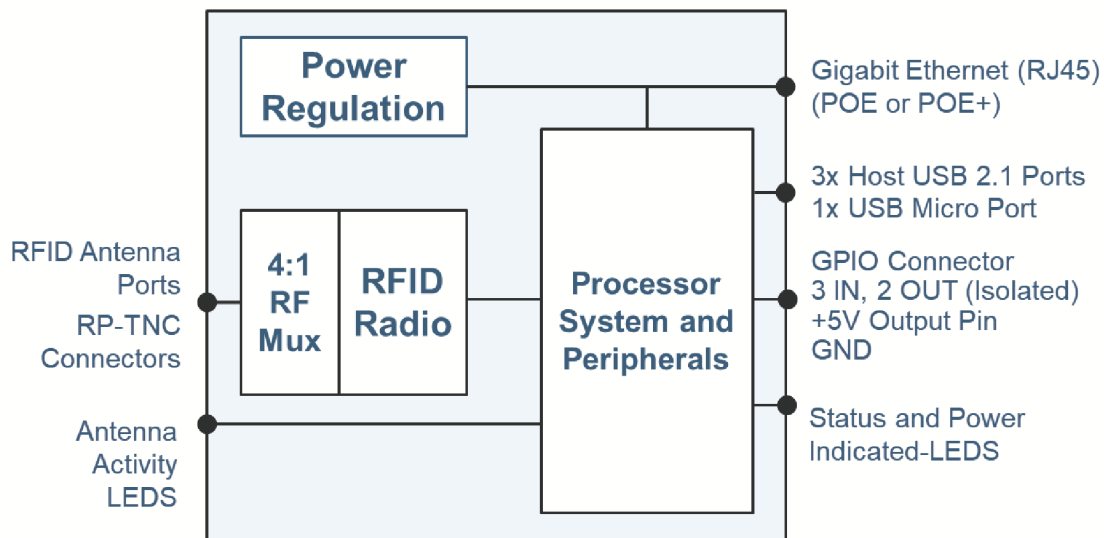
The Impinj R700 RAIN RFID reader is a four-port RFID reader compliant with the GS1 UHF Gen2v2 standard which ISO/IEC standardized as 18000-63. The Impinj R700 has been specifically designed to meet the increasing demands of next-generation IoT solutions and enterprise-grade RAIN deployments.

## 1.1 Features

- -92 dBm receive sensitivity enables reading smaller, global RAIN RFID tags at high speed for demanding use cases such as RAIN-based loss prevention
- 1 GHz dual-core processor, 1 GB RAM, and gigabit ethernet allow developers to deploy sophisticated on-reader tag-processing algorithms that leverage low-latency connectivity to enterprise IoT applications
- Integrated, standardized connectors provide rich support for external peripherals
- A secure, upgradable Linux operating system, encrypted software image, and a secure software boot with chain-of-trust prevents unauthorized software execution and addresses the demanding security needs of enterprise customers

## 1.2 Block Diagram

Figure 7: Impinj R700 Block Diagram



## 2 SPECIFICATIONS

### 2.1 Mechanical

**Table 2: Impinj R700 Mechanical Specifications**

| SPECIFICATION               | DESCRIPTION                                                                                                                                                                                    |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <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)<br>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>Mounting</b>             | <ul style="list-style-type: none"><li>• VESA 100 x 100 on bottom of the enclosure</li><li>• Two removable brackets compatible with Impinj Speedway mounting system</li></ul>                   |
| <b>Weight</b>               | 2.12 lb, 0.96 kg                                                                                                                                                                               |
| <b>Housing Material</b>     | Die-cast Aluminum                                                                                                                                                                              |
| <b>Factory Reset Button</b> | Restores reader to known factory state                                                                                                                                                         |
| <b>LED Indicators</b>       | System status, inventory, firmware upgrade, antenna activity, network activity                                                                                                                 |

### 2.2 Environmental

**Table 3: Impinj R700 Environmental Specifications**

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

## 2.3 RFID

**Table 4: Impinj R700 RFID Specifications**

| SPECIFICATION                  | DESCRIPTION                                                                                                                                                         |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Air Protocol</b>            | EPCglobal UHF Class 1 Gen 2 / ISO 18000-63 RFID                                                                                                                     |
| <b>Transmit Power</b>          | 10 – 30 dBm, 0.25 dB resolution (PoE)<br>10 – 31.5 dBm, 0.25 dB resolution (PoE+, ETSI Lower Band)<br>10 – 33 dBm, 0.25 dB resolution (PoE+, FCC / ETSI Upper Band) |
| <b>Frequency Range</b>         | IPJ-R700-341 Global Reader: 902 – 928 MHz<br>IPJ-R700-241 ETSI Reader 865 – 868 MHz, 915 – 921 MHz                                                                  |
| <b>Return Loss</b>             | 10 dB min                                                                                                                                                           |
| <b>Read Rate</b>               | Up to 1100 reads per second                                                                                                                                         |
| <b>Antenna Impedance</b>       | 50 ohm                                                                                                                                                              |
| <b>Max Receive Sensitivity</b> | -92 dBm at $10^{-3}$ bit error rate, Dense Reader M8 reader mode                                                                                                    |
| <b>Gen 2 Reader Modes</b>      | Static and Dynamic RF Modes various per region                                                                                                                      |

### 2.3.1 Transmit Power

The Impinj R700 max transmit power is the available power at the RF port on the reader. The maximum transmit power varies by region due to the rules specified by different regulatory bodies. When configured for a specific region the Impinj R700 will only present valid output powers for that region.

### 2.3.2 Read Rate

The Impinj R700 read rate varies depending on the reader configuration and number of tags in the field of view.

### 2.3.3 Gen 2 Reader Modes

The Impinj R700 includes support for two types of reader modes, static and dynamic. The number of modes varies per region to comply with regulatory agencies. For additional detail on Reader Modes visit the Impinj Support Portal.

## 2.4 Connectivity

**Table 5: Impinj R700 Connectivity Specifications**

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



## 2.4.1 Power

The Impinj R700 is 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, a midspan injector can be used to add inline power to a network connection via a power supply. When connected to a switch that supports Link Layer Discovery Protocol (LLDP), the Impinj R700 will automatically detect if PoE+ power is available. If the switch supports PoE+ the Impinj R700 will configure itself to use PoE+.

## 2.4.2 GPIO

The Impinj R700 utilizes a Phoenix Contact 9 position 3.81mm 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 6: Impinj R700 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 GPIO Pin Locations**



**Table 7: Impinj R700 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 8: Impinj R700 Operating System Specifications**

| SPECIFICATION      | DESCRIPTION                             |
|--------------------|-----------------------------------------|
| Processor          | Dual-Core 1 GHz Cortex A7               |
| Memory             | 1 GB Flash, 1 GB RAM                    |
| Operating System   | Linux, 5.1 kernel                       |
| Firmware           | Impinj R700 LLRP with Impinj extensions |
| 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 9: Impinj R700 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 10: Impinj R700 Regulatory Specifications**

| SPECIFICATION        | DESCRIPTION                                                                                                                                                                                                                                                                                                                    |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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> |
| 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 11: 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  |

### 5.2 Accessories and Warranties

**Table 12: Impinj R700 Hardware Accessories and Services**

| PART NUMBER   | DESCRIPTION                                         |                        |     |                     |
|---------------|-----------------------------------------------------|------------------------|-----|---------------------|
| IPJ-A2010     | PoE+ midspan power injector (without AC power cord) |                        |     |                     |
| IPJ-A2041-xxx | AC power cord for PoE+ injector                     |                        |     |                     |
|               | 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                                               |                        |     |                     |
| IPJ-C205x     | Warranty extension                                  |                        |     |                     |
|               | 1                                                   | 1-year                 |     |                     |
|               | 2                                                   | 2-year                 |     |                     |
|               | 3                                                   | 3-year                 |     |                     |
| IPJ-C2001     | Firmware Updates (1-year)                           |                        |     |                     |

## 5.3 Antennas and Antenna Cables

**Table 13: 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-A0311-xxx | Impinj Threshold antenna<br>EU1 ETSI<br>USA FCC         | Impinj Threshold antennas identify items as they pass over or under a threshold or boundary. The antenna's high-capacity read range is designed to maximize intensity in highly-specific zones providing wide zone coverage ideal for a road race course or other boundary or threshold crossing. Provides optimized performance in FCC- and ETSI-supported regions. |
| IPJ-A0400-xxx | CSL Brickyard Antenna<br>EU1 ETSI<br>USA FCC            | Brickyard antennas by CSL are ideal for fixed spaces that need exceptional control in a small zone. These antennas are unobtrusive and are optimal for tracking items on tables, point of sale terminals, or within cabinets.                                                                                                                                        |
| IPJ-A0402-xxx | Impinj Guardwall Antenna<br>EU1 ETSI<br>USA FCC         | Deployed in pairs, Impinj Guardwall antennas provide a tightly-controlled read zone to monitor items, packages, or cases moving on conveyor systems. Provides optimized performance in FCC- and ETSI-supported regions.                                                                                                                                              |
| 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-A1000-xxx | Laird Far-Field LHP antenna<br>EU1 ETSI<br>USA FCC      | Far-Field antennas by Laird provide highly-efficient coverage with a weather-resistant design. These antennas have maximum performance at distances over 5 feet, and are ideal for situations where the tagged item will be at different angles and heights.<br>Left hand circularly polarized (LHP) version.                                                        |
| IPJ-A1001-xxx | Laird Far-Field RHP antenna<br>EU1 ETSI<br>USA FCC      | Far-Field antennas by Laird provide highly-efficient coverage with a weather-resistant design. These antennas have maximum performance at distances over 5 feet, and are ideal for situations where the tagged item will be at different angles and heights.<br>Right hand circularly polarized (RHP) version.                                                       |
| IPJ-A1100-xxx | Times-7 Slim Outdoor antenna<br>EU1 ETSI<br>USA FCC     | Slim Outdoor antennas by Times-7 provide maximum zone coverage in a low profile design for both indoor and outdoor use. These rugged antennas have optimal read performance in a broad range of environments over long read ranges up to 29 feet.                                                                                                                    |
| IPJ-A1200-xxx | Times-7 Compact Outdoor antenna<br>EU1 ETSI<br>USA FCC  | Compact Outdoor antennas by Times-7 provide read zone coverage in a compact design for both indoor and outdoor use. These compact antennas have an aesthetically-pleasing design and provide optimal performance in a broad range of environments over long read ranges up to 19 feet. Provides optimized performance in FCC- and ETSI-supported regions             |
| IPJ-A300x-000 | Antenna Cable<br>2 2 meters<br>4 4 meters<br>8 8 meters | RG58, SMA male to R-TNC male                                                                                                                                                                                                                                                                                                                                         |
| IPJ-A311x-000 | Antenna Cable<br>2 2.1 meters<br>4 4.6 meters           | Low Loss/High Flex, SMA male to R-TNC male                                                                                                                                                                                                                                                                                                                           |
| IPJ-A312x-000 | Antenna Cable<br>2 2.1 meters<br>4 4.6 meters           | Low Loss/High Flex, SMA male to SMA male                                                                                                                                                                                                                                                                                                                             |

## 6 IMPINJ FIXED READER COMPARISON

Table 14: Impinj Fixed Reader Comparison

| FEATURE                           | IMPINJ R700       | IMPINJ R420           | IMPINJ R220           | IMPINJ R120           |
|-----------------------------------|-------------------|-----------------------|-----------------------|-----------------------|
| Antenna Ports                     | 4                 | 4                     | 2                     | 1                     |
| Read Zones (max)                  | 32                | 32                    | 2                     | 8                     |
| Read Rate (max per-second)        | 1100              | 1100                  | 200                   | 200                   |
| Transmit Power (max, dBm)         | 33.0              | 32.5                  | 32.5                  | 30                    |
| Receive Sensitivity (max, dBm)    | -92               | -84                   | -84                   | -84                   |
| Processor Speed                   | 1 GHz (dual-core) | 400 MHz (single core) | 400 MHz (single core) | 400 MHz (single core) |
| Random Access Memory (MB)         | 1024              | 256                   | 256                   | 256                   |
| Custom Application Partition (MB) | 128               | 32                    | 32                    | 32                    |
| Autopilot Reader Modes            | yes               | yes                   | yes                   | yes                   |
| USB Peripheral Slots              | 3                 | 1                     | 1                     | 1                     |
| GPIO Connector                    | Integrated        | Accessory             | Accessory             | Accessory             |
| Ethernet Network Speed            | 10/100/1000       | 10/100                | 10/100                | 10/100                |
| Power Over Ethernet Support       | PoE<br>PoE+       | PoE<br>PoE+ EU2 model | PoE                   | PoE                   |

## 7 ADDITIONAL USER DOCUMENTATION

The following table lists documents that may be helpful in operating the Impinj R700. These documents can be found on the Impinj support portal at [support.impinj.com](https://support.impinj.com).

Table 15: Impinj R700 User Documentation

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

## 9 NOTICES

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