



## Octane LLRP

Version 8.0

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# 1 Introduction

## 1.1 Purpose

This document describes the Low Level Reader Protocol (LLRP) capabilities of the Impinj Octane 8.0 software release for the Impinj R700 reader, including Octane LLRP custom extensions.

## 1.2 Scope

This document defines Impinj Octane 8.0 LLRP. It provides a summary for system architects so they can validate and understand the standard LLRP features supported by Impinj Octane 8.0 LLRP, as well as the unique Impinj Octane LLRP custom extensions, which provide added capabilities. It provides detailed information to developers who are planning to support Impinj readers through LLRP.

## 1.3 References

The documents in the following table are supplemental references:

Topic	Document	Version
LLRP	<a href="#">EPCglobal Low Level Reader Protocol (LLRP)</a>	1.0.1
Gen2	<a href="#">EPC UHF Gen2 Air Interface Protocol</a>	2.1
Setup	R700 Installation and Operations Guide	8.0
LTK	LLRP Toolkit Impinj Custom Extension Definition	11.0.0

## 1.4 Terms

### AccessSpec

Access Specification is a data element passed to the reader to describe a set of operations to perform on a tag. It includes a filter set that describes the tag population to which this rule applies. In addition, it includes a list of read, write, lock, and kill commands to execute on each tag that matches the filter.

### AISpec

Antenna Inventory Specification list is contained in a ROSpec (see below), and executes in order. Each AISpec contains radio frequency (RF) parameters, inventory parameters, and duration.

### AntennaConfiguration

Each AISpec can contain one or more AntennaConfiguration parameters. These describe the RF parameters (power, frequency, receive sensitivity) and Gen2 settings (mode, filters, session) to use during an AISpec execution.

### EPCglobal

EPCglobal is an organization that leads the development of industry-driven standards for the Electronic Product Code (EPC) to support the use of RFID.

### FOV

Field-of-view is the reader-observable world and the angular extent that is visible at a given moment. This typically relates to antenna type, number, and position.

### LLRP

The EPCglobal Low Level Reader Protocol (LLRP) is the industry standard.

### LTK

The llrp-toolkit is an open source LLRP library development project.

## **RO**

Reader Operations is the group chartered within EPCglobal to define LLRP.

## **ROSpec**

Reader Operation Specification is a data element passed to the reader to describe a bounded (start and end), triggered, and inventory operation.

## **1.5 Overview**

In April 2007, EPCglobal ratified the Low Level Reader Protocol (LLRP) standard, a specification for the network interface between the reader and its controlling software or hardware. The UHF Gen 2 standard provides a standardized tag and reader radio frequency (RF) air interface protocol.

Other standards have been proposed for the controller-to-reader network interface. Why has Impinj chosen LLRP as part of its Octane software solution? LLRP is modular with respect to air-protocol. LLRP allows basic configuration and operation independent of air protocol, and supports simple configuration of readers without any knowledge of air protocol specifics. In LLRP 1.0, EPCglobal developed a parameter set to control the full functionality of Gen2 readers. For protocol-specific operations, LLRP's Gen2 parameter set provides simple access to Gen2 functionality such as read, write, lock, and kill. It also provides simple methods to select the Gen2 link parameters.

Previous standardization approaches did not go far enough to accommodate the needs of both reader and application software providers, needs that included the ability to better leverage the competitive advantages of their respective products. By creating this new LLRP standard, the advocating group led by Impinj and other RFID vendors made a rich set of vendor extension points available. These extensions provide reader vendors with the flexibility to innovate and differentiate their products within the standardized network framework. These innovations will drive future developments of the standard.

This document is divided into sections, described below.

- Section 2 describes how to configure and establish LLRP connections with Octane.
- Section 3 describes the standard LLRP capabilities of Octane 8.0 as supported on the Impinj R700 reader.
- Section 4 specifies the Octane LLRP custom extensions available on the Impinj R700 reader.
- Section 5 discusses advanced tag topics.
- Section 6 contains tables that define how each extension is encoded and decoded into LLRP messages and parameters.

## **1.6 Document Conventions**

In this document, the term **reader** is used to refer to the Impinj R700 reader.

Throughout this document, references are made to both standard and extended LLRP messages, parameters, and fields. To help visually distinguish between these different types, the table below provides details on the conventions that are used.

### **Document Style Conventions**

Type	Example	Style
LLRP message	IMPINJ_ENABLE_EXTENSIONS	Caps with underscores
LLRP parameter	<i>AntennaConfiguration</i>	Camel-case italics
LLRP field	<i>ResetToFactoryDefault</i>	Camel-case italics
Enumerated field value	'Upon N Tags or End of AISpec'	Single-quoted
File name	<b>'ImpinjDef.xml'</b>	Single-quoted bold
LTK function	<b><i>getLLRPStatus</i></b>	Bold italics; case matches programming syntax

Type	Example	Style
LTK class names	<b>CIMPINJ_TCS_RESPONSE</b>	Bold; case matches programming syntax

## 2 Octane LLRP Connections

Octane LLRP allows both reader- and client-initiated connections. By default, the reader listens for LLRP connections on the IANA-assigned TCP port 5084. Users can modify the LLRP listening port through Octane RShell or web interface. Users can enable Octane LLRP to make outgoing connections to a configurable server and port number. The address, port, and retry timers can be configured via the Octane RShell or web interface. See the ***RShell Reference Manual*** for more information about changing the LLRP connection configuration.

Octane LLRP accepts the first incoming connection on this port, and rejects subsequent connections as long as the first connection is active. If a connection request is received, the reader will check the health of any existing connection. If the client TCP connection does not respond within 3.5 seconds, the reader will automatically close the dead connection and will accept the new connection. When reconnecting after a network outage, it may take up to 3.5 seconds to accept a connection.

### 3 Octane LLRP Capabilities

The next two tables display the capabilities supported by the Octane LLRP implementation on the Impinj R700 reader, as defined by the LLRP standard. These tables are organized by LLRP feature, and there is one for each basic reader configuration (with and without an attached antenna hub). Not all reader models support each Octane feature. Where relevant, the reader reports these capabilities via the LLRP GET\_READER\_CAPABILITIES\_RESPONSE message.

**Octane LLRP Capabilities for R700 Without Antenna Hub (Firmware Version 8.0.0.240)**

LLRP FEATURE	Support	Informational Notes
GPI	2	See the "GPIO Details" section in the <i>R700 Installation and Operations Guide</i> .
GPO	3	See the "GPIO Details" section in the <i>R700 Installation and Operations Guide</i> .
Antenna	4	The antennas correspond to antenna ports 1-n.
UTC (real-world) Clock	✓	
Air Protocol Support	1	UHF Class 1 Generation 2 (C1G2)
Number of ROSpecs	1	
ROSpec Priority Support	1	Priority must always be set to 0.
RFSurvey Support	-	
Number of AISpecs per ROSpec	32	
Number of InventoryParameterSpecs per AISpec	1	
State-Aware Singulation Support	-	See <a href="#">ImpinjInventorySearchMode Parameter</a> for alternate control of singulation strategies.
Number of Inventory Filters	5	
Truncate Flag Support	-	Truncate flag must always be set to 0 (unspecified).
Number of AccessSpecs	1508	
Number of OpSpecs per AccessSpec	8	
ClientRequestOpSpec Support	-	
Number of Gen2 Modes	Varies	Number depends on model and regulatory region. Use LLRP capabilities to discover available modes. See <a href="#">C1G2RFControl Parameter</a> for setting the Gen2 mode.
Buffer Overflow Warning Support	✓	

LLRP FEATURE	Support	Informational Notes
Buffered Report Support	✓	See <a href="#">LLRP Buffered Events and Reports</a> for usage details.
AirProtocolInventory CommandSettings per AntennaConfiguration	1	
BlockWrite Support	✓	
BlockErase Support	-	
Disconnected Operation Support	✓	Reader will continue to execute RO Specs and Access Specs when disconnected. To stop disconnected operation, disable or delete all RO Specs and Access Specs before disconnecting. See <a href="#">LLRP Buffered Events and Reports</a> for details on how events and reports are handled in this mode of operation.
Set AntennaProperties Support	-	
TLS Encrypted Connection Support	-	Only TCP connections are supported.
Web Interface	✓	

### Octane LLRP Capabilities for R700 With Antenna Hubs (Firmware Version 8.0.0.240)

With an antenna hub connected and enabled, the Impinj R700 reader will report all the same capabilities as in the above table, with the one exception being a change in the number of reported antennas:

LLRP FEATURE	Support	Informational Notes
Antenna	32	With one or more hubs connected, the reader always reports 32 antennas.

## 3.1 Octane LLRP Usage Notes

### 3.1.1 Octane Future Extensions

To be compatible with future versions of Octane extensions, your application must ignore all custom parameters with subtypes that it cannot understand when received at any valid LLRP or Octane extension point. In addition, it should treat any out of range enumerations as error conditions.

### 3.1.2 LLRP Response Timeout

Most commands will complete within milliseconds (nominally « 1 second). However, the following exceptions should be noted.

- GET\_READER\_CONFIG\_RESPONSE with the AntennaProperties parameter can take up to 10 seconds while the reader checks the status and connectivity of its antennas.
- IMPINJ\_SAVE\_SETTINGS\_RESPONSE can take up to 2 seconds while the reader commits the configuration settings to persistent storage.

### 3.1.3 LLRP Message Size

Messages longer than 64 Kbytes received by the reader will cause a READER\_EVENT\_NOTIFICATION message containing a *ConnectionCloseEvent* parameter to be sent, followed by a close of the LLRP connection. The reader transmit buffer is limited to 512 Kbytes. This corresponds to roughly 2000 TagReportData parameters per RO\_ACCESS\_REPORT. Client implementations should configure the ROReportSpec properly to avoid excessively large individual reports.

### 3.1.4 C1G2RFControl Parameter

Reader Gen2 modes are selected by Impinj system engineering to provide the best performance. No Tari adjustment is necessary. Tari values passed by the client will be ignored. Octane supports automatic control and optimization of Gen2 Mode settings (Autoset) for the reader operating environment, covering both single interrogator and dense interrogator environments. In addition, Octane supports several pre-configured Gen2 modes.

- A *C1G2RFControl ModeIndex* of 1000 (Autoset) configures the reader to choose the best Gen2 link parameters for environments where the tags might be transient and we do not wish to overcommit in our search for the weakest tag.
- A *C1G2RFControl ModeIndex* of 1002 (Autoset Static) configures the reader to choose the best Gen2 link parameters for the environments where the tags population is relatively static and we wish to attempt to search for the weakest tag.
- A *C1G2RFControl ModeIndex* of 1003 (Autoset Static Fast) is an adaptation of Autoset Static for good RF environments.
- A *C1G2RFControl ModeIndex* of 1004 (Autoset Static DRM) is an adaptation of Autoset Static for difficult RF environments.
- A *C1G2RFControl ModeIndex* of 1005 (Autoset Custom) is reserved for future use.
- Link parameters reported for Autoset modes in the *C1G2UHFRFModeTableEntry* should be ignored.

The table below documents the official names of the Gen2 modes supported by the Impinj R700 reader. Available modes vary depending on the model and regulatory region.

#### Official Octane Gen2 Mode Names

ModeIdentifier	Official Name
0	Max Throughput
1	Hybrid Mode (High throughput (M=2))
2	Dense Reader (M=4)
3	Dense Reader (M=8)
4	Max Miller (High throughput (M=4)). Not supported by regions that support mode 5. ETSI, China, India, Japan, Korea, and South Africa.
5	Dense Reader 2 (M=4). Faster forward link than mode 2. Only available with regions: ETSI, China, India, Japan, Korea, and South Africa.
1000	AutoSet
1002	AutoSet Static (default mode)
1003	AutoSet Static Fast
1004	AutoSet Static DRM
1005	AutoSet Custom. Reserved for future use.

### 3.1.5 Per-Antenna Configuration

LLRP supports per-antenna configuration for many standard parameters. The following parameters must be configured the same for all enabled antennas in a particular AISpec or an error will be returned.

- *C1G2RFControl* parameter
  - *ModeIndex* must be configured the same.
- *RFTransmitter* parameter
  - *HopTableID* must be configured the same.
  - *ChannelIndex* must be configured the same.
- *C1G2Filter* parameter
  - All fields and sub-parameters must be configured the same.

All other parameters can be set to unique per-antenna values.

Impinj extension parameters that control antenna settings may also be restricted in a similar manner. For details about custom parameter requirements, see the individual section that documents the extension.

### 3.1.6 LLRP Data Persistence

LLRP configuration data, including data that is set by SET\_READER\_CONFIG, ADD\_ROSPEC, and ADD\_ACCESSSPEC messages, are persistent across LLRP connections. However, a reboot of the device will reset these parameters to their default values. See [ImpinjSaveSettings Message](#) for details about saving the configuration. For information about default values for configuration data, see [Octane LLRP Default Values](#).

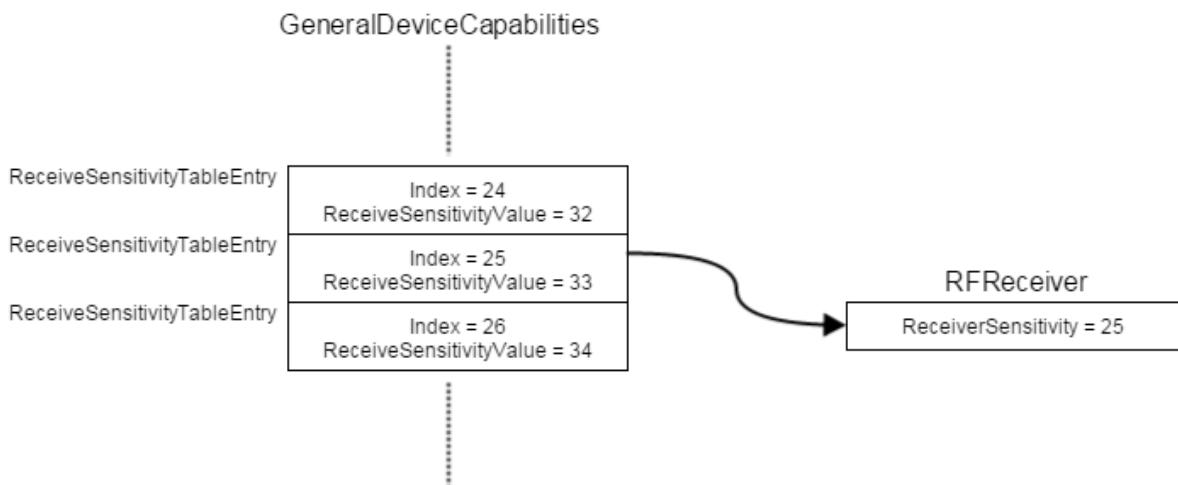
### 3.1.7 LLRP Receive Sensitivity

The Impinj R700 reader supports a Receive Sensitivity range of -80 dBm to -30 dBm.

The RSSI sensitivity levels are referenced to an absolute sensitivity of -80 dBm.

In order to set a receive sensitivity level of -47 dBm, the user must identify the *ReceiveSensitivityTableEntry* parameter within the *GeneralDeviceCapabilities* such that: -80 dBm + *ReceiveSensitivityValue* = -47 dBm

In this case, the *ReceiveSensitivityValue* is calculated to be 33, which corresponds to *Index* 25 in the Octane 8.0 LLRP capabilities. To complete the example, to set the receive sensitivity level to -47 dBm for an antenna, the *ReceiverSensitivity* field of the *RFReceiver* parameter should be set to 25.



Conversely, given the *ReceiverSensitivity* field from the *RFReceiver* parameter, the effective receive sensitivity level in dBm can be determined as follows:

- Find the `ReceiveSensitivityTableEntry` parameter within `GeneralDeviceCapabilities` whose `Index` equals the value of the `ReceiverSensitivity` field.
- Use the `ReceiveSensitivityValue` from this `ReceiveSensitivityTableEntry` to compute the receive sensitivity level using the equation:  $\text{Receive Sensitivity (dBm)} = -80 \text{ dBm} + \text{ReceiveSensitivityValue}$

### 3.1.8 LLRP GPO Control

When a user disconnects from LLRP, the output state of the port pins remains as it was when connected. If the unit reboots, the GPO will be restored to the last saved GPO configuration. See [ImpinjSaveSettingsMessage](#) for details about saving the configuration. In the absence of a saved configuration, the GPO will resort to the default configuration, as described in [Octane LLRP Default Values](#).

### 3.1.9 LLRP AntennaEvent Parameter

The `AntennaEvent` parameter within a `READER_EVENT_NOTIFICATION` message reports the current connected state of the antenna. The Octane firmware can detect when antennas are connected or disconnected during inventory operation.

The reader tracks the state of the antennas continuously and will only generate a `READER_EVENT_NOTIFICATION` with the `AntennaEvent` parameter if a change is detected from the last reported status. If an antenna was previously reported to be disconnected, and a new AISpec is started, client implementations should not expect another event to be reported until the antenna is reconnected.

The recommended method for tracking antenna connectivity is to issue a `GET_READER_CONFIG` upon connecting to the reader. The reader will report the current connected state of each antenna via the `AntennaProperties` parameter. The client can then monitor the connection for any new `READER_EVENT_NOTIFICATION` messages that contain `AntennaEvent` parameters and update the state as appropriate. This process is done asynchronously with respect to inventory control.

This feature is only available for fixed readers which have external antenna ports. Since the antenna detection algorithm relies on reflected power from an antenna port to determine the connected state of an antenna, antenna events are most reliable when operating at or near maximum transmit power and will become less reliable as transmit power is lowered.

With an Antenna Hub connected to the reader and the feature enabled in RShell, connected and disconnected events for the antenna are disabled by default. Enable the events with the `ReaderEventNotificationSpec` parameter in the `SET_READER_CONFIG` message.

### 3.1.10 LLRP Trigger Details

LLRP allows multiple types of start, stop, and report triggers. For some trigger types, additional information is required in the form of optional parameters. The LLRP specification is clear that these parameters must be present for a given trigger type. However, it does not clearly state what happens if one of these parameters appears when the trigger type does not require its presence. Octane LLRP assumes that these parameters can be present if, and only if, the trigger type requires them. As an example, if the `GPITriggerValue` parameter is present within the `ROSpecStartTrigger` of an `ROSpec` when the `ROSpecStartTriggerType` is set to 'Periodic', Octane returns an error.

### 3.1.11 LLRP Inventory Filtering

LLRP allows Inventory filtering to be set up using AISpec(s) with one or more `C1G2Filter` parameters. The `C1G2Filter` parameter roughly corresponds to a Gen2 Select command sent to select a particular tag population prior to inventory. If one or two `C1G2Filter` parameters are specified, the reader sends the appropriate Gen2 Select command(s) and applies additional filtering to suppress reports corresponding to non-conforming tags that may have responded because they did not 'hear' the Select command(s). If more than two `C1G2Filter` parameters are specified, the additional filtering is not applied and some non-conforming tags may be reported. Note: the `C1G2Filter` parameters must be the same for all antennas.

### 3.1.12 LLRP C1G2Read Parameter

LLRP allows Gen2 Read command(s) to be set up using OpSpec(s) with *C1G2Read* parameter(s). The number of words to be read is specified by the *WordCount* field in the *C1G2Read* parameter. Octane supports a maximum *WordCount* of 60 for the *C1G2Read* parameter.

The Gen2 protocol supports sending a Gen2 Read command with a *WordCount* of 0 (zero) to read the entire memory bank starting with the word indicated by the *WordPointer*. The Octane releases covered by this document do not support this feature and will reject a *C1G2Read* parameter with *WordCount* of 0.

### 3.1.13 LLRP C1G2Write Parameter

LLRP allows Gen2 Write command(s) to be set up using OpSpec(s) with *C1G2Write* parameter(s). The number of words to be written is specified by the *WordCount* field in the *C1G2Write* parameter. Octane supports a maximum *WordCount* of 32 for the *C1G2Write* parameter.

### 3.1.14 LLRP C1G2BlockWrite Parameter

LLRP allows Gen2 BlockWrite command(s) to be set up using OpSpec(s) with *C1G2BlockWrite* parameter(s). The number of words to be written is specified by the *WordCount* field in the *C1G2BlockWrite* parameter. Octane supports a maximum *WordCount* of 32 for the *C1G2BlockWrite* parameter.

### 3.1.15 LLRP Non-Specific Tag Errors

LLRP access operations (Read, Write, Kill, Lock, BlockWrite and BlockErase) all contain a result type of 'Non-Specific Tag Error' within the appropriate *C1G2OpSpecResult* parameter. Because the LLRP specification does not expose all possible C1G2 tag access error codes, the Octane firmware uses this error code as a catchall for the more specific tag errors. The table below documents the possible errors that might have occurred during tag access if the Octane firmware reports a 'Non-Specific Tag Error'.

#### Octane Non-Specific Tag Error Translation

LLRP Access Operation	Possible Specific Tag Errors
C1G2Read	CRC Error, Memory Locked, Memory Overrun
C1G2Write	Invalid Password, Tag Lost
C1G2Kill	Tag Cannot be Killed, Tag Lost
C1G2Lock	Memory Permalocked, Memory Overrun, Invalid Password, Tag Lost
C1G2BlockWrite	Invalid Password, Tag Lost
C1G2BlockErase	N/A (not supported)

### 3.1.16 LLRP Buffered Events and Reports

The default configuration value for *HoldEventsAndReportsUponReconnect* is **false** for the reader. In this mode, any events or reports generated by the reader without a client LLRP connection are silently discarded. If a client wants to have the reader buffer reports generated in the absence of a client connection, it must set *HoldEventsAndReportsUponReconnect* to **true**. The reader will then internally buffer generated reports until it receives an **ENABLE\_EVENTS\_AND\_REPORTS** message from the client. Upon receiving this message, all buffered reports are delivered. All future events and reports will be delivered as they are generated. Note that, in this mode, reports are buffered but events are always discarded.

### 3.1.17 LLRP TagTransitTime Field

The *TagTransitTime* field in the *C1G2SingulationControl* parameter is defined by the LLRP Specification as "...the measure of expected tag mobility in the field of view...". Internally, the reader uses this value as part of a coarse low duty-cycle control mechanism. This means that unusually large values for this field are ignored, and the value is instead saturated at a maximum which is 10 seconds. The reader can accept larger values, but they have no impact on the reader operation.

It should be noted that the use of this field for low duty-cycle control is crude at best. We recommend that the low duty-cycle extension be used for precise control of reader RF transmissions. For more information, see [ImpinjLowDutyCycle Parameter](#).

### 3.1.18 LLRP ROReportSpec Parameter

The *ROReportSpec* parameter is treated as an autonomous parameter by the reader. This varies slightly from other parameters, such as *AntennaConfiguration*, which can be decomposed. For example, if an AISpec contains an *AntennaConfiguration* parameter that does not contain an *RFReceiver* parameter, the reader will consult the default configuration for the *RFReceiver* settings to use for that antenna. On the other hand, if an ROSpec contains a *ROReportSpec* parameter that does not have an *AirProtocolEPCM* or *MemorySelector* parameter (within *TagReportContentSelector*), or an *ImpinjTagReportContentSelector* parameter, the reader assumes that those parameters are turned off for the subject *ROReportSpec*. The reader does not consult the default configuration for these settings. Therefore, any *ROReportSpec* parameter that appears in a ROSpec is autonomous and complete, and will override all *ROReportSpec* settings in the default configuration.

### 3.1.19 LLRP Keepalive Messages

LLRP provides a heartbeat mechanism between the reader, and client applications via KEEPALIVE and KEEPALIVE\_ACK messages. The reader is configured to initiate KEEPALIVE messages via the *KeepaliveSpec* in SET\_READER\_CONFIG. However, the LLRP Specification does not state what action the reader can take if its KEEPALIVE messages are not acknowledged by the client. Some versions of Octane firmware can be configured to either ignore KEEPALIVE\_ACK messages, or to process these messages and use them to infer the health of a current connection. For more information, see [ImpinjLinkMonitorConfiguration Parameter](#).

### 3.1.20 LLRP Transmit Power

LLRP defines transmit power as an offset into the **TransmitPowerLevelTableEntry** table for the reader, advertised in *UHFBandCapabilities*. Because the capabilities of one product may differ from another, the absolute transmit power in dBm should not be inferred from the value configured in the *TransmitPower* field of *RFTxmitter*. For example, a *TransmitPower* index of 61 is 30 dBm on one product, while on another the same 30 dBm absolute power is a *TransmitPower* index of 81. Client applications should always reference the advertised reader capabilities when determining absolute power values.

### 3.1.21 C1G2 Version 1.2.0 Support

Octane 8.0 is based on LLRP version 1.0.1, which does not support C1G2 version 1.2.0. However, to provide access to a subset of the C1G2 1.2.0 features, Octane includes vendor extensions to expose the underlying air protocol features. For more information, refer to the documentation for the individual extensions.

## 4 Octane LLRP Configuration

Octane extends LLRP with custom extensions to provide critical functionality unique to Impinj reader products. These features utilize the custom extension mechanism provided by LLRP. The table below summarizes the Octane LLRP custom extensions for the Impinj R700 reader.

For each Octane LLRP custom extension, the documentation includes a description of the feature, a discussion of LLRP dependencies, the allowable extension points for the extension, and the definition of API elements. The subsections below outline the information provided for each Octane LLRP custom extension and its relevance to the developer or system architect who want to use Octane LLRP:

**Description:** The description subsection contains specific information about the extension, including what it does and how to use it. The description contains the high-level information required to implement the extension.

**LLRP Dependency:** The LLRP Dependency subsection describes how the contents of the extension affect other standard LLRP fields and parameters. Many extensions provide additional functionality over what standard LLRP offers. The settings in the standard version of the protocol elements can be modified or overridden entirely by the presence of an extension parameter. Where applicable, the LLRP dependency section clarifies the behavior.

**Allowable Extension Points:** The allowable extension point subsection describes where the extension is permitted within the LLRP messaging structure. Not all parameters in LLRP allow the presence of custom parameters. The LLRP specification documents the allowable locations of custom extensions.

Octane further restricts each individual custom extension and where they may appear within LLRP messages. Each custom parameter (not applicable for custom messages) lists the LLRP extension points at which the parameter may appear. Octane LLRP custom extension parameters can appear in any order in an LLRP custom extension point.

**Definition:** The definition subsection of each Octane extension defines the fields and sub-parameters that make up the extension. Field types and definitions for enumerated values are included in this section.

### Octane Custom LLRP Extension Summary for the Impinj R700 Reader Fixed Reader

Octane LLRP Extension	Support	Links	Description
Enable Extensions	✓	<a href="#">Message</a> , <a href="#">Response</a>	Required to utilize any of the Octane LLRP custom extension features.
Detailed Version Information	✓	<a href="#">Parameter</a>	Provides detailed version information for the subcomponents that make up the reader.
Sub-Regulatory Region Control and Reporting	✓	<a href="#">Parameter</a>	Used when regulatory regions offer several distinct modes of operation or when a single reader offers multiple regulatory regions. The response to this command can take up to 10 seconds, because the reader must reconfigure itself for the new region.

Octane LLRP Extension	Support	Links	Description
Inventory Search Mode	✓	Parameter	Configures the inventory algorithms for optimum performance. This is an alternate method to the <b>StateAwareSingulation</b> parameter in LLRP that requires detailed Gen2 knowledge.
Fixed Frequency List	✓	Parameter	Allows the client to control and configure automatic frequency selection for regulatory regions with fixed frequency operation.
Low Duty Cycle	✓	Parameter	Provides clients the ability to configure a low duty cycle mode to limit interference. The reader manages the duty cycle based on tag observation statistics.
Save Settings	✓	Message, Response	Allows the application to save configuration settings in the reader. The response to this command can take up to two seconds, while the reader commits the configuration to persistent storage.
GPI Debounce	✓	Parameter	Configures the minimum period between general-purpose input (GPI) transitions reported by the reader. Debounce allows the reader to be directly connected to mechanical switches or other "noisy" inputs.
Advanced GPO	✓	Parameter	Allows for more advanced use of the reader general-purpose outputs (GPOs). GPOs can be pulsed for a specific duration, or can be tied to a specific reader operational status.

Octane LLRP Extension	Support	Links	Description
Temperature Reporting	✓	<a href="#">Parameter</a>	Allows for polled reporting of the internal reader temperature.
Link State Monitoring	✓	<a href="#">Parameter</a>	Configures the reader to monitor the state of a LLRP connection using the LLRP KEEPALIVE mechanism.
Report Buffer Behavior	✓	<a href="#">Parameter</a>	Instructs the reader on how to buffer reports it sends to client applications. It can be used to decrease latency of tag reports at the expense of both reader and client CPU utilization.
Access Spec Configuration	✓	<a href="#">Parameter</a>	Allows for fine-tuned control over AccessSpec execution, including the number of words sent over the air interface during a BlockWrite operation and how many times an operation is retried before declaring failure.
C1G2 BlockPermalock	✓	<a href="#">Parameter</a>	Exposes the C1G2 air protocol BlockPermalock operation.
QT Technology™	✓	<a href="#">Parameter</a>	Allows the reader to access and configure the QT Technology™ of the Impinj Monza 4QT tags. For more information about this feature, reference the Monza 4QT datasheet.
Impinj Margin Read	✓	<a href="#">Parameter</a>	Exposes the Impinj MarginRead operation for confirming the data integrity on Monza tag chips with Integra.
Serialized TID	✓	<a href="#">Parameter</a>	Allows the reader to report both the EPC and TID as part of normal inventory, without the need for an explicit AccessSpec.

Octane LLRP Extension	Support	Links	Description
RF Phase Angle	✓	Parameter	Reports the RF phase angle of the communication with the tag over the air interface.
High Resolution RSSI	✓	Parameter	Reports the peak power of the tag backscatter in a higher resolution than is available via LLRP.
GPS Location	✓	Parameter	Allows the reader to report its GPS location when attached to a supported GPS-capable device. The GPS location can be obtained instantaneously or included within tag reports.
Optimized Read	✓	Parameter	Allows for the reporting of additional tag memory content during inventory without the use of AccessSpecs. The reads are optimized by the reader for enhanced performance.
AISpec Looping	✓	Parameter	Allows the reader to execute AISpecs repeatedly.
Intelligent Antenna Mgmt	✓	Parameter	Allows for the reader's Intelligent Antenna Management feature to be disabled. Enabled by default for fixed readers, this feature ensures that the reader uses an antenna only if tags are detected on it.
Inventory Configuration	✓	Parameter	Allows for Impinj-specific inventory related behavior to be configured.
RF Power Sweep	✓	Parameter	Allows for Impinj-specific RF Power Sweep feature to be configured.

## 4.1 Standard Messages

The following subsections describe standard messages that are special cases supported in Octane LLRP.

## 4.2 Custom Messages

The following subsections describe the custom messages supported in Octane LLRP.

### 4.2.1 IMPINJ\_ENABLE\_EXTENSIONS Message

This top-level extension custom message is used to enable the exchange of all other Impinj extensions. By default, all of the Impinj extensions are unavailable to the client, and the reader will respond to any Impinj extensions with an error. The client sends the custom message to the reader after the connection is established if it wants to use Impinj extensions. If the connection is lost, the extensions revert to the unavailable state. However, reader features that are controlled by the earlier use of extensions remain configured through connections, unless otherwise noted.

By sending this message to the reader, the client acknowledges the ability to process all Impinj extensions. The client must ignore any unrecognized information received from the reader, including the following:

- Unknown custom messages
- Unknown custom parameters
- Unknown reserved enumeration values in custom parameters
- Use of reserved bits in custom parameters and messages

#### LLRP Dependencies

The IMPINJ\_ENABLE\_EXTENSIONS message only applies for the duration of the current LLRP connection. If the LLRP connection is broken and re-established, the application must re-issue this command. Sending a SET\_READER\_CONFIG message with the *ResetToFactoryDefault* flag set has no effect on the Impinj Extensions state.

#### Definition

##### IMPINJ\_ENABLE\_EXTENSIONS Message Definition

Message Field	Description
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameters</i> > [optional]

For more information, see the [message layout](#).

### 4.2.2 IMPINJ\_ENABLE\_EXTENSIONS\_RESPONSE Message

This custom message is the reader response to an IMPINJ\_ENABLE\_EXTENSIONS message. If the reader is capable of enabling the Impinj extensions, the reader returns the success code in the LLRPStatus parameter. If there is an error, the reader returns an appropriate error code.

#### LLRP Dependencies

This custom message has no LLRP dependencies.

#### Definition

##### IMPINJ\_ENABLE\_EXTENSIONS\_RESPONSE Message Definition

Message Field	Description
Status	LLRPStatus Parameter
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

For more information, see the [response message layout](#).

#### 4.2.3 IMPINJ\_SAVE\_SETTINGS Message

The IMPINJ\_SAVE\_SETTINGS custom message instructs the reader to save the current configuration to persistent storage. The saved parameters then become the power-on and reader reset settings. The specific configuration parameters that are saved to persistent storage are specified using the Boolean fields. These Boolean fields are implemented as a bit-field as shown in the section describing the [message layout](#). Unused reserved bits must be set to zero. Note that there is no way to recall this configuration during runtime. The configuration is only applied after a reader power-on or reset.

The entire reader state is saved to persistent storage. This includes settings from SET\_READER\_CONFIG, in addition to any configured RO Specs and Access Specs. The current state of *RO Specs* and *Access Specs* is preserved with one exception. The 'Active' *RO Spec* is saved in the 'Inactive' (but enabled) state. This means an *RO Spec* with an 'Immediate' start trigger is saved in the 'Inactive' state, but will then run immediately upon power-on or reset. Similarly, an *RO Spec* with a GPI start trigger will run upon the first GPI transition after power-on or reset. For *Access Specs*, the countdown value (if any) is saved as soon as this custom message is received. Automatic update of the persistent configuration during Reader operation is not supported.

##### LLRP Dependencies

The configuration of the reader when the IMPINJ\_SAVE\_SETTINGS message is received becomes the default configuration for all reader resets. However, a SET\_READER\_CONFIG command with the *ResetToFactoryDefault* flag set will override the persistent settings. The reader will then initialize with factory settings on subsequent resets until it receives another IMPINJ\_SAVE\_SETTINGS command.

##### Definition

###### IMPINJ\_SAVE\_SETTINGS Message Definition

Message Field	Description
SaveConfiguration	Boolean
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

For more information, see the [message layout](#).

#### 4.2.4 IMPINJ\_SAVE\_SETTINGS\_RESPONSE Message

This custom save-settings message is the response by the reader to an IMPINJ\_SAVE\_SETTINGS message. If the reader was capable of saving the current configuration to persistent storage, the reader returns the success code in the LLRPStatus parameter. If there is an error, the reader returns an appropriate error code.

##### LLRP Dependencies

This custom message has no LLRP dependencies.

##### Definition

###### IMPINJ\_SAVE\_SETTINGS\_RESPONSE Message Definition

Message Field	Description
Status	LLRPStatus Parameter
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

For more information, see the [message layout](#).

## 4.3 Custom Parameters

The following subsections describe the custom parameters supported in Octane LLRP.

### 4.3.1 ImpinjRequestedData Parameter

This custom parameter allows the client to choose specific extensions for inclusion in either a GET\_READER\_CAPABILITIES\_RESPONSE or a GET\_READER\_CONFIG\_RESPONSE message. If the client requests 'All' in the command message and Impinj extensions have been enabled, then all Impinj extensions are included in the response. In order to reduce the response size, the client might request specific response parameters using this extension.

**Note:** This only applies to direct extensions of these two response messages. Custom extensions nested within parameters that are already present in either of these response messages are included provided the reader has received the IMPINJ\_ENABLE\_EXTENSIONS message. Although this parameter can appear in either a GET\_READER\_CAPABILITIES or a GET\_READER\_CONFIG message, not all ranges for the enumerated *RequestedData* field are valid in both messages.

#### LLRP Dependencies

There are no LLRP dependencies for this custom parameter. The standard LLRP requested data field is processed independently from the custom requested data field, with the exception that 'All' in the standard field also means 'All' in the custom field, if this parameter is omitted and extensions have been enabled.

#### Allowable Extension Points

- GET\_READER\_CAPABILITIES message (field values 1000 - 1999)
- GET\_READER\_CONFIG message (field values 2000 - 2999)

#### Definition

##### ImpinjRequestedData Parameter Definition

Parameter Field	Description
RequestedData	Unsigned Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### Possible Values of RequestedData

Value	Description
1000	'All_Capabilities'
1001	'Impinj_Detailed_Version'
1002	'Impinj_Frequency_Capabilities'
2000	'All_Configuration'
2001	'Impinj_Sub_Regulatory_Region'
2003	'Impinj_GPI_Debounce_Configuration'
2004	'Impinj_Reader_Temperature'
2005	'Impinj_Link_Monitor_Configuration'
2006	'Impinj_Report_Buffer_Configuration'
2007	'Impinj_Access_Spec_Configuration'
2008	'Impinj_GPS_NMEA_Sentences'

Value	Description
2009	'Impinj_Advanced_GPO_Configuration'
2015	'Impinj_Hub_Configuration'
All others	Reserved for future use

#### 4.3.2 ImpinjSubRegulatoryRegion Parameter

Use this custom parameter when a particular regulatory region supports multiple operational modes. The reader validates the *RegulatoryRegion* field against the regulatory regions for which the reader was manufactured, and only allows compatible regions to be set. Note that when you set the sub-regulatory region by using the SET\_READER\_CONFIG message, the *ResetToFactoryDefault* field must be set to **true**. This will delete any configured *ROSpecs* and *AccessSpecs*. Failure to set the *ResetToFactoryDefault* field will result in an error. The client should subsequently issue a GET\_READER\_CAPABILITIES command after it updates the regulatory region, because the change might have affected the advertised reader capabilities. After the reader accepts this parameter, it will begin to reload appropriate regulatory settings: this can take several seconds. Applications should plan for an additional delay of several seconds for the SET\_READER\_CONFIG\_RESPONSE.

**Note:** Setting an LLRP *ResetToFactoryDefault* that changes the *RegulatoryRegion* will result in the same behavior as described above.

Not all regulatory regions are supported by each reader model. The following table shows supported regions for the Impinj R700 reader.

#### Supported regions for R700

ID	Region Name
0	FCC part 15.247
3	Hong Kong 920-925 MHz
4	Taiwan 922-928 MHz
7	ETSI EN 302-208 (version 1.4.1)
8	Korea 917-921 MHz
9	Malaysia 919-923 MHz
10	China 920-925 MHz
12	South Africa 915-919 MHz
13	Brazil 902-907/915-928 MHz
14	Thailand 920-925 MHz
15	Singapore 920-925 MHz
16	Australia 920-926 MHz
17	India 865-867 MHz
18	Uruguay 916-928 MHz
19	Vietnam 918-923 MHz
21	Philippines 918-920 MHz
22	Vietnam 920-923 MHz
23	Indonesia 920-923 MHz

ID	Region Name
24	New Zealand 921.5-928 MHz
25	Japan 916-921 MHz w/o LBT
26	Latin America 902-928 MHz
27	Peru 916-928 MHz
28	Bangladesh 925-927 MHz
29	ETSI 915-921 MHz

**Note:** Inclusion of a country or region in the above tables does not imply regulatory compliance. Refer to the Impinj Support Portal for a list of certified countries and regions by product. The list changes over time as new countries are certified and as certificates expire.

### LLRP Dependencies

When a particular LLRP region supports multiple operational modes, this parameter is required. For example, the LLRP ETSI region might support both with and without LBT. For regions that don't support multiple modes, the reader will set this parameter automatically, based on the hardware version of the reader, and the region information specified at manufacturing.

### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message

### Definition

#### ImpinjSubRegulatoryRegion Parameter

Parameter Field	Description
RegulatoryRegion	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

### Possible Values of RegulatoryRegion

Value	Description
0	'FCC part 15.247'
1	'ETSI EN 300-220'
2	'ETSI EN 302-208 (with LBT)'P0F
3	'Hong Kong 920-925 MHz'
4	'Taiwan 922-928 MHz'
5	'Japan 952-954 MHz'P1F - (no longer supported)
6	'Japan 952-955 MHz, 10mW max power' - (no longer supported)
7	'ETSI EN 302-208 (version 1.4.1)'
8	'Korea 917-921 MHz'
9	'Malaysia 919-923 MHz'

Value	Description
10	'China 920-925 MHz'
11	'Japan 952-956 MHz (without LBT)'
12	'South Africa 915-919 MHz'
13	'Brazil 902-907 and 915-928 MHz'
14	'Thailand 920-925 MHz'
15	'Singapore 920-925 MHz'
16	'Australia 920-925 MHz'
17	'India 865-867 MHz'
18	'Uruguay 916-928 MHz'
19	'Vietnam 918-923 MHz'
20	'Israel 915-917 MHz'
21	'Philippines 918-920 MHz'
22	'Vietnam 920-923 MHz'
23	'Indonesia 923-925 MHz'
24	'New Zealand 922-927 MHz'
25	'Japan 916.7-920.9 MHz'
26	'Latin America 902-928 MHz'
27	'Peru 916-928 MHz'
28	'Bangladesh 925-927 MHz'
29	'ETSI 915-921 MHz'
30-65535	Reserved for future use

**Note:** Inclusion of a country or region in the above table does not imply regulatory compliance. Refer to the Impinj Support Portal for a list of certified countries and regions by product. The list changes over time as new countries are certified and as certificates expire.

#### 4.3.3 ImpinjInventorySearchMode Parameter

Specify the Impinj-specific inventory search mode used by a particular antenna using this custom parameter. The inventory search mode may be configured as either part of the default reader configuration (via a SET\_READER\_CONFIG message), or as part of individual AISpecs within a ROSpec (via an ADD\_ROSPEC message).

#### LLRP Dependencies

Impinj readers implement state unaware singulation and therefore the Client does not control how the reader attempts to singulate tags. This parameter provides a high-level control over the search algorithm and consequently does not interfere with any of the standard LLRP settings. When the `InventorySearchMode` is set to zero, the reader will pick the inventory search mode that provides the most consistent performance for the session and timing parameters provided by LLRP.

#### Allowable Extension Points

- `C1G2InventoryCommand` parameter

## Definition

### ImpinjInventorySearchMode Parameter

Parameter Field	Description
InventorySearchMode	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

### Possible Values of InventorySearchMode

Value	Name	Typical Use Case	What it does
0	Reader Selected		Reader selected mode (default). Serves as demo mode to get tag read data. Single target used if Session 0 or 1. Dual target used if Session 2 or 3.
1	Single Target Inventory	High tag count, high-throughput use cases where a reduction in repeated tag observation is acceptable.	Inventories tags in state A, transitioning the tags to state B.
2	Dual Target Inventory	Low-to-medium tag count, low-throughput use cases where repeated tag observation is desirable.	Inventories tags in state A, transitioning the tags to state B Inventories tags in state B, transitioning the tags back to state A.
3	Single Target Inventory with Suppression (aka TagFocus)	High tag count, high-throughput use cases where a reduction in repeated tag observations is acceptable. Suppresses repeated observations for extended periods of time while tags are energized. Supported only with Monza tags using Session 1.	Inventories tags in state A, transitioning the tags to state B. Tags will persist in state B if they are energized. Tags will transition to state A in <= 5 seconds when de-energized.
4	Reserved for future use		
5	Single Target Reset Inventory	Used in conjunction with 'Single Target Inventory' to achieve higher throughput when using Sessions 2 and 3 that have longer decay intervals.	Inventories tags in state B, transitioning the tags to state A.

Value	Name	Typical Use Case	What it does
6	Dual Target Inventory with Reset	High tag count, high-throughput use cases where repeated tag observation is desirable.	Inventories tags in state A, transitioning the tags to state B. Sends Gen2 Select command to transition tags back to state A.
> 6	Reserved for future use.		

#### 4.3.4 ImpinjFixedFrequencyList Parameter

Use this custom parameter to allow the reader to make intelligent decisions about which channel to use in fixed frequency or intelligent hopping regulatory regions. The *FixedFrequencyMode* field determines how the reader will select the active channel. When set to **zero** (disabled), the reader ignores this parameter and instead uses the frequency information in the LLRP *RFTransmitter* parameter. When set to **1**, the reader chooses the active channel automatically , based on the rules of the regulatory region. When set to **2**, the reader chooses the active channel from a configurable list of channel indices based on the *ImpinjFrequencyCapabilities* parameter advertised in the reader’s capabilities. The maximum number of channels allowed in the configurable list is shown in the table below. A repeated channel index means the reader will test the channel multiple times. When *FixedFrequencyMode* is set to zero or one, the *ChannelList* array is ignored.

This parameter can only be added in an operational mode, such as ‘not disabled’, when the reader is operating in a fixed frequency or intelligent hopping regulatory region. The parameter contents must be consistent across all enabled antennas in an AISpec.

#### ImpinjFixedFrequencyList Regulatory Information

ID	Region Name	Available FixedFrequencyMode	Maximum ChannelList Size
0	FCC part 15.247	0	N/A
1	ETSI EN 300-220	N/A	N/A
2	ETSI EN 302-208	See region 7	See region 7
3	Hong Kong 920-925 MHz	0	N/A
4	Taiwan 922-928 MHz	0	N/A
5	Japan 952-954 MHz	N/A	N/A
6	Japan 952-955 MHz, 10mW max power	N/A	N/A
7	ETSI EN 302-208 (version 1.4.1)	0, 1, 2	4
8	Korea 917-921 MHz	0	N/A
9	Malaysia 919-923MHz	0	N/A
10	China 920-925 MHz	0, 1, 2	16
11	Japan 952-956 MHz (without LBT)	0, 1, 2	4
12	South Africa 915-919 MHz	0	17
13	Brazil 902-907/915-928 MHz	0	N/A
14	Thailand 920-925 MHz	0	N/A
15	Singapore 920-925 MHz	0	N/A
16	Australia 920-925 MHz	0	N/A

ID	Region Name	Available FixedFrequencyMode	Maximum ChannelList Size
17	India 865-867 MHz	0, 1, 2	4
18	Uruguay 916-928 MHz	0	N/A
19	Vietnam 918-923 MHz	0	N/A
20	Israel 915-917 MHz	0	N/A
21	Philippines 918-920 MHz	0, 1, 2	4
22	Vietnam 920-923 MHz	0	N/A
23	Indonesia 923-925 MHz	0	N/A
24	New Zealand 922-927 MHz	0	N/A
25	Japan 916.7-920.9 MHz	0, 1, 2	4
26	Latin America 902-928 MHz	0	N/A
27	Peru 916-928 MHz	0	N/A
28	Bangladesh 925-927 MHz	0	N/A
29	ETSI 915-921 MHz	0, 1, 2	4

**Note:** Inclusion of a country or region in the above table does not imply regulatory compliance. Refer to the Impinj Support Portal for a list of certified countries and regions by product. The list changes over time as new countries are certified and as certificates expire.

### LLRP Dependencies

When present and enabled, this parameter overrides the *ChannelIndex* field of the *RFTransmitter* parameter. The reader will always return the last value set in the *ChannelIndex* field if queried, but if a client sets this custom parameter, that value must be ignored.

### Allowable Extension Points

- *C1G2InventoryCommand* parameter

### Definition

#### ImpinjFixedFrequencyList Parameter

Parameter Field	Description
FixedFrequencyMode	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

### Possible Values of FixedFrequencyMode

Value	Description
0	'Disabled' (default)
1	'Reader will choose the channel from those allowed in the current regulatory region'
2	'Reader will choose the channel from the channel indices provided in the ChannelList field'
3-65535	Reserved for future use

**Note:** *ChannelList*: Short Array. An array of indices into the reader's *ImpinjFrequencyCapabilities* that can be used.

#### 4.3.5 ImpinjFrequencyCapabilities Parameter

The frequency capabilities custom parameter is included in the reader's capabilities and carries each frequency supported by the reader (see [ImpinjFixedFrequencyList Parameter](#) for more information). The *FrequencyList* field is a one-based array of frequencies in kHz.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- GET\_READER\_CAPABILITIES\_RESPONSE

##### Definition

##### ImpinjFrequencyCapabilities Parameter

Parameter Field	Description
FrequencyList	Unsigned Integer Array. Frequency in kHz.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### 4.3.6 ImpinjLowDutyCycle Parameter

Use this custom parameter to provide additional control of the RF duty cycle of the reader beyond the control already provided by the *TagTransitTime* field in the LLRP *C1G2SingulationControl* parameter. During inventory, if the reader detects zero tags in the field-of-view (a definition that is model-specific, as described in this section), *EmptyFieldTimeout* specifies in milliseconds the amount of time the reader will wait before entering low duty cycle mode. In this low duty cycle mode, the reader will rescan the FOV every *FieldPingInterval* milliseconds, checking for tags. When a tag is detected, the full duty cycle will resume. The reader exits the low duty cycle mode at the start of each AISpec, and restarts the empty field timers.

For regulatory region compliance, low duty cycle operation will occur in some regions, whether low duty cycle operation parameters are specified or not. For such regions, if valid low duty cycle operation parameter values are specified, the reader might choose to adjust the specified values in order to maintain regulatory region compliance. This parameter is invalid in regions that use LBT, as shown in the table below.

The FOV is defined as the tags visible by a single antenna, independent of the other antennas enabled in the current AISpec. Thus, each antenna manages its own FOV, empty field timer, and field ping timer. This means that the low duty cycle settings can be configured independently from other antennas that are enabled in the current AISpec. The only requirement is that, if one antenna in the AISpec uses the *ImpinjLowDutyCycle* parameter, all antennas must use the extension. However, the timer values can vary between enabled antennas.

As an example, assume that, for one of the antennas in the current AISpec, *EmptyFieldTimeout* is set to 500 milliseconds and *FieldPingInterval* is set to 200 milliseconds. After that antenna detects zero tags in the field-of-view, that antenna's empty field timer is started. If that antenna subsequently detects tags, the timer stops. If that antenna detects zero tags for 500 milliseconds, a timeout occurs and the antenna enters low duty cycle mode. During this mode, the antenna will switch on briefly every 200 milliseconds to check for tags in its FOV. While this is all occurring, the same algorithm is running on each of the other enabled antennas independently.

Note: Low duty cycle mode is not supported if only one antenna is enabled. Note: If Low Duty Cycle is enabled, then Intelligent Antenna Management will be temporarily enabled. Note: Low duty cycle is not

recommended for use with gateways.

### ImpinjLowDutyCycle Regulatory Information

ID	Region Name	Available LowDutyCycleMode
0	FCC part 15.247	0, 1
1	ETSI EN 300-220	N/A
2	ETSI EN 302-208	See region 7
3	Hong Kong 920-925 MHz	0, 1
4	Taiwan 922-928 MHz	0, 1
5	Japan 952-954 MHz	N/A
6	Japan 952-955 MHz, 10mW max power	N/A
7	ETSI EN 302-208 (version 1.4.1)	0, 1
8	Korea 917-921 MHz	0, 1
9	Malaysia 919-923MHz	0, 1
10	China 920-925 MHz	0, 1
11	Japan 952-956 MHz (without LBT)	0, 1
12	South Africa 915-919 MHz	0, 1
13	Brazil 902-907/915-928 MHz	0, 1
14	Thailand 920-925 MHz	0, 1
15	Singapore 920-925 MHz	0, 1
16	Australia 920-925 MHz	0, 1
17	India 865-867 MHz	0, 1
18	Uruguay 916-928 MHz	0, 1
19	Vietnam 918-923 MHz	0, 1
20	Israel 915-917 MHz	0, 1
21	Philippines 918-920 MHz	0, 1
22	Vietnam 920-923 MHz	0, 1
23	Indonesia 923-925 MHz	0, 1
24	New Zealand 922-927 MHz	0, 1
25	Japan 916.7-920.9 MHz	0, 1
26	Latin America 902-928 MHz	0, 1
27	Peru 916-928 MHz	0, 1
28	Bangladesh 925-927 MHz	0, 1
29	ETSI 915-921 MHz	0, 1

**Note:** Inclusion of a country or region in the above table does not imply regulatory compliance. Refer to the Impinj Support Portal for a list of certified countries and regions by product. The list changes over time as new countries are certified and as certificates expire.

### LLRP Dependencies

If present and enabled, this parameter overrides the *TagTransitTime* field in the LLRP *C1G2SingulationControl* parameter. The reader always returns the last value that was set in the *TagTransitTime* field if queried. However, if a client has set this custom parameter, that value must be ignored.

### Allowable Extension Points

- *C1G2InventoryCommand* parameter

### Definition

#### ImpinjLowDutyCycle Parameter

Parameter Field	Description
LowDutyCycleMode	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### Possible Values of LowDutyCycleMode

Value	Description
0	'Disabled' (default)
1	'Enabled' (Not recommended for use with gateways)
2-65535	Reserved for future use

**Note:** *EmptyFieldTimeout*: Unsigned Short Integer. The time in milliseconds the reader will wait, having detected no tags on all enabled antennas, before switching to low duty cycle mode.

**Note:** *FieldPingInterval*: Unsigned Short Integer. The time in milliseconds before the reader switches on the transmitter to search for tags in the field during low duty cycle mode.

#### 4.3.7 ImpinjDetailedVersion Parameter

Use this custom parameter to provide detailed information about the individual components running on the reader. The primary platform version is available in the *ReaderFirmwareVersion* field in the *GeneralDevice-Capabilities* parameter of the reader's capabilities. However, there are sub-components of the reader that contain independent version information that is unavailable by using the primary platform version. This custom parameter provides the detailed information. The meaning behind each field varies by reader model. The following table provides the translation for the Impinj R700 reader.

#### ImpinjDetailedVersion Field Descriptions

Field	Translation
ModelName	The model name of the reader.
SerialNumber	The serial number of the reader.
SoftwareVersion	The primary platform firmware version (SOP). Same as ReaderFirmwareVersion.
FirmwareVersion	The firmware version of the Command Sequencer component.
FPGAVersion	The firmware version of the FPGA component.
PCBAVersion	The hardware version of the PCBA component.

Field	Translation
ImpinjHubVersions	Hardware, firmware versions and serial numbers of attached Antenna Hubs.
ImpinjArrayVersion	Array specific hardware and version information that is considered additional to ImpinjDetailedVersion information.
ImpinjBLEVersion	The firmware version of the BLE (Bluetooth Low Energy) hardware.

## LLRP Dependencies

This custom parameter has no LLRP dependencies.

## Allowable Extension Points

- GET\_READER\_CAPABILITIES\_RESPONSE message

## Definition

### ImpinjDetailedVersion Parameter

Parameter Field	Description
<i>ModelName</i>	UTF-8 String
<i>SerialNumber</i>	UTF-8 String
<i>SoftwareVersion</i>	UTF-8 String
<i>FirmwareVersion</i>	UTF-8 String
<i>FPGAVersion</i>	UTF-8 String
<i>PCBAVersion</i>	UTF-8 String
<i>ImpinjHubVersions</i>	Custom Parameter
<i>ImpinjArrayVersion</i>	Custom Parameter
<i>ImpinjBLEVersion</i>	Custom Parameter
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

### ImpinjHubVersions Parameter

Parameter Field	Description
<i>ImpinjArrayVersion</i> List	List of <i>ImpinjArrayVersion</i> parameters for each attached hub.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

### ImpinjArrayVersion Parameter

Parameter Field	Description
<i>SerialNumber</i>	UTF-8 String
<i>FirmwareVersion</i>	UTF-8 String

Parameter Field	Description
<i>PCBAVersion</i>	UTF-8 String
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### ImpinjBLEVersion Parameter

Parameter Field	Description
<i>FirmwareVersion</i>	UTF-8 String
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### 4.3.8 ImpinjGPIDebounceConfiguration Parameter

Use this custom parameter to control the GPI debounce timing. The *GPIPortNum* field is the 1-based GPI number, identical to *GPIPortNum* in the *GPIPortCurrentState* LLRP parameter. Once a transition is detected, whether rising or falling, subsequent transitions are ignored for *GPIDebounceTimerMSec* milliseconds. This timer value must be a multiple of 10 milliseconds and has a maximum value of 1000 (corresponding to a 1-second debounce). Setting *GPIDebounceTimerMSec* to zero effectively disables debounce. The GPI debounce timer affects triggered ROSpecs and GPI event reporting.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message

##### Definition

#### ImpinjGPIDebounceConfiguration Parameter

Parameter Field	Description
<i>GPIPortNum</i>	Unsigned Short Integer.
<i>GPIDebounceTimerMSec</i>	The debounce duration in milliseconds. Must be a multiple of 10 milliseconds. Maximum value is 1000. Zero turns off the debounce algorithm for this GPI.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

#### 4.3.9 ImpinjAdvancedGPOConfiguration Parameter

Use this custom parameter to control the advanced GPO feature of fixed readers. When set to **Normal** (default) the GPO is set via the regular LLRP SET\_READER\_CONFIG message. When set to **Pulsed**, the GPO changes state based on the SET\_READER\_CONFIG message, and will change to the opposite state after *GPOPulseDurationMSec* milliseconds. When set to 'Reader\_Operational\_Status', 'LLRP\_Connection\_Status', 'Reader\_Inventory\_Status', 'Network\_Connection\_Status', or 'Reader\_Inventory\_Tags\_Status', the GPO status acts like a Boolean value. When high (**true**, 1), the corresponding status is **true**, which means that the reader is operating, has a LLRP connection, is inventorying, has a network connection, or tags are being singulated (respectively). When low (**false**, 0), the opposite is the case. The GPO might lag the actual internal status. Notably the

worst case delay on the 'Network\_Connection\_Status' can be up to 17 seconds.

Note: When the pin is configured for 'Reader\_Inventory\_Status', the reader asserts the GPO pin if an inventory operation is in progress. The state of the GPO pin is updated every 250 ms so it may take up to 500 ms for the pin to reflect a change in status.

### LLRP Dependencies

Whenever a GPO has been associated with a specific reader status, it cannot be set via the normal LLRP protocol. If a SET\_READER\_CONFIG message is received that attempts to change the state of a GPO that is associated with a specific reader status, the message will be rejected by the reader.

### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message

### Definition

#### ImpinjAdvancedGPOConfiguration Parameter

Parameter Field	Description
<i>GPOPortNum</i>	Unsigned Short Integer.
<i>GPOMode</i>	Unsigned Short Integer.
<i>GPOPulseDurationMSec</i>	Unsigned Integer.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

### Possible Values of GPOMode

Value	Description
0	'Normal' (default)
1	'Pulsed'
2	'Reader_Operational_Status'
3	'LLRP_Connection_Status'
4	'Reader_Inventory_Status'
5	'Network_Connection_Status'
6	'Reader_Inventory_Tags_Status'
7-65535	Reserved for future use

**Note:** *GPOPulseDurationMSec*: Unsigned Integer. The duration of the GPO pulse. This field is only valid when *GPOMode* is set to **Pulsed**. When GPOMode is set to **Pulsed**, this value must be non-zero. The duration is specified in milliseconds.

#### 4.3.10 ImpinjReaderTemperature Parameter

Use this custom parameter to report the current temperature of the reader in degrees Celsius. The temperature that is reported is the internal temperature of the reader, not the ambient temperature of the reader surroundings. The temperature is accurate to within 2 degrees C across all operating temperatures.

### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message

#### Definition

##### ImpinjReaderTemperature Parameter

Parameter Field	Description
<i>Temperature</i>	Signed Short Integer. The current temperature in degrees Celsius.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

#### 4.3.11 ImpinjLinkMonitorConfiguration Parameter

Use this custom parameter to configure the reader to monitor LLRP link health by using KEEPALIVE and KEEPALIVE\_ACK messages. When disabled, the reader ignores KEEPALIVE\_ACK messages entirely. When this parameter is enabled, if the reader fails to receive *LinkDownThreshold* consecutive KEEPALIVE\_ACK messages from the client, the reader will close the current connection. Note that this parameter must be configured in conjunction with the *KeepaliveSpec* LLRP parameter in the standard LLRP configuration. The frequency with which the reader is configured to send KEEPALIVE messages, along with the threshold set in this parameter, determines how long the reader will tolerate missing KEEPALIVE\_ACK messages. The reader uses the LLRP *MessageID* field to correlate KEEPALIVE and KEEPALIVE\_ACK messages. Clients must send the same *MessageID* when responding to reader KEEPALIVE requests.

Note: The recommended KEEPALIVE interval is at least 10 seconds. Setting a shorter KEEPALIVE interval may result in errors.

#### LLRP Dependencies

This custom parameter must be set in conjunction with the LLRP *KeepaliveSpec* parameter. If you set this parameter alone without configuring a Periodic KeepaliveSpec, it has no effect.

#### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message

#### Definition

##### ImpinjLinkMonitorConfiguration Parameter

Parameter Field	Description
<i>LinkMonitorMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

#### Possible Values of LinkMonitorMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

**Note:** *LinkDownThreshold*: Unsigned Short Integer. The number of consecutive KEEPALIVE\_ACK response messages that were not received before the reader closes the current connection.

#### 4.3.12 ImpinjReportBufferConfiguration Parameter

Use this custom parameter to configure how the reader buffers asynchronous reports sent to the client. In **Normal** mode, the reader buffers RO\_ACCESS\_REPORT messages internally for an optimal time period before transmission over the network. Response messages, KEEPALIVE messages, and READER\_EVENT\_NOTIFICATION messages are not affected, and are sent immediately. In **Low\_Latency** mode, the reader sends RO\_ACCESS\_REPORT messages as soon as they are available. In general, the default mode is well suited to most applications. Applications that require immediate access to inventory reports may require **Low\_Latency** mode, but users should first evaluate network and system load.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message

##### Definition

#### ImpinjReportBufferConfiguration Parameter

Parameter Field	Description
<i>ReportBufferMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

##### Possible Values of ReportBufferMode

Value	Description
0	'Normal' (default)
1	'Low_Latency'
2-65535	Reserved for future use

#### 4.3.13 ImpinjAccessSpecConfiguration Parameter

Use this custom parameter to allow additional control over how the reader executes *AccessSpecs*. This parameter does not contain any specific controls, but it encapsulates individual parameters that do. Each parameter that it contains is optional, which allows for maximum flexibility for client implementations.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies, although the parameters that it contains might. Reference the individual parameters for information about how they affect LLRP behavior.

##### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message
- SET\_READER\_CONFIG message
- *AccessSpec* parameter

## Definition

### ImpinjAccessSpecConfiguration Parameter

Parameter Field	Description
<i>ImpinjBlockWriteWordCount</i>	< <i>ImpinjBlockWriteWordCount</i> parameter> [optional]
<i>ImpinjOpSpecRetryCount</i>	< <i>ImpinjOpSpecRetryCount</i> parameter> [optional]
<i>ImpinjAccessSpecOrdering</i>	< <i>ImpinjAccessSpecOrdering</i> parameter> [optional]
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### 4.3.14 ImpinjBlockWriteWordCount Parameter

Use this parameter to configure the number of words sent at one time to a tag, when processing a *C1G2BlockWrite* OpSpec custom parameter. The LLRP *C1G2BlockWrite* parameter has a word vector that contains the data to be written to a tag. Internally, the reader breaks this vector up into individual C1G2 BlockWrite commands. This parameter determines the number of words sent via each BlockWrite command. Note that it is the user's responsibility to ensure that the tag population supports the BlockWrite word count that is configured via this parameter. BlockWrite commands to tags that do not support the configured word count will fail. The reader automatically aligns C1G2BlockWrite commands to appropriate boundaries and accounts for odd data lengths. The default word count is one.

#### LLRP Dependencies

This custom parameter determines the number of words sent at a time over the C1G2 air interface when processing a LLRP *C1G2BlockWrite* parameter.

#### Allowable Extension Points

- None included in *ImpinjAccessSpecConfiguration* parameter.

## Definition

### ImpinjBlockWriteWordCount Parameter

Parameter Field	Description
<i>WordCount</i>	Unsigned Short Integer. Allowable range is 1-2.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### 4.3.15 ImpinjAccessSpecOrdering Parameter

This parameter configures how AccessSpecs are added on readers. AccessSpecs are executed based on the order in which they were added to the reader. By default, the reader adds AccessSpecs in a first-in-first-out (FIFO) order, compliant with the LLRP specification. When the OrderingMode is configured to Ascending, the reader will add new AccessSpecs in ascending order based on the AccessSpecID. If the ordering mode is changed from FIFO to Ascending while AccessSpecs are already configured, the existing AccessSpecs will be sorted.

This parameter exists within the ImpinjAccessSpecConfiguration parameter, which may be present in either a SET\_READER\_CONFIG message or an ADD\_ACCESSSPEC message. However, because this is a global parameter and does not logically apply in a per-AccessSpec context, this parameter may only be included in a SET\_READER\_CONFIG message. If this parameter is present in the context of an individual AccessSpec, the message will be rejected by the reader.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- None included in the *ImpinjAccessSpecConfiguration* parameter.

#### ImpinjAccessSpecOrdering Parameter

Parameter Field	Description
<i>OrderingMode</i>	Unsigned Short Integer. Allowable range 0-1.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of OrderingMode

Value	Description
0	FIFO
1	Ascending

#### 4.3.16 ImpinjOpSpecRetryCount Parameter

Use this custom parameter to configure the number of times an OpSpec operation will be automatically retried by the reader before failure is declared. The reader intelligently chooses which types of failures to retry. For example, the reader will not retry if the tag indicates that the operation failed due to a memory locked or memory overrun, which are operations that have no chance of succeeding. However, if the operation failed due to transient errors, such as CRC errors due to interference, the reader will automatically retry *RetryCount* attempts before failure is declared. LLRP dictates that OpSpec failure be declared once a single operation has failed, therefore the default *RetryCount* is 0.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- None included in the *ImpinjAccessSpecConfiguration* parameter.

#### Definition

#### ImpinjOpSpecRetryCount Parameter

Parameter Field	Description
<i>RetryCount</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of RetryCount

Value	Description
0-3	The number of times each operation is retried.

#### 4.3.17 ImpinjBlockPermalock Parameter

This OpSpec custom parameter configures the *C1G2 BlockPermalock* status of a particular memory bank from a tag. The *AccessPassword* field is the password that is required to move the tag into the secured state, if needed.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpec* choice parameter.

##### Definition

#### ImpinjBlockPermalock Parameter

Parameter Field	Description
<i>RetryCount</i>	Unsigned Short Integer.
<i>OpSpecID</i>	Unsigned Short Integer.
<i>AccessPassword</i>	Unsigned Integer.
<i>MB</i>	Integer.
<i>BlockPointer</i>	Unsigned Short Integer. Specifies the starting address for <i>BlockMask</i> in units of 16 blocks.
<i>BlockMask</i>	Unsigned Short Integer Array. Specifies the blocks to lock, starting at <i>BlockPointer</i> and ending ((16*( <i>BlockMask</i> array length)) - 1) blocks later.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

##### Possible Values of MB

Value	Description
0-3	The memory bank on which to perform the <i>BlockPermalock</i> .

#### 4.3.18 ImpinjBlockPermalockOpSpecResult Parameter

This custom parameter is the result of an *ImpinjBlockPermalock* OpSpec.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpecResult* choice parameter.

##### Definition

#### ImpinjBlockPermalockOpSpecResult Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.

Parameter Field	Description
<i>Result</i>	Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of Result

Value	Description
0	'Success'
1	'Insufficient power to perform block permalock operation'
2	'Non-specific tag error'
3	'No response from tag'
4	'Non-specific reader error'
5	'Incorrect password error'
6	'Tag memory overrun error'

#### 4.3.19 ImpinjGetBlockPermalockStatus Parameter

Use this custom parameter to retrieve the OpSpec *C1G2 BlockPermalock* status of a particular memory bank from a tag. The *AccessPassword* field is the password that is required to move the tag into the secured state, if needed.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpec* choice parameter.

##### Definition

#### ImpinjGetBlockPermalockStatus Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>AccessPassword</i>	Unsigned Integer.
<i>MB</i>	Integer.
<i>BlockPointer</i>	Unsigned Short Integer. Specifies the starting address to retrieve in units of 16 blocks.
<i>BlockRange</i>	Unsigned Short Integer. Specifies the range of blocks to retrieve, starting at <i>BlockPointer</i> and ending ((16 * <i>BlockRange</i> ) - 1) blocks later.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of MB

---

Value	Description
0-3	The memory bank on which to retrieve the BlockPermalock status.

---

#### 4.3.20 ImpinjGetBlockPermalockStatusOpSpecResult Parameter

This custom parameter is the result of an *ImpinjGetBlockPermalockStatus* OpSpec.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpecResult* choice parameter.

##### Definition

#### ImpinjGetBlockPermalockStatusOpSpecResult Parameter

---

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>PermalockStatus</i>	Unsigned Short Integer Array. Specifies the Permalock status of each block requested.
Result	Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

---

##### Possible Values of Result

---

Value	Description
0	'Success'
1	'Non-specific tag error'
2	'No response from tag'
3	'Non-specific reader error'
4	'Incorrect password error'
5	'Tag memory overrun error'

---

#### 4.3.21 ImpinjSetQTConfig Parameter

Use this custom parameter to set the OpSpec for the QT® Technology configuration on Impinj Monza 4QT tags. For more information about the meaning of the fields in this parameter and the use cases for this technology, see the Impinj Monza 4QT datasheet.

Some tags might not be reported when you use Serialized TID reporting and Monza4-QT tags with both public and short range modes. For more information, see [Serialized TID Reporting and Monza4 Tags](#).

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- AccessCommandOpSpec choice parameter.

## Definition

### ImpinjSetQTConfig Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>AccessPassword</i>	Unsigned Integer.
<i>DataProfile</i>	Integer. Determines which data profile is exposed by the tag.
<i>AccessRange</i>	Integer. Determines the range at which the tag may be accessed (Read, Write, Lock, etc.). The range at which the tag is inventoried is not affected.
<i>Persistence</i>	Integer. Determines how long the changes made to the QT configuration with this OpSpec remain in effect.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

### Possible Values of DataProfile

Value	Description
1	'Private'. The tag exposes its private data profile.
2	'Public'. The tag exposes its public data profile.
0,3-255	Reserved for future use.

### Possible Values of AccessRange

Value	Description
1	'Normal_Range'. The tag responds to access operations at the maximum range supported by the environment.
2	'Short_Range'. The tag only responds to access operations from a short range.
0,3-255	Reserved for future use.

### Possible Values of Persistence

Value	Description
1	'Temporary'. The changes made by this command only last until the tag is powered down, at which time the previous configuration is restored.
2	'Permanent'. The changes made by this command are stored permanently to nonvolatile memory.

Value	Description
0,3-255	Reserved for future use.

#### 4.3.22 ImpinjSetQTConfigOpSpecResult Parameter

This custom parameter is the result of an *ImpinjSetQTConfig* OpSpec.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpecResult* choice parameter.

##### Definition

#### ImpinjSetQTConfigOpSpecResult Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
Result	Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

##### Possible Values of Result

Value	Description
0	'Success'
1	'Insufficient power to perform QT write operation'
2	'Non-specific tag error'
3	'No response from tag'
4	'Non-specific reader error'
5	'Incorrect password error'

#### 4.3.23 ImpinjGetQTConfig Parameter

Use this custom parameter to retrieve the OpSpec QT&® Technology configuration on Impinj Monza 4QT tags. For more information about the meaning of the fields within this parameter, and the use cases for this technology, refer to the Impinj Monza 4QT datasheet.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpec* choice parameter.

##### Definition

#### ImpinjGetQTConfig Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>AccessPassword</i>	Unsigned Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### 4.3.24 ImpinjGetQTConfigOpSpecResult Parameter

This custom parameter is the result of an *ImpinjGetQTConfig* OpSpec.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- AccessCommandOpSpecResult choice parameter.

##### Definition

#### ImpinjGetQTConfigOpSpecResult Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>Result</i>	Integer.
<i>DataProfile</i>	Integer. Determines which data profile is exposed by the tag.
<i>AccessRange</i>	Integer. Determines the range at which the tag may be accessed (Read, Write, Lock, etc.). The range at which the tag is inventoried is not affected.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

##### Possible Values of Result

Value	Description
0	'Success'
1	'Non-specific tag error'
2	'No response from tag'
3	'Non-specific reader error'
4	'Incorrect password error'

##### Possible Values of DataProfile

Value	Description
0	'Unknown'
1	'Private' The tag exposes its private data profile.
2	'Public' The tag exposes its public data profile.

Value	Description
3-255	Reserved for future use

### Possible Values of AccessRange

Value	Description
0	'Unknown'.
1	'Normal_Range'. The tag responds to access operations at the maximum range supported by the environment.
2	'Short_Range'. The tag only responds to access operations from a short range.
3-255	Reserved for future use

#### 4.3.25 ImpinjMarginRead Parameter

Use this custom parameter to perform a MarginRead on Impinj Monza tags that support this feature. Currently, Monza 6 family (R6, R6-P and S6-C) and M700 family (M730, M750) support MarginRead. The MarginRead command can be used to confirm data integrity on Monza tag chips with Integra. This command allows a reader to explicitly verify that the non-volatile memory (NVM) in the tag chip is not weakly written, guaranteeing a minimum margin on NVM. It can be used for quality control to ensure data integrity and for failure analysis.

The AccessPassword field is the password required to move the tag into the secured state if needed. Unlike most other Access commands, Margin Read can be performed at the individual bit level. The BitPointer and BitLength fields are for the starting bit address and number of bits to check, respectively.

For more information about the mapping of the fields within this parameter, refer to the relevant Impinj tag datasheet.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *AccessCommandOpSpec* choice parameter.

#### Definition

#### ImpinjMarginRead Parameter

Parameter Field	Description
OpSpecID	Unsigned Short Integer.
AccessPassword	Unsigned Integer.
MB	Integer. The memory bank on which to perform MarginRead.
BitPointer	Unsigned Short Integer. The starting bit address in the memory bank at which to start the MarginRead.
BitLength	Unsigned Byte. The number of bits starting at the BitPointer for which to perform MarginRead.

Parameter Field	Description
Mask	Unsigned Short Integer Array. Specifies the bits in the specified memory on which to perform MarginRead.
Custom Extension Point List	List of [optional]

#### 4.3.26 ImpinjMarginReadOpSpecResult Parameter

This custom parameter is the result of an *ImpinjMarginRead* OpSpec.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- AccessCommandOpSpecResult choice parameter.

##### Definition

#### ImpinjMarginReadOpSpecResult Parameter

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>Result</i>	Unsigned Byte.

##### Possible Values of Result

Value	Description
0	'Success'
1	'Failure'
2	'Insufficient power'
3	'Non-specific Tag error'
4	'No response from tag'
5	'Non-specific reader error'
6	'Incorrect password error'
7	'Tag Memory Overrun error'
8	'Tag Memory Locked error'

#### 4.3.27 ImpinjTagReportContentSelector Parameter

Use this custom parameter to configure additional parameters that are reported via the *TagReportData* parameter. Each optional parameter individually enables or configures a particular feature. Note that, because of how the *ROReportSpec* parameter is handled (described in [LLRP ROReportSpec Parameter](#)), if the optional parameter used to control a particular feature is absent, the feature is considered disabled. See the documentation for the actual parameters for full feature descriptions.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *ROReportSpec* parameter.

#### Definition

#### ImpinjTagReportContentSelector Parameter

Parameter Field	Description
<i>ImpinjEnableSerializedTID</i>	<ImpinjEnableSerializedTID parameter> [optional]
<i>ImpinjEnableRFPhaseAngle</i>	<ImpinjEnableRFPhaseAngle parameter> [optional]
<i>ImpinjEnablePeakRSSI</i>	<ImpinjEnablePeakRSSI parameter> [optional]
<i>ImpinjEnableGPSCoordinates</i>	<ImpinjEnableGPSCoordinates parameter> [optional]
<i>ImpinjEnableOptimizedRead</i>	<ImpinjEnableOptimizedRead parameter> [optional]
<i>ImpinjEnableRFDopplerFrequency</i>	<ImpinjEnableRFDopplerFrequency parameter> [optional]
<i>ImpinjEnableTxPower</i>	<ImpinjEnableTxPower parameter> [optional]
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.28 ImpinjEnableSerializedTID Parameter

Use this custom parameter to configure the Impinj Serialized TID feature. For tags that support this feature, when it is enabled, the *TagReportData* in the RO\_ACCESS\_REPORT will contain an *ImpinjSerializedTID* parameter that reports the tag TID. For more information see [ImpinjSerializedTID parameter](#) and the associated [ImpinjTIDParity parameter](#).

Some tags may not be reported when you use Serialized TID reporting and Monza4-QT tags with both public and short range modes. For more information, see [Serialized TID Reporting and Monza4 Tags](#). Serialized TID reporting is optimized for Impinj tags and may result in reduced tag read rates when used with non-Impinj tags. Further note that Serialized TID reporting will not work for non-Impinj tags with TID memory size less than 96 bits.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- None. Extension points are included in the *ImpinjTagReportContentSelector* parameter.

#### Definition

#### ImpinjEnableSerializedTID Parameter

Parameter Field	Description
<i>SerializedTIDMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of <Impinj Custom Parameters> [optional]

#### Possible Values

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

#### 4.3.29 ImpinjEnableRFPhaseAngle Parameter

Use this custom parameter to configure the *ImpinjRFPhaseAngle* feature. When enabled, the *TagReportData* in the RO\_ACCESS\_REPORT will contain an *ImpinjRFPhaseAngle* parameter that reports the tag's RF Phase Angle. For more information, see the [ImpinjRFPhaseAngle parameter](#).

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- None. Extension points are included in the *ImpinjTagReportContentSelector* parameter.

##### Definition

#### ImpinjEnableRFPhaseAngle Parameter

Parameter Field	Description
<i>RFPhaseAngleMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

##### Possible Values of RFPhaseAngleMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

#### 4.3.30 ImpinjEnablePeakRSSI Parameter

Use this custom parameter to configure the *ImpinjPeakRSSI* feature. When enabled, the *TagReportData* in the RO\_ACCESS\_REPORT will contain an *ImpinjPeakRSSI* parameter that reports the peak RSSI for the tag. For more information, see the [ImpinjPeakRSSI parameter](#).

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- None. Extension points are included in the *ImpinjTagReportContentSelector* parameter.

##### Definition

#### ImpinjEnablePeakRSSI Parameter

Parameter Field	Description
<i>PeakRSSIMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of PeakRSSIMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

#### 4.3.31 ImpinjEnableGPSCoordinates Parameter

Use this custom parameter to configure the *ImpinjGPSCoordinates* feature. If enabled, and if the GPS receiver has acquired a location fix, the *TagReportData* in the RO\_ACCESS\_REPORT will contain an *ImpinjGPSCoordinates* parameter. For more information, see the [ImpinjGPSCoordinates parameter](#).

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- None. Extensions points are included in the *ImpinjTagReportContentSelector* parameter.

##### Definition

#### ImpinjEnableGPSCoordinates Parameter

Parameter Field	Description
<i>GPSCoordinatesMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of GPSCoordinatesMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

#### 4.3.32 ImpinjEnableOptimizedRead Parameter

Use this custom parameter to configure the *ImpinjOptimizedRead* feature. *ImpinjOptimizedRead* allows the reporting of additional tag memory content during an inventory without the use of AccessSpecs. The reader optimizes the execution of these reads for improved overall inventory performance.

The memory bank and location of the reads are specified using the *C1G2Read* parameter, just as they are when using AccessSpecs. Similarly, the results of the reads are reported using the *C1G2ReadOpSpecResult*

parameter in the *TagReportData* parameter. Reads issued using the *ImpinjOptimizedRead* feature are reported the same as reads using AccessSpecs and thus users should ensure that the OpSpecIDs used for the operations are unique.

Users may configure up to two optimized read operations. One departure from the AccessSpec model is that optimized reads are always attempted, even if the first read fails. So, for example, if the first read results in a failure due to a memory overrun, the second read will still be attempted. Therefore, if there are two optimized reads configured, it is guaranteed that there will be two *C1G2ReadOpSpecResult* parameters in each *TagReportData* parameter generated by the reader.

Because this feature was designed for optimized inventory performance, any retries configured via the *ImpinjOpSpecRetryCount* parameter do not apply. For more information, see the [ImpinjOpSpecRetryCount parameter](#).

### LLRP Dependencies

When the *ImpinjOptimizedRead* feature is enabled, AccessSpecs may still be configured and executed. The results of the AccessSpec execution are reported in the *TagReportData* parameter, after the results of the optimized read. Users should enable the reporting of the AccessSpecID parameter, and use unique *OpSpecIDs* to correlate the results to the actions.

### Allowable Extension Points

- None. Extension points are included in *ImpinjTagReportContentSelector* parameter.

### Definition

#### **ImpinjEnableOptimizedRead Parameter**

Parameter Field	Description
<i>OptimizedReadMode</i>	Unsigned Short Integer.
<b>CIG2 Read List</b>	List of <C1G2Read parameters> [optional, maximum of 2]
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

### Possible Values for OptimizedReadMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

### 4.3.33 ImpinjEnableRFDopplerFrequency Parameter

Use this custom parameter to configure the *ImpinjRFDopplerFrequency* feature. If enabled, the *TagReportData* in the RO\_ACCESS\_REPORT will contain an *ImpinjRFDopplerFrequency* parameter that reports the estimated RF Carrier Doppler shift. For more information, see [ImpinjRFDopplerFrequency parameter](#).

### LLRP Dependencies

This custom parameter has no LLRP dependencies.

### Allowable Extension Points

- None. Extension points are included in *ImpinjTagReportContentSelector* parameter.

## Definition

### ImpinjEnableRFDopplerFrequency Parameter

Parameter Field	Description
<i>RFDopplerFrequencyMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

### Possible Values of RFDopplerFrequencyMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

#### 4.3.34 ImpinjEnableTxPower Parameter

Use this custom parameter to configure the *ImpinjEnableTxPower* feature. This custom parameter specifies the Impinj-specific inventory related configuration parameter that may be configured as either part of the default reader configuration (via a SET\_READER\_CONFIG message), or as part of individual AISpecs within a ROSpec (via an ADD\_ROSPEC message). For any AISpec, each enabled antenna must be configured to use the same configuration. Mismatched antennas will result in an error reported by the reader.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- None. Extension points are included in *ImpinjTagReportContentSelector* parameter.

## Definition

### ImpinjEnableTxPower Parameter

Parameter Field	Description
<i>TxPowerReportingMode</i>	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

### Possible Values of TxPowerReportingMode

Value	Description
0	'Disabled' (default)
1	'Enabled'
2-65535	Reserved for future use

### 4.3.35 ImpinjSerializedTID Parameter

Use this custom parameter to report the contents of the tag TID memory bank for Monza tags that support the *ImpinjSerializedTID* feature. Refer to the Monza datasheets to determine which tags support this feature.

For Impinj tags that support the Integra™ Technology TID Parity Check feature, if a TID parity error is detected the *ImpinjTIDParity* sub-parameter will be included indicating the error condition. Again, refer to the Monza datasheets to determine which tags support this feature.

This parameter will return the TID for tags that do not support this feature but at a severely reduced rate since SerializedTID reporting is optimized for Impinj tags.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *TagReportData* parameter.

#### Definition

##### ImpinjSerializedTID Parameter

Parameter Field	Description
<i>TID</i>	Unsigned Short Array. The contents of the tag TID memory bank.
<i>ImpinjTIDParity</i>	<ImpinjTIDParity parameter> [optional]
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

### 4.3.36 ImpinjTIDParity Parameter

This custom parameter provides the status of TID Parity Check for Impinj tags that support the feature. The parameter will be included in the *ImpinjSerializedTID* parameter only if a TID parity error is detected.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *ImpinjSerializedTID* parameter.

#### Definition

##### ImpinjTIDParity Parameter

Parameter Field	Description
ParityError	Boolean - When true, TID parity error has been detected.
Custom Extension Point List	List of <Impinj custom parameter> [optional]

### 4.3.37 ImpinjRFPhaseAngle Parameter

Use this custom parameter to report the RF phase angle of a singulated tag during normal inventory (EPC backscatter). The *PhaseAngle* field is a scaled, 12-bit value, with **0** representing 0 degrees (0 radians), and **4096** representing 360 degrees ( $2\pi$  radians). For example, if the reported phase angle is 1985, the corresponding angle can be calculated as:

$$1985 \times 360^\circ / 4096 = 174.46^\circ \text{ or } 1985 \times 2\pi \text{ rad} / 4096 = 3.04 \text{ rad}$$

If report accumulation is enabled via the *ROReportSpec* for the currently executing *ROSpec*, the RF phase angle that is reported via this parameter is the phase angle of the last tag singulation. No accumulation of phase data is available.

#### **LLRP Dependencies**

This custom parameter has no LLRP dependencies.

#### **Allowable Extension Points**

- *TagReportData* parameter.

#### **Definition**

#### **ImpinjRFPhaseAngle Parameter**

Parameter Field	Description
<i>PhaseAngle</i>	Unsigned Short Integer. The scaled phase angle of the tag response during normal inventory. See the Description for a calculation example.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### **4.3.38 ImpinjPeakRSSI Parameter**

Report the peak RSSI of the tag during the current reporting interval with this custom parameter. Standard LLRP reports peak RSSI in whole dBm units. This parameter provides the same RSSI value in more precise dBm x 100 units. Applications requiring precise RSSI calculations may enable this parameter instead of (or in addition to) the PeakRSSI LLRP parameter.

#### **LLRP Dependencies**

This custom parameter has no LLRP dependencies.

#### **Allowable Extension Points**

- *TagReportData* parameter.

#### **Definition**

#### **ImpinjPeakRSSI Parameter**

Parameter Field	Description
<i>RSSI</i>	Signed Short Integer. The peak received power of the EPC backscatter in dBm x 100.
<b>Custom Extension Point List</b>	List of < <i>Impinj custom parameter</i> > [optional]

#### **4.3.39 ImpinjGPSCoordinates Parameter**

Use this custom parameter to report the GPS coordinates of the reader when the tag was singulated . If the GPS receiver has not acquired a location fix, this parameter will not be included in the report. If LLRP accumulation is enabled, the reported coordinates correspond to the last known reader location when the tag was singulated. The GPS coordinates are reported in signed micro-degrees, so a minor conversion is required to convert the reported value to GPS coordinate formats that are typically used.

For example, if the reported GPS coordinates are 41948240 latitude and -87655562 longitude, this would correspond to:

(41.948240,-87.655562)

or

(41° 56' 53.664" N, 87° 39' 20.023" W)

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *TagReportData* parameter.

#### Definition

#### ImpinjGPSCoordinates Parameter

Parameter Field	Description
<i>Latitude</i>	Signed Integer. Latitude coordinates in micro-degrees.
<i>Longitude</i>	Signed Integer. Longitude coordinates in micro-degrees.
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.40 ImpinjRFDopplerFrequency Parameter

Use this custom parameter to report the estimated RF carrier Doppler frequency shift. The estimate is made over the duration of each tag EPC and has units of Hz. This 16-bit parameter has twelve integer bits and four fractional bits. Accuracy and precision depend on reader mode and measurement length.

If report accumulation is enabled via the *ROReportSpec* for the currently executing ROspec, the RF Doppler frequency that is reported by this parameter is the Doppler frequency of the last tag singulation. No accumulation of Doppler frequency data is available.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *TagReportData* parameter.

#### Definition

#### ImpinjRFDopplerFrequency Parameter

Parameter Field	Description
<i>DopplerFrequency</i>	Signed Short Integer. RF carrier Doppler shift measured over EPC duration.
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.41 ImpinjLoopSpec Parameter

Use this custom parameter to allow the reader to loop execution of AISpecs within an ROspec. If it is included in the list of *SpecParameters* in a ROspec, it must be the last *SpecParameter* present. There also must be at least one *AISpec* preceding the *ImpinjLoopSpec* parameter. If either condition is not met, the reader will respond with an error.

#### LLRP Dependencies

This custom parameter overrides the end of a ROSpec. When the last AISpec completes execution, the first AISpec will be executed again until the ROSpec has been executed *LoopCount* iterations.

#### Allowable Extension Points

- *SpecParameter* parameter.

#### Definition

#### ImpinjLoopSpec Parameter

Parameter Field	Description
<i>LoopCount</i>	Unsigned Integer. The number of times to loop execution of the AISpecs of the ROSpec (0 means unlimited).
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.42 ImpinjGPSNMEASentences Parameter

This custom parameter encapsulates the various NMEA (National Marine Electronic Association) sentences that are supported by the GPS device attached to the reader. For more information about NMEA sentences, visit the NMEA website.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message.

#### Definition

#### ImpinjGPSNMEASentences Parameter

Parameter Field	Description
<i>ImpinjGGASentence</i>	<ImpinjGGASentence Parameter> [optional]
<i>ImpinjRMCSentence</i>	<ImpinjRMCSentence Parameter> [optional]
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.43 ImpinjGGASentence Parameter

This custom parameter contains the current GPS information of the reader's location, as reported in NMEA GGA sentence format. If the GPS device has not acquired a location fix, the string is reported empty.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- None. Extension points are included in *ImpinjGPSNMEASentences* parameter.

#### Definition

#### ImpinjGGASentence Parameter

Parameter Field	Description
<i>GGASentence</i>	UTF-8 String
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.44 ImpinjRMCSentence Parameter

This custom parameter contains the current GPS information of the reader's location as reported in NMEA RMC sentence format. If the GPS device has not acquired a location fix, the string is reported empty.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- None. Extension points are included in *ImpinjGPSNMEASentences* parameter.

##### Definition

#### ImpinjRMCSentence Parameter

Parameter Field	Description
<i>RMCSentence</i>	UTF-8 String
<b>Custom Extension Point List</b>	List of <Impinj custom parameter> [optional]

#### 4.3.45 ImpinjIntelligentAntennaManagement Parameter

Readers implement the Intelligent Antenna Management feature whereby the reader looks for the presence of tags on an antenna before proceeding to inventory tags on it. This ensures that no time is wasted on antennas that might not have tags in their field of view. However, in some applications it may be desirable for the reader to attempt to singulate tags on all selected antennas on a regular basis. This custom parameter allows the user to enable or disable the Intelligent Antenna Management feature.

##### LLRP Dependencies

Intelligent Antenna Management is integral to the Low Duty Cycle feature. If Low Duty Cycle is enabled, the Intelligent Antenna Management feature will be temporarily enabled.

##### Allowable Extension Points

- None. Extension points are included in *ImpinjIntelligentAntennaManagement* parameter.

##### Definition

#### ImpinjIntelligentAntennaManagement Parameter

Parameter Field	Description
ManagementEnabled	1-bit. If set to 1, feature is enabled If set to 0, feature is disabled (default).
Custom Extension Point List	List of <Impinj custom parameter> [optional]

#### 4.3.46 ImpinjHubConfiguration Parameter

This custom parameter displays connected Antenna Hubs. Hubs are identified with IDs 1-4 and in normal operation will display **No\_Fault**. If a port is not connected to a hub, the corresponding Hub ID displays

**Disconnected.**

### LLRP Dependencies

If exception events are enabled when an Antenna Hub fault is detected or cleared, an *ImpinjHubConfiguration* parameter will be sent in a *ReaderExceptionEvent* parameter.

### Allowable Extension Points

- GET\_READER\_CONFIG\_RESPONSE message.

### Definition

#### ImpinjHubConfiguration Parameter

Parameter Field	Description
<i>HubID</i>	Unsigned Short Integer.
Connected	Unsigned Short Integer.
Fault	Unsigned Short Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

#### Possible Values of Connected

Value	Description
0	'Unknown'
1	'Disconnected'
2	'Connected'

#### Possible Values of Fault

Value	Description
0	'No_Fault'
1	'RF_Power'
2	'RF_Power_On_Hub_1'
3	'RF_Power_On_Hub_2'
4	'RF_Power_On_Hub_3'
5	'RF_Power_On_Hub_4'
6	'No_Init'
7	'Serial_Overflow'
8	'Disconnected'

#### 4.3.47 ImpinjInventoryConfiguration Parameter

Use this parameter to configure two Impinj-specific inventory related configuration parameters.

EnableAntDwellTimeLimit enables the antenna dwell time restriction (250ms) in Single Target Inventory Search Modes. Set by default, it can be reset to disable this dwell time restriction.

EnableSelectGapClose is valid only if Inventory Search Mode is set to Dual Target with Reset. Reset by default, it can be set in difficult RF environments to improve the reliability of the transition of tags from state B to state A by following the Gen2 Select command with a simplified inventory to 'mop up' tags that may not have seen the Gen2 Select command.

This parameter may be specified either as part of the default reader configuration (via a SET\_READER\_CONFIG message), or as part of individual AISpecs within a ROSpec (via an ADD\_ROSPEC message). For any AISpec, each enabled antenna must be configured to use the same configuration. Mismatched antennas will result in an error reported by the reader.

**Note:** This custom parameter requires expert knowledge and is intended for Impinj internal use only.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *C1G2InventoryCommand* parameter

#### Definition

#### ImpinjInventoryConfiguration Parameter

Parameter Field	Description
EnableAntDwellTimeLimit	Boolean - When true, limit antenna dwell time to 250ms in Single Target Inventory Modes.
EnableSelectGapClose	Boolean - When true, and in Dual Target with Reset Search Mode, run a simplified inventory following the Gen2 Select command to improve the reliability of transition of tags from State B to State A.
Custom Extension Point List	List of < <i>Impinj Custom Parameters</i> > [optional]

#### 4.3.48 ImpinjRFPowerSweep Parameter

Use this parameter to configure Impinj-specific RF Power Sweep operation.

When this feature is enabled, the reader performs each inventory operation - transitioning tags from one state to another (A to B or B to A) - at multiple power levels starting at or above the MinimumPowerLevel, in increments of PowerLevelStepSize, ending with the maximum power level specified for the antenna.

For example, if the MinimumPowerLevel is specified as 63 (25.5 dBm) and the maximum power level for the antenna is configured to be 81 (30 dBm), with PowerLevelStepSize set to 8 (2 dBm), each inventory operation will be performed at power levels 65 (26 dBm), 73 (28 dBm), and 81 (30 dBm), in that order.

This parameter may be specified either as part of the default reader configuration (via a SET\_READER\_CONFIG message), or as part of individual AISpecs within a ROSpec (via an ADD\_ROSPEC message). For any AISpec, each enabled antenna must be configured to use the same configuration. Mismatched antennas will result in an error reported by the reader.

**Note:** This custom parameter requires expert knowledge and is intended for Impinj internal use only.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *C1G2InventoryCommand* parameter

## Definition

### ImpinjRFPowerSweep Parameter

Parameter Field	Description
EnableRFPowerSweep	Boolean - When true, enables RF Power Sweep operation.
MinimumPowerLevel	Unsigned Short Integer - Transmit Power Level above which to start the RF Power Sweep, expressed as an index into the TransmitPowerTable. Ignored when EnablePowerSweep is false (i.e. when disabling RF Power Sweep).
PowerLevelStepSize	Unsigned Short Integer - Transmit Power Level step size by which to sweep power. Specified as power level index. Ignored when EnablePowerSweep is false (i.e. when disabling RF Power Sweep).
Custom Extension Point List	List of < <i>Impinj Custom Parameters</i> > [optional]

### 4.3.49 ImpinjTruncatedReplyConfiguration Parameter

Use this custom parameter to control the truncated reply feature. The presence of an ImpinjTruncatedReplyConfiguration within the C1G2InventoryCommand will enable a truncated reply.

Gen2v2TagsOnly: If only Gen2v2 tags are in the field of view then setting the Gen2v2TagsOnly flag will perform an additional CRC check to further validate the integrity of the tag response. If this flag is enabled, non-Gen2v2 tags will be ignored.

**Note:** This custom parameter requires expert knowledge and is intended for Impinj internal use only.

#### LLRP Dependencies

This custom parameter has no LLRP dependencies.

#### Allowable Extension Points

- *C1G2InventoryCommand* parameter

## Definition

### ImpinjTruncatedReplyConfiguration Parameter

Parameter Field	Description
Gen2v2TagsOnly	Boolean - if enabled, non-Gen2v2 tags will be ignored.
EPCLength	Unsigned Integer - EPC Length of all tags in the field of view. Only tags with EPCs of this length can reply; tags with EPCs that are not this length will be ignored.
Pointer	Unsigned Short Integer - Selects a starting bit location in the EPC memory bank that will be used for the truncating select command.

Parameter Field	Description
TagMask	Variable Length Integer - Specifies the mask that must match the EPC memory bank starting at Pointer. The end of the mask defines the start location of the EPC reported by the tag. If the RO Spec contains C1G2Filters then the length of TagMask must be 0. Filter validation is disabled when truncated reply is used.
Custom Extension Point List	List of < <i>Impinj Custom Parameters</i> > [optional]

#### 4.3.50 ImpinjAuthenticate Parameter

Use this custom parameter to perform the Gen2v2 Authenticate command.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpec* parameter

#### ImpinjAuthenticate Parameter

Parameter Field	Description
OpSpecID	Unsigned Short Integer
AccessPassword	Unsigned Integer - The password required to move the tag into the secured state if needed.
SendRep	Boolean - Set to 1 for the tag to send the response in a reply.
IncRepLen	Boolean - Set to 0 to omit length from the reply.
CSI	Unsigned Integer - Set to 01 to enable the crypto suite.
Message	Variable Length Integer - Set to challenge the authentication engine. Must be 48 bits currently. If 0, the response is 64 bits. Otherwise the response is 128 bits.

#### 4.3.51 ImpinjAuthenticateOpSpecResult Parameter

This custom parameter is the result of an ImpinjAuthenticate OpSpec.

When Result is Success, this is the tag's response to the challenge issued to its authentication engine. The response is either 64 bits, or 128 bits if a short TID is included with it.

##### LLRP Dependencies

This custom parameter has no LLRP dependencies.

##### Allowable Extension Points

- *AccessCommandOpSpec* parameter

### **ImpinjAuthenticateOpSpecResult Parameter**

Parameter Field	Description
<i>OpSpecID</i>	Unsigned Short Integer.
<i>Result</i>	Integer.
<b>Custom Extension Point List</b>	List of < <i>Impinj Custom Parameters</i> > [optional]

### **Possible Values of Result**

Value	Description
0	'Success'
1	'Insufficient Power'
2	'Not Supported Error'
3	'Non-specific Tag Error'
4	'Non-specific Reader Error'
5	'No Response From Tag'

## 5 Advanced Topics

### 5.1 Serialized TID Reporting and Monza4 Tags

Some tags might not be reported when you use Serialized TID reporting and Monza4-QT tags with both public and short range modes. The reader has an optional Serialized TID reporting feature that is intended to provide more information efficiently. The Monza4 has an optional public, short range feature that is intended to provide less information for privacy reasons. When the two features are used together, some tags might not be reported, yet everything is working exactly as intended.

The Serialized TID reporting feature -- EPC+TID -- causes the reader to ask the tags for their Serialized TID during routine inventory operations. Usually tags are asked only for their EPC. By asking the tags to immediately send their TID, fewer interactions with the tag are needed to obtain both EPC and TID, and performance or the number of tags per second is better. When EPC+TID reporting is enabled, the reader strives to consistently report both EPC and TID.

If a tag responds with only the EPC, the reader immediately issues a read TID operation. If a transient error occurs the tag is skipped, not reported, and is retried later. If a persistent error occurs, the reader reports only the EPC to the application.

The Monza4 tag has two independent modes, which are both intended to protect privacy. While a Monza4 tag is in **public** mode, it intentionally does not provide the TID when asked for EPC+TID. While a Monza4 tag is in **short range** mode, it intentionally does not support certain operations, including a read TID operation, unless it is close to the reader antenna.

Specifically, the reader requests EPC+TID from a Monza4 tag in **public** mode and **short range** mode. In this case, the Monza4 tag will only respond with the EPC. The reader will immediately try to read the TID. If the Monza4 is close to the antenna, the TID read operation will work, which means that the EPC and TID are reported to the application. However, if the Monza4 tag is over a meter from the antenna, the TID read operation is simply ignored. The Monza4 tag deems reading the tag as a possible privacy invasion, and the reader interprets the lack of tag response as a transient error and therefore **not reporting the tag**, unless a retry is successful. The retry can't be successful until the tag is brought close to the antenna read zone.

## 6 Custom Extension Encoding

This section describes the encoding of Impinj custom extensions.

### 6.1 Encoding of Custom Messages

All LLRP custom messages are encoded with a common header to ensure a unique namespace across all LLRP implementations. This header appears in each of the custom messages below for completeness. Byte and bit order are shown as the first and second row of the table respectively. The vendor ID field contains the Impinj Private Enterprise Number (PEN): 25882. A unique subtype indicator defines each custom extension message.

#### Impinj Custom Message Header Encoding

0									1							2									3																	
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1											
Rsvd	Ver									Message Type=1023							Message Length [31:16]																									
										Message Length [15:0]							Message ID [31:16]																									
										Message ID [15:0]							Vendor ID=25882[31:16]																									
										Vendor ID [15:0]							Subtype=Varies																									

#### 6.1.1 IMPINJ\_ENABLE\_EXTENSIONS Encoding

0									1							2									3																					
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Rsvd	Ver									Message Type=1023							Message Length [31:16]																													
										Message Length [15:0]							Message ID [31:16]																													
										Message ID [15:0]							Vendor ID [31:16]																													
										Vendor ID [15:0]							Subtype=21																													
										Reserved [23:0]																																				
										Impinj Custom Parameter(0-n)																																				

For more information, see the section describing the [IMPINJ\\_ENABLE\\_EXTENSIONS message](#).

#### 6.1.2 IMPINJ\_ENABLE\_EXTENSIONS\_RESPONSE Encoding

0									1							2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																
Rsvd	Ver									Message Type=1023							Message Length [31:16]																														
										Message Length [15:0]							Message ID [31:16]																														
										Message ID [15:0]							Vendor ID [31:16]																														
										Vendor ID [15:0]							Subtype=22																														
										LLRPSstatus(1)																																					
										Impinj Custom Parameter(0-n)																																					

For more information, see the section describing the [IMPINJ\\_ENABLE\\_EXTENSIONS response](#).

#### 6.1.3 IMPINJ\_SAVE\_SETTINGS Encoding

0									1							2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																
Rsvd	Ver									Message Type=1023							Message Length [31:16]																														
										Message Length [15:0]							Message ID [31:16]																														
										Message ID [15:0]							Vendor ID [31:16]																														
										Vendor ID [15:0]							Subtype=23		C		Reserved																										
										Impinj Custom Parameter(0-n)																																					

Abbreviations: C Save Configuration

For more information, see the section describing the [IMPINJ\\_SAVE\\_SETTINGS message](#).

#### 6.1.4 IMPINJ\_SAVE\_SETTINGS\_RESPONSE Encoding

0									1								2								3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
Rsvd		Ver																													
				</td																											

### 6.2.3 ImpinjInventorySearchMode Parameter Encoding

0									1									2									3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
Reserved					Type=1023					Parameter Length																							
Vendor ID=25882														Subtype=23																			
InventorySearchMode														Impinj Custom Parameter(0-n)																			

For more information, see the section describing the [ImpinjInventorySearchMode](#) parameter.

### 6.2.4 ImpinjFixedFrequencyList Parameter Encoding

0									1									2									3																					
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882														Subtype=26																																		
FixedFrequencyMode														Reserved																																		
ChannelList Short Count														ChannelList[0]																																		
ChannelList...														ChannelList[N]																																		

For more information, see the section describing the [ImpinjFixedFrequencyList](#) parameter.

### 6.2.5 ImpinjFrequencyCapabilities Parameter Encoding

0									1									2									3																					
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882														Subtype=30																																		
FrequencyList Word Count														FrequencyList[0] [31:16]																																		
FrequencyList[0] [15:0]														FrequencyList...																																		
FrequencyList...														FrequencyList[N] [31:16]																																		
FrequencyList[N] [15:0]														Impinj Custom Parameter(0-n)																																		

For more information, see the section describing the [ImpinjFrequencyCapabilities](#) parameter.

### 6.2.6 ImpinjLowDutyCycle Parameter Encoding

0									1									2									3																					
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882														Subtype=28																																		
LowDutyCycleMode														EmptyFieldTimeout																																		
FieldPingInterval														Impinj Custom Parameter(0-n)																																		

For more information, see the section describing the [ImpinjLowDutyCycle](#) parameter.

### 6.2.7 ImpinjDetailedVersion Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=29																																																				
ModelName Byte Count													ModelName=Variable length UTF-8 String																																							
SerialNumber Byte Count													SerialNumber=Variable length UTF-8 String																																							
SoftwareVersion Byte Count													SoftwareVersion=Variable length UTF-8 String																																							
FirmwareVersion Byte Count													FirmwareVersion=Variable length UTF-8 String																																							
FPGAVersion Byte Count													FPGAVersion=Variable length UTF-8 String																																							
PCBAVersion Byte Count													PCBAVersion=Variable length UTF-8 String																																							
ImpinjHubVersions(0-1)																																																				
ImpinjArrayVersion(0-1)																																																				
ImpinjBLEVersion(0-1)																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjDetailedVersion parameter](#).

### 6.2.8 ImpinjHubVersions Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1537																																																				
ImpinjArrayVersion(1-n)																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjHubVersions parameter](#).

### 6.2.9 ImpinjArrayVersion Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1520																																																				
SerialNumber Byte Count													SerialNumber=Variable length UTF-8 String																																							
FirmwareVersion Byte Count													FirmwareVersion=Variable length UTF-8 String																																							
PCBAVersion Byte Count													PCBAVersion=Variable length UTF-8 String																																							
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjArrayVersion parameter](#).

### 6.2.10 ImpinjBLEVersion Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1580																																																				
FirmwareVersion Byte Count																																																				
FirmwareVersion=Variable length UTF-8 String																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjBLEVersion parameter](#).

### 6.2.11 ImpinjGPIDebounceConfiguration Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=36																																																				
GPIPortNum													GPIDebounceTimerMSec [31:16]																																							
GPIDebounceTimerMSec [15:0]																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjGPIDebounceConfiguration parameter](#).

### 6.2.12 ImpinjAdvancedGPOConfiguration Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=64																																																				
GPOPortNum													GPOMode																																							
GPOPulseDurationMSec																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjAdvancedGPOConfiguration parameter](#).

### 6.2.13 ImpinjReaderTemperature Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=37																																																				
Temperature													Impinj Custom Parameter(0-n)																																							

For more information, see the section describing the [ImpinjReaderTemperature parameter](#).

#### 6.2.14 ImpinjLinkMonitorConfiguration Parameter Encoding

0									1									2									3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
Reserved					Type=1023					Parameter Length												Vendor ID=25882											
													Subtype=38																				
LinkMonitorMode													LinkDownThreshold																				
													Impinj Custom Parameter(0-n)																				

For more information, see the section describing the [ImpinjLinkMonitorConfiguration parameter](#).

#### 6.2.15 ImpinjReportBufferConfiguration Parameter Encoding

0									1									2									3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
Reserved					Type=1023					Parameter Length												Vendor ID=25882											
													Subtype=39																				
ReportBufferMode													Impinj Custom Parameter(0-n)																				

For more information, see the section describing the [ImpinjReportBufferConfiguration parameter](#).

#### 6.2.16 ImpinjAccessSpecConfiguration Parameter Encoding

0									1									2									3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
Reserved					Type=1023					Parameter Length												Vendor ID=25882											
													Subtype=40																				
ImpinjBlockWriteWordCount(0-1)													ImpinjOpSpecRetryCount(0-1)																				
ImpinjAccessSpecOrdering(0-1)													Impinj Custom Parameter(0-n)																				

For more information, see the section describing the [ImpinjAccessSpecConfiguration parameter](#).

#### 6.2.17 ImpinjBlockWriteWordCount Parameter Encoding

0									1									2									3						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1		
Reserved					Type=1023					Parameter Length												Vendor ID=25882											
													Subtype=41																				
WordCount													Impinj Custom Parameter(0-n)																				

For more information, see the section describing the [ImpinjBlockWriteWordCount parameter](#).

### 6.2.18 ImpinjOpSpecRetryCount Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=63																																																				
RetryCount																																																				
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjOpSpecRetryCount](#) parameter.

### 6.2.19 ImpinjBlockPermalock Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=42																																																				
OpSpecID													AccessPassword [31:16]																																							
AccessPassword [15:0]													MB	Reserved		BlockPointer [15:8]																																				
BlockPointer [7:0]							BlockMask Short Count															BlockMask[0] [15:8]																														
BlockMask[0] [7:0]							BlockMask...															BlockMask[N] [15:8]																														
BlockMask[N] [7:0]							Impinj Custom Parameter(0-n)																																													

For more information, see the section describing the [ImpinjBlockPermalock](#) parameter.

### 6.2.20 ImpinjBlockPermalockOpSpecResult Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=43																																																				
Result							OpSpecID																																													
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjBlockPermalockResult](#) parameter.

### 6.2.21 ImpinjGetBlockPermalockStatus Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=44																																																				
OpSpecID													AccessPassword [31:16]																																							
AccessPassword [15:0]													MB	Reserved		BlockPointer [15:8]																																				
BlockPointer [7:0]							BlockRange																																													
Impinj Custom Parameter(0-n)																																																				

For more information, see the section describing the [ImpinjGetBlockPermalockStatus](#) parameter.

**6.2.22 ImpinjGetBlockPermalockStatusOpSpecResult Parameter Encoding**

For more information, see the section describing the `ImpinjGetBlockPermalockStatusOpSpecResult` parameter.

### 6.2.23 ImpinjSetQTConfig Parameter Encoding

For more information, see the section describing the [ImpinjSetQTConfig parameter](#).

#### 6.2.24 ImpinjSetQTConfigOpSpecResult Parameter Encoding

For more information, see the section describing the `ImpinjSetQTConfigOpSpecResult` parameter.

### 6.2.25 ImpinjGetQTConfig Parameter Encoding

For more information, see the section describing the [ImpinjGetQTConfig](#) parameter.

### 6.2.26 ImpinjGetQTConfigOpSpecResult Parameter Encoding

0									1									2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																		
Reserved					Type=1023									Parameter Length																																			
Vendor ID=25882																																																	
Subtype=49																																																	
Result					OpSpecID												DataProfile																																
AccessRange					Reserved [31:8]																																												
Reserved [7:0]					Impinj Custom Parameter(0-n)																																												

For more information, see the section describing the [ImpinjGetQTConfigOpSpecResult parameter](#).

### 6.2.27 ImpinjMarginRead Parameter Encoding

0									1									2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																		
Reserved					Type=1023									Parameter Length																																			
Vendor ID=25882																																																	
Subtype=1578																																																	
OpSpecID													AccessPassword [31:16]																																				
AccessPassword [15:0]													MB	Reserved		BitPointer [15:8]																																	
BitPointer [7:0]					BitLength												Mask Short Count																																
Mask[0]					Mask...																																												
Mask[N]					Impinj Custom Parameter(0-n)																																												

For more information, see the section describing the [ImpinjMarginRead parameter](#).

### 6.2.28 ImpinjMarginReadOpSpecResult Parameter Encoding

0									1									2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																		
Reserved					Type=1023									Parameter Length																																			
Vendor ID=25882																																																	
Subtype=1579																																																	
Result					OpSpecID												Impinj Custom Parameter(0-n)																																

For more information, see the section describing the [ImpinjMarginReadOpSpecResult parameter](#).

### 6.2.29 ImpinjTagReportContentSelector Parameter Encoding

0									1									2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																		
Reserved					Type=1023									Parameter Length																																			
Vendor ID=25882																																																	
Subtype=50																																																	
ImpinjEnableSerializedTID(0-1)																																																	
ImpinjEnableRFPhaseAngle(0-1)																																																	
ImpinjEnablePeakRSSI(0-1)																																																	
ImpinjEnableGPSCoordinates(0-1)																																																	
ImpinjEnableOptimizedRead(0-1)																																																	
ImpinjEnableRFDopplerFrequency(0-1)																																																	
ImpinjEnableTxPower(0-1)																																																	
Impinj Custom Parameter(0-n)																																																	

For more information, see the section describing the [ImpinjTagReportContentSelector](#) parameter.

#### 6.2.30 ImpinjEnableSerializedTID Parameter Encoding

0									1								2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882																																																
Subtype=51																																																
SerializedTIDMode																																																
Impinj Custom Parameter(0-n)																																																

For more information, see the section describing the [ImpinjEnableSerializedTID](#) parameter.

#### 6.2.31 ImpinjEnableRFPhaseAngle Parameter Encoding

0									1								2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882																																																
Subtype=52																																																
RFPhaseAngleMode																																																
Impinj Custom Parameter(0-n)																																																

For more information, see the section describing the [ImpinjEnableRFPhaseAngle](#) parameter.

#### 6.2.32 ImpinjEnablePeakRSSI Parameter Encoding

0									1								2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882																																																
Subtype=53																																																
PeakRSSIMode																																																
Impinj Custom Parameter(0-n)																																																

For more information, see the section describing the [ImpinjEnablePeakRSSI](#) parameter.

#### 6.2.33 ImpinjEnableGPSCoordinates Parameter Encoding

0									1								2									3																						
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																	
Reserved					Type=1023					Parameter Length																																						
Vendor ID=25882																																																
Subtype=54																																																
GPSCoordinatesMode																																																
Impinj Custom Parameter(0-n)																																																

For more information, see the section describing the [ImpinjEnableGPSCoordinates](#) parameter.

### 6.2.34 ImpinjEnableOptimizedRead Parameter Encoding

0									1									2									3								
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1				
Reserved					Type=1023					Parameter Length																									
Vendor ID=25882													Subtype=65																						
OptimizedReadMode													C1G2Read(0-n)																						
Impinj Custom Parameter(0-n)																																			

For more information, see the section describing the [ImpinjEnableOptimizedRead parameter](#).

### 6.2.35 ImpinjEnableRFDopplerFrequency Parameter Encoding

0									1									2									3								
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1				
Reserved					Type=1023					Parameter Length																									
Vendor ID=25882													Subtype=67																						
RFDopplerFrequencyMode													Impinj Custom Parameter(0-n)																						

For more information, see the section describing the [ImpinjEnableRFDopplerFrequency parameter](#).

### 6.2.36 ImpinjSerializedTID Parameter Encoding

0									1									2									3								
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1				
Reserved					Type=1023					Parameter Length																									
Vendor ID=25882													Subtype=55																						
TID Short Count													TID[0]																						
TID...													TID[N]																						

For more information, see the section describing the [ImpinjSerializedTID parameter](#).

### 6.2.37 ImpinjTIDParity Parameter Encoding

0									1									2									3									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1					
Reserved					Type=1023					Parameter Length																										
Vendor ID=25882													Subtype=1566																							
P	Reserved				Impinj Custom Parameter(0-n)																															

Abbreviations: P - ParityError

For more information, see the section describing the [ImpinjTIDParity parameter](#).

### 6.2.38 ImpinjRFPhaseAngle Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=56																																														
PhaseAngle																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjRFPhaseAngle parameter](#).

### 6.2.39 ImpinjPeakRSSI Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=57																																														
RSSI																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjPeakRSSI parameter](#).

### 6.2.40 ImpinjGPSCoordinates Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=58																																														
Latitude																																														
Longitude																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjGPSCoordinates parameter](#).

For more information, see the section describing the [ImpinjRFDopplerFrequency parameter](#).

#### 6.2.42 ImpinjLoopSpec Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=59																																														
LoopCount																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjLoopSpec parameter](#).

#### 6.2.43 ImpinjGPSNMEASentences Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=60																																														
ImpinjGGASentence(0-1)																																														
ImpinjRMCSentence(0-1)																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjGPSNMEASentences parameter](#).

#### 6.2.44 ImpinjGGASentence Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=61																																														
GGASentence Byte Count																																														
GGASentence=Variable length UTF-8 String																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjGGASentence parameter](#).

#### 6.2.45 ImpinjRMCSentence Parameter Encoding

0									1									2									3																			
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1															
Reserved					Type=1023					Parameter Length																																				
Vendor ID=25882																																														
Subtype=62																																														
RMCSentence Byte Count																																														
RMCSentence=Variable length UTF-8 String																																														
Impinj Custom Parameter(0-n)																																														

For more information, see the section describing the [ImpinjRMCSentence parameter](#).

### 6.2.46 ImpinjIntelligentAntennaManagement Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1554																																																				
M	Reserved				Impinj Custom Parameter(0-n)																																															

Abbreviations:

M - ManagementEnabled

For more information, see the section describing the [ImpinjIntelligentAntennaManagement](#) parameter.

### 6.2.47 ImpinjAntennaConfiguration Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1524																																																				
ImpinjAntennaEventHysteresis(0-1)																																																				
ImpinjAntennaEventConfiguration(0-1)																																																				
Impinj Custom Parameter(0-n)																																																				

### 6.2.48 ImpinjAntennaEventConfiguration Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=1576																																																				
E	Reserved				Impinj Custom Parameter(0-n)																																															

Abbreviations:

E - EnableAntennaAttemptNotification

### 6.2.49 ImpinjInventoryConfiguration Parameter Encoding

0									1									2									3																									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1																					
Reserved					Type=1023					Parameter Length																																										
Vendor ID=25882																																																				
Subtype=69																																																				
A	S	Reserved				Impinj Custom Parameter(0-n)																																														

Abbreviations:

A - EnableAntDwellTimeLimit S - EnableSelectGapClose

For more information, see the section describing the [ImpinjInventoryConfiguration](#) parameter.

### 6.2.50 ImpinjRFPowerSweep Parameter Encoding

0									1									2									3				
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
Reserved										Type=1023										Parameter Length											
																				Vendor ID=25882											
																				Subtype=1582											
R	Reserved									MinimumPowerLevel									PowerLevelStepSize [15:8]												
	PowerLevelStepSize [7:0]									Impinj Custom Parameter(0-n)																					

Abbreviations:

R - EnableRFPowerSweep P - PowerLevelStepSize[0]

For more information, see the section describing the [ImpinjRFPowerSweep parameter](#).

## 7 Octane LLRP Toolkit Information

Octane LLRP is tested against some libraries that are produced by the open source llrp-toolkit (LTK) project. The following table shows the compatibility of Octane with the LTK. For information about building custom versions of the LTK, go to the [toolkit site](#).

### Octane LTK Compatibility

Language	Version	Source	Notes
Perl	1.0.x	Sourceforge	Available as open source; not fully tested against R700.
C	10.28.0.240	Impinj	
C++	10.28.0.240	Impinj	
C# .NET	10.28.0.240	Impinj	
Java	10.28.0.240	Impinj	

## 8 Octane LLRP Default Values

The following table describes the factory default values for LLRP and Octane custom extension parameters for the available Octane regulatory regions. Commanding the reader to restore LLRP factory defaults via the *ResetToFactoryDefault* field of the LLRP SET\_READER\_CONFIG message will restore the reader to these factory defaults. Non-LLRP settings such as network settings, root password, or other settings programmable via a separate API on the reader are not affected.

### Octane LLRP Default Configuration Values (1)

	FCC	ETSI	Hong Kong	Taiwan	Japan	Korea	Malaysia	China	South Africa
Channel Index			Index 3 N/A	Channel 10 866.9MHz	N/A	Index 1 Channel 2 954.8MHz	N/A	N/A	Index 1 Channel 3 920.625MHz
Hop Table ID	1	N/A	1	1	N/A	1	1	N/A	1
Transmit Power	30 dBm (TransmitPower index varies by product)								
Receive Sensitivity	0 dB above maximum sensitivity								
Gen2 Mode ID	1002 (Autoset)								
Session	Session 1								
Tag Transit Time	0								
Tag Population	32								
RO Spec	No ROSpecs are configured								
Access Spec	No AccessSpecs are configured								
RO Report Trigger	Tag data will be reported on each singulation (N=1)								
Tag Report Data	AntennaID, PeakRSSI, and FirstSeenTimestamp are enabled								
Access Report Trigger	Access data will be reported at the completion of each AccessSpec								
Keep Alive	Disabled								
Reader Events	Antenna and ReaderExceptionEvents are enabled								
Hold Events and Reports	False								
GPI Configuration	All GPI are disabled								
GPI Debounce Timer	20 milliseconds								
GPO State	All GPO are driven low								
Impinj Extensions	Disabled								
Impinj Sub-Regulatory Region	0      7		3	4	11	8	9	10	12
Impinj Fixed Frequency List	Disabled								
Impinj Low Duty Cycle	Disabled								
Impinj Reduced Power Frequency List	Disabled								
Impinj Inventory Search Mode	Reader will select the appropriate search mode								
Link State Monitoring	Disabled								
Report Buffer Behavior	Normal								
Block Write Word Count	1								
Serialized TID Reporting	Disabled								
RF Phase Reporting	Disabled								
Intelligent Antenna Management	Enabled								

### Octane LLRP Default Configuration Values (2)

	Brazil	Thailand	Singapore	Australia	India	Uruguay	Vietnam 918	Israel
Channel Index	N/A	N/A	N/A	N/A	Index 3	Channel 10	N/A	N/A
					866.3MHz			
Hop Table ID	N/A	1	1	N/A	1	1	N/A	N/A
Transmit Power	30 dBm (TransmitPower index varies by product)							
Receive Sensitivity	0 dB above maximum sensitivity							
Gen2 Mode ID	1002 (Autoset)							
Session	Session 1							
Tag Transit Time	0							
Tag Population	32							
RO Spec	No ROSpecs are configured							
Access Spec	No AccessSpecs are configured							
RO Report Trigger	Tag data will be reported on each singulation (N=1)							
Tag Report Data	AntennaID, PeakRSSI, and FirstSeenTimestamp are enabled							
Access Report Trigger	Access data will be reported at the completion of each AccessSpec							
Keep Alive	Disabled							
Reader Events	Antenna and ReaderExceptionEvents are enabled							
Hold Events and Reports	False							
GPI Configuration	All GPI are disabled							
GPI Debounce Timer	20 milliseconds							
GPO State	All GPO are driven low							
Impinj Extensions	Disabled							
Impinj Sub-Regulatory Region	13	14	15	16	17	18	19	20
Impinj Fixed Frequency List	Disabled							
Impinj Low Duty Cycle	Disabled							
Impinj Reduced Power Frequency List	Disabled							
Impinj Inventory Search Mode	Reader will select the appropriate search mode							
Link State Monitoring	Disabled							
Report Buffer Behavior	Normal							
Block Write Word Count	1							
Serialized TID Reporting	Disabled							
RF Phase Reporting	Disabled							
Intelligent Antenna Management	Enabled							

### Octane LLRP Default Configuration Values (3)

	Philippines 920	Vietnam 920	Indo- nesia	New Zealand	Japan	Latin America	Peru	Bang- ladesh	ETSI (EU2)
Channel Index	Index 3	Index 3			Index 3				
	Channel 1 919.25MHz	N/A	N/A	N/A	Channel 18 919.2MHz	N/A	N/A	N/A	N/A
Hop Table ID	N/A	1	1	1	N/A	1	1	1	1
Transmit Power	30 dBm (TransmitPower index varies by product)								
Receive Sensitivity	0 dB above maximum sensitivity								
Gen2 Mode ID	1002 (Autoset)								
Session	Session 1								
Tag Transit Time	0								
Tag Population	32								
RO Spec	No ROSpecs are configured								
Access Spec	No AccessSpecs are configured								
RO Report Trigger	Tag data will be reported on each singulation (N=1)								
Tag Report Data	AntennaID, PeakRSSI, and FirstSeenTimestamp are enabled								
Access Report Trigger	Access data will be reported at the completion of each AccessSpec								
Keep Alive	Disabled								
Reader Events	Antenna and ReaderExceptionEvents are enabled								
Hold Events and Reports	False								
GPI Configuration	All GPI are disabled								
GPI Debounce Timer	20 milliseconds								
GPO State	All GPO are driven low								
Impinj Extensions	Disabled								
Impinj Sub-Regulatory Region	21	22	23	24	25	26	27	28	29
Impinj Fixed Frequency List	Disabled								
Impinj Low Duty Cycle	Disabled								
Impinj Reduced Power Frequency List	Disabled								
Impinj Inventory Search Mode	Reader will select the appropriate search mode								
Link State Monitoring	Disabled								
Report Buffer Behavior	Normal								
Block Write Word Count	1								
Serialized TID Reporting	Disabled								
RF Phase Reporting	Disabled								
Intelligent Antenna Management	Enabled								

## 9 Regulatory Region Information

The tables in this section provide information about the capabilities of the Octane firmware in each regulatory region. This is for informational purposes only. For an accurate and complete list of a reader's capabilities in a particular regulatory region, use the LLRP GET\_READER\_CAPABILITIES message.

- The first table documents the information contained in the *TransmitPowerLevelTableEntry* parameter list within *UHFBandCapabilities* for the R700.
- The second table documents the information contained in the *FrequencyList* field within *ImpinjFrequencyCapabilities*.

**NOTE:** Inclusion of a country or region in these tables does not imply regulatory compliance. Refer to the [Impinj Support Portal](#) for a list of certified countries by reader model. The list varies over time as new countries are added and as certificates expire.

### Regional Transmit Power Capabilities for R700

ID	Region Name	PoE Range	PoE+ Range
0	FCC part 15.247	10-30	10-33
1	ETSI EN 300-220	N/A	N/A
2	<a href="#">ETSI EN 302-208</a>	N/A	N/A
3	Hong Kong 920-925 MHz	10-30	10-33
4	Taiwan 922-928 MHz	10-30	10-33
5	<a href="#">Japan 952-954 MHz</a>	N/A	N/A
6	Japan 952-955 MHz, 10mW max power	N/A	N/A
7	ETSI EN 302-208 (version 1.4.1)	10-30	10-31.5
8	Korea 917-921 MHz	10-30	10-33
9	Malaysia 919-923MHz	10-30	10-33
10	China 920-925 MHz	10-30	10-33
11	Japan 952-956 MHz (without LBT)	10-30	10-30
12	South Africa 915-919 MHz	10-30	10-33
13	Brazil 902-907/915-928 MHz	10-30	10-33
14	Thailand 920-925 MHz	10-30	10-33
15	Singapore 920-925 MHz	10-30	10-33
16	Australia 920-925 MHz	10-30	10-33
17	India 865-867 MHz	10-30	10-31.5
18	Uruguay 916-928 MHz	10-30	10-33
19	Vietnam 918-923 MHz	10-30	10-33
20	Israel 915-917 MHz	10-30	10-32.5
21	Philippines 918-920 MHz	10-30	10-33
22	Vietnam 920-923 MHz	10-30	10-33
23	Indonesia 923-925 MHz	10-30	10-33
24	New Zealand 922-927 MHz	10-30	10-33
25	Japan 916.7-920.9 MHz	10-30	10-30

ID	Region Name	PoE Range	PoE+ Range
26	Latin America 902-928 MHz	10-30	10-33
27	Peru 916-928 MHz	10-30	10-33
28	Bangladesh 925-927 MHz	10-30	10-33
29	ETSI 915-921 MHz	10-30	10-33

Note: Region 2: ETSI EN 302-208 (with LBT) is deprecated and internally mapped to 7: ETSI EN 302-208 (version 1.4.1).

Note: Region 5: Japan 952-954 MHz is no longer supported. It has been replaced by 11: Japan 952-956 (without LBT).

### Regional Frequency Capabilities

ID	Region	Chan Index	Freq. (MHz)
0	FCC part 15.247	1	902.750
		2	903.250
		3	903.750
		4	904.250
		5	904.750
		6	905.250
		7	905.750
		8	906.250
		9	906.750
		10	907.250
		11	907.750
		12	908.250
		13	908.750
		14	909.250
		15	909.750
		16	910.250
		17	910.750
		18	911.250
		19	911.750
		20	912.250
		21	912.750
		22	913.250
		23	913.750
		24	914.250
		25	914.750

ID	Region	Chan Index	Freq. (MHz)
		26	915.250
		27	915.750
		28	916.250
		29	916.750
		30	917.250
		31	917.750
		32	918.250
		33	918.750
		34	919.250
		35	919.750
		36	920.250
		37	920.750
		38	921.250
		39	921.750
		40	922.250
		41	922.750
		42	923.250
		43	923.750
		44	924.250
		45	924.750
		46	925.250
		47	925.750
		48	926.250
		49	926.750
		50	927.250
1	ETSI EN 300-220	N/A	N/A
2	ETSI EN 302-208	Rgn. 7	Rgn. 7
3	Hong Kong 920-925 MHz	1	920.250
		2	920.750
		3	921.250
		4	921.750
		5	922.250
		6	922.750
		7	923.250
		8	923.750
		9	924.250
		10	924.750

ID	Region	Chan Index	Freq. (MHz)
4	Taiwan 922-928 MHz	1	920.750
		2	921.250
		3	921.750
		4	922.250
		5	922.750
		6	923.250
		7	923.750
		8	924.250
		9	924.750
		10	925.250
		11	925.750
		12	926.250
		13	926.750
		14	927.250
5	Japan 952-954 MHz	N/A	N/A
6	Japan 952-955 MHz, 10mW max power	N/A	N/A
7	ETSI EN 302-208 (version 1.4.1)	1	865.700
		2	866.300
		3	<b>866.900</b>
		4	867.500
8	Korea 917-921 MHz	1	917.300
		2	917.900
		3	918.500
		4	919.100
		5	919.700
		6	920.300
9	Malaysia 919-923MHz	1	919.250
		2	919.750
		3	920.250
		4	920.750
		5	921.250
		6	921.750
		7	922.250
		8	922.750
10	China 920-925 MHz	1	<b>920.625</b>
		2	920.875
		3	921.125

ID	Region	Chan Index	Freq. (MHz)
11	Japan 952-956 MHz (without LBT)	4	921.375
		5	921.625
		6	921.875
		7	922.125
		8	922.375
		9	922.625
		10	922.875
		11	923.125
		12	923.375
		13	923.625
		14	923.875
		15	924.125
		16	924.375
		1	952.400
		2	953.600
		3	<b>954.800</b>
		4	956.000
12	South Africa 915-919 MHz	1	915.600
		2	915.800
		3	916.000
		4	916.200
		5	916.400
		6	916.600
		7	916.800
		8	917.000
		9	917.200
		10	917.400
		11	917.600
		12	917.800
		13	918.000
		14	918.200
		15	918.400
		16	918.600
		17	918.800
13	Brazil 902-907/915-928 MHz	1	902.750
		2	903.250
		3	903.750

ID	Region	Chan Index	Freq. (MHz)
		4	904.250
		5	904.750
		6	905.250
		7	905.750
		8	906.250
		9	906.750
		10	907.250
		11	915.250
		12	915.750
		13	916.250
		14	916.750
		15	917.250
		16	917.750
		17	918.250
		18	918.750
		19	919.250
		20	919.750
		21	920.250
		22	920.750
		23	921.250
		24	921.750
		25	922.250
		26	922.750
		27	923.250
		28	923.750
		29	924.250
		30	924.750
		31	925.250
		32	925.750
		33	926.250
		34	926.750
		35	927.250
14	Thailand 920-925 MHz	1	920.250
		2	920.750
		3	921.250
		4	921.750
		5	922.250

ID	Region	Chan Index	Freq. (MHz)
15	Singapore 920-925 MHz	6	922.750
		7	923.250
		8	923.750
		9	924.250
		10	924.750
		1	920.250
		2	920.750
		3	921.250
		4	921.750
		5	922.250
16	Australia 920-925 MHz	6	922.750
		7	923.250
		8	923.750
		9	924.250
		10	924.750
		1	920.250
		2	920.750
		3	921.250
		4	921.750
		5	922.250
17	India 865-867 MHz	6	922.750
		7	923.250
		8	923.750
		9	924.250
		10	924.750
18	Uruguay 916-928 MHz	1	865.100
		2	865.700
		3	<b>866.300</b>
		4	866.900
19	Brazil 916-928 MHz	1	916.250
		2	916.750
		3	917.250
		4	917.750
		5	918.250
		6	918.750
		7	919.250
		8	919.750

ID	Region	Chan Index	Freq. (MHz)
		9	920.250
		10	920.750
		11	921.250
		12	921.750
		13	922.250
		14	922.750
		15	923.250
		16	923.750
		17	924.250
		18	924.750
		19	925.250
		20	925.750
		21	926.250
		22	926.750
		23	927.250
19	Vietnam 918-923 MHz	1	918.750
		2	919.250
		3	919.750
		4	920.250
		5	920.750
		6	921.250
		7	921.750
		8	922.250
20	Israel 915-917 MHz	1	916.250
21	Philippines 918-920 MHz	1	918.250
		2	918.750
		3	<b>919.250</b>
		4	919.750
22	Vietnam 920-923 MHz	1	920.750
		2	921.250
		3	921.750
		4	922.250
23	Indonesia 923-925 MHz	1	923.250
		2	923.750
		3	924.250
		4	924.750
24	New Zealand 922-927 MHz	1	922.250

ID	Region	Chan Index	Freq. (MHz)
		2	922.750
		3	923.250
		4	923.750
		5	924.250
		6	924.750
		7	925.250
		8	925.750
		9	926.250
		10	926.750
25	Japan 916.7-920.9 MHz	1	916.800
		2	918.000
		3	<b>919.200</b>
		4	920.400
26	Latin America 902-928 MHz	1	902.750
		2	903.250
		3	903.750
		4	904.250
		5	904.750
		6	905.250
		7	905.750
		8	906.250
		9	906.750
		10	907.250
		11	907.750
		12	908.250
		13	908.750
		14	909.250
		15	909.750
		16	910.250
		17	910.750
		18	911.250
		19	911.750
		20	912.250
		21	912.750
		22	913.250
		23	913.750
		24	914.250

ID	Region	Chan Index	Freq. (MHz)
		25	914.750
		26	915.250
		27	915.750
		28	916.250
		29	916.750
		30	917.250
		31	917.750
		32	918.250
		33	918.750
		34	919.250
		35	919.750
		36	920.250
		37	920.750
		38	921.250
		39	921.750
		40	922.250
		41	922.750
		42	923.250
		43	923.750
		44	924.250
		45	924.750
		46	925.250
		47	925.750
		48	926.250
		49	926.750
		50	927.250
27	Peru 916-928 MHz	1	916.250
		2	916.750
		3	917.250
		4	917.750
		5	918.250
		6	918.750
		7	919.250
		8	919.750
		9	920.250
		10	920.750
		11	921.250

ID	Region	Chan Index	Freq. (MHz)
		12	921.750
		13	922.250
		14	922.750
		15	923.250
		16	923.750
		17	924.250
		18	924.750
		19	925.250
		20	925.750
		21	926.250
		22	926.750
		23	927.250
28	Bangladesh 925-927 MHz	1	925.250
		2	925.750
		3	926.250
		4	926.750
29	ETSI 915-921 MHz	1	916.300
		2	917.500
		3	918.700

**Note:** Inclusion of a country or region in the above table does not imply regulatory compliance. Refer to the Impinj Support Portal for a list of certified countries and regions by product. The list changes over time as new countries are certified and as certificates expire.

**Note:** When operating in the China region, the reader defaults to hopping on channels 1, 5, 9, and 13. Standard LLRP requires that the reader specify a separate HopTable for each combination of channel; however, since the reader allows configuration of a custom hop list of any size, the GET\_READER\_CAPABILITIES\_RESPONSE returns a single HopTable with a list of all frequencies. The user can then use the Impinj FixedFrequencyList extension to configure a custom hop list of any size.

**Note:** Default frequencies for fixed frequency regions are listed in bold.

## 10 Revision History

Date	Revision	Comments
2/28/2020	7.0.1	Added R700 capabilities.
9/23/2020	7.3	Minor updates.
12/22/2021	7.4	Added authentication.
3/9/2021	7.5	Minor updates.
6/22/2021	7.6	Added regions.
12/17/2021	8.0	Separating gateway content.

## 11 Notices

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