

Features

- Certified for conformance and interoperability to the EPCglobal™ Class-1 Generation-2 UHF RFID Protocol for operation in dense-interrogator environments.
- Compliant to the ISO 18000-6 Type-C UHF RFID Standard.
- Software-defined radio architecture provides best-in-class performance and maximum flexibility to support anticipated future EPCglobal™ standards.
- Simplifies RFID deployments and dramatically cuts system costs by using a single transmit/receive antenna for each of its four ports, eliminating the need for separate transmit and receive antennas. This arrangement provides industry-leading performance while reducing the number of deployed antennas *per reader* from 8 to 4.
- Tag data rates of up to 640 kbps enables inventory rates in excess of 1,000 tags/second.
- Embedded Linux operating system.
- Uses modern radio techniques to decode tag backscatter, reducing the probability of false EPCs (i.e., ghost reads) to less than one event per year of operation.
- Supports all Gen 2 commands, including write, lock, and kill.
- Eliminates the need for reader synchronization by automatically self-configuring for optimum performance, including sensing the presence of other readers in the area and adjusting its communication parameters appropriately.
- A tuning range that spans the North American 902 – 928 MHz ISM band, a tuning step size that allows operation under FCC 15.247 guidelines, and frequency accuracy and stability that satisfies the EPCglobal dense-interrogator frequency requirements over a temperature range of –20 °C to +55 °C.
- Operation in Europe (865 – 868 MHz under ETSI EN 302 208-1) and Japan (952 – 954 MHz), and other regions.

Overview

The Speedway™ reader, a key element of Impinj's GrandPrix™ RFID system solution, is the first high-performance reader designed from the ground up (not merely upgraded) to support the EPCglobal Gen 2 standard in its entirety. That includes the horsepower to accommodate 640 kbps tag-to-reader data rates, robust performance in dense-reader environments, the flexibility to read at the case, pallet, or item level, and more. Combined with an extensible architecture that supports seamless integration of field-upgradeable, third party application software, the Speedway reader is the most adaptable reader solution available today.

Speedway's unparalleled flexibility is essential to fully exploit the power of the Gen 2 protocol, which allows an unlimited number of reader transmit and receive modes, each of which might generate a different combination of unique reader-to-tag command rate, tag-to-reader backscatter rate, modulation format, and backscatter type. What's more, the Gen 2 protocol allows a range of



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settable parameters (such as the choice of inventory round management parameters) that have an equally strong impact on throughput and overall reader performance. *Speedway automatically self-configures all of these parameters for optimal performance*, cutting through the technical details and delivering unsurpassed tag inventory rate and reliability. Speedway also senses the presence of other readers within range and self-configures to maintain the performance level of the overall reader network, reducing its impact on neighboring readers. It does all of this without requiring cumbersome network synchronization.

Finally, the ease and convenience of Speedway's duplexed single-antenna operation no longer means compromising on performance; Speedway's high-performance noise-canceling design effectively renders cumbersome dual-antenna systems (with separate transmit and receive antennas at each port) obsolete.



It all adds up to RFID that just works™

Operating System and Application Software

Speedway provides a platform for seamless integration with third-party application software. Speedway provides the radio performance you need, then allows you to choose the application software you want, providing an RFID solution that supports a wide range of end-user requirements.

Speedway is delivered with the Linux operating system, and is configured with the powerful Speedway modem API. To ensure that your system can grow with increasing demands, Speedway's software architecture supports remote software/firmware upgrade, self-test, and measurable performance metrics. Three essential elements of the Speedway reader's software suite include:

Modem API: Speedway's onboard API provides a flexible modem interface for third-party application software to leverage all of the features of the Gen 2 protocol, including read, write, lock, and kill with low command latency.

End Users: Although the Speedway API is transparent to end users who interact with the third-party application software that runs on the API, these same end users can rest assured that it leverages all of Impinj's deep expertise with Gen 2. Simply put, the Speedway API allows end users to harness the power of Gen 2.

Application Software Developers: The Speedway API's functionality allows not only the ability to inventory tags, but also to access and read, write, lock, and kill them. Importantly, it deals effectively with the latency issues associated with these Gen 2 functions.

Operating System with SDK: The Speedway reader's operating system is Montavista Linux (Kernel 2.4), bundled with a software development kit (SDK) that includes:

- Drivers and setup for all peripherals and network, serial, and GPIO interfaces
- Firmware upgrade agent via TCP/IP
- Reader self-test and diagnostics
- NTP support
- SNMP v2 with MIB2
- Speedway-specific MIB

Application Software: Speedway can be configured with custom end-user application software, or with software developed by Impinj's application software partners to yield a powerful enterprise system. The functionality that typically resides with the application software includes:

- Real-time tag data filtering and smoothing, including time-stamping when tags enter or exit the field
- Tag data buffering and reporting in a format selected by the end user
- Real-time, ruled-based tag processing that allows autonomous tag access operations (read, write, lock, kill) on matching tags without requiring network data exchange
- On-board diagnostics that identify and report reader alarms or failures (these functions are in addition to reader management data available via the SNMP interface)
- Event triggering and trigger management via multiple GPIO interfaces

Application Processor

To ensure maximum performance, Speedway incorporates two processors—one dedicated to modem functions and the second to run the application software. Speedway's dual-processor architecture ensures that third-party application and network interfacing does not impact time-critical modem operations, and vice versa.

The application processor is a 266 MHz Intel IXP420, configured as follows:

- 64 Mbyte SDRAM operating at 133 MHz
- 64 Mbyte Flash memory
- 8-bit parallel interface to the modem processor
- Real-time clock

Interfaces

Speedway includes a full array of network, service, and general-purpose control interfaces, including:

- Network Communications:
 - 10/100BASE-T Ethernet (RJ45 connector)
 - Configurable to use fixed IP address or DHCP
 - An optional 802.11B module can be installed at time of manufacture
- Management / Service:
 - RS-232 for local login (DB9 connector)
 - Built-in HTTP web server
 - Usage indicators including LEDs for power, antenna selection, and status
- Trigger / Control Actuator Management:
 - RS-232 interface to control external devices (DB25 connector)
 - 4 input and 8 output GPIOs to sense external triggers and control actuators (DB25 connector)

Antennas

Speedway has four antenna ports, each of which uses a single, duplexed antenna (i.e., a single antenna for transmit and receive) per port.

- Connectors: Reverse-gender TNC
- Protection: No damage from open or short
- Port Termination: Not required

Power

Speedway uses an external power converter to convert 110–250V AC to DC power:

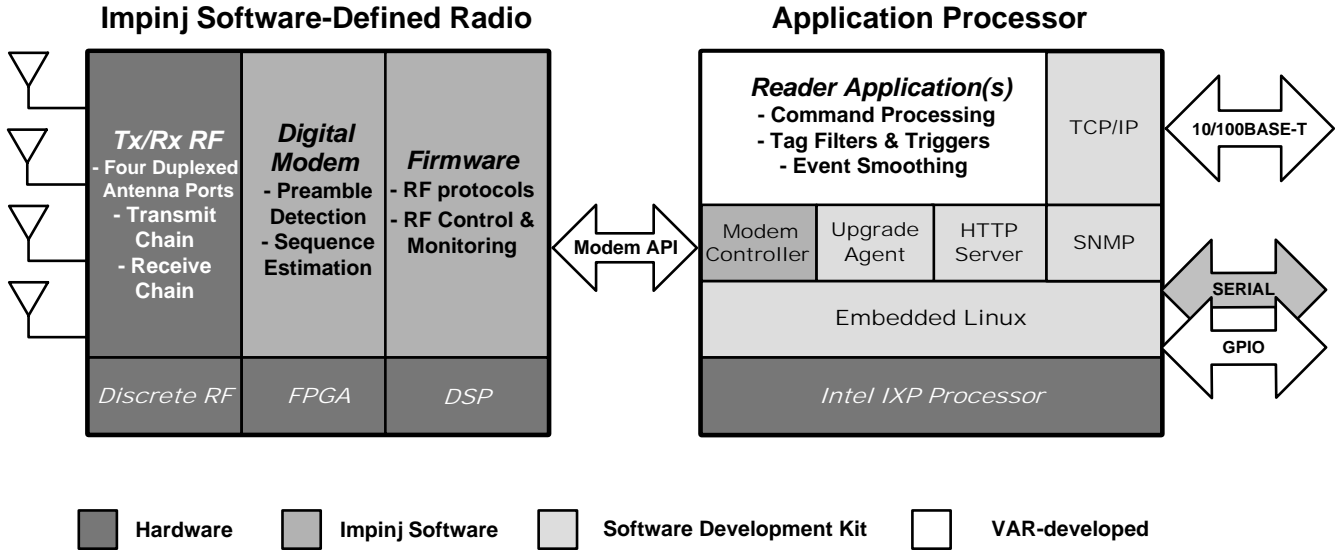
- Reader power interface: 12–36 V DC input
- Power connector: Positive locking type

Physical Dimensions & Environmental

Speedway is designed to operate continuously in industrial environments.

- Dimensions: 22.7 × 32.4 × 5.7 cm (8.95 in × 12.75 in × 2.25 in)
- Weight: 2.7 kg (6 lbs)
- Mounting: Horizontal or vertical orientation, with mounting tabs
- Environmental:
 - Operating temperature: –20 to 55 °C
 - Storage temperature: –20 to 85 °C
 - Environmental sealing: Per IEC 529 IP54
 - Humidity: 5-95% relative, non-condensing

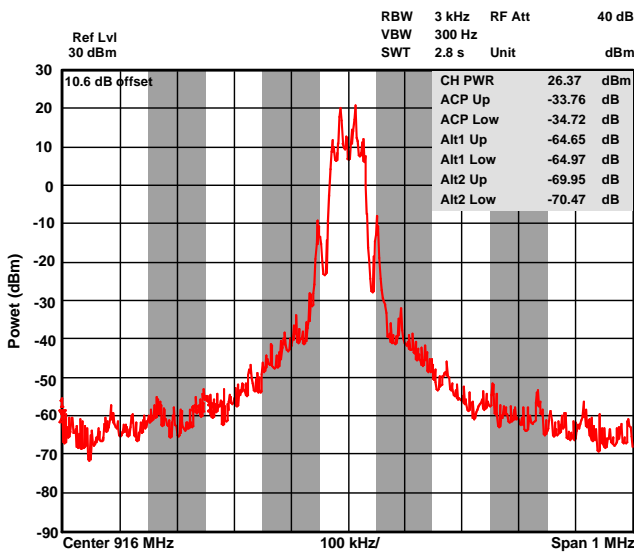
Speedway™ Reader Architecture



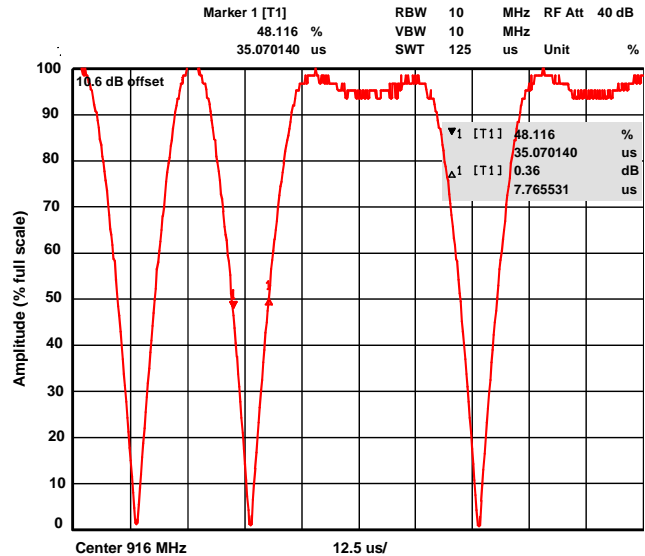
Speedway™ Dense-Reader Transmit Mask Performance

Per the plots shown below, Speedway’s outstanding frequency domain performance (left) comes without compromise to its time-domain performance (right).

Speedway Transmissions: Frequency Domain



Speedway Transmissions: Time Domain



Speedway Reader Specifications

Parameter	Min	Typ	Max	Unit	Comments
Transmit					
<i>LO and tuning</i>					
Tuning range	902		928	MHz	FCC 15.247
Tuning step size	250	500		kHz	Self-configuring
Tuning frequency accuracy	-10		10	ppm	
RF Power			30	dBm	Measured at antenna connector
Attenuation range	0		15	dB	
Attenuation step size		0.25		dB	
Modulation depth	80		100	%	
Receive					
Receive sensitivity		-77		dBm	160 kbps FM0, BER=10 ⁻³
Input power			30	dBm	At the connector, no damage
Reader spacing	3			m	Boresight-to-boresight (note ^a)
Physical parameters					
Supply voltage	12	24	36	VDC	Via external power converter
Power consumption		25		W	
Boot time		50		s	Boot-up at 23 °C
Survivability					
ESD protection	4			kV	HBM, any input
Forced DC voltage	-5		+5	V	Any RF port
Forced DC current			50	mA	Any pin; DC source must observe forced DC voltage limits

a. This parameter is specified for Gen 2 dense-interrogator operation only. Usable reader spacing may be limited by tag demodulator desensitization rather than by reader sensitivity or adjacent-channel interference rejection.

Notices:

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