

Intermec



Integration Guide

IM4 Module

Intermec Technologies Corporation

Corporate Headquarters
6001 36th Ave. W.
Everett, WA 98203
U.S.A.

www.intermec.com

The information contained herein is proprietary and is provided solely for the purpose of allowing customers to operate and service Intermec-manufactured equipment and is not to be released, reproduced, or used for any other purpose without written permission of Intermec.

Information and specifications contained in this document are subject to change without prior notice and do not represent a commitment on the part of Intermec Technologies Corporation.

© 2005 Intermec Technologies Corporation. All rights reserved.

The word Intermec, the Intermec logo, Norand, ArciTech, CrossBar, Data Collection Browser, dcBrowser, Duratherm, EasyADC, EasyCoder, EasyLAN, Enterprise Wireless LAN, EZBuilder, Fingerprint, i-gistics, INCA (under license), Intellitag, InterDriver, Intermec Printer Network Manager, IRL, JANUS, LabelShop, Mobile Framework, MobileLAN, Nor*Ware, Pen*Key, Precision Print, PrintSet, RoutePower, SmartSystems, TE 2000, Trakker Antares, and Virtual Wedge are either trademarks or registered trademarks of Intermec Technologies Corporation.

Throughout this manual, trademarked names may be used. Rather than put a trademark (™ or ®) symbol in every occurrence of a trademarked name, we state that we are using the names only in an editorial fashion, and to the benefit of the trademark owner, with no intention of infringement.

There are U.S. and foreign patents pending.

Contents

Before You Begin.....	v
Safety Summary.....	v
Safety Icons	vi
Global Services and Support	vi
Who Should Read This Document?	vii
Related Documents	vii
Patent Information	viii
About the IM4.....	9
Configuring the IM4 as a PC Card Module (Default).....	10
Configuring the IM4 as a Serial Module.....	12
How the IM4 Operates.....	14
Heat Dissipation Requirements	14
Power Requirements.....	15
Antenna Requirements	15
Specifications.....	17

Contents

Before You Begin

This section provides you with safety information, technical support information, and sources for additional product information.

Safety Summary

Your safety is extremely important. Read and follow all warnings and cautions in this document before handling and operating Intermec equipment. You can be seriously injured, and equipment and data can be damaged if you do not follow the safety warnings and cautions.

Do Not Repair or Adjust Alone

Do not repair or adjust energized equipment alone under any circumstances. Someone capable of providing first aid must always be present for your safety.

First Aid

Always obtain first aid or medical attention immediately after an injury. Never neglect an injury, no matter how slight it seems.

Resuscitation

Begin resuscitation immediately if someone is injured and stops breathing. Any delay could result in death. To work on or near high voltage, you should be familiar with approved industrial first aid methods.

Energized Equipment

Never work on energized equipment unless authorized by a responsible authority. Energized electrical equipment is dangerous. Electrical shock from energized equipment can cause death. If you must perform authorized emergency work on energized equipment, be sure that you comply strictly with approved safety regulations.

Safety Icons

This section explains how to identify and understand warnings, cautions, and notes that are in this document. You may also see icons that tell you when to follow ESD procedures.



A warning alerts you of an operating procedure, practice, condition, or statement that must be strictly observed to avoid death or serious injury to the persons working on the equipment.

Avertissement: Un avertissement vous avertit d'une procédure de fonctionnement, d'une méthode, d'un état ou d'un rapport qui doit être strictement respecté pour éviter l'occurrence de mort ou de blessures graves aux personnes manipulant l'équipement.



A caution alerts you to an operating procedure, practice, condition, or statement that must be strictly observed to prevent equipment damage or destruction, or corruption or loss of data.

Attention: Une précaution vous avertit d'une procédure de fonctionnement, d'une méthode, d'un état ou d'un rapport qui doit être strictement respecté pour empêcher l'endommagement ou la destruction de l'équipement, ou l'altération ou la perte de données.



Note: Notes either provide extra information about a topic or contain special instructions for handling a particular condition or set of circumstances.

Global Services and Support

Warranty Information

To understand the warranty for your Intermec product, refer to your OEM agreement.

Disclaimer of warranties: The sample code included in this document is presented for reference only. The code does not necessarily represent complete, tested programs. The code is provided “as is with all faults.” All warranties are expressly disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.

Web Support

Visit the Intermec web site at www.intermec.com to download our current documents (in PDF). To order printed versions of the Intermec manuals, contact your local Intermec representative or distributor.

Visit the Intermec technical knowledge base (Knowledge Central) at intermec.custhelp.com to review technical information or to request technical support for your Intermec product.

Telephone Support

These services are available from Intermec Technologies Corporation.

Service	Description	In the U.S.A. and Canada call 1-800-755-5505 and choose this option
Factory Repair	Request a return authorization number for authorized service center repair.	1
Technical Support	Get technical support on your Intermec product.	2
Service Contract Status	Inquire about an existing contract, renew a contract, or ask invoicing questions.	3
Schedule Site Surveys or Installations	Schedule a site survey, or request a product or system installation.	4
Ordering Products	Talk to sales administration, place an order, or check the status of your order.	5

Outside the U.S.A. and Canada, contact your local Intermec representative. To search for your local representative, from the Intermec web site, click **Contact**.

Who Should Read This Document?

This integration guide explains how to integrate the IM4 module into a computer or other device. It is written for the person who will be evaluating the IM4 to integrate into their device or for the person who will be engineering the device to accommodate the IM4.

Before you install and configure the IM4, you should be familiar with Intermec RFID systems and how to implement them. You should also be familiar with your network and general networking terms, such as IP address.

Related Documents

The Intermec web site at www.intermec.com contains our current documents that you can download in PDF format.

To download documents

- 1 Visit the Intermec web site at www.intermec.com.
- 2 Click **Service & Support > Manuals**.
- 3 In the **Select a Product** field, choose the product whose documentation you want to download.

To order printed versions of the Intermec manuals, contact your local Intermec representative or distributor.

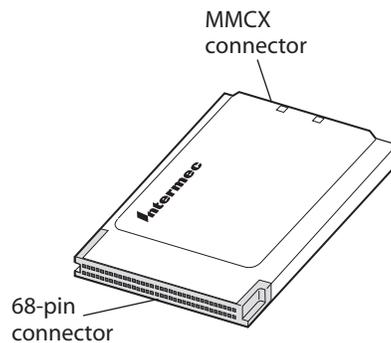
Before You Begin

Patent Information

There may be U.S. and foreign patents pending.

About the IM4

The Intermec Intellitag™ IM4 module is designed to let you easily incorporate the reading and writing of RFID tags into your computers, printers, and other mobile devices. It is an enhanced Intermec replacement for the existing IM3 module and the RFID PC card.

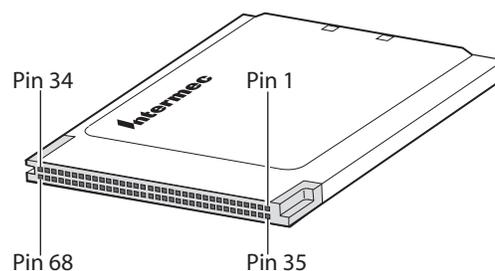


IM4 Intellitag Module

You can use the IM4 in most worldwide RFID applications. Intermec has versions of the IM4 that cover the UHF band from 865 MHz to 928 MHz. The IM4 is a PCMCIA Type II card package with a standard 68-pin connector. When you integrate the IM4 into your computers, the connector functions as either a PC card module (default) or as a serial module.

Note that the IM4:

- has different pinouts if it is functioning as a PC card module or as a serial module. To use the IM4 as a serial module, you need to tie pins 7, 44, and 45 to ground.



- may have heat dissipation requirements. In most situations, the IM4 has an Overtemperature mode that will sufficiently protect it against very high temperatures. However, if you use the IM4 in a high duty cycle application, you may want to attach a heatsink to it.
- has certain power requirements. The PC card slot must be able to supply enough power for the card, which is about 900 mA. Most laptop PC card slots do not supply this much power.
- has antenna connector requirements for its one antenna.

Configuring the IM4 as a PC Card Module (Default)

In PC Card mode, the IM4 interface looks like a standard 16C550 UART. It appears as a serial port and you can use a communications program, such as HyperTerminal, to communicate with it using the Basic Reader Interface (BRI). For more information on the BRI, see the *Basic Reader Interface (BRI) Programmer's Reference Guide* (P/N 937-000-001).

All signals are 3.3 V logic levels (5 V tolerant inputs).

	Low	High	Notes
Inputs	0 V to 0.8 V	2.4 V to 5.5 V	Input current is $\pm 10 \mu\text{A}$ max
Outputs	0.4 V Max @ 8 mA	2.9 V min @ -8 mA	



Note: Pins with a # in the pin name indicate an active low signal.

Pins 7 (CE1#), 44 (IORD#), and 45 (IOWR#) determine if the IM4 operates in PC Card mode or in Serial mode. If the three signals are NOT grounded, the IM4 operates in PC Card mode.

PC Card Module Pinouts

Pin No.	Pin Name	Definition	Pin No.	Pin Name	Definition
1	GND	Ground Vss	35	GND	Ground Vss
2	D3	Data bit 3	36	CD1#	Card detect 1 (GND)
3	D4	Data bit 4	37	D11	Data bit 11
4	D5	Data bit 5	38	D12	Data bit 12
5	D6	Data bit 6	39	D13	Data bit 13
6	D7	Data bit 7	40	D14	Data bit 14
7	CE1#	Card enable 1	41	D15	Data bit 15
8	A10	Address bit 10	42	CE2#	Card enable 2
9	OE#	Output enable	43	VS1#	Voltage sense 1 (NC)
10	A11	Address bit 11	44	IORD#	“I/O read from host”
11	A9	Address bit 9	45	IOWR#	“I/O write from host”
12	A8	Address bit 8	46	A17#	Address bit 17
13	A13	Address bit 13	47	A18	Address bit 18
14	A14#	Address bit 14	48	A19	Address bit 19
15	NC	Not connected	49	A20	Address bit 20
16	NC	Not connected	50	A21	Address bit 21
17	Vcc	+5V for this IM4	51	Vcc	+5V for this IM4
18	Vpp	Programming supply voltage (not connected)	52	Vpp	Programming supply voltage (not connected)
19	A16	Address bit 16	53	A22	Address bit 22
20	A15	Address bit 15	54	A23	Address bit 23
21	A12	Address bit 12	55	A24	Address bit 24
22	A7	Address bit 7	56	A25	Address bit 25
23	A6	Address bit 6	57	VS2#	Voltage sense 2 (not connected)
24	A5	Address bit 5	58	RESET	Reset from host
25	A4	Address bit 4	59	WAIT#	Extend bus cycle
26	A3	Address bit 3	60	INPACK#	Input port acknowledge
27	A2	Address bit 2	61	REG#	Register select and I/O enable
28	A1	Address bit 1	62	SPKR#	Audio digital waveform
29	A0	Address bit 0	63	STSCHG#	Card status changed
30	D0	Data bit 0	64	D8	Data bit 8
31	D1	Data bit 1	65	D9	Data bit 9
32	D2	Data bit 2	66	D10	Data bit 10
33	WP/IOIS16#	Write protect in Memory mode. I/O port is 16-bit in I/O mode	67	CD2#	Card detect 2 (GND)
34	GND	Ground Vss	68	GND	Ground Vss

Configuring the IM4 as a Serial Module

In Serial mode, the IM4 interface provides two 16C850 UART channels, an SPI channel, eight auxiliary inputs, and eight auxiliary outputs. It appears as a serial port and you can use a communications program, such as HyperTerminal, to communicate with it using the Basic Reader Interface (BRI). For more information on the BRI, see the *Basic Reader Interface (BRI) Programmer's Reference Guide* (P/N 937-000-001).

All signals are 3.3 V logic levels (5 V tolerant inputs).

	Low	High	Notes
Inputs	0 V to 0.8 V	2.4 V to 5.5 V	Input current is $\pm 10 \mu\text{A}$ max
Outputs	0.4 V Max @ 8 mA	2.9 V min @ -8 mA	



Note: Pins with a # in the pin name indicate an active low signal.

Pins 7 (NC), 44 (IORD#), and 45 (IOWR#) determine if the IM4 operates in PC Card mode or in Serial mode. If the three signals are grounded, the IM4 operates as a serial module.

These pins are carryovers from the PC card interface. These signals are mutually exclusive for any PC card application. In order for the IM4 to operate in Serial mode, you must ground all three of these signals. This condition keeps the card from driving signals defined for serial operation into a regular PC card socket.

Use these notes with the Serial Module Pinouts table on the next page.

¹ You must use software to enable SPI channel. Until you enable this channel, inputs to it are ignored and outputs to it are 3-stated.

² The Debug signals are intended for use during any debug efforts. You can also configure these signals for use as a second UART channel.

³ The Auxiliary outputs are 3-stated on power-up until they are written to the first time. During this condition, you should provide pullups or pulldowns to keep any external logic disabled.

Serial Module Pinouts

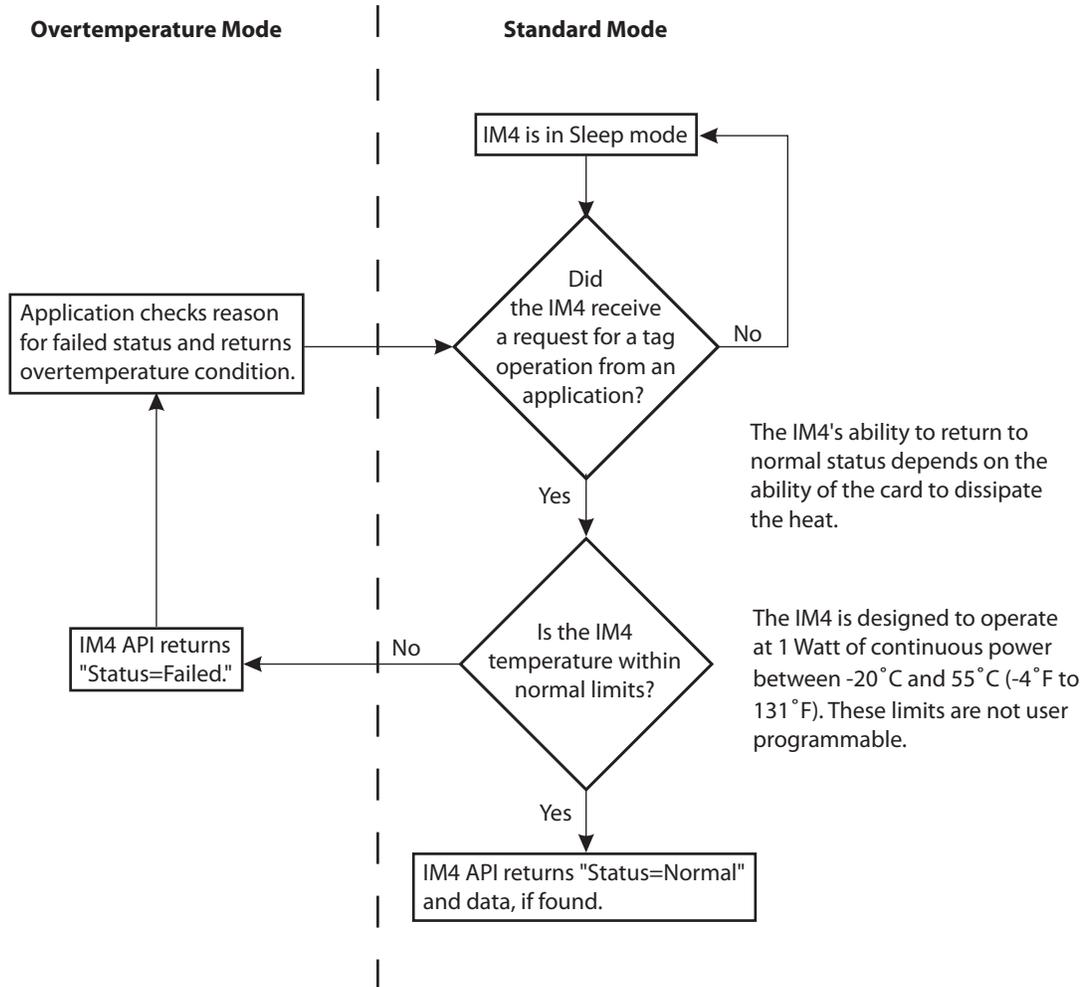
Pin No.	Pin Name	Definition	Pin No.	Pin Name	Definition
1	GND	Ground Vss	35	GND	Ground Vss
2	SPI_SCLK ¹	SPI clock out of IM4	36	CD1#	Card detect 1 (GND)
3	SPI_DO ¹	SPI data out of IM4	37	AUX-OUT 3 ³	User output 3
4	TXD	Transmit to host	38	AUX-OUT 4 ³	User output 4
5	RTS#	Request to send to host	39	AUX-OUT 5 ³	User output 5
6	DTR#	Data terminal ready to host	40	AUX-OUT 6 ³	User output 6
7	NC	Not connected	41	AUX-OUT 7 ³	User output 7
8	Debug RXD ²	Serial debug into IM4	42	NC	Not connected
9	NC	Not connected	43	NC	Not connected
10	IrDA_L	'1' = RS232, '0' = IrDA	44	IORD#	"I/O read from host"
11	Debug CTS# ²	Debug clear to send	45	IOWR#	"I/O write from host"
12	NC	Not connected	46	RI#	Ring indicator from host
13	RXD	Receive from host	47	AUX-IN 0	User input 0
14	CTS#	Clear to send from host	48	AUX-IN 1	User input 1
15	NC	Not connected	49	AUX-IN 2	User input 2
16	NC	Not connected	50	AUX-IN 3	User input 3
17	Vcc	+5V for this IM4	51	Vcc	+5V for this IM4
18	NC	Not connected	52	NC	Not connected
19	CD#	Carrier detect from host	53	AUX-IN 4	User input 4
20	DSR#	Data set ready from host	54	AUX-IN 5	User input 5
21	SPI_DI ¹	SPI data into IM4	55	AUX-IN 6	User input 6
22	NC	Not connected	56	AUX-IN 7	User input 7
23	NC	Not connected	57	NC	Not connected
24	NC	Not connected	58	RESET#	Reset_L to/from IM4/host (open drain)
25	NC	Not connected	59	NC	Not connected
26	NC	Not connected	60	NC	Not connected
27	NC	Not connected	61	NC	Not connected
28	NC	Not connected	62	NC	Not connected
29	NC	Not connected	63	NC	Not connected
30	Debug TXD ²	Serial debug data from IM4	64	AUX-OUT 0 ³	User output 0
31	Debug RTS# ²	Debug request to send	65	AUX-OUT 1 ³	User output 1
32	SPI_ENB# ¹	SPI enable out	66	AUX-OUT 2 ³	User output 2
33	NC	Not connected	67	CD2#	Card detect 2 (GND)
34	GND	Ground Vss	68	GND	Ground Vss

¹ You must use software to enable an SPI channel. Until you enable this channel, inputs to it are ignored and outputs to it are 3-stated.

² The Debug signals are intended for use during any debug efforts. You can also configure these signals for use as a second UART channel.

³ The Auxiliary outputs are 3-stated on power-up until they are written to the first time. During this condition, you should provide pullups or pulldowns to keep any external logic disabled.

How the IM4 Operates



This flow chart illustrates how the IM4 operates in Overtemperature mode and in Standard mode.

Heat Dissipation Requirements

In most usage scenarios, the IM4 uses a maximum of 4.5 W of power from its host device. Since its RF transmit power is 1 W, it needs to dissipate up to 3.5 W of heat. Normally, the host naturally dissipates this heat.

However, under high ambient temperature conditions or in a high duty cycle application, this heat may need to be conducted outside the host to prevent the IM4 from entering Overtemperature mode. The IM4 has a built-in Overtemperature mode that will sufficiently protect it against very high temperatures. When it enters Overtemperature mode, it shuts down until it is cool enough to continue operating.

In the IM4, heat is transferred to the back side (non-label side) of its case. Any heat transfer mechanism (such as moving air, a metal heatsink, a heat pipe, etc.) that is applied to this surface will help this dissipate the heat.

You should keep the IM4 temperature below 65°C (149°F).

Power Requirements

The PC card slot must be able to supply enough power for the IM4, which is approximately 900 mA. Note that most laptop PC card slots do not supply this much power.

Antenna Requirements



Caution

Government regulatory agencies require that the IM4 only use approved antennas. Do not use antennas not approved for use with this module.



Caution

Failure to use Intermec-approved antennas may require your system to be approved by the appropriate regulatory agencies for the countries in which your devices are being used. Using an unauthorized antenna or other peripheral device may result in possible communications interference or radio safety hazards.

The antenna receptacle is an MMCX connector (50 ohm, coaxial). Once the IM4 is installed in a device, the device must not be co-located or operating in conjunction with any other antenna without regulatory agency approval. Co-location of antennas operating within 20 cm (7.9 in.) of each other requires co-location authorization.

The next two tables list the Intermec-approved antennas for use in the U.S.A. and in Canada. The antenna safe distances for all antennas (869 MHz and 915 MHz) is 20 cm (7.9 in.) The cable length measurement is for antennas with an attached cable and is included in gain measurement. The cable loss measurement is for the cable that connects the antenna to the device.

IM4—Intermec-Approved 869 MHz RFID Antennas

Intermec Part Number	Description	Cable Loss	Dimensions
805-616-003	Patch, Circular-Polarized, 0 dBi, 2.5", MMCX	N/A	7.9 cm x 7.9 cm x 0.6 cm (3.1 in. x 3.1 in. x 0.25 in.)
805-623-001	Patch, Circular-Polarized, 5.0 dBi, N	2.2 dB	25.9 cm x 39.1 cm x 5.8 cm (10.2 in. x 15.4 in. x 2.3 in.)
805-626-002	Patch, Linear-Polarized, 6.0 dBi, N	2.2 dB	15.5 cm x 34.0 cm x 4.8 cm (6.1 in. x 13.4 in. x 1.9 in.)

IM4—Intermec-Approved 915 MHz RFID Antennas

Intermec Part Number	Description	Cable Loss	Dimensions
805-591-001	Patch, Circular-Polarized, 2.0 dBi, 48", MMCX	N/A	19.3 cm x 19.3 cm x 2.5 cm (7.6 in. x 7.6 in. x 1.0 in.)
805-609-001	Patch, Circular-Polarized, 4.0 dBi, 156", SMA(RP)	N/A	25.9 cm x 25.9 cm x 3.8 cm (10.2 in. x 10.2 in. x 1.5 in.)
805-610-001	Patch, Linear-Polarized, 8.0 dBi, 60", N(RP)	N/A	21.8 cm x 19.8 cm x 5.8 cm (8.6 in. x 7.8 in. x 2.3 in.)
805-616-002	Patch, Circular-Polarized, 0 dBi, 2.5", MMCX	N/A	7.9 cm x 7.9 cm x 0.6 cm (3.1 in. x 3.1 in. x 0.25 in.)
805-622-002	Patch, Circular-Polarized, 6.5 dBi, N(RP)	2.4 dB	25.9 cm x 63.5 cm x 5.8 cm (10.2 in. x 25 in. x 2.3 in.)
805-623-002	Patch, Circular-Polarized, 5.5 dBi, N(RP)	2.4 dB	25.9 cm x 39.1 cm x 5.8 cm (10.2 in. x 15.4 in. x 2.3 in.)
805-626-001	Patch, Linear-Polarized, 6.0 dBi, N(RP)	2.4 dB	15.5 cm x 34.0 cm x 4.8 cm (6.1 in. x 13.4 in. x 1.9 in.)
805-629-001	Patch, Circular-Polarized, 7.0 dBi, N(RP)	2.4 dB	31.2 cm x 31.2 cm x 8.9 cm (12.3 in. x 12.3 in. x 3.5 in.)
A270001-02	Log, Linear-Polarized, 7.0 dBi, N(RP)	2.4 dB	27.9 cm x 12.7 cm x 21.6 cm (11 in. x 5 in. x 8.5 in.)

Intermec has partnered with Kathrein, formerly known as Scala, to provide antennas for the IM4. Kathrein supports the RFID industry with special antenna products for various RFID applications.

For antenna integration support, contact:

Kathrein Inc., Scala Division
 Attention: Dan Fowler
 P.O. Box 4580
 Medford, OR 97501 U.S.A.
 Tel: 541-779-6500
 Cell: 541-840-9889
 Fax: 541-779-3991
 e-mail: dfowler@kathrein.com
 Web: www.kathrein-scala.com

Specifications

General Specifications

Physical description	PCMCIA Type II card
Weight	34.0 ±2.8 g (1.2 oz ±0.2 oz)
Temperature	Operating: -20°C to 55°C (-4°F to 131°F) Storage: -40°C to +70°C (-40°F to 158°F)
Humidity (Operating Temperature)	0-95% relative humidity, non-condensing process

Transceiver Specifications

Frequency range	Europe (Future): 865.6 to 867.6 MHz hopping Europe (Current): 869.525 fixed U.S.A.: 902 to 928 MHz hopping
Data rates	32 Kbps
Modulation	AM, OOK
Coding	Manchester: from reader to tag FM0: from tag to reader
RF output impedance	50 Ω with better than 10 dB return loss
Dwell time	50 mS
Bus interface	PCMCIA or ASCII serial (16C650 serial port)
Air Interface protocol	ISO 18000-6b, ISO 18000-6c, EPC Gen 1 – Class 1, EPS Gen 2 – Class 1, Intellitag
FCC	Compliant to Part 15

Power Supply Specifications

Operating voltage	Minimum: 4.5V Maximum: 5.5V On IM4, digital regulated to 3.3V
Standby current	Typical: 2 mA Maximum: 5 mA
Read current	Typical: 800 mA Maximum: 960 mA Tx circuits, Rx circuits, VCO, temperature sensor
Ripple	Maximum: 100 mV Peak-to-peak
Timing	
Standby to active	Typical 1.5 mS; Maximum: 2 mS Internal time not seen by the host
Channel switching	Maximum: 30 μS Tx on a channel to Tx on any other channel

Specifications

Transmitter Specifications

Power output (at the antenna connector— assume 0.3 dB of cable loss)	Minimum: 588 mW Typical: 800 mW Maximum: 1000 mW
Frequency stability	Minimum: -30 PPM Maximum: 30 PPM
Phase noise	-60 dBc/Hz @ 30 kHz from carrier
Spurious emissions	-55 dBc in band
Overtemperature shutdown temperature	70°C (158°F) as measured on the power amplifier



6001 36th Avenue West
Everett, Washington 98203
U.S.A.

tel 425.348.2600

fax 425.355.9551

www.intermec.com

© 2005 Intermec Technologies
Corporation. All rights reserved.

IM4 Module Integration Guide



P/N 944-623-001