Honeywell

Revision

2

USER MANUAL

IM11-PRT RFID MODULE

MODEL NO:IM11-PRT RFID MODULE

Table of Contents

Chapter

1

Introduction

This document specifies the details for a IM11-PRT RFID MODULE

About IM11

IM11-PRT RFID Reader Module is designed for quick integration into computers, printers, and any other products that need to be RFID-enabled. The IM11 includes these features:

- Allows the RFID-enabled product to read and write to tags used in most worldwide applications:
- The IM11 can comply with the regulatory requirements for ETSI 4 channels in Europe, USA, Taiwan, Australia, Thailand, Brazil, Hong Kong, Malaysia, Singapore, China, Philippines, South Africa, Israel, South Korea, and New Zealand.
- The IM11 cannot comply with regulatory requirements for Japan.
- Operates across the entire frequency band. The country code defines the frequency bands of operation, the power levels, the hop tables, and other country-specific parameters. The default country code is defined by the location where the

module is delivered.

- Covers UHF bands from 865 to 928 MHz Supports four channel operation over the 865 to 868 MHz band.

- Supports 50 channels in the FCC band from 902 to 928 MHz.
- Supports the ISO 18000-6c protocol (EPC Class 1, Gen 2)
- Supports the BRI (Basic Reader Interface) host communication protocol.

Chapter 2

Technical Specifications

Physical Specifications

Specification	Values
Physical	50.95 mm long x 30 mm wide x 4.76 mm thick
Weight	

Environmental Specifications

Specification	Values
Operating Temperature	-20 °C to +60 °C
Storage Temperature	-40 °C to +70 °C
Humidity	25 °C to 60 °C, 0% to 95% relative humidity, non-condensing process
Shock	2000 g, 0.5 ms pulse, 10 times on each axis
Vibration	GRMS. 10 to 500 Hz, in 3 axis
ESD	Passes CE mark requirements. 4 kV contact discharge and 8 kV air discharge, while unpowered.

Power Supply Specifications

Specification	Minimum	Typical	Maximum	Unit	Notes
Operating Voltage	3.15	3.8	5.2	V	All internal voltages regulated on module
Deep Sleep			100	µA	Vbatt current when enable low powers Real-Time Clock
Standby Current		30		mA	At 3.8 V, USB connection in Suspend mode, no GPIO loading

Power Supply Specifications (continued)

Specification	Minimum	Typical	Maximum	Unit	Notes
Read Current		1.3		A	Tx/Rx circuits, VCO, temperature sense
Ripple			100	mV	Peak-to-peak
Timing					
• Enable to Active		5		S	Only at initial power up
• Standby to Active		1.5	2	mS	An internal time, not seen by the host
• Channel Switching			30	µS	Tx on a channel to Tx on any other channel

Transmitter Specifications

Specification	Minimum	Typical	Maximum	Unit	Notes
Frequency Stability	-20		+20	PPM	
Spurious Emissions - FCC	-55 -50			dBc dBc	In band Out of band
Spurious Emissions - ETSI	-54			dBm	Out of band

Thermal Shutdown	85	°C	As measured by sensor on module
Thermal Recovery	75	°C	

Transceiver Specifications

Specification	Values
Output Power Control	29.5 dBm. User adjustable in 1 dBm down to 10.5 dBm. Tolerance drift from +0.5 to -0.7.
Bus Interface (USB or serial)	USB 2.0 compliant client 12 Mbps (full speed) Serial 115.2 Kbps
RF Output Impedance	50 Ohms with better than 10 dB return loss
Modulation	PR-ASK
Data Encoding	DRM or FM0
RF Sensitivity	DRM: Monostatic 15 dB S/N Power [dBm] ON: -70 dBm RF sensitivity is the minimum RF conducted power for measuring a given 15 dB return loss on the antenna port.
Tags/Protocols Supported	EPC Class 1 Gen 2, UHF Version 1.2.0 ISO 18000-6C NXP SL3ICS1002 G2XM, can read 512-bit extended user memory and custom commands Fujitsu FJ64 Kb Impinj Monza 4QT
Tag Data Rate	EPC Class 1 Gen2, ISO 18000-6C DRM back link frequency up to 320 KHz FM0 back link frequency 160 KHz
Read Range	>6 m (20 ft), provided that the module: • is using DRM operation mode. • is connected to an antenna system with 9 dBiC gain (circular polarized). • has no occurrence of multipath or other environmental interference.
Read Speed	>200 tags per second (using 32 conducted

	tags) 50 tags per second (using over air tags)
Performance Testing	AD 223 tags on cardboard

Receiver Specifications

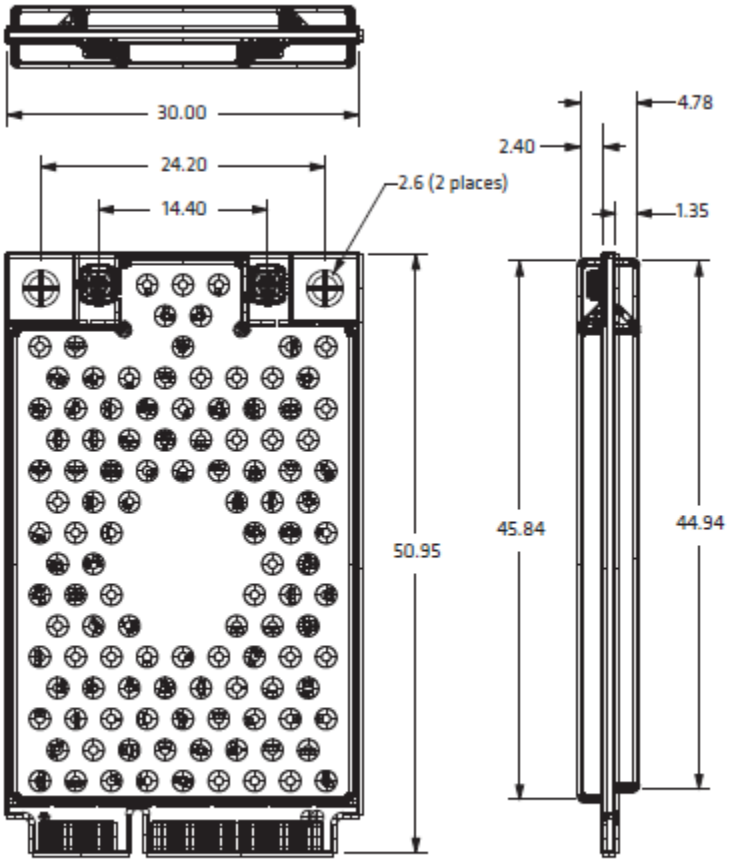
Receiver Input	Values
Sensitivity	Typical: -70 dBm 15 dB return loss
Maximum Reverse Input Power	Maximum: +20 dBm

Honeywell

Mechanical Integration

The module fits within the Mini PCI Express specifications.

For physical dimensions, see the illustration.



IM11 RFID Reader Module Physical Specifications: *50.95 mm long x 30 mm wide x 4.78 mm thick. Exceptions to the MiniPCI Express form factor: top shield side thickness is 2.4 mm (instead of 2.01 mm) and bottom shield side thickness is 1.35 mm (instead of 1.75 mm).*

Electrical Integration

The module communicates either over USB or through serial:

- The USB client communication follows the CDC profile and is USB 2.0-compliant, operating at 12 Mbps (full speed).
- In Serial mode, the module communicates as a standard PC COM port, operating at 115.2 Kbps. It has eight general purpose inputs and outputs for monitoring and controlling external signals.

  A Digital Signal Processor (DSP) controls the radio functions and provides communication with the host. This interface allows direct reprogramming and updating of the on-board FLASH memory

Power Requirements

The module operates off power input from 3.15 VDC to 5.2 VDC. If the input is 3.3 V DC or less, you must account for significant increased current demand. If the input drops below 3.15 VDC, 1 Watt output is not possible.

The module handles its own power management and goes into Standby mode automatically when there are no outstanding commands. However, even in Standby mode, the IM11 immediately responds to host activity, eliminating any potential host timeout conditions.

To achieve an even lower power Standby mode, the host needs to support USB suspend and remote wakeup.

To reduce power, the module duty cycles its transmitter. The duty cycling happens according to the read commands that the application executes. To achieve the lowest power, after all tags are read, the transmitter turns off. After a period of time, the transmitter activates to identify new tags in the field. After all new tags are read, the transmitter turns off for the rest of the period.

Also, the module automatically reduces the power out if the input voltage is too low or the temperature of the module is too high.

Reader Power States

There are four different power states for the RFID module.

Reader Power States and Levels of Consumption

Power State	*Level of Consumption*
Off	0 (3.3 V turned off to the module)
Deep Sleep	• 3.3 V on • RF enable = Off • < 1 mA • Real Time Clock (RTC) = On (< 100 µA to power RTC)* • Enable (Pin 20) is low
Idle	• 3.3 V on • RF enable = On • No USB activity • About 35 mA • Enable (Pin 20) is high
Read	Max current during tag read about 1.5 A

*You cannot turn off the RTC unless you remove power Pin 2 (VBATT) on the mini-PCI connector.

Supported Antennas:

These antennas are approved to work with iM11:

- Compact Yagi (6.0 dBi Linear)
- Microstrip Antenna, "Coupler" with -19.96 dBi gain
- Microstrip Antenna, "Coupler" with -24 dBi gain
- Microstrip Antenna, "coupler" with -14 dBi gain.

Honeywell

Chapter 3

Mini-PCI Connector Pin Descriptions

Pin Descriptions

Pin	Pin Name	Description
1	Reserved	Do NOT connect
2	+V_BATT	Power input
3	Reserved	Do NOT connect
4	GND	Ground
5	No Connect	Not connected
6	GPIO2	
7	No Connect	Not connected
8	No Connect	Not connected
9	GND	Ground
10	No Connect	Not connected
11	No Connect	Not connected
12	No Connect	Not connected
13	Reserved	Do NOT connect
14	No Connect	Not connected
15	GND	Ground
16	GPIO0	
17	Reserved	Do NOT connect
18	GND	Ground
19	Reserved	Do NOT connect
20	ENABLE	Input. Logic high level turns on power to IM11
21	GND	Ground
22	UART_SEL_L	Input. Low level activates UART instead of USB (at Enable active)
23	Reserved	Do NOT connect
24	+V_BATT	Power input
25	Reserved	Do NOT connect

26	GND	Ground
27	GND	Ground
28	GPIO1	
29	GND	Ground
30	GPIO3	
31	Reserved	Do NOT connect
32	GPIO4	
33	RESET_L	Logic low level resets IM11
34	GND	Ground
35	GND	Ground
36	USB_DM	USB data minus
37	GND	Ground
38	USB_DP	USB data plus
39	+V_BATT	Power input
40	GND	Ground
41	+V_BATT	Power input
42	No Connect	Not connected
43	GND	Ground
44	GPIO5	
45	HOST_CTS1	Future use
46	GPIO6	
47	HOST_RTS1	Future use
48	GPIO7	
49	HOST_RX1	Output. Rx data output to host
50	GND	Ground
51	HOST_TX1	Input. Tx data input from host
52	+V_BATT	Power input

Notes:

- GPIOx: General purpose inputs/outputs. The pins are high impedance inputs when initially powered, following a module reset. You can configure all pins as inputs or outputs under software control.
- Host TX1/RX1 and host RTS1/CTS1: Standard logic levels. No RS-232 transceiver.
- USB_DP: If UART_SEL_L is low, pull up to wake up. If logic level is low, IM11 is in Sleep mode.
- All signals are 3.3 V logic levels (5 V tolerant inputs).

Honeywell

Input and Output Voltage Level Descriptions

Voltage Levels

	Low	High	Notes
Inputs	0 to 0.8 V	2.4 to 5.5 V	± 10 µA max input current
Outputs	0.4 V max @ 4 mA	2.9 V min @ -4 mA	

Transmit Power

The module is able to adjust transmit power from 29.5 dBm to 10.5 dBm, configurable in 1 dBm steps with an accuracy (the measure of the power output for each level) of +/-0.5 dBm. The initial tolerance (the measure of the power output for each level) is +/-0.5 dBm. The output power is set on each of the antennas. Output power tolerance from the nominal setting is +/- 0.75 dBm over an ambient temperature range of -20 °C to 60 °C.

The module supports PR-ASK modulation for EPC Class 1 Gen 2 tags only.

RF Integration

The module supports two antenna connections. You can use software to control the selection of either connection. The module switches from one antenna to the other in 5 ms or less. The switching time is defined from the 90% power point as the RF is turned off at the first port to the 90% power point as the RF is turned on at the second port.

The module uses an integrated RFID transceiver. It features autotuning on the antenna ports to match the antenna return loss dynamically. The system compensates for antennas with a VSWR of 2.0 or lower (a VSWR of <1.7 is optimum).

There are no termination requirements for the antenna ports. The module will not transmit to any open antenna ports

Honeywell

Chapter 4

Agency Approvals

FCC Communications commission interface statement

Model: IM11PRT

FCC ID: HD5-IM11R

This device complies with FCC Part 15 Subpart C Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including, an interference that may
cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by

turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

• Reorient or relocate the receiving antenna.

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

• Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the users authority to operate this equipment

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radio exposure statement:

This equipment complies with FCC radiation exposure limits set fourth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20cm is maintained between the antenna and users.

2) The transmitter module may not be co-located with any other transmitter or antenna

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end -product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in visible area with the following: “Contains FCC ID: HD5-IM11R”. The grantee’s FCC ID can be used only when all FCC compliance requirements are met.

Manual Information to the end user:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product with integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

Honeywell

Industry Canada

Model: IM11PRT

IC: 1693B-IM11R

This device complies with ISED's license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux RSS exemptés de licence de l'ISED. L'opération est soumise aux deux conditions suivantes : (1) cet appareil peut ne pas causer d'interférences nocives, et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent provoquer un fonctionnement non désiré de l'appareil.

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration sur l'exposition aux rayonnements :

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et actionné avec la distance minimale 20cm entre le radiateur et votre corps.

Honeywell

DETACHABLE ANTENNA USAGE

This radio transmitter (IC: 1693B-IM11R/ Model: IM11-PRT) has been approved by ISED to operate with the antenna type listed below with maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Approved antenna's list

Antenna Type	Gain	Part Number	Manufacture
Compact Yagi	6.0 dBi	NA	Honeywell
Microstrip Antenna, "coupler"	-19.96 dBi	MAF95123-1	Laird Technologies
Microstrip Antenna, "coupler"	-24 dBi	H2B1JH1AH0200	Unictron Technologies
Microstrip Antenna, "coupler"	-14 dBi	LUPUS14V2	Honeywell

Cet émetteur radio (IC : 1693B-IM11R/ Modèle : IM11-PRT) a été approuvé par l'ISED pour fonctionner avec le type d'antenne énuméré ci-dessous avec un gain maximal autorisé indiqué. Les types d'antennes non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdits d'utilisation avec cet appareil.

This device is intended only for OEM integrators under the following conditions: (For module device use)

1) The antenna must be installed such that 20cm is maintained between the antenna and users.

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end -product for any additional compliance requirements required with this module installed.

Honeywell

Cet appareil est destiné uniquement aux intégrateurs OEM dans les conditions suivantes : (Pour l'utilisation du module)

1) L'antenne doit être installée de telle sorte que 20cm soit maintenu entre l'antenne et les utilisateurs.

2) Le module émetteur ne peut pas être co-localisé avec un autre émetteur ou antenne.

Tant que 2 conditions ci-dessus sont remplies, un autre test d'émetteur ne sera pas nécessaire. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requises avec ce module installé.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent pas être remplies (par exemple certaines configurations d'ordinateurs portables ou la co-implantation avec un autre émetteur), alors l'autorisation du Canada n'est plus considérée comme valide et ic ID ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur oem sera chargé de réévaluer le produit final (y compris l'émetteur) et d'obtenir une autorisation distincte du Canada.

Honeywell

End Product Labeling:

This transmitter module is authorized only for use in devices where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in visible area with the following: "Contains IC: **1693B-IM11R**".

Étiquetage final des produits :

Ce module émetteur n'est autorisé que pour une utilisation dans les appareils où l'antenne peut être installée de telle sorte que 20cm peut être maintenu entre l'antenne et les utilisateurs. Le produit final doit être étiqueté dans la zone visible avec ce qui suit: "Contient IC: 1693B-IM11R ".

Manual Information to the end user:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product with integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

Informations manuelles à l'utilisateur final :

L'intégrateur OEM doit être conscient de ne pas fournir d'informations à l'utilisateur final sur la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final avec intègre ce module. Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires et avertissements requis, comme le montre ce manuel.

Operational Use Conditions:

The IM11-PRT RFID module is designed to be integrated and used for product applications such as Industrial Fixed RFID readers, Industrial Printers designed to be used for indoor applications.

CATION : The module is designed for industrial applications only. Not be used in any other environment like aircraft, automotives, military applications etc.

This device complies with Part 15 Subpart C of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.

2. This device must accept any interference received, including, an interference that may cause undesired operation.

The Module is to be used only with the dedicated antennas listed below

Antenna Type	Gain	Part Number	Manufacture
Compact Yagi	6.0 dBi	NA	Honeywell
Microstrip Antenna, "coupler"	-19.96 dBi	MAF95123-1	Laird Technologies
Microstrip Antenna, "coupler"	-24 dBi	H2B1JH1AH0200	Unictron Technologies
Microstrip Antenna, "coupler"	-14 dBi	LUPUS14V2	Honeywell

The module must be used for the power settings as defined below.

Antenna Type	Part Number	POWER SETTING
Compact Yagi	NA	30dBm
Microstrip Antenna, "coupler"	MAF95123-1	30dBm
Microstrip Antenna, "coupler"	H2B1JH1AH0200	30dBm
Microstrip Antenna, "coupler"	LUPUS14V2	25dBm

The final host /product with module integrated is to be evaluated against US FCC Part 15 f or unintentional radiators.

The final host/product with the module integrated is to be evaluated f or spurious emissions to ensure the final configuration continues to be compliant with the FCC limit

Limited Modular Procedures :

Nort applicable as the module is certified as Fully Modular

Trace Antenna Designs

Not Applicable as the Module has a U.FL connector which gets connected directly to the dedicated antennas & couplers.

RF Exposure Conditions:

The radiated output power of this device meets the limits of FCC/IC radio frequency exposure limits. This device should be operated with a minimum separation distance of 20 cm between the equipment and a person's body.

The Product / Host is to ensure that there are no other Transmitters or Antennas collocated along with this Module.

The Product /Host where in this module installed shall add following statement

" This Product should be operated with a minimum separation of 20cm between the device /product and person's body.

Note : The Host /Product Manufacturer shall ensure above conditions are met, if not host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Antennas

The module is designed and approved to be used along with below antennas only. The cable assemblies are part of the antennas or couplers mentioned below.

Below antennas or couplers can be coupled to the RFID module with unique antenna connector U.FL

Antenna Type	Gain	Part Number	Manufacture
Compact Yagi	6.0 dBi	NA	Honeywell
Microstrip Antenna, "coupler"	-19.96 dBi	MAF95123-1	Laird Technologies
Microstrip Antenna, "coupler"	-24 dBi	H2B1JH1AH0200	Unictron Technologies
Microstrip Antenna, "coupler"	-14 dBi	LUPUS14V2	Honeywell

Label & Compliance Information

Devices incorporating this module must include an external, visible, permanent marking or label or e-label which states the following:

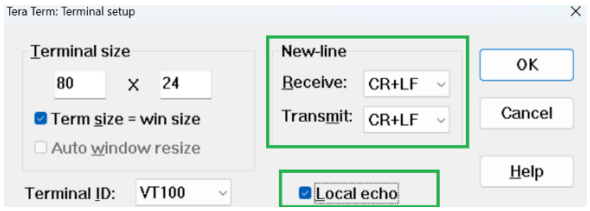
Contains FCC ID: HD5-IM11R

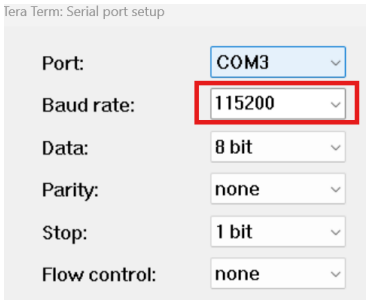
Information on test modes and additional testing requirements

A. for product testing, the device is to be configured as mentioned in below steps to perform the testing

   a) Access the USB serial communication port of the RFID module using tera term.

      Make the following settings on the terminal





Commands for Testing

Util enable=”EV98203U”	Enable the module for testing
util hopping=off/on	Set the hopping to ON/FCC based on the test
attrib fs=xx,xx	Example attribs fs=30dB,30dB set the power 30dBm for both ant1, ant2 (only one port is enabled at a time).
attrib ants=1 or attrib ants=2	Select the Antenna to be transmitted either Ant 1 or Ant2
util channel=xx	Set the channel for testing between 5 & 54
r loop	Modulated Continuous Transmission until enter button is pressed on terminal
util rf=off	Alternative to enter, press r stop to stop RFID communication
util rf=on	Continuous Un-modulated Carrier Signal for testing

Certified Power settings is to be used for testing:

Antenna Type	Gain	Part Number	Module Power Settings
Compact Yagi	6.0 dBi	NA	30dBm
Microstrip Antenna, "coupler"	-19.96 dBi	MAF95123-1	30dBm
Microstrip Antenna, "coupler"	-24 dBi	H2B1JH1AH0200	30dBm
Microstrip Antenna, "coupler"	-14 dBi	LUPUS14V2	25dBm

Honeywell

Additional testing, Part 15 Subpart B Disclaimer

The Module is certified as per the FCC Part 15C.

The final host /product with module integrated is to be evaluated against US FCC Part 15 f or unintentional radiators.

The final host/product with the module integrated is to be evaluated f or spurious emissions to ensure the final configuration continues to be compliant with the FCC limit

The Host / Product Manufacturer where this device is integrated shall evaluate the other FCC rules that are applicable to the Host/ product and get necessary FCC Certification and Grant Approvals.

Note EMI Considerations

It is recommended host / product manufacture where this module is integrated to follow the guidelines defined in 996369 D04 Module Integration Guide which recommends the "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

How to Make Changes to the Module

Note : Only Honeywell is permitted to make the permissive change to this module. The Host / product shall contact their respective sales team or Honeywell Integrators to understand the procedure if Host / Product intended to use the module differently.

For our latest contact information, go to
https://automation.honeywell.com/us/en