

	<p style="text-align: center;">Title:</p> <h2 style="text-align: center;">Antenna, Cable, and Accessories Application Guide For RFID Readers</h2>	<p style="text-align: center;">Document Number:</p> <p style="text-align: center;">631773</p>
<p>Document Level:</p>		<p style="text-align: center;">Revision:</p> <p style="text-align: center;">A- Draft</p>
<p>Process Owner:</p> <p>Engineering, WPG</p>		<p style="text-align: center;">Page:</p> <p style="text-align: center;">1 of</p>

Approved By:

Robert Zigler
James Lundberg

Mechanical Engineer, Wireless Products Group (Author)
Engineering Manager, Wireless Products Group

Referenced forms, documents, and records:

Table of Contents

Introduction	3
Regulatory Concerns	3
Basic Antenna Concepts	4
Typical Installations	
IF4, IF5, and IV7	5
IV7 Data and Power Cables	6
IF6 and IV6 Data and Power Cable	7
Connectors, Adapters, Crimp Tool, Terminators	
Standard N Receptacle	8
Reverse Polarity N Receptacle	8
592030-001 - Adapter, SMA RP Plug/TNC RP Receptacle	20
592154-001- Tool, Crimp, SMA N, RG58	20
345-004-001 - Terminator, 50 ohm, SMA RP Plug	21
345-005-001 - Terminator, 50 ohm, SMA Plug	22
Antennas with Reverse Polarity Connectors	
203-655-001 - Antenna, 5 dBd, SMA RP Plug	9
805-609-001 - Antenna, 7 dBd, SMA RP Plug	10
805-610-001 - Antenna, 6 dBi, N RP Receptacle	11
805-619-001 - Antenna, 5 dBi, SMA RP Plug	12
805-622-002 - Antenna, 9 dBi, N RP Receptacle	13
805-623-002 - Antenna, 8 dBi, N RP Receptacle	14
805-626-001 - Antenna, 6 dBi, N RP Receptacle	15
Antennas with Standard Connectors	
805-622-001 - Antenna, 9 dBi, N Receptacle	16
805-623-001 - Antenna, 5 dBi, N Receptacle	17
805-626-002 - Antenna, 6 dBi, N Receptacle	18
805-628-001 - Antenna, 10.5 dBi, N Receptacle	19

Introduction

The purpose of this document is to provide Intermec Technologies Corp. personnel a tool that will enable them to better understand how the various Intermec antennas, cable assemblies, and accessories blend together. This guide is biased towards 2.4 GHz offerings. Future updates will include 900 MHz and UHF.

Regulatory Concerns

Note: The information below will help you to understand some of the regulatory issues surrounding the use of antenna, antenna circuits, and radios. However, it is critical to remember that all antennas must be approved and certified before they can be used with radio (RF) equipment purchased from Intermec.

FCC

FCC requirements limit the total output power of a wireless LAN system operating in the 900 MHz and 2.4 GHz frequency ranges to 4 Watts. This limit is expressed in EIRP, which stand for “Effective Isotropically Radiated Power.” This is the total power created by the transmitter and gain generated by the antenna, minus any loss due to cabling and connections. Given this 4W (4000 mW) maximum, the EIRP must not exceed 36dBi. The FCC has no stated EIRP maximums of UHF systems.

ETSI

ETSI requirements limit the total output power of a 2.4 GHz wireless LAN system to 0.1 Watt (100 mW). Given this 100 mW maximum, the EIRP must not exceed 20dBm. 900 MHz systems are not allowed and UHF system maximum EIRPs vary from country to country. Most European countries such as France and Italy operate under a lower power directive, which limits them to a maximum output limit of 10 mW.

Non-ETSI & Non-FCC Countries

Electromagnetic-transmission regulations are mandated by each country’s own governing body. Many countries follow the directives issued by ETSI or the FCC but others create their own regulations.

Before adding radios or antennas to a RF system, please consult a certified Intermec Systems Consultant operating in the country where the system will be used.

Basic Antenna Concepts

Antennas and Power

Antennas do not increase nor decrease the power applied to them. They can only transmit or receive the amount of power that is applied to them. It is possible to have some power loss before or after the signal leaves the antenna. An example of this is “line loss: which is a decrease in power due to imperfect connections and imperfect conductivity to cabling materials. It is, however, possible to increase the power output in a certain direction. But the total power emitted will always be the same as the amount applied to the antenna minus the amount lost due to line loss, ohmic loss, reflection loss etc...

dBi – (decibels relative to an isotropic {spherical} radiation pattern)

An isotropic antenna is a theoretical antenna that radiates in the shape of a perfect sphere.

dBm – (decibels relative to one milliwatt)

dBm is a commonly used unit of measurement in the RF industry that expresses radio frequency power relative to a 1 mW point of reference.

dBd – (decibels relative to a ½ wave dipole antenna)

dBd is gain with respect to a ½ wave dipole antenna. Some commercial antenna companies use dBd to rate their antennas.

EIRP – (Effective isotropically radiated power)

The mathematical product of (1) the power supplied to the antenna and (2) its gain.

Gain

Gain is given in dB (decibels). If an “I” is added as in 3dBi, this rating is relative to an “isotropic” antenna. An isotropic antenna is a theoretical antenna that radiates in the shape of a perfect sphere. If a “d” is added as in 3dBd, this rating is relative to a “dipole” antenna. A dipole antenna with a rating of 2.14dB is equivalent to a 0dBd antenna.

Line-of-sight

This refers to the fact that some electromagnetic wave frequencies require a clear line of sight between transmitter and receiver. This is largely because higher frequency electromagnetic waves, such as those in the 2.4 GHz range, do not bend around or penetrate objects as well as some lower frequency signals.

Multipath, Reflection, or Physical Interference

Because of the electromagnetic properties of waves used to transmit data, large metal objects in the immediate transmission path of the antenna will likely cause distortion of the signal and should therefore be avoided.

Omnidirectional

An omnidirectional antenna radiates evenly horizontally around the antenna in a plane parallel to the earth. These antennas do not always radiate evenly vertically around the antenna in a plane perpendicular to the earth. By giving up vertical coverage, above and or below the antenna and refocusing that signal around the antenna, it is possible to achieve gain with an omnidirectional antenna.

Omni-gain

Wavelength and operating frequency determine the size of the antenna. By using a longer antenna, you do not achieve greater overall coverage, but you can achieve greater distance in a focused direction. For example, omnidirectional antennas with gain achieve some measure of gain in the horizontal plane.

IF4, IF5, IV7


345-004-001 - Terminator, 50 ohm, SMA RP

203-720-001 - Kit, Cable, SMA RP Plug/N RP Plug - 12 feet
203-720-002 - Kit, Cable, SMA RP Plug/N RP Plug - 20 feet
 (Customer trims cable and terminates N plug)


236-021-001 - Cable, SMA RP Plug/N RP Plug - 13 feet
321-574-001 - Cable, SMA RP Plug/SMA RP Receptacle - 6 feet
321-574-002 - Cable, SMA RP Plug/SMA RP Receptacle - 10 feet


063247 - Cable, SMA RP Plug/N RP Receptacle - 12 inch
 Use with Extension Cables:
064616 - Cable N RP Plug/N RP Plug - 30 inches
063245 - Cable N RP Plug/N RP Plug - 5 feet
063246 - Cable N RP Plug/N RP Plug - 20 feet
071179 - Cable N RP Plug/N RP Plug - 30 feet



203-655-001 - Antenna, 5 dBi - SMA RP Plug
 (Includes 236-021-001 Cable)

805-609-001 - Antenna, 7 dBi - SMA RP Plug, 13 feet
805-610-001 - Antenna, 6 dBi - N RP Receptacle, 5 feet
805-619-001 - Antenna, 5 dBi - SMA RP Plug, 13 feet
805-622-002 - Antenna, 9 dBi - N RP Receptacle
805-623-002 - Antenna, 8 dBi - N RP Receptacle
805-626-001 - Antenna, 6 dBi - N RP Receptacle
805-628-002 - Antenna, 10.5 dBi - N RP Receptacle


345-005-001 - Terminator, 50 ohm, SMA

236-044-001 - Cable, SMA Plug/N Plug- 10 Feet (305 cm)
236-045-001 - Cable, SMA Plug/N Plug - 22.5 Feet (686 cm)
236-046-001 - Cable, SMA Plug/N Plug - 28.5 Feet (869 cm)


203-719-001 - Kit, Cable, SMA Plug/N Plug - 12 feet
203-720-002 - Kit, Cable, SMA Plug/N Plug - 20 feet
 (Customer trims cable and terminates N plug)



805-622-001 - Antenna, 9 dBi - N Receptacle
805-623-001 - Antenna, 8 dBi - N Receptacle
805-626-002 - Antenna, 6 dBi - N Receptacle
805-628-001 - Antenna, 10.5 dBi - N Receptacle

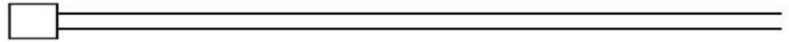

915MHz
IF4
IF5
IV7
 915 MHz units
 are equipped with
 reverse polarity
 SMA Receptacles


865/869MHz
IF4
IF5
IV7
 865/869 MHz units
 are equipped with
 standard polarity
 SMA Receptacles

IV7



075128 - Cable, RS232, 8 position/9 position dsub socket - 36 inches
075513 - Cable, RS232, 8 position/9 position dsub socket - 9 feet



075511 - Cable, RS232, 8 position - 9 feet



075512 - Cable, RS232, 9 position dsub socket - 6 feet



203-713-001 - Kit, Power Cable
(includes fuse, fuse-holder, cable ties,
terminals, shrink tubing, cord clips)

IF6/IV6



236-040-001 - Cable, I/O
(Does not include connector
for terminal)



203-714-001 - Kit, Combination Power and I/O Cable
(includes fuse, fuse-holder, cable ties, cord clips,
shrink tubing, and 2-position circular plug for
connecting to Intermec fork lift power conditioner.
Does not include connector for terminal.)

Standard N Receptacle
(For use in Europe with 865 MHz
and 869 MHz Systems)



Reverse Polarity N Receptacle
(For use in United States and
Canada with 915 MHz Systems)



203-655-001
Antenna – 5dBd – SMA RP Plug
(includes 236-021-001 Cable)



Frequency Range: 800 – 1000 MHz
Gain: 5 dbd
VSWR: 50ohms maximum - 1.5:1
Polarization: Vertical
Pattern Direction: Directional
Horizontal Beam Width: 90 degrees
Vertical Beam Width: 60 degrees
Average Power Input: 50 Watts maximum
Front to Back Ratio: 25 dB

Cable Length: 156 inches

805-609-001
Antenna – 7dBi – SMA RP Plug



Frequency Range: 902 – 928 MHz
Gain: 7 dBi
Front to Back Ratio: 18 dB
3 dB Horizontal Beam Width: 65 degrees
3 dB Vertical Beam Width: 65 degrees
VSWR: 1.5:1
Power Rating: 1 Watt maximum
Polarization: Right Hand Circular
Impedance: 50 Ohms

Size: 10.2 x 10.2 x 1.5 inches
Weight: 1.25 lbs

Cable Length: 156 inches

805-610-001
Antenna – 6dBi – N RP Receptacle



Frequency Range: 890 – 945 MHz

Gain: 6 dBd

Front to Back Ratio: 15 dB

3dB Horizontal Beam Width: 70 degrees

3dB Vertical Beam Width: 60 degrees

VSWR: less than 1.5:1

Power: 50 Watts maximum

Radiation Pattern: Directional

Polarization: Vertical, Linear

Impedance: 50 Ohms

Size: Width - 8.6 inches, Height – 7.8 inches, Depth – 2.25 inches

Weight: 1.0 lbs

Cable Length: 5 feet

805-619-001
Antenna – 5 dBi – SMA RP Plug



Frequency Range: 824 – 896 MHz

Gain: 5 dBi

Polarization: Elliptical

Coverage: Hemispherical

Azimuth and Elevation: 360 degrees and 120 degrees respectively

Front to Back Ratio: 15dB

VSWR: 1.2:1

Impedance: 50 Ohms

Power: 50 Watts

Size: 7.0 x 7.0 x 5.2 inches

Weight: 1 lb

Cable Length: 13 feet

805-622-002
Antenna – 9 dBi – N RP Receptacle



Frequency Range: 868-956 MHz

Gain: 9 dBi

Front to Back Ratio: >23 dB

H-plane Beam Width: 80 degrees (half power)

E-plane Beam Width: 30 degrees (half power)

VSWR: 1.8:1 over full frequency range

1.4:1 over 902 – 956 MHz frequency range

Power: 100 Watts maximum

Polarization: Right Hand Circular

Impedance: 50 Ohms

**Size: Width – 6.1 inches, Length – 25.5 inches (including mounting brackets),
Height – 2.25 inches**

Weight: 5.2 lbs

805-623-002
Antenna – 8 dBi – N RP Receptacle



Frequency Range: 865 – 928 MHz

Gain: 8 dBi

**Axial Ratio: 3 dB over entire half power beam
<1dB at boresight**

Front to Back Ratio: >20 dB

H-plane Beam Width: 60 degrees (half power)

E-plane Beam Width: 60 degrees (half power)

VSWR: 1.3:1 over full frequency range

Power: 100 Watts maximum

Polarization: LH Circular

Impedance: 50 Ohms

**Size: Width - 10.3 inches, Length – 15.4 inches (including mounting brackets),
Height – 2.4 inches**

Weight: 3.8 lbs

805-626-001
Antenna – 6 dBi – N RP Receptacle



Frequency Range: 865 – 928 MHz

Gain: 6 dBi

Front to Back Ratio: >20 dB

H-plane Beam Width: 90 degrees (half power)

E-plane Beam Width: 70 degrees (half power)

VSWR: 1.5:1 over full frequency range

Power: 100 Watts maximum

Polarization: Vertical

Impedance: 50 Ohms

**Size: Width – 6.1 inches, Length – 13.4 inches (including mounting brackets),
Height – 1.9 inches**

Weight: 3.3 lbs

805-622-001
Antenna – 9 dBi – N Receptacle



Frequency Range: 868 – 956 MHz

Gain: 9 dBi

Front to Back Ratio: >23 dB

H-plane Beam Width: 80 degrees (half power)

E-plane Beam Width: 30 degrees (half power)

VSWR: 1.8:1 over full frequency range

1.4:1 over 902 – 956 MHz frequency range

Power: 100 Watts maximum

Polarization: Right Hand Circular

Size: Width – 155 mm (6.1 inches), Length – 648 mm (25.5 inches) (including mounting brackets), Height – 57 mm (2.25 inches)

Weight: 2.35 kg (5.2 lbs)

805-623-001
Antenna – 8 dBi – N Receptacle



Frequency Range: 865 – 928 MHz

Gain: 8 dBi

Front to Back Ratio: >20dB

H-plane Beam Width: 60 degrees (half power)

E-plane Beam Width: 60 degrees (half power)

VSWR: 1.3:1 over full frequency range

Power: 100 Watts maximum

Polarization: Left Hand Circular

Impedance: 50 Ohms

Size: Width – 262 mm (10.3 inches), Length – 390 mm (15.4 inches) (including mounting brackets), Height – 59 mm (2.4 inches)

Weight: 1.7 kg (3.8 lbs)

805-626-002
Antenna – 6 dBi – N Receptacle



Frequency Range: 865 – 928 MHz

Gain: 6 dBi

Front to Back Ratio: >20 dB

H-plane Beam Width: 90 degrees (half power)

E-plane Beam Width: 70 degrees (half power)

VSWR: 1.5:1 over full frequency range

Power: 100 Watts maximum

Polarization: Vertical

Impedance: 50 Ohms

Size: Width – 155 mm (6.1 inches), Length – 340 mm (13.4 inches) (including mounting brackets), Height – 49 mm (1.9 inches)

Weight: 1.5 kg (3.3 lbs)

805-628-001
Antenna – 10.5 dBi – N Receptacle



Frequency Range: 865 – 870 MHz
Gain: 10.5 dBi
Axial Ratio: <3 dB over entire half power beam
Front to Back Ratio: >20 dB
H-plane Beam Width: 70 degrees (half power)
E-plane Beam Width: 30 degrees (half power)
VSWR: 1.3:1 over full frequency range
Power: 100 Watts maximum
Polarization: Left Hand Circular
Impedance: 50 Ohms

Size: Width – 262 mm (10.3 inches), Length – 635 mm (25 inches) (including mounting brackets), Height – 59 mm (2.3 inches)

Weight: 3.62 kg (8 lbs)

592030-001

**Adapter, SMA RP Plug/ TNC RP Receptacle
(Used to convert Readers from TNC RP Receptacles
to SMA RP Plugs. This allows existing antenna /cable
Infrastructure to operate with IF4 and IF5 Readers.)**

592154-001

**Tool, Crimp, SMA N, RG58
(Used to crimp N connectors to RG58 Coaxial
cable in Kits 203-719-001, 203-719-002,
203-720-001, and 203-720-002)**



345-004-001
Terminator, 50 ohm, SMA RP Plug



345-005-001
Terminator, 50 ohm, SMA Plug

