Intech Instruments

Intech Wireless Antennas

for 900MHz Radio Modems

RoHS Compliant CE

Installation Guide.

Wireless Antennas Installation Guide Index.

Intech Wireless Antennas

900MHz Wireless Frequency
Indoor & Outdoor Antennas

Description.

Intech supports a range of antennas that are intended to be used in conjunction with the Digi® Radio Modems Wireless Nodes. These antennas cover applications where outdoor use or extra gain is required to establish a more reliable wireless connection.

Features.

- Indoor and outdoor Antenna types.
- Directional and Omni Directional Antennas.
- High Gain Options.
- Easy to Install.

Ordering Information.

Antenna:

DL-OD900-40	- 900MHz 4dBi Indoor/Outdoor Omni Directional Antenna.
DL-OD900-60	- 900MHZ 6dBi Outdoor Omni Directional Monopole Antenna.
DL-OD900-80	- 900MHZ 8dBi Outdoor Omni Directional Monopole Antenna.
EZE-ANT-205	- Dual Band 10/11dBi Outdoor Directional Antenna.

900MHz Wireless Radio Modem:

IN-Digi485	- 900MHz Digi® Radio Modem for RS485/RS422 Communications.

Recommended Coax Cables:

ZB-P-57	- 0.5m Coax N-Female Bulkhead to RP-SMA Male.
ZB-P-77	- 5.0m Coax N-Male to RP-SMA Male.

More coax cable options on request.

4dBi Omni Directional Cabinet Mount Antenna.

DL-OD900-40

The 4dBi fibre glass antenna operates on the 915MHz ISM Band. With good gain and omnidirectional spread, means it's ideal for medium range Mesh topology or also point to multi-point wireless networks, which makes this antenna a perfect companion with the Digi® radio modems.

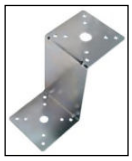
This antenna features an integral N- type connector that mounts directly to the normally supplied N-Female bulkhead and coax lead. This allows the antenna to be mounted onto outdoor enclosures with minimal hassle. There is also an optional bracket kit available for pole mounting applications.

Specifications:

Frequency Range	902~928MHz.
Gain	4dBi.
Range with Digi485 Radio	7.0Km Ideal Line of Sight.
Polarisation	Vertical.
Connector Type	N-Male.
Dimensions	H=600mm, Ø=23mm.

Optional Outdoor Bracket Mounts:

ZB-BKT-16
Right angled pole mount bracket with 16mm hole for N-Female bulkhead attachment. Includes U-bolts and nuts for attaching to 25~50mm diameter pole.



ZB-BKT-18
Ceiling/wall universal antenna mount bracket with 16mm hole for N-Female bulkhead attachment, great for ceiling mount for monopoles. Can also be used for wall mounting directional antennas.

NEMA-4X-1 Enclosure

6dBi Omni Directional Monopole Medium Gain Antenna.

DL-OD900-60

The 6dBi HyperLink antenna is a high performance omnidirectional antenna designed for the 800/900MHz ISM Band. If you're after a robust wireless Mesh network, then this antenna is the match you require for the Digi® radio modems.

This antenna comes standard with a heavy-duty steel bracket for pole mounting. The rugged construction of both antenna and bracket means it's designed for all weather operation.

Specifications:

Frequency Range	824~960MHz.
Gain	6dBi.
Range with Digi485 Radio	8.5Km Ideal Line of Sight.
Vertical Beam Width	30°.
Horizontal Beam Width	360°.
Polarisation	Vertical.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~85°C.
Pole Size	32~50mm.
Wind Speed	170Km/hr Max
Dimensions	H=600mm, Ø=33mm.

Recommended items not included:

- 5m low loss coax cable N-Male to RP-SMA male - to connect to Digi® Radio Modem.
- Coax-Seal Hand Mouldable Plastic - to keep outdoor coax connections weather tight.

8dBi Omni Directional Monopole High Gain Antenna.

DL-OD900-80

The 8dBi HyperGain antenna is a high performance omnidirectional antenna designed for the 900MHz ISM Band. If you need to push the boundaries of you wireless multipoint network, then this antenna is the upgrade you need. Paired with Digi® radio modems, you can achieve very impressive performance.

Specifications:

Frequency Range	900~928MHz.
Gain	8dBi.
Range with Digi485 Radio	12.5Km Ideal Line of Sight.
Vertical Beam Width	16°.
Horizontal Beam Width	360°.
Polarisation	Vertical.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~85°C.
Pole Size	32~50mm.
Grid Dimensions	H=1200mm, Ø=43.5mm.

Recommended items not included:

- 5m low loss coax cable N-Male to RP-SMA male - to connect to Digi® Radio Modem.
- Coax-Seal Hand Mouldable Plastic - to keep outdoor coax connections weather tight.

10dBi Directional High Gain Antenna.

EZE-ANT-205

The 10dBi broadband antenna had been borrowed from our Eze GSM modem kit to support the Digi® Radio modems simply because it's very high gain and low cost make it such and attractive choice.

Easily covering the 900MHz ISM band at a gain of 10dBi means it's equipped to punch through local interference or cover an impressive distance. Ideally suited for point to point applications.

Specifications:

Frequency Range	698~960MHz, 1710~2700MHz.
Gain	10dBi (11dBi for 1710-2700MHz).
Range with Digi485 Radio	25Km Ideal Line of Sight (estimated).
Vertical Beam Width	50°.
Horizontal Beam Width	75°.
Polarisation	Adjustable using bracket orientation.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~85°C.
Pole Size	40~50mm.
Wind Speed	170Km/hr Max
Dimensions	L=442mm, W=64mm, H=209mm.

Recommended items not included:

- 5m low loss coax cable N-Male to RP-SMA male - to connect to Digi® Radio Modem.
- Coax-Seal Hand Mouldable Plastic - to keep outdoor coax connections weather tight.

Placement Considerations.

Antennas are devices that focus energy in a particular direction similar to the way the megaphone focuses voice energy. Antennas can provide different radiation patterns depending on the design and application. How much the energy is focused in a given direction is referred to as Antenna Gain.

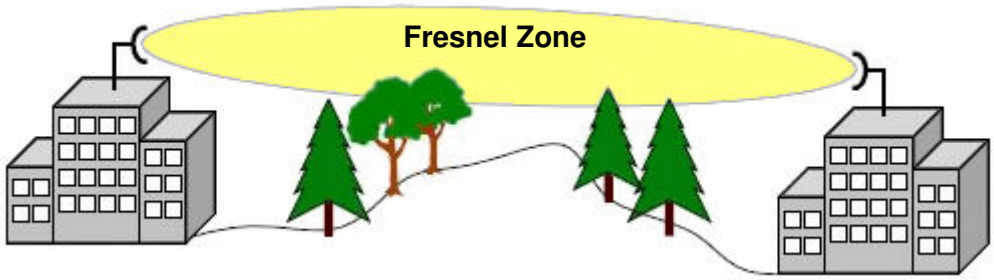
Environment.

Physical obstructions can enter into the environment and limit the system's ability to get information from one place to another. Range-reducing elements are commonly introduced into simple wireless communications systems in the form of walls, vehicles, trees, wind, etc.

Visual vs. RF Line-of-Sight.

Attaining RF Line-of-Sight (LOS) between the sending and receiving antennas is essential in achieving optimum range in wireless communication systems. There are two types of LOS that are generally used to describe an environment.

- ***Visual LOS:*** Visual LOS is the ability to see from one site to the other. It requires only a straight linear path between two points.
- ***RF LOS:*** RF LOS requires not only visual LOS, but also a football-shaped path (Fresnel Zone), free of obstacles for data to optimally travel from one point to another.



Fresnel Zone.

The Fresnel Zone can be thought of as a football-shaped tunnel between two sites that provides a path for RF signals. In order to achieve the greatest range, the football-shaped path in which radio waves travel must be free of obstructions. Buildings, trees, trucks or any other obstacles in the path will decrease the communication range. If the antennas are mounted just barely off the ground, over half of the Fresnel zone ends up being obstructed by the earth, resulting in significant reduction in range. To avoid this problem, the antennas should be mounted high enough off of the ground so that the earth does not interfere with the central diameter of the Fresnel zone.

It is also important to understand that the environment may change over time due to growing vegetation, building construction, etc.

How high above the ground and other obstacles the antennas need to be can be determined by the radius of the Fresnel zone. The radius of the Fresnel zone depends upon the radio frequency and measured distance between the two radios. Typically, 20% Fresnel Zone obstruction introduces little signal loss to the radio link. Beyond 40% obstruction, signal loss will become very significant.

Various estimate data points at 900MHz are given below**:**

Range Distance	**Fresnel Radius**	**80% of Fresnel Zone Radius**
500 m	6.4m	5.1m
1.0 km	9.0m	7.2m
3.0 km	15.6m	12.5m
5.0 km	20.2m	16.2m
10 km	28.6m	22.8m
15 km	35.0m	28.0m

To have ground clearance, the combined antenna height should be equal to the diameter of the Fresnel zone; these are the ideal numbers. Most installations will not be able to provide sufficient clearance and this will reduce the range available between the Antennas.

Intech antenna Ideal LOS distance specifications are measured with no Fresnel zone obstructions and no measureable wireless interference.

Antenna Gain versus Beam Widths.

Omni-directional antennas focus energy evenly in a doughnut-shape around the antenna. Here is an example of antenna gain versus vertical beam width (VBW) using 900MHz Omni-directional antennas:

Gain	**vs.**	**VBW** (*Horizontal Beam width = 360º*)
3dBi	=	60º
6dBi	=	30º
8dBi	=	16º

Directional Antennas focus energy more in one direction. Here is an example of antenna gain versus vertical and horizontal beam widths (VBW & HBW) using 900MHz Yagi antennas:

Gain	vs.	VBW		HBW
9dBi	=	48º	~	54º
11dBi	=	40º	~	48º
13dBi	=	30º	~	30º

Getting the most out of your Wireless Network.

Under ideal conditions, increasing the gain of an antenna at one end by 6dBi should double the distance the link will work over. Higher antenna gain means that the signal will be focused more in one direction; you do not get more power from antenna gain, just a more focused beam of energy to give a greater distance. Using the highest gain antenna is not always best. This is because a higher gain antenna has a narrower focused signal beam; while it does travel further, there is a smaller 'sweet spot'. This can make point to point links more tricky to align and they can easily go out of alignment if the antenna mast moves slightly.

Also, with a high gain omni directional antenna the signal is focused into a narrower vertical beam width. This can mean the areas above and below the antenna may have poor coverage. When choosing an antenna for your system, you need to consider your surroundings first. Sometimes a 4dBi antenna will give you better performance than a 8dBi. If your problem is due to large distances then 8dBi is good, but if the problem is hard surfaces obstructing the signal, then the 4dBi can be better than the 8dBi. The 8dBi has a more concentrated beam and will reflect more off the surfaces, causing multipathing problems that reduce signal quality. Also never forget to consider the use of one or more signal repeaters to overcome obstructions.

Attenuation.

The makeup of a building can affect the signal strength, things such as metal studs in walls, concrete, concrete fibreboard walls, aluminium cladding, foil-backed insulation in the walls or under the cladding, pipes, electrical wiring and tinted or mesh windows.

Here are some common building materials with their average attenuation:

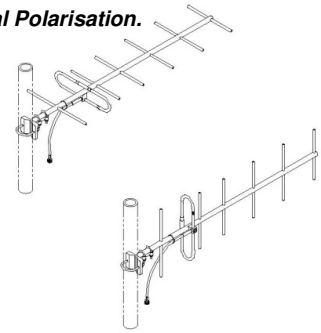
Single glazed window:	0.8dB
Double glazed window:	2.0dB
Timber wall (76mm)	2.8dB
Brick wall: (89mm)	3.5dB
Brick wall: (267mm)	7dB
Concrete Wall (102mm):	12dB
Reinforced Concrete (203mm):	27dB

Solid metal structures are not listed above because radio waves do not propagate through metal. Keep your wireless radio as high as possible and away from metal objects and concrete walls as these can block and/or reflect the signal causing signal degradation. If you are going between floors on a multi story building, tilting the antenna may give you a better coverage.

Antenna Polarisation.

It is important when installing antennas that both ends have the same polarization, otherwise there will be almost no communication between them at all. Polarisation is the relationship between the antennas physical orientation and the electric field that is parallel to the radiating element. Omni directional antennas tend to have vertical polarisation due to the fact that they stand vertically. Most directional antennas can be installed in either vertical or horizontal polarisation; you just have to have the same directional antenna type at both ends.

Example of Horizontal Polarisation.



Example of Vertical Polarisation.

Good Signal Can't be Guaranteed.

Even when all the above precautions are taken into account, no one can guarantee a good link, as there are many more factors that could cause problems. With Digi® radio modems, additional interposing radio modems can be used in between as a repeater (particularly good when transmitting around solid objects).

Important.

Make sure you power off any wireless equipment before you connect the antenna, as you can damage the radio transmitter if you don't. Also, all outdoor coax connections that are exposed to the weather should be sealed with a suitable coax seal tape or the connection may become damaged over time. Many wireless installers forget about this vital part of their installation and end up with expensive repairs a few months later. It is very important to seal all outside connector joints to prevent moisture from entering.
Self bonding tape is supplied with all outdoor antennas.

Intech Related Products.

MODEL	DESCRIPTION	
IN-DIGI485	Digi® Radio Modem for RS485/RS422 communications, operates on the 900MHz ISM band.	
NEMA-4X-1	Weatherproof NEMA 4X enclosure supplied with pole mounting Brackets. (Antenna not included - Pictured with the 4dBi omni antenna.)	
ZB-P-45	0.2 metre, short length coax extension lead with bulkhead fitting. Ideal for mounting the supplied whip antenna on the outside of a cabinet. *Indoor use only.*	
ZB-P-58	10 metre coax cable for longer runs. Requires adapters to fit onto the Digi® radio modem, ie: the ZB-P-57 0.5m Coax N-Female Bulkhead to RP-SMA Male.	

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