Intech Instruments

Intech Wireless Antennas

for MicroScan Data and Discrete Analogue Connections

RoHS Compliant CE

Installation Guide.

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Intech Wireless Antennas

2.4GHz Wireless Frequency Indoor & Outdoor Antennas

Description.

The Intech wireless antennas are intended to be used in conjunction with the 2.4GHz Z-2400 Zigbee® Wireless Nodes. Intech provides a range of antennas to cover applications where the radio signal requires extra gain to cover a greater distance.

Features.

- Indoor and outdoor Antenna types.
- Directional and Omni Directional Antennas.
- Supplied as a Complete Kit.
- Easy to Install.

Ordering Information.

Z-2400 Antennas:

ZB-ANT-05 - 2.4GHz 5.5dBi Rubber Duck Indoor Antenna.
ZB-ANT-02 - 2.4GHz 2.2dBi Omni Directional Whip Antenna.
ZB-ANT-08 - 2.4GHz 8.0dBi Omni Directional Monopole.
ZB-ANT-14 - 2.4GHz 14.5dBi Directional Yagi Antenna.
ZB-ANT-19 - 2.4GHz 19dBi Directional Parabolic Grid.

Recommended Coax Cables:

ZB-P-77 - 5m Coax N-Male to RP-SMA Male.
ZB-P-38 - 6m Coax N-Male to SMA Male.

10 Metre Coax Option:

ZB-P-58 - 10m Coax N-Male to N-Male
10m Coax also requires adapters:
ZB-P-57 - 0.5m Coax N-Female Bulkhead to RP-SMA Male.
ZB-P-40 - 0.3m Coax N-Female Bulkhead to SMA Male.

Coax Tape for Outdoor Connections:

ZB-Tape-01 - 1.5m of Coax Seal.

Z-2400-A2 Series Models:

- Z-2400-A2O
- Z-2400-A2I
- Z-2400-A2R

Z-2400 MicroScan Series Models:

- Z-2400-TCP-T
- Z-2400-RB-T
- Z-2400-A2I
- Z-2400-SLEEPER

2.4GHz 5.5dBi Rubber Duck Indoor Antenna.

The 5.5dBi Rubber Duck antenna has been added to the Intech wireless antenna range as a simple upgrade option, which attaches directly onto the Z-2400 unit. The Antenna features a tilt-and-swivel RP-SMA connector, allowing the antenna to be set at any angle. For indoor use only.

Specifications:

Frequency Range	2400~2500MHz.
Gain	5.5dBi.
Vertical Beam Width	120°.
Horizontal Beam Width	360°.
Polarisation	Vertical.
Impedance	50Ω.
Connector Type	RP-SMA (SMA Adapter MicroScan Models).
Operating Temperature	-40°~60°C.
Dimensions	H=208mm, MaxØ=13mm.

2.4GHz 2.2dBi Omni Directional Rubber Duck Antenna.

The 2.4GHz 2.2dBi rubber duck antenna is designed for indoor or outdoor use. Because it's omni directional, its great for short range Mesh topology and also point to point wireless networks.
This antenna features an integral N-Male type connector that mounts directly to the supplied N-Female bulkhead and coax lead. This allows the antenna to be mounted almost anywhere with minimal hassle.

Specifications:

Frequency Range	2400-2484MHz, 5150-5825MHz.
Gain	2.2dBi.
Vertical Beam Width	90°.
Horizontal Beam Width	360°.
Polarisation	Vertical.
Connector Type	N-Male.
Dimensions	H=193mm, BaseØ=20mm, RadomeØ=12.7mm.

Recommended items not included:

- 0.5m Coax for RP-SMA connections.
  Or 0.3m Coax for SMA connections.
- Coax-Seal hand mouldable plastic.
- Mounting bracket.

ZB-BKT-SSP

2.4GHz 8dBi Omni Directional Monopole Antenna.

The 2.4GHZ Monopole Antenna is designed for outdoor medium range, Mesh or point to point wireless communications. Included is a pole mounting kit consisting of a heavy-duty steel bracket and a pair of U-bolts. Constructed for all weather operation, the monopole antenna features a sealed collinear brass elements inside a durable UV-stable machine grey fiberglass radome. A vented end cap and drain hole in the base help prevent moisture build-up inside the antenna.

Specifications:

Frequency Range	2400~2500MHz.
Gain	8dBi.
Vertical Beam Width	15°.
Horizontal Beam Width	360°.
Polarisation	Vertical.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~85°C.
Pole Size	Ø 25~50mm.
Rated Wind Velocity	240Km/hr Max.
Weight	0.5Kg.
Dimensions	H=500mm, BaseØ=32mm, RadomeØ=19mm.

Pole mounting bracket included.

Recommended items not included:

- 5m low loss coax cable for RP-SMA connections.
  Or 6m low loss coax cable for SMA connections.
- Coax-Seal Hand Mouldable Plastic.

Additional bracket types available. >>

ZB-BKT-18

15dBi omni-directional model is also available on request.

2.4GHz 14.5dBi Directional Radome Enclosed Yagi Antenna.

The 2.4GHz Yagi Antenna is design for outdoor long range Point to Point wireless communications. The Yagi is enclosed within a UV-stable, UL flame rated radome for all-weather operation. The unique design of this antenna allows it to be installed for either vertical or horizontal polarization for greater versatility.
Easy mounting with the adjustable 60 degree tilt and swivel mast mount kit.

Specifications:

Frequency Range	2400~2500MHz.
Gain	14.5dBi.
Vertical Beam Width	30°.
Horizontal Beam Width	30°.
Polarisation	Vertical or Horizontal.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-20°~60°C.
Pole Size	Ø 32~50mm.
Bracket Tilt	60°.
Rated Wind Velocity	240Km/hr.
Weight	0.81Kg.
Grid Dimensions	L = 462mm, Ø = 76mm.

Pole mounting bracket included.

Recommended items not included:

- 5m low loss coax cable for RP-SMA connections.
  Or 6m low loss coax cable for SMA connections.
- Coax-Seal Hand Mouldable Plastic.

2.4GHz 19dBi Directional Parabolic Grid Antenna.

The 2.4GHZ Parabolic Antenna is design for outdoor long range Point to Point wireless communications. The rust-proof die cast aluminum reflector grid features ultra low wind loading while providing excellent RF performance. Easy mounting with the adjustable system made of galvanized steel with stainless steel hardware.

Specifications:

Frequency Range	2400~2483MHz.
Gain	19dBi.
Vertical Beam Width	12°.
Horizontal Beam Width	16°.
Polarisation	Vertical or Horizontal.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~65°C.
Pole Size	Ø 30~50mm.
Bracket Tilt	60°.
Rated Wind Velocity	210Km/hr.
Weight	2.4Kg.
Grid Dimensions	630mm x 420mm.

Pole mounting bracket included.

Recommended items not included:

- 5m low loss coax cable for RP-SMA connections.
  Or 6m low loss coax cable for SMA connections.
- Coax-Seal Hand Mouldable Plastic.

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.

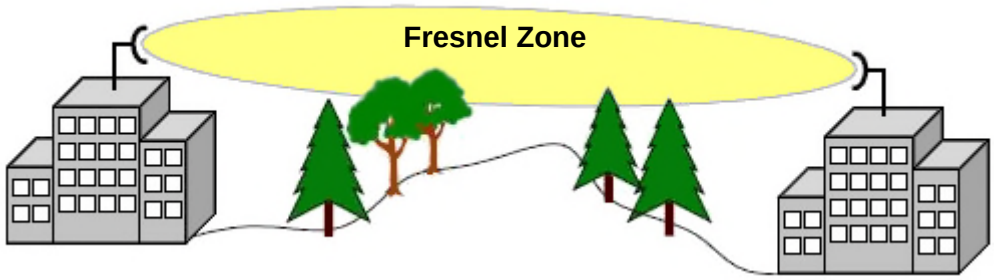
Environment.

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 2.4GHz are given below**:**

Range Distance	**Fresnel Radius**	**80% of Fresnel Zone Radius**
400 m	3.5m	2.9m
900 m	5.3m	4.3m
1.5 km	6.8m	5.5m
3 km	9.7m	7.8m
5 km	12.5m	10.0m
10 km	17.7m	14.2m
15 km	21.7m	17.3m

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.

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 Omni-directional Hyper-gain antennas:

Gain	**vs.**	**VBW** (*Horizontal Beam width = 360º*)
4dBi	=	50º
6dBi	=	28º
8dBi	=	15º
15dBi	=	8º

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

Gain	vs.	VBW		HBW
15dBi	=	17º	~	21º
19dBi	=	11º	~	17º
24dBi	=	8º	~	10º

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 5dBi antenna will give you better performance than a 8dBi. If your problem is due to distance in a wooden house the 8dBi is good, but if it is due to metal and concrete blocking, the signal of the 5dBi 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.

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 furniture. Tinted windows will severely weaken 2.4 GHz signals also, as will wire mesh with holes smaller than a quarter wavelength (about 2.5cm), wire mesh with holes up to 12.5cm will also affect signal as well.

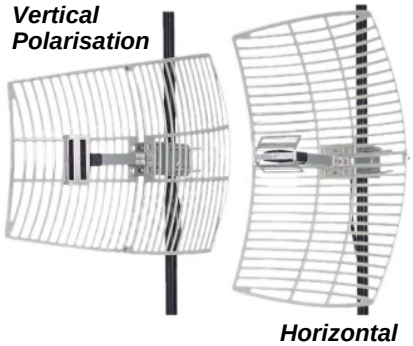
Here are some common building materials with their average attenuation:

Office window:	3dB
Plasterboard wall:	3dB
Block wall:	4dB
Glass wall with metal frame:	6dB
Metal door:	6dB
Metal door in brick wall:	12.4dB

Keep your access point 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 will 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. For vertical polarisation on Intech parabolic antennas; make sure the grid and dipole are running vertically as pictured.



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 the Z-2400 Series, an additional interposing remote can be used in between as a repeater (particularly good when transmitting through solid walls).

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 Wireless Nodes, Bracket Kit and Enclosure.

MODEL	DESCRIPTION	
Z-2400-A2IO	Z-2400-A2I Analogue/Digital Input Remote and Z-2400-A2O Analogue/Digital Output Base. Supplied as a Paired Kit. (PSW-10-F power supply required.)	
Z-2400-TCP-T	Z-2400-TCP-T Turbo Base Node with Ethernet TCP/IP communications. (Plug pack *power supply included.*)	
Z-2400-RB-T	Z-2400-RB-T Turbo Base or Remote Node with RS485, 422 or 232 communications. (Plug pack *power supply included.*)	
Z-2400-A2I	Z-2400-A2I Analogue/Digital Input Remote Node (Set to MicroScan Mode). (PSW-10-F power supply required.)	
Z-2400-SLEEPER	Z-2400-SLEEPER is a Battery Powered Analogue Input Node for Remote Applications. (Power supply not included.)	
ZB-BKT01	Bracket Kit for Z-2400 Indoor Antennas (*Supplied Whip or the 5.5dBi*). • 1m of low loss cable and bulkhead attachment included. • Additional RP-SMA Adapter Required for Z-2400-A2 Series. *Indoor use only.*	
NEMA-4X-1	Weatherproof NEMA 4X Enclosure Supplied with Pole Mounting Brackets. (Antenna not included.)	
ZB-P-45	0.2 metre, short length coax extension lead with bulkhead fitting. To be used with the Z-2400-A2 series with RP-SMA connection. Ideal for mounting the supplied antenna on the outside of a cabinet. *Indoor use only.*	
ZB-P-56	0.3 metre, short length coax extension lead with bulkhead fitting. To be used with the Z-2400 MicroScan series with SMA connection. Ideal for mounting the supplied antenna on the outside of a cabinet. *Indoor use only.*	

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