

Intech Wireless Antennas

for MicroScan Data and Discrete Analogue Connections

RoHS
Compliant



Installation Guide.

Wireless Antennas Installation Guide Index.

Description.	Page 3
Features.	Page 3
Ordering Information.	Page 3
2.4GHz 5.5dBi Rubber Duck Indoor Antenna.	Page 3
2.4GHz 3dBi Omni Directional Whip Antenna.	Page 4
2.4GHz 8dBi Omni Directional Monopole Antenna.	Page 4
2.4GHz 12dBi Mini Directional Antenna.	Page 5
2.4GHz 19dBi Directional Parabolic Grid Antenna.	Page 5
Placement Considerations.	Page 6
Environment.	Page 6
Visual vs. RF Line-of-Sight.	Page 6
Visual LOS.	Page 6
RF LOS.	Page 6
Fresnel Zone.	Page 6
Antenna Gain Versus Beam Widths.	Page 6
Getting the most out of your Wireless Network.	Page 7
Attenuation.	Page 7
Antenna Polarisation.	Page 7
Good Signal Can't be Guaranteed.	Page 7
Important.	Page 7
Intech Wireless Nodes, Bracket Kit and Enclosure.	Page 8

Product Liability. This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification. Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.

Warning: These products are not designed for use in, and should not be used for patient connected applications. In any critical installation an independent fail-safe back-up system must always be implemented.

Description.

The Intech wireless antennas are intended be used in conjunction with either the 2.4GHz Z-2400 Zigbee[®] Wireless Nodes, or the 2.4GHz Tel-Link Radio Modems. Intech provides a range of antennas to cover applications where the range of the radio signal requires extra gain.

Features.

- Antennas which can suit either Z-2400 or Tel-Link RF modules.
- Directional and Omni Directional Antennas.
- Easy to Install.

Ordering Information.

Z-2400-A2 Antennas:

- ZA-OD24-5** - 2.4GHz 5.5dBi Rubber Duck Indoor Antenna.
- ZA-OD24-3** - 2.4GHz 3dBi Omni Directional Whip Antenna.
- ZA-OD24-8** - 2.4GHz 8dbi Omni Directional Monopole.
- ZA-MD24-12** - 2.4GHz 12dBi Mini Directional Antenna.
- ZA-PG24-19** - 2.4GHz 19dBi Directional Parabolic Grid.

Z-2400 MicroScan Antennas:

- ZB-OD24-5** - 2.4GHz 5.5dBi Rubber Duck Indoor Antenna.
- ZB-OD24-3** - 2.4GHz 3dBi Omni Directional Whip Antenna.
- ZB-OD24-8** - 2.4GHz 8dbi Omni Directional Monopole.
- ZB-MD24-12** - 2.4GHz 12dBi Mini Directional Antenna.
- ZB-PG24-19** - 2.4GHz 19dBi Directional Parabolic Grid.

Tel-Link Antennas:

- TL-OD24-8** - 2.4GHz 8dbi Omni Directional Monopole.
- TL-MD24-12** - 2.4GHz 12dBi Mini Directional Antenna.
- TL-PG24-19** - 2.4GHz 19dBi Directional Parabolic Grid.

2.4GHz 5.5dBi Rubber Duck Indoor Antenna.

The 5.5dBi Rubber Duck antenna is to be used in conjunction with the **Z-2400 wireless nodes only**. This antenna was added to the antenna range as a simple upgrade option, featuring 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.
VSWR	<2.0.
Impedance	50Ω.
Connector Type	RP-SMA (SMA Adapter Included for ZB-OD24-5).
Operating Temperature	-40°~60°C.
Compliance	RoHS, CE.
Dimensions	H=208mm, MaxØ=13mm.



2.4GHz 3dBi Omni Directional Whip Antenna.

The 2.4GHz 3dBi Whip antenna is designed for outdoor short range, Mesh or point to point wireless communications. This antenna features an integral N-Male type connector that mounts directly to the supplied N-Female bulkhead and coax lead (ZA-OD24-3 = 0.5m or ZB-OD24-3 = 0.3m). This allows the antenna to be mounted almost anywhere with minimal hassle.

Specifications:

Frequency Range	2400~2500MHz
Gain	7dBi
Vertical Beam Width	32°
Horizontal Beam Width	360°
Polarisation	Vertical
VSWR	<2.0
Connector Type	N-Male.
Impedance	50Ω
Operating Temperature	-40°~85°C
Compliance	RoHS.
Dimensions	H=159mm, Ø=20mm



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.
VSWR	1.5:1.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~85°C.
Pole Size	25~50mm.
Wind Speed	240Km/hr Max
Compliance	RoHS, CE
Dimensions	H=500mm, BaseØ=32mm, RadomeØ=19mm



Supplied with:

- 3, 5 or 6 metre low loss coax cable. (ZA antennas = 3m N-Male to RP-SMA Male, ZB antennas = 6m N-Male to SMA Male, TL antennas = 5m N-Male to RP-TNC Male. 10m coax upgrade is available.)
- Coax-Seal Hand Mouldable Plastic.
- Mounting Brackets. (Additional bracket type available.)



15dBi omni-directional model is also available.

2.4GHz 12dBi Mini Directional Antenna.

This very compact panel antenna provides 12dBi gain with very broad coverage, suitable for both indoor and outdoor applications. Designed for all weather operation, this antenna features drain holes in the radome to help prevent moisture build-up inside the antenna. The mini directional antenna is supplied with a tilt and swivel mast mount kit. This allows the antenna to be positioned for optimal performance, which can be adjusted up or down from 0~30°.

Specifications:

Frequency Range	2400~2500MHz.
Gain	12dBi.
Vertical Beam Width	34°.
Horizontal Beam Width	65°.
Polarisation	Vertical or Horizontal.
VSWR	1.5:1.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~70°C.
Pole Size	26~43mm.
Bracket Tilt	±30°.
Wind Speed	240Km/hr Max.
Compliance	RoHS, CE
Dimensions	W=102mm, H=102mm, D=102mm.



Supplied with:

- 3, 5 or 6 metre low loss coax cable. (ZA antennas = 3m N-Male to RP-SMA Male, ZB antennas = 6m N-Male to SMA Male, TL antennas = 5m N-Male to RP-TNC Male. 10m coax upgrade is available.)
- Coax-Seal Hand Mouldable Plastic.
- Mounting Brackets.

2.4GHz 19dBi Directional Parabolic Grid Antenna.

The 2.4GHz Parabolic Antenna is design for outdoor long range Point to Point wireless communications. Utilising a patented parabolic grid design with a patented high performance dipole feed. The antennas are constructed of welded steel wires which are galvanized and then powder coat painted with a light grey epoxy paint. The wire grid semi-parabolic design offers unsurpassed low wind loading while maintaining good RF performance. The compact low visual impact attractive styling blends well in almost any application. Mounting is simplified with the adjustable system made of galvanized steel with stainless steel hardware.

Specifications:

Frequency Range	2400~2485MHz.
Gain	19dBi.
Vertical Beam Width	11°.
Horizontal Beam Width	17°.
Polarisation	Vertical or Horizontal.
VSWR	1.5:1.
Connector Type	N-Female.
Impedance	50Ω.
Operating Temperature	-40°~70°C.
Pole Size	25~50mm.
Bracket Tilt	45°.
Wind Speed	200Km/hr Max.
Compliance	RoHS.
Dimensions	W=610mm, H=419mm.



Supplied with:

- 3, 5 or 6 metre low loss coax cable. (ZA antennas = 3m N-Male to RP-SMA Male, ZB antennas = 6m N-Male to SMA Male, TL antennas = 5m N-Male to RP-TNC Male. 10m coax upgrade is available.)
- Coax-Seal Hand Mouldable Plastic.
- Mounting Brackets.

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.

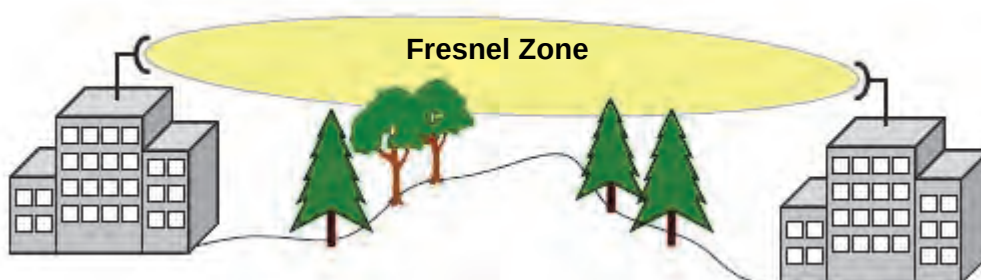
Environment.

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 far above the ground and other obstacles the antennas need to be is determined by the diameter of the Fresnel zone. The diameter of the Fresnel zone depends upon the frequency and distances between the two radios.

Various estimate data points at 2.4GHz are given below:

Range Distance	Fresnel Diameter
400 m	3.5m
900 m	5.3m
1.5 km	6.8m
3 km	9.7m
5 km	12.5m
10 km	17.7m
15 km	21.7m

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 Width.

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 = 360°)
4dBi	=	50°
6dBi	=	28°
8dBi	=	15°
15dBi	=	8°

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	=	17° ~	21°
19dBi	=	11° ~	17°
24dBi	=	8° ~	10°

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 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, and 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 at both ends. For vertical polarisation on Intech parabolic antennas; make sure the grid is running vertically.

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 ZB & TL 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.	
Z-2400-TCP-T	Z-2400-TCP-T Turbo Base Node with Ethernet TCP/IP communications. (Power supply included.)	
Z-2400-RB-T	Z-2400-RB-T Turbo Base or Remote Node with RS485, 422 or 232 communications. (Power supply included.)	
Z-2400-A2I	Z-2400-A2I Analogue/Digital Input Remote Node (Set as MicroScan Mode).	
Z-2400-SLEEPER	Z-2400-SLEEPER is Battery Powered Analogue Input Node for Remote Applications.	
TL-485O-24	RS485/422 Outdoor Radio Modem, supplied with Outdoor 3dBi Whip Antenna, 2m Data Cable and Stainless Steel Bracket and U-bolts. (Power supply requirements: 12Vdc @ 300mA.)	
ZB-BKT01	Bracket Kit for Z-2400 Indoor Antennas. (not to be used with ZB-OD24-8.) (1m of low loss cable and bulkhead attachment included.)	
NEMA-4X-1	Weatherproof NEMA 4X Enclosure Supplied with Pole Mounting Brackets.	

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