WBS-700 Mhz

Outdoor Wi-Fi Base Station

Installation Guide

Rev. 1

September   2010

Copyright Notice

FCC Notice to Users and Operators

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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by using one of the following measures:

- Reorient or relocate the receiving antenna.

- Increase separation between the equipment and receiver.

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

- Consult the dealer or an experienced radio/TV technician.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Contents

About This Guide

Preface

This guide details the Wavion WBS-700 installation procedures. The intended audience of this document is trained technical professionals.

Conventions

The exclamation point within a triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product.

The lightning flash with an arrowhead symbol within a triangle is intended to alert the user to the presence of uninsulated dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The notebook is intended to alert the user of a note containing further information.

Contacting Technical Support

For technical support, contact Wavion using these methods:

Address:	Wavion Technical Support Wavion 5 Hamada Street, PO BOX 580 Yoqneam Illit, 20692 Israel
Telephone:	+972-4-9097343
Fax:	+972-4-9097322
Email:	support@wavionnetworks.com
Web:	www.wavionnetworks.com

Chapter 2

Introduction

WBS-700 a high capacity, IP services oriented Broadband Wireless access system.
WBS-700 is a new category of Broadband Wireless Base Station designed from the ground up for metro-Wi-Fi deployments. The system employs wireless packet switched data technology to support high-speed IP services including fast Internet and Virtual Private Networks. WBS-700 users are provided with a network connection that is always on, supporting immediate access to the Internet and other IP services at high data rates. The system is designed for cellular-like deployment, enabling the system architecture to vary in size and structure. A system can include any number of cells, each containing several base station access units for better coverage of densely populated areas.

It is based on six antennas and radios and custom-built ASICs, utilizing Wavion's powerful multi-antenna signal processing technologies, and provides significant performance gains to off-the-shelf 802.11 standards-based clients.

The WBS-700 may be mounted on streetlights or rooftops and may be easily interfaced with wired internet connections, wireless mesh or backhaul equipment.

Complete management of the WBS-700 is provided through SNMP, a graphical user interface, and SYSLOG services.

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Chapter 3

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Package Content

Check that the package contains:

Qty	Description
1	WBS-700 outdoor unit with connections to external antennas
6	N-type to N-type RF cables
6	Antennas
2	CLAMPS 46-125 X 14 MM STST
1	POST CLAMP
1	Safety cable
1	POE injector unit with wall mounting kit
1	AC PLUG, US
24	Screws 10-32 X 1/2" SOCKET CAP SCREW
24	Lock Washers
24	FLAT Washers
1	LN tool , 4mm Allen wrench
	Sealing tape SCOTCH 130C

Additional Equipment and Tools required for Installation
- Ethernet cable (straight for connecting to a hub/switch)
- Crimping tool for RJ-45 connectors.
- Ground cable with an appropriate termination.
- Mains plug adapter or termination plug (if the power plug on the supplied AC power cord does not fit local power outlets).
- Portable PC with Ethernet card and Telnet software and a straight Ethernet cable.

WARNING: Use straight Ethernet (POE) cable connecting the injector to WBS-700 in order to have all the features work properly (reset button and Link LED). Using cross cable might cause turn Link led to "ON" permanently and also may be the cause software reset. DATA cable connecting the injector to the network can be cross cable as well.

- Addition tools and materials, including appropriate means (e.g. a pole) for installing the outdoor equipment.
- 1/4-inch flat blade screwdriver

WARNING: ONLY experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas. Failure to do so may void the WBS-700 product warranty and may expose the end user or Service Provider to legal and financial liabilities. Wavion and its resellers or distributors are not liable for injury, damage or regulation violations associated with the installation of Outdoor Units or antennas

Installing the Wavion WBS-700 Metro Base Station

This guide explains how to safely install the Wavion WBS-700 Metro Base Station. The following topics are covered in this chapter:

- Important Safety Instructions
- Preparing for Installation
- Mounting Strategies
- Using Hose Clamps
- Mounting on a Pole
- Grounding the Wavion WBS-700
- Connecting Antennas
- Connecting Power and Data
- Safety Information for the Wavion WBS-700
- Service Instructions

Important Safety Instructions

WARNING: It is illegal to modify the construction of this product. Modifying the operating frequency or enhancing the transmit output power through the use of external amplifiers or other equipment is specifically disallowed by the "Telecommunications Act."

WARNING: This device is for outdoor or indoor use with conditions that no harmful interference to authorized radio stations results from the operation of this device. This device shall not influence aircraft security and/or interfere with legal communications as defined in the "Telecommunications Act." If this device is found to cause interference, the operator of this equipment shall cease operating this device immediately until no interference is achieved.

Note: This device must be installed by a trained professional, value added reseller or systems integrator who is familiar with RF planning issues and the regulatory limits in the United States of America.

Caution: Read and save these instructions. Heed all warnings. Follow all instructions.
Do not defeat the safety purpose of the grounding.
Caution: Only use attachments/accessories specified by the manufacturer.

Caution: Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way. For example, if the power-supply cord or plug is damaged, liquid has been spilled on the apparatus, objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, it does not operate normally, or has been dropped.

Warning: Risk of personal injury or death when installing this device! There is a risk of personal injury or death if the WBS-700 antennas come near electric power lines. Carefully read and follow all instructions in this manual. By nature of the installation, you may be exposed to hazardous environments and high voltage. Use caution when installing the outdoor system.

Warning: This apparatus must be connected to earth ground

Warning: Do not open the unit. There is a risk of electric shock inside.

Caution: You are cautioned that any change or modification not expressly approved
in this manual could void your authority to operate this equipment.

Caution: There are no user-serviceable parts inside. All service must be performed by qualified personnel.

Caution Only UL listed parts and components will be used for installation. Use UL listed devices having an environmental rating equal to or better than the enclosure rating to close all unfilled openings.

Caution To maintain Overvoltage (Installation) Category II, install a suitable surge suppressor device in the branch circuit to limit expected transients to Overvoltage Category II values. The limits are based on IEC60664 and are also located in Table 2H of UL60950 (for mains 110V, the transient rating is 1500V).

Caution The WBS-700 must be installed only with the equipped antennas.

Caution A minimum distance of 46 cm from the WBS-700 antenna should be kept when the system is operated.

Caution Read and save these instructions. Heed all warnings. Follow all instructions

Preparing for Installation

ONLY experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas.

The following lists the equipment required for installation and explains how to prepare the installation site.

WARNING: Do not modify the construction of this product. Modifying the operating frequency or enhancing the transmit output power through the use of external amplifiers or other equipment is illegal.

WARNING This device is for use outdoors or indoors on the condition that operation of this device causes no harmful interference to authorized radio stations. This device shall not influence aircraft security and/or interfere with legal communications. If this device is found to cause interference, the operator of this equipment shall cease operating this device immediately.

Choosing a Location

To ensure the optimal performance select the locations for the equipment using the following guidelines:

- The antenna (not-integrated on the front panel of the outdoor unit) should provide a direct, or near line of sight, with the sector location that need to be covered.
- The antenna should be aligned to face the CPEs that aim to be in service, higher the placement of the antenna, the better the achievable link quality (but not in all cases).
- Average rooftop (depend on the topology of the location) should be
- The location of the outdoor unit should enable easy access to the unit for installation and testing
- Avoid installations in locations that devices operating in the same frequency range.
- The outdoor unit should be installed at the highest point of a metal pole that there will be no interference caused by RF reflections. If this is not possible, it should be installed at least 3 meters from the metal pole.

- It is recommended to use maximum distance possible from an RF radiating source.

Preparing the Site

1. Follow the appropriate electrical and building codes to ensure safe and durable wiring.

2. Follow the National Electrical Code (NEC) requirements, unless local codes in your area take precedence over the NEC code

3. The length of the indoor-to-outdoor Ethernet cable should not exceed 90 meters. The length of the Ethernet cable connecting the indoor unit to the user's equipment, together with the length of the Indoor-to-Outdoor cable, should not exceed 40 meters.

4. An appropriate ground cable should be available. Connect a grounding cable between the Ground terminal of the outdoor unit and a good ground connection.

Please refer to standards for building entrance protection.

Mounting Strategies

Consider the available mounting structures and antenna clearance when choosing a mounting location. Wavion outdoor unit WBS-700 should always be mounted with the top of the unit parallel to the ground, and with the antennas pointing upward and clear of obstruction.

It is recommended to attach ground and data cables to the WBS-700 prior to mounting. Before mounting the WBS-700, read the wiring instructions in Grounding the Wavion WBS-700 and Connecting Power and Data.

> Note: The WBS-700 should be mounted with at least 4 ft/3 Meter of clearance around the antennas to eliminate potential interference from the mounting structure.
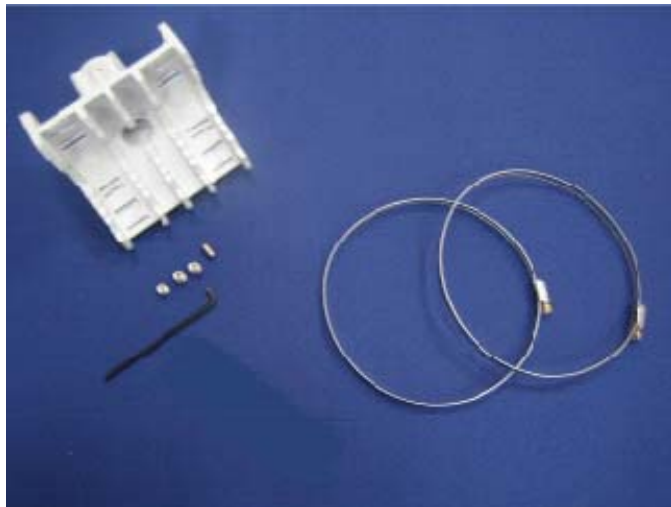

Figure 4.1   Pole mounting kit for the Outdoor Unit & Sealing kit

Using Hose Clamps

Special hose clamps that include threaded holes are used by the mounting assembly to secure the WBS-700 to the mounting structure. Figure 4.2 demonstrate how to correctly use the hose clamps. The bands must be threaded through holes in the post clamp, and then attached to either a vertical or a horizontal pole and tightened.

There are two pairs of threaded holes on the back of the unit, enabling to use the special clamps for mounting the unit on diverse pole diameters.
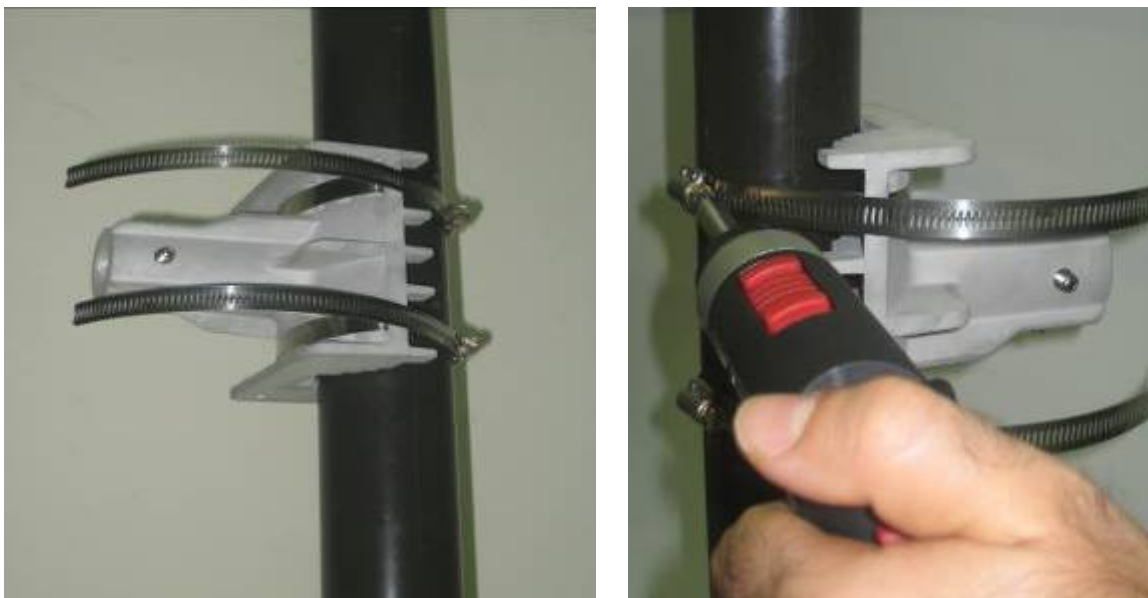

Figure 4.2   Using Special Hose Clamps & Screwing the Clamps

Mounting on a Pole/Streetlight

WBS-700 can be mounted on a pole, tower, or streetlight. It is recommended to mount the WBS-700 on aluminum or galvanized steel structures.

> **Note** The Wavion WBS-700 must be mounted with the top of the unit parallel with the ground and with the antennas pointing upward.
>
> **Note** Before mounting the WBS-700, read the wiring instructions in Grounding the Wavion WBS-700 and Connecting a Data Port chapter.

Metal/Wood/Streetlight Pole Mounting

Figure 4.3 illustrate how to mount an WBS-700 unit on a pole, using the clamp on an outdoor metal pole.

Metal pole installation requires that the antennas are higher than the top of the pole

Figure 4.3   Mounting on a Metal Pole

> **Warning**: Metal pole installation requires that the antennas are higher than the top of the pole.

> **Note** Antennas must be higher than the top of the metal pole and clear of any obstructions
>
> **Note** Mounting to wood, concrete, or painted poles requires primary grounding for the unit. Check the national electrical codes in your area for specific rules.

To mount the Wavion WBS-700 on a metal/wood/streetlight pole:

1. Choose a mounting location. You can attach the WBS-700 outdoor unit to any pole or pipe with diameter of 3-10 inches. Wooden poles of larger diameter require different types of clamps (any streetlight arm with diameter of 3 to 10 inches will fit for this installation).

2. Slip the bands of the hose clamps through the slots of the post clamp

3. Use the hose clamps to fasten the post clamp to the pole.

4. Insert the WBS-700 into the post clamp.

Figure 4.4   Insert the WBS-700 into the post clamp

5. Attach safety cable to protect installed unit

Figure 4.5   Attached Safety Cable

6. Use a torque wrench click type or digital set to 10 ft-lb, put a layer of loctite 242 type on the screws surface and torque all 4 screws. Re- torque to 15 ft-lb

Figure 4.6   Use a torque wrench click

Note: The WBS-700 unit must be parallel to the ground. The unit can be rotated to obtain the correct position.

Note Installations on large wooden poles require band clamps such as those supplied by Panduit, www.panduit.com. Such a product is listed as "Metal, Locking Tie Extra Heavy Duty 304 Stainless Steel". The tie and the installation tool are shown below
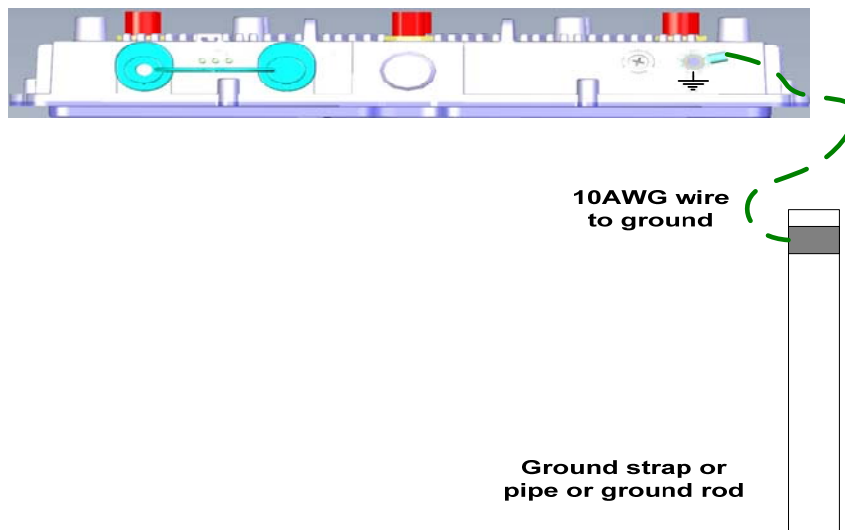
7. Grounding WBS-700.

Figure 4.7   Grounding Method

⚠	Caution: You must always install an external grounding wire. You must also ground the outdoor data protection device to a ground rod or a bonded pipe. Make sure you have completed grounding before you connect power to the WBS-700.

⚡	Warning: Transient or electrostatic discharges that may occur at the WBS-700, for example a lightning strike, may damage your network equipment connected to the WBS-700 and cause personnel injury or death of persons touching the exposed metal connectors of the equipment. You must install a properly grounded lightning surge protector. Carefully follow the installation instructions provided by the manufacturer of the protection device.

To ground the Wavion WBS-700:

The Grounding screw is located on the side panel of the outdoor unit.
To connect the grounding cable:

1. Connect one end of a grounding cable to the grounding terminal and tighten the grounding screw firmly.

    Do the following steps:

    a. Remove the nut and star washers from the grounding screw.

    b. Attach one star washer to the grounding screw.

    c. Attach #10 AWG bare copper wires with an M6 terminal ring to the grounding screw.

    d. Attach the second star washer and tighten the nut.

2. Connect the other end of the grounding cable to a good ground (earth) connection. (For example, a grounding rod).

Figure 4.8   Grounding

Grounding the Data Protection Device

The grounding method for an indoor data protection device is shown in Figure 4.9.

To ground an indoor data protection device:

1. Position the protection device as close to the building entrance as possible.

2. Attach a length of #10 AWG bare copper wires to the ground post on the data protection device.

3. Attach the other end of the grounding wire to the ground connection of an electrical outlet or a grounded water pipe.
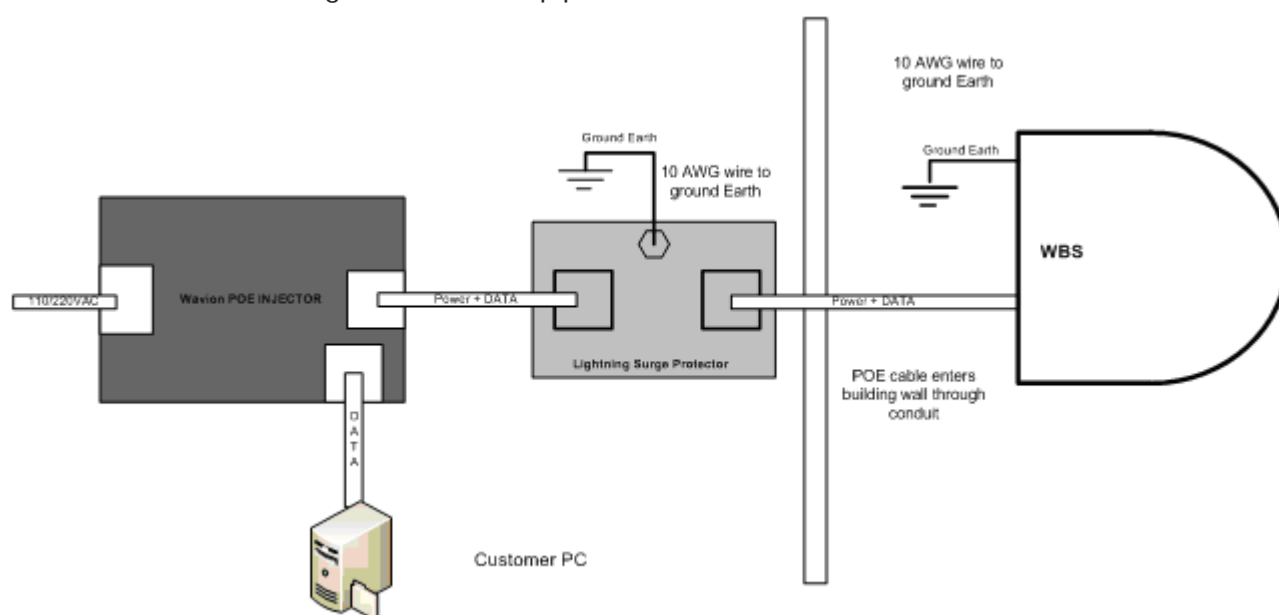

Figure 4.9   Grounding indoor injector by Network Protection Unit
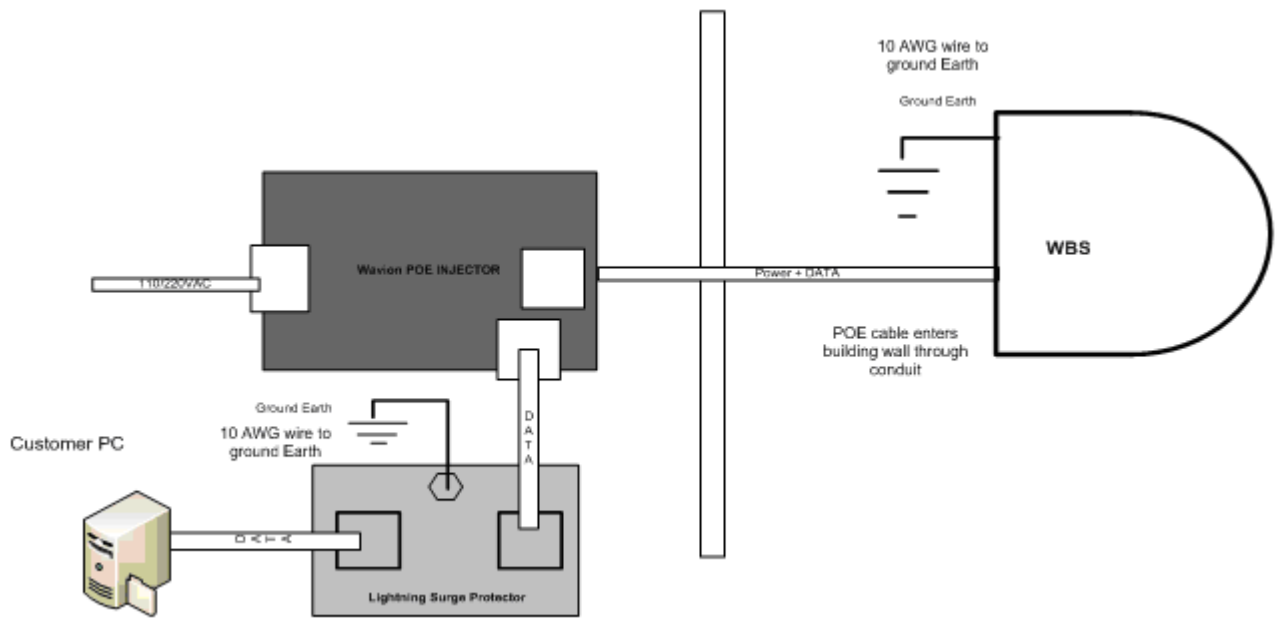
Figure 4.10   Grounding injector that located outdoor by Network Protection Unit

Connecting Antennas

This section explains how to connect the six antennas to the WBS-700X. In order for the WBS-700 to work properly, six antennas must be connected.

Use 6 RF cables to connect all 6 Antennas to the unit body. Each RF cable has two sides with right angle and straight N-type connectors.

Connect straight N-type to the antenna and right angle N-type to the unit body.

Figure 4.11   Connecting straight N-Type connector to the antenna

Figure 4.12   Connecting right angle N-Type connector to the antenna
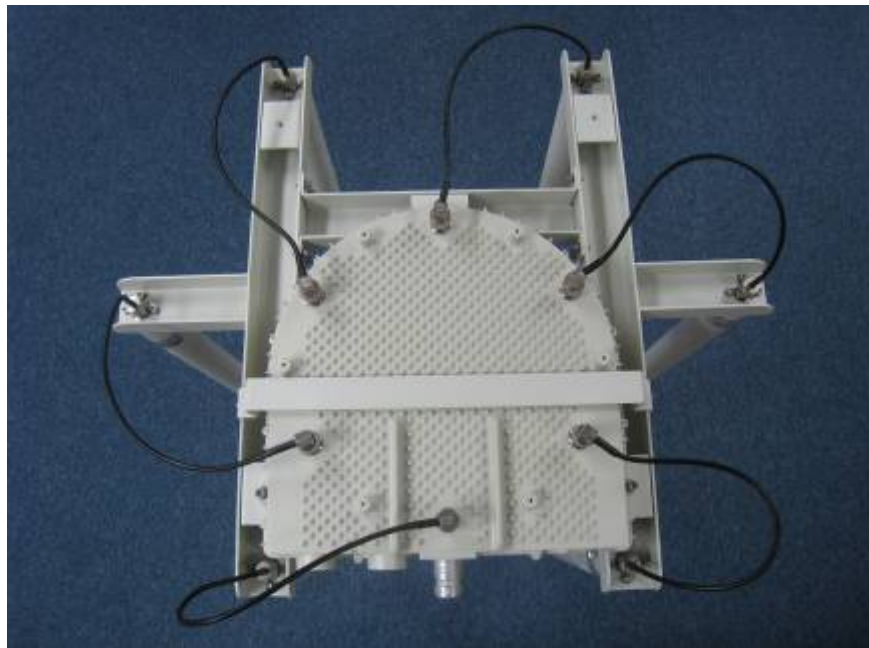
Figure 4.13   Connecting 6 antennas

WARNING: Only connect the unit to the power supply once all the antennas are connected.

WARNING: Use caution when connecting the antennas. Undue haste can damage the unit.

WARNING: Do not screw in the antenna when holding the top section of the antenna. You will most likely damage the antenna.

WARNING: The installation should be done after connecting the antennas. After installation, the user should connect the antennas.

Antenna Sealing

The following describes antenna sealing procedure

⚠️	Caution: It is important to read carefully this procedure and perform all its steps to ensure maximal moisture protection.

Sealing Technique:

After the antenna is connected, use isolation material to cover the N-Type connectors

Apply the tape with tacky side up on the antenna and N-Type connector.
Stretch and lapped sealing tape to form smooth, void-free splice

Figure 4.14   Antenna sealing

Connecting Power and DATA

The following describes how to apply power and data to the WBS-700

⚠️ Caution: You must always install an external grounding wire. Perform a simple continuity check between the WBS-700and the ground termination point to confirm. You must also ground the outdoor data protection device to a ground rod or a bonded pipe. Make sure you have completed grounding before you connect power to the WBS-700.

The Wavion WBS-700 is equipped with two RJ45 connectors. The right hand port named "TEST" is for engineering use. Use the ETH port to connect data and power cable.
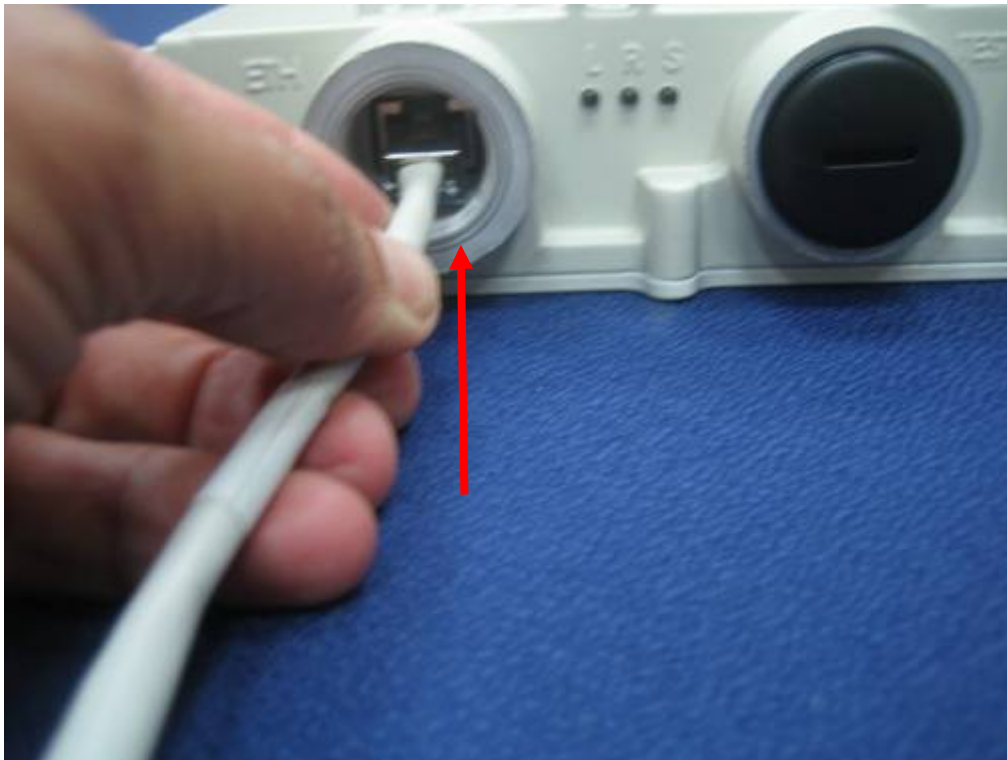

Figure 4.15   Connecting PoE cable

⚡ WARNING: The port named "TEST" is for engineering use only. **In any case do not connect PoE source to "TEST" port (!)**

WARNING: The shields of the Cat5 cable must be properly terminated and bonded to the unit and to the protective earth (PE) at the building entrance. This provides protection against the risk of fire, electrical hazard and ensures the reliable operation of this equipment.

Note: National Electrical Codes (NEC) Article 800 requires the use of an Agency Listed (UL/CSA) Building Entrance Protector for all power and communications cables entering a building. Article 800 is intended to protect the building and occupants from fires caused by transient voltage and current surges.

Note: This is not a mid-span powered device. Do not attempt to daisy-chain Power Over Ethernet devices.

When connecting to the Ethernet port, if you need to terminate the Ethernet cable, use a standard RJ45 termination. Use a shielded RJ45 plug and be sure to connect the shield of the Ethernet cable to the shield of the RJ 45 plug.

To connect to the data port:

1. Make sure that the power is turned off for the designated circuits.

2. Run shielded Category 5 Ethernet cable appropriates for outdoor use from a POE injector to the Wavion WBS-700 through the lightning protection device. See "Grounding the Data protection device" section for connection diagram.

3. Connect one end of the Category 5 cable to the "RADIO" port of the Wavion POE injector.

4. Unscrew the plastic cap and the cap cover from the Wavion WBS-700.

5. Thread the Ethernet cable through the cap cover and the cap.

6. Connect the other cable end to ETH port on the WBS-700. Use a shielded RJ45 8-pin modular plug to terminate the cables at the desired lengths

7. After connecting the Ethernet cable to the "ETH" port screw the plastic cap, make sure it is well tighten.

8. Screw the cap cover to ensure perfect sealing. It will ensure IP-67 compliance.

9. "Test" port: The test port must be sealed with the provided plastic cap., make sure it is attached properly.

Step 1

Step 2

Step 1 and Step 2: Unscrew the plastic cap and the cap cover. Thread the Ethernet cable through the cap cover and the cap. Connect the Ethernet cable to the "ETH" port.

Step 3

Step 4

Step 3 and Step 4: Screw the plastic cap; make sure it is well tightening. Furthermore screw the cap cover to ensure perfect sealing. It will ensure IP-67 compliance.

Figure 4.16   Steps to connect the Ethernet cable.

POE port RJ45 Pin Descriptions

Pin	T/R	Signal	Color	Description
1	T	TXD+	Orange-White	TX Data 10/100BaseT
2	R	TXD-	Orange	TX Data 10/100BaseT
3	T	RXD+	Green-White	RX Data 10/100BaseT
4	R	PoE+	Blue	Power input, 55 VDC (+)
5	T	PoE+	Blue-White	Power input, 55 VDC (+)
6	R	RXD-	Green	RX Data 10/100BaseT
7	T	PoE-	Brown-White	Power input, 55 VDC (-)
8	R	PoE-	Brown	Power input, 55 VDC (-)

Safety Information for the Wavion WBS-700

The Federal Communications Commission (FCC) with its action in ET Docket 96-8 has adopted a safety standard for human exposure to RF electromagnetic energy emitted by FCC certified equipment. Proper operation of the Wavion WBS-700according to the instructions found in this manual, results in user exposure that is substantially below the FCC recommended limits.

Follow these guidelines to ensure safe operation of the Wavion WBS-700:

- Do not touch or move the antennas while the unit is transmitting or receiving.

- Make sure the antennas are connected when operating the radio or attempting to transmit data, otherwise, the radio may be damaged.

- Do not hold the antenna to be close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.

- The use of wireless devices on airplanes is governed by the Federal Aviation Administration (FAA).

- The use of wireless devices in hazardous locations is limited to the constraints posed by the safety directors of such environments.

- The use of wireless devices in hospitals is restricted to the limits set forth by each hospital.

- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment.

- The Wavion WBS-700 must be used only with Wavion approved components and antennas.

- Use safety cable to protect installed unit

Service Instructions

The Wavion WBS-700 contains no user serviceable parts inside.

Product Specification WBS-700

The tables in this chapter contain specifications for the Wavion WBS-700.

Physical Specifications	
Network Interfaces	• Auto-sensing 10/100 Ethernet • Input from Wavion Injector
Power Input	• Power from a Wavion POE Injector.
Indicator Lights	• Ethernet port LED Link/Act indicator • System Status LED indicator • RF channel status indicator
Physical Dimensions	• Antenna Array Diameter: 650mm • Antenna Height: 1120mm • Weight: 9.8kg (with post clamp ,with antenna)

Power Specifications	
Power Input	• 55VDC, supplied over Ethernet from Wavion injector.
Input Power Consumption	• Power from Wavion Injector max.0.9A @ 55VDC • Power consumption may vary for the different part numbers – maximum will be 50W.

Environmental Specifications

Operating Temperature Range	-40°C to +55°C (without sun shield) -40°C to +60°C (with sun shield)
Storage Temperature Range	-45°C to +85°C
Weather Rating	IP67
Wind Survivability	165 mph
Salt and Fog Rust Resistance	MIL-STD-810F 509.4
Shock and Vibration	ESTI 300-192-4 spec T41.E
Transportation	ISTA2A

Approvals

RF	FCC CFR 47 part 27
Safety	TUVus EN 60950-1:2001+A11:2004 IEC 60950-1:2001 Second Edition Information Technology equipment – Safety – Part 1
EMC	FCC CFR 47 Part 15, Sub Part B, Class B (USA)

Installation Accessories

This chapter describes the accessories available for the WBS-700 and ordering information. The following topics are covered in this chapter:

- Ethernet Cables
- Lightning Protection
- Power Over Ethernet

Ethernet Cables

Description	Manufacturer	Part Number	Distributor	Contact Information
Outdoor CAT5e double jacket 4-pair data cable	Teldor	8393204101	G.Bares	Tel: +972-(4)-8215450

Lightning Protection

Description	Manufacturer	Part Number	Contact Information
Data protection device	Hyperlink	HGLN-CAT5-HP High Power CAT5 Lightning Protector	www.hyperlinktech.com

Power Over Ethernet

Description	Product Name	Part Number
Wavion Injector for powering the WBS-700 over an Ethernet cable. Output 55VDC, 1A.	WPI-AC-55W	27002213

Chapter 7

Wind Loading Considerations

This chapter describes wind loading considerations for the WBS-700.

> **Note:** It is recommended to evaluate the static and dynamic load bearing capabilities for each assembly and installation individually. It is your responsibility to evaluate the load bearing capabilities of the structure.

The Wavion WBS-700 weighs approximately 22 lbs, including all mounting hardware. When the Wavion WBS-700 is mounted on a pole, the sail area of the WBS-700 is approximately TBD square foot. The Wavion WBS-700 can load a pole with a maximum load of TBD Newton in wind conditions of 165mph.

Acronyms

Acronym	Description
2P	Two-Phase or Split Phase
2W	Two-Wire
3W	Three-Wire
AC	Alternating Current
ANSI	American National Standards Institute
AWG	American Wire Gauge
C	Celsius
CAT	Category
CCK	Complementary Code Keying
CFR	Code of Federal Regulations
CSA	Canadian Standard Association
dB	Decibels
dBi	Decibels Relative to an Isotropic Radiator
DBPSK	Differential-Binary Phase-Shift Keying
DC	Direct Current
DQPSK	Differential-Quadrature Phase-Shift Keying
DSSS	Direct-Sequence Spread Spectrum
EMC	Electromagnetic Compatibility
EN	IEC standard
ESD	Electrostatic Discharge
FCC	Federal Communications Commission
Hz	Hertz
HPoE	High Power over Ethernet
IEEE	Institute of Electrical and Electronics Engineers
IP67	Ingress Protection Standard
ISTA	International Safe Transit Association
LAN	Local Area Network
Mbps	Megabits Per Second

MHz	Megahertz
MIL-STD	Military Standard
N	Neutral
NEC	National Electrical Codes
NEMA	National Electrical Manufacturers Association
OFDM	Orthogonal Frequency Division Multiplexing
P	Phase
PE	Protective Earth
PoE	Power over Ethernet
RJ45	Registered Jack 45
RSS	Received Signal Strength
Rx	Receive
RXD	Receive Data
TUV	Technical Inspection Association
Tx	Transmit
TXD	Transmit Data
UL	Underwriters Laboratories
VAC	Voltage (Alternating Current)
VCCI	Voluntary Control Council for Interference
VDC	Voltage (Direct Current)
W	Watts