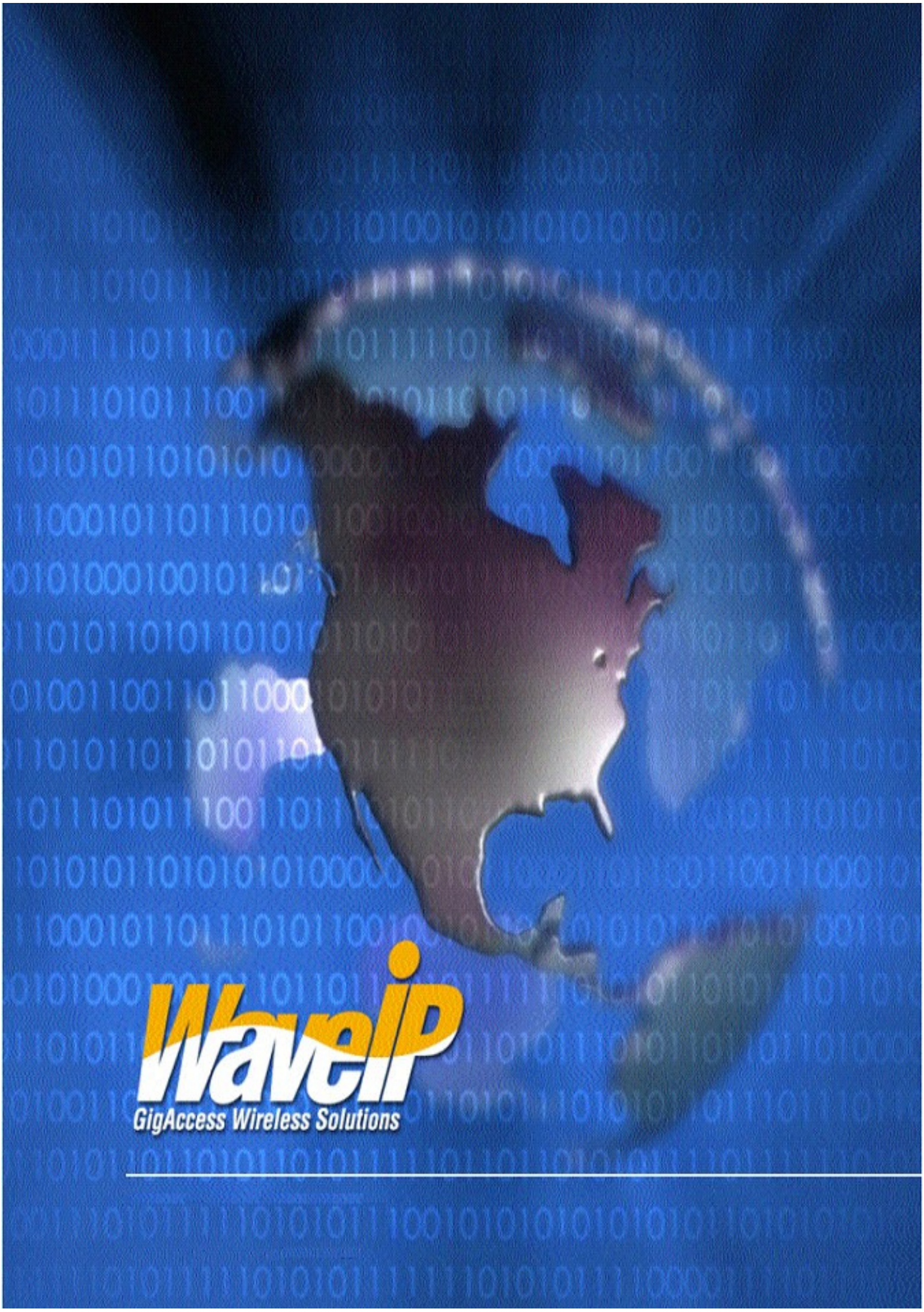
WaveIP
GigAccess Wireless Solutions

WipAir 6000/3000

Installation and Operation Instructions

October 2009

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Notices

Radio Frequency Statement

WipAir 6000/3000 has been tested and found to comply with part 15 of the FCC rules and EN 301 489-1 rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment notwithstanding use in commercial, business and industrial environments. 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.

IMPORTANT! It is the responsibility of the installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

IMPORTANT! Outdoor units and antennas should be installed ONLY by experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void the product warranty and may expose the end user or the service provider to legal and financial liabilities. WaveIP and its resellers or distributors of this equipment are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

R&TTE Declaration on Conformity

CE ⓘ Hereby, WaveIP Ltd, declares that WipAir 6000/3000 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. The declaration of conformity may be consulted through WaveIP Ltd., Teradion Industrial Park, Misgav 20179, Israel.

Compliance with European Union WEEE Directives

In January 2003, the European Union adopted an important environmental directive -- the Directive on Waste Electrical and Electronic Equipment (WEEE). It represents an important milestone in providing a safer environment for future generations.

The WEEE label and instructions for disposal are as follows:

Instructions for Disposal of Waste Equipment by Users in the European Union

This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact WaveIP.

Warranty

WaveIP warrants that this product shall be free from defects in workmanship and materials for a period of one year from the date of original purchase. If the product should fail to operate correctly in normal use during the warranty period, WaveIP will replace or repair it free of charge. No liability can be accepted for damage due to misuse or circumstances outside WaveIP's control. WaveIP will not be responsible for any loss, damage or injury arising directly or indirectly from the use of this product. WaveIP's total liability under the terms of this warranty shall in all circumstances be limited to the replacement value of this product.

If any difficulty is experienced in the installation or use of this product that you are unable to resolve, please contact WaveIP.

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1. Introduction

Thank you for purchasing WipAir 6000/3000 point-to-point solution. **WipAir 6000/3000** is a carrier grade, the best of its class point-to-point and Point-to-multipoint broadband wireless bridge. **WipAir 6000/3000** is the next generation of radio technology with field proven features of WipAirII. **WipAir 6000/3000** comprises of Reliability, High Capacity, Lowest Latency, RF Robustness, Rugged outdoor design, Flexibility and Simplicity to install and maintain.

1.1 Applications

Point-to-Point (PTP):

The basic subsystem is composed of a Master Unit (MU) and a Slave Unit (SU).

Typical applications:

- IP data backhaul of:
  - WiMAX operators
  - Metro WiFi Networks
  - Cellular and 3G
- Backhaul of video surveillance systems

Point-to-Multipoint (PTMP):

The basic subsystem is composed of the same Master Unit (MU) and multiple Slave Units (SUs). Typical applications:

- Multiple backhauls solutions
- Multiple Video surveillance systems
- High bandwidth campus solutions

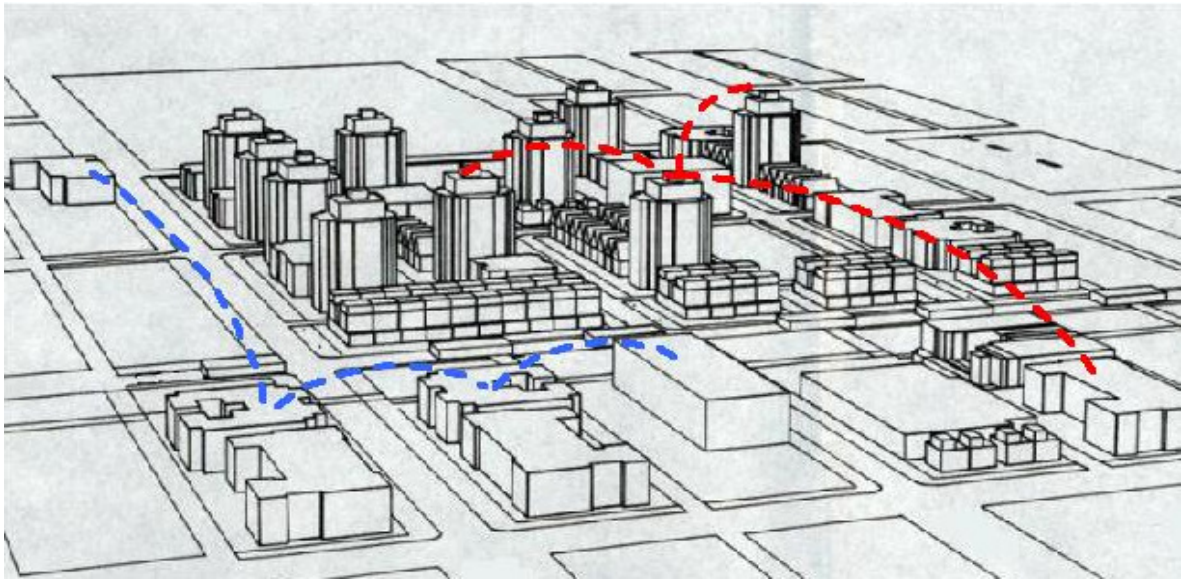

Figure 1-1: WipAir 6000/3000 PTP (blue) and PTMP (red)

1.2 Technical overview

WipAir 6000/3000 introduces unmatched benchmark of features and built in technological advantages:

- **Advanced OFDM 2x2 MIMO** - Utilizing superior Advanced OFDM 2x2 dual polarization MIMO (Multiple Input Multiple Output), WipAir 6000 provides cutting edge advantages:
  - Higher capacity and spectral efficiency - 100 Mbps full duplex. **2x2** MIMO transmits 2 streams that double the throughput on same channel bandwidth.
  - Long range - MIMO can deliver same throughput by transmitting 2 lower rate streams, achieving sustained throughput over long distances.
  - Increased reliability and availability - transmitting 2 lower rate streams provides higher fade margin, increasing reliability and link's availability.

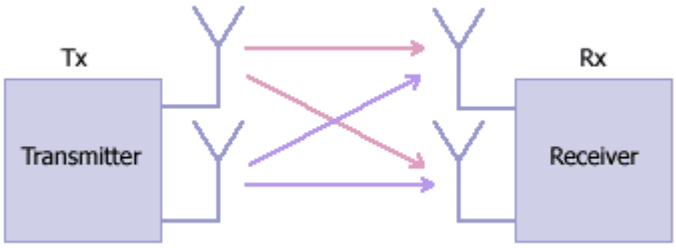

Figure 1-2: WipAir 6000 2x2 dual polarization MIMO

- **High capacity** – up to 100 Mbps full duplex net throughput.
- **Best latency** - 1msec typical (PTP). Ideal for backhaul, multi-hop backhauls and voice, video & interactive applications.
- **More than 50,000 PPS** (Packets Per Second) – ideal for VOIP backhaul applications
- **Superior 7.5 bit/Hz spectral efficiency** – 300 Mbps over 40 MHz channel via:
  - 2x2 dual polarization MIMO
  - Advanced OFDM:
    - Higher number of OFDM Subcarriers.
    - Reduced guard interval.
  - Forward Error Correction of 5/6 @ 64QAM
- **Symmetric / dynamic throughput** - up/downstream throughput can be symmetric or dynamic & automatic according to the actual traffic, optimizing the link to the application.

- **Output Power -** High dynamic range of **40 dB up to 26 dBm**.

- **Versatile radio** – increase flexibility and scalability:
  - Configurable channel bandwidth (5/10/20/40 MHz) maximizes capacity and availability.
  - Multiple frequency bands in one radio.

- **RF and interference robustness -** WipAir 6000/3000 introduces unique and robust interference mitigation mechanisms:
  - **Automatic Interference Sensibility** - proprietary solution that increases RF robustness by eliminating false receptions of noise thus maintaining constant throughput and latency. The automatic sensibility sets an Rx threshold above the noise level as shown in figure 3.
  - **ACM** - Adaptive Modulation and Coding (modulation can be defined manually as well).
  - **FEC** - Forward Error Correction, K = 1/2, 2/3, 3/4, 5/6.
  - **Fast ARQ** - Automatic Retransmit reQuest.

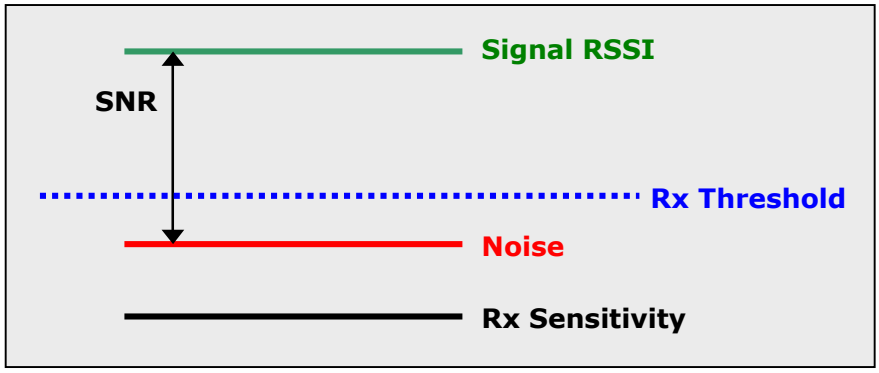

Figure 1-3: Automatic interference sensibility

- **128-bit AES encryption** – non-compromising security.

- **Networking and QoS** – built in QoS in both PTP and PTMP modes:
  - Bandwidth control – define maximum throughput for each direction (uplink and downlink) independently.
  - 8 priority queues – packets are classified according to TOS and VLAN priority into the queues (7 = highest priority and 0 = lowest priority).
  - Packet filtering: VLAN based and broadcast filters.
  - VLAN tagging/stripping per terminal.

- **Real time synchronization** - by GPS or internal. WipAir 6000/3000 built in time synchronization technology allows collocation of multiple MUs on the same tower and on collocated towers while reusing frequencies, eliminating self-interference between them.

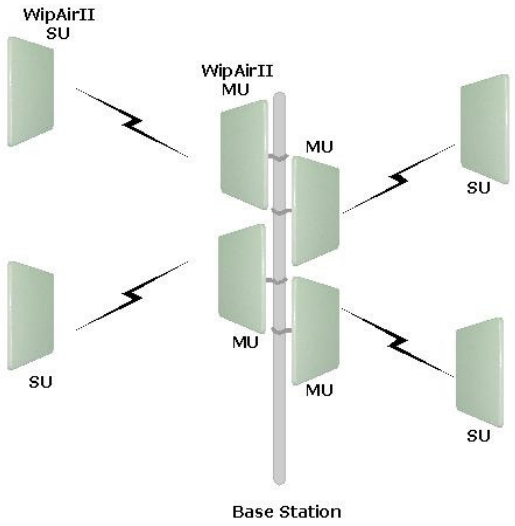

Figure 1-4: Multiple WipAir 6000/3000 MUs on one tower

Without time synchronization, one MU will transmit while the other MU receives. The transmittion of the first MU will block the reception of the second MU since they are close to each other (can even occur when the MUs are on different channels).

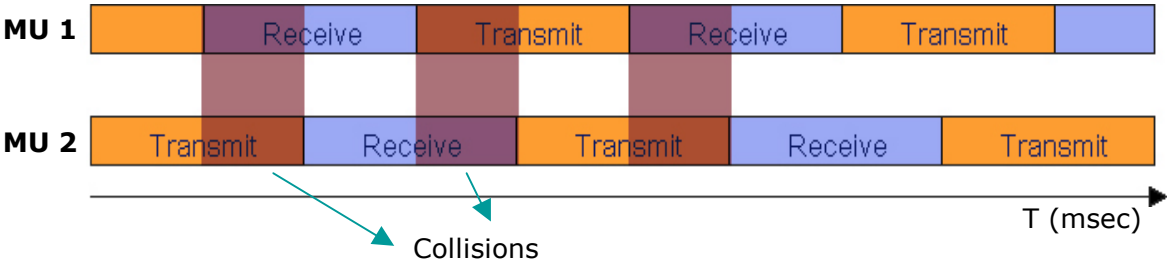

Figure 1-5: Self-interference without time synchronization

Time synchronization synchronizes the transmission and reception of all MUs, thus eliminating self interference between them and allowing better frequency reuse.

Figure 1-6: Time synchronization eliminates self-interference

- **Built in redundancy** -
  - Power & data redundancy via 2xRJ-45.
  - 1+1 trunking capability.
  - **Consecutive AP™** - concatenation capability with power redundancy, as shown in figure 7.

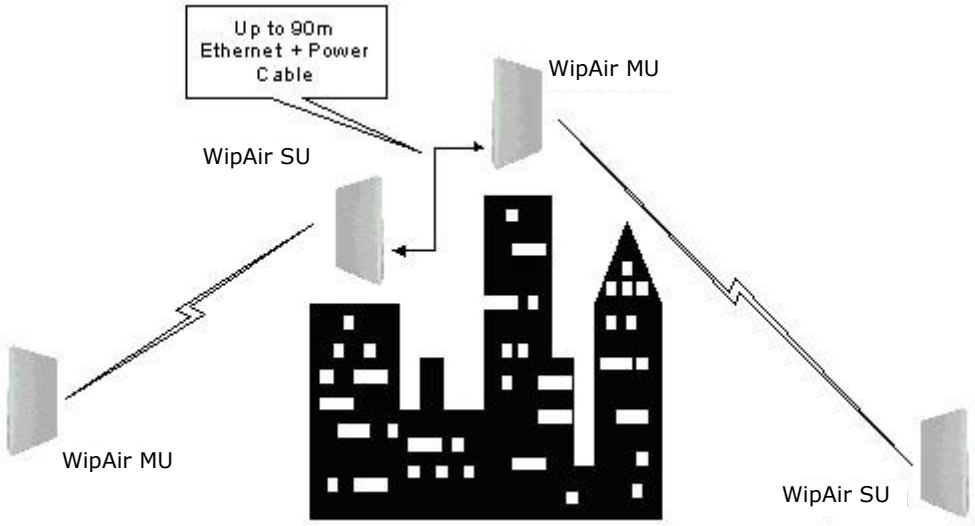

Figure 1-7: Consecutive AP™ principle

- **Lowest total cost of ownership** - Engineered for affordability, WipAir 6000/3000 empowers operators with extremely low CAPEX & OPEX:
  - Most competitive price
  - Rugged & reliable weather proof design
  - Compact and very simple to install:
    - Fast installation by 1 technician.
    - Built in RSSI buzzer for easy alignment.
    - Built in RF analyzer - simplest site survey tool.
    - ACS – Automatic Channel Selection (automatic site survey).
    - Extremely low power consumption: < 6Watt.
  - Multiple frequency bands in one radio – ease of stocking and maintenance.
  - Over the air remote management

1.3 Element Management System

WipAir 6000/3000 is managed in three ways:

1.3.1 NMS

As part of a deployment, The Network Management system (ViewAir NMS) provides one point of management for all the links deployed and allows the operator to monitor and control the units:

- Managing entire deployment composed of WipAir Radios
- Radio link monitoring and configuration.
- Easy PTMP configuration – all in one point.
- System health in a glance.
- Multiple networking modes under single MU.

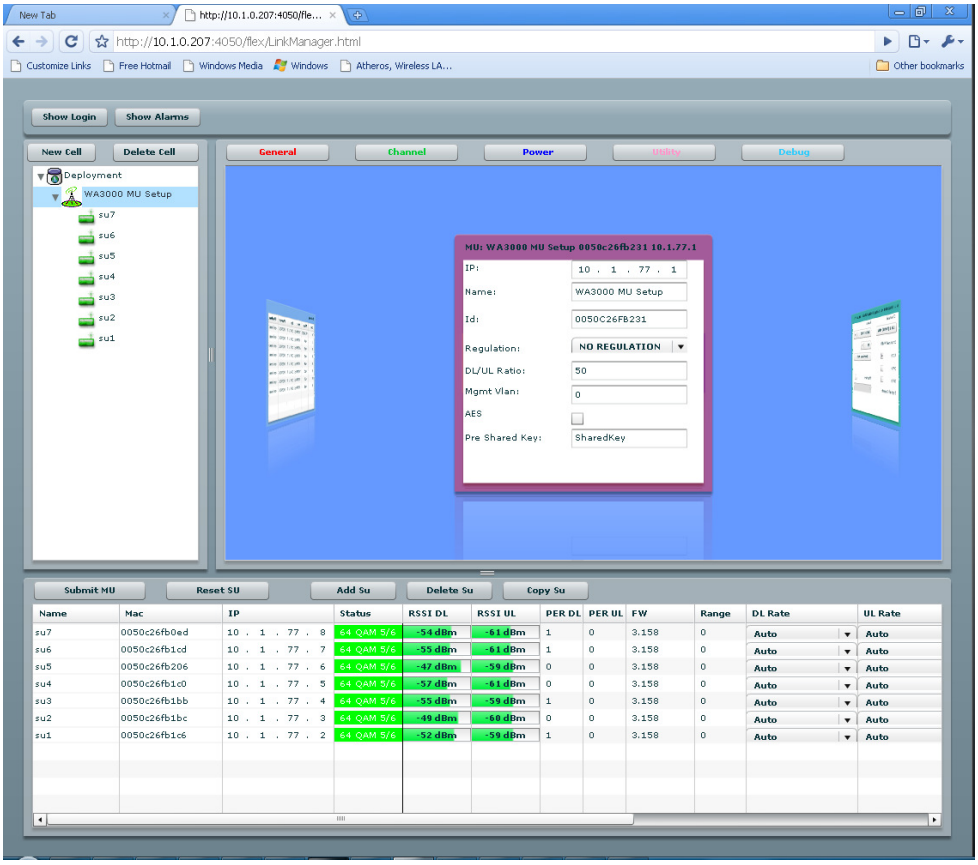

Figure 1-8: WIPview

1.3.2 Link Manager

In a technician level, The Element Management System (Link Manager) provides a complete GUI system to configure/monitor the radio.

The Link Manager automatically connects to the radio (from either side), discovers the radio and allows the technician to configure and monitor the radio with WYSIYG application.

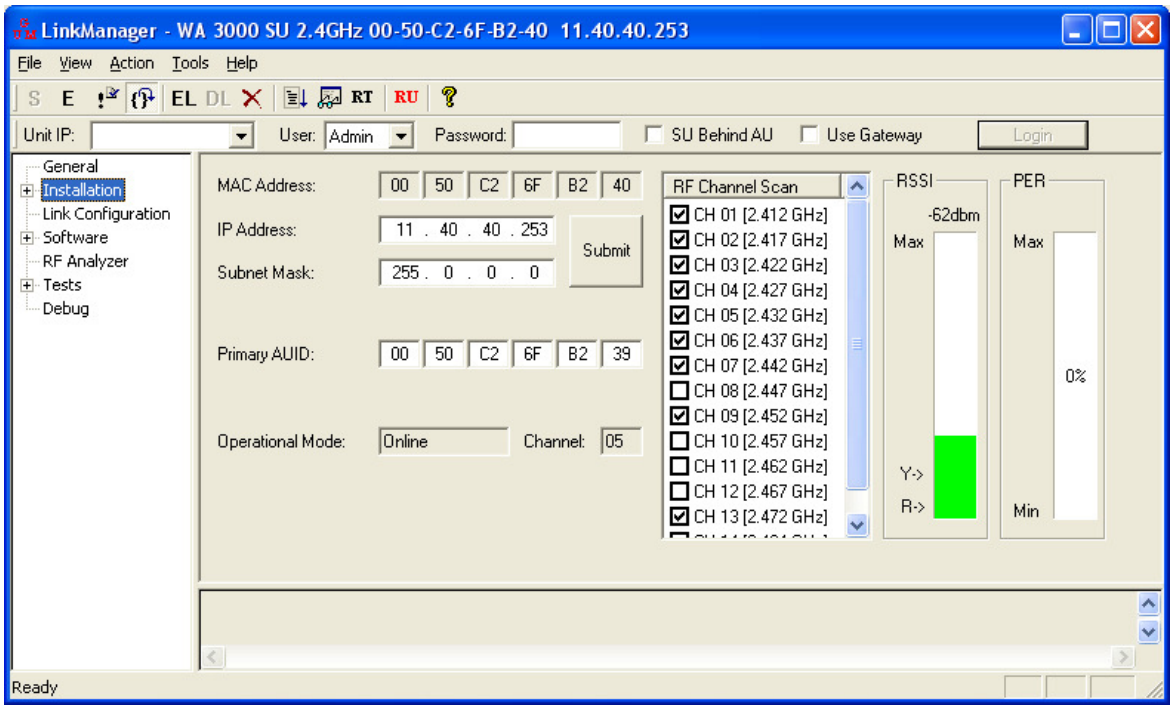

Figure 1-9: Link Manager

The Link Manager contains a built in:

- RF analyzer.
- Numerous link indicators and counters.
- Traffic generator – throughput test tool.

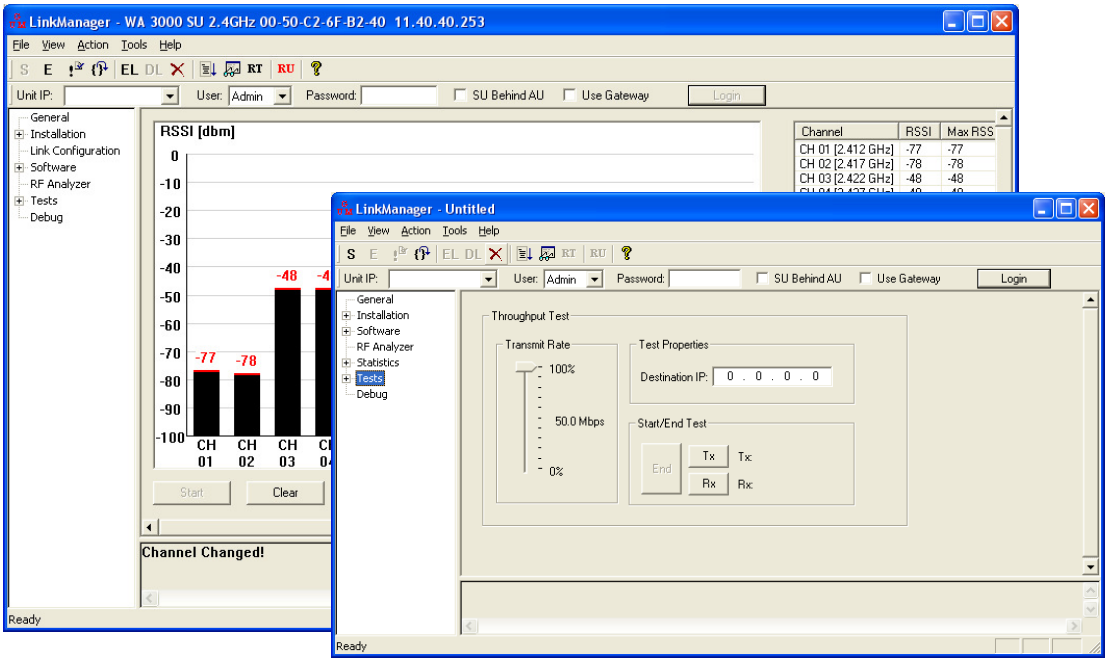

Figure 1-10: Built in RF analyzer and throughput test tool

1.3.3 Standard Protocols

WipAir 6000/3000 supports the following protocols:

- WEB (HTTP) – Manage the radio using an Internet browser.
- SNMP – Supports v2c with a private MIB, Traps and notifications.
- Telnet.

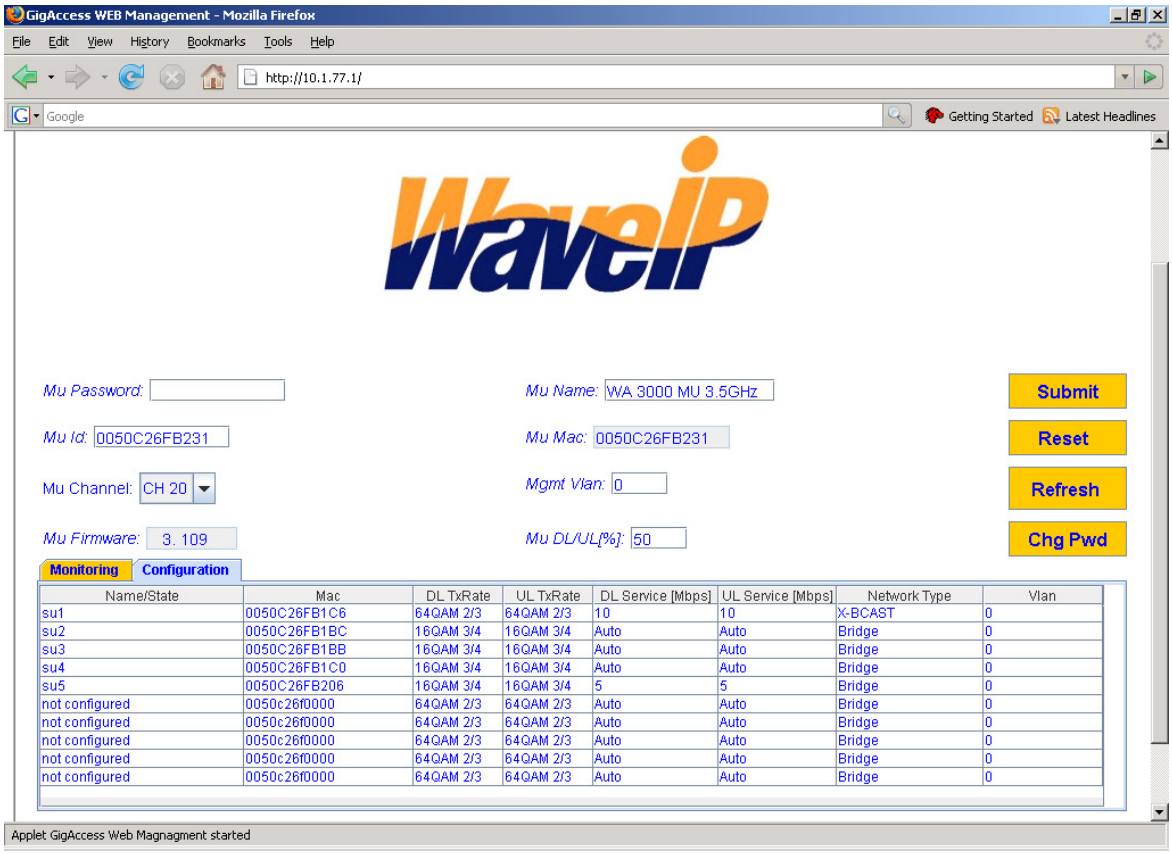

Figure 1-11: WEB interface

2. Installation

2.1 Packing List

When you first open the package, verify that the unit is complete with the following components:

1. Outdoor Unit – WipAir 6000/3000 MU or SU.
2. Indoor PoE Outlet.
3. Indoor Power Supply (AC input).
4. Pole mounting kit (will not be added if advanced mounting kit is provided).

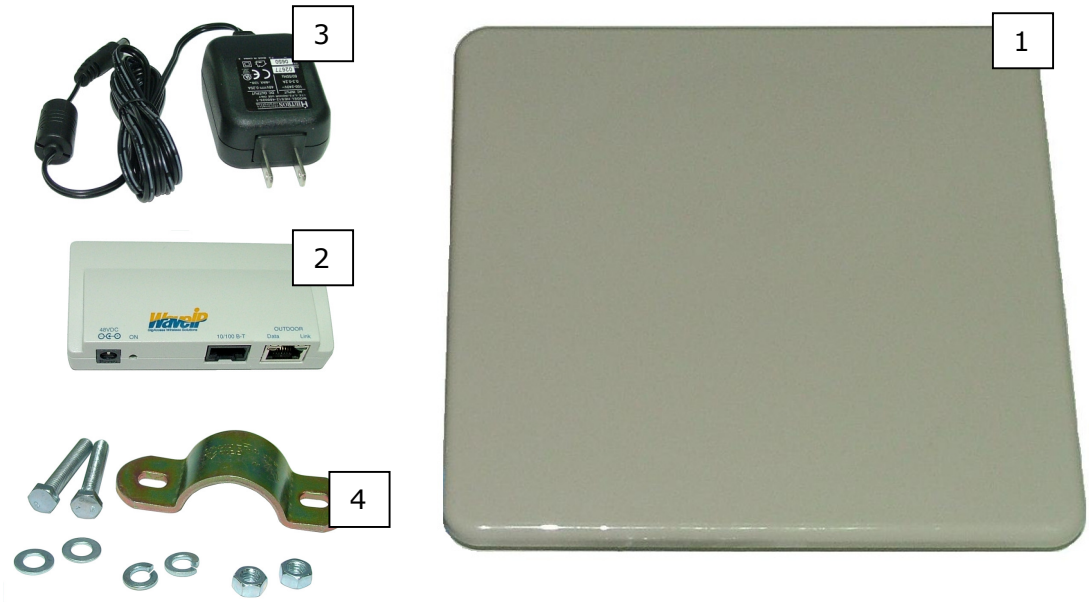

Figure 2-1: General System View

2.2 Additional Part List – Required for Installation

- Outdoor Unit grounding cable
- Outdoor-to-Indoor shielded CAT5 cable (Up to 90 meters).
- Indoor CAT5 cable.
- RJ-45 - Installation KIT.
- RJ-45 - Crimping tool.
- Adjustable wrench + screwdriver.

2.3 Installation Overview

This section provides installation information for WipAir 6000/3000 system.

Note: Outdoor units and antennas should be installed ONLY by experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities. Failure to do so may void the product warranty and may expose the end user or the service provider to legal and financial liabilities. WaveIP and its resellers or distributors of this equipment are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

Typical installation scheme:

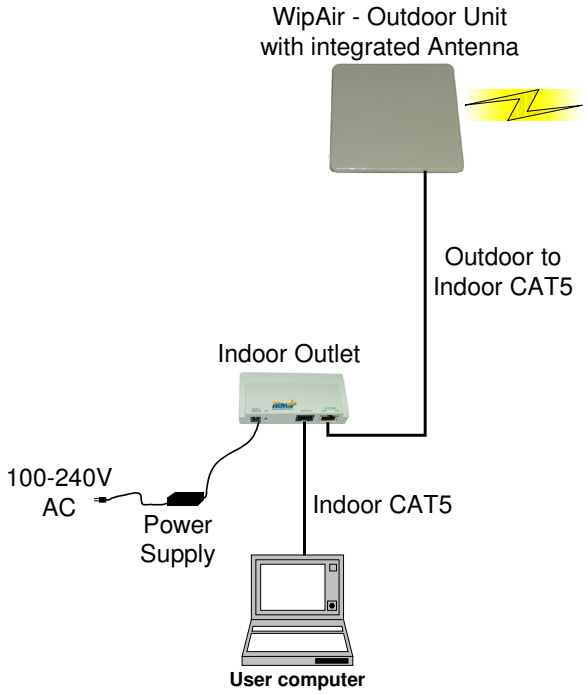

Figure 2-2: WipAir 6000/3000 - General Installation Scheme

Installation process summary:

1) Select the appropriate location for the Outdoor unit and the indoor PoE Outlet.
2) Mount the Outdoor unit. If you are using detached antenna mount the antenna and connect it to the Outdoor unit.
3) Connect a ground cable between the Outdoor unit and an appropriate grounding point.
4) Connect the Outdoor-to-Indoor shielded CAT5 cable to the Outdoor unit and route it to the location selected for the PoE Outlet. Assemble the enclosed connector on the cable.
5) Mount the Indoor Outlet.
6) Connect the Outdoor-to-Indoor cable to the PoE Outlet 'OUTDOOR' port. (This port supplies 48 VDC in addition to the Ethernet data).

7) Connect the CAT5 Ethernet cable from the user's network/PC to the PoE Outlet '10/100 B-T' port.
8) Connect the power supply to the PoE Outlet power port ('48VDC').
9) Align the antenna and secure the unit by fastening the mounting screws.

2.3.1 Select the Best Location

Select the appropriate locations for the outdoor unit using the following guidelines:

- The outdoor unit can be pole or wall mounted.
- The location should allow easy access to the unit for installation.
- When using an external antenna, the unit should be installed as near as possible to the antenna.
- Make sure clear Line of Sight between the units.

Path of Clearest Propagation

A propagation path is the path that signals traverse between the antennas of any two bridges. The "line" between two antenna sites is an imaginary straight line, which may be drawn between the two antennas. Any obstacles in the path of the "line" degrade the propagation path. The best propagation path is, therefore, a clear line of sight with good clearance between the "line" and any physical obstacle.

Physical Obstacles

Any physical object in the path between MU and SU can cause signal attenuation. Common obstructions are buildings, trees and hills located in the path between the two sites. Install outdoor antennas high enough to avoid any obstacles, which may block the signal.

Minimal Path Loss

Path loss is determined by several factors:

- **Distance between sites** – Path loss is lower when distances between sites are shorter.
- **Clearance** – Path loss is minimized when there is a clear line of sight. The number, location, and size of obstacles determine their contribution to path loss.
- **Antenna height** – Path loss is lower when antennas are positioned higher. Antenna height is the distance from the imaginary line connecting the antennas at the two sites to "ground" level. "Ground" level in an open area is the actual ground. In dense urban areas, "ground" level is the average height of the buildings between the antenna sites.

2.3.2 Mounting

Outdoor Unit can be mount on a pole or on a wall.
A general description of wall mount is given in Figure 2-3.

Figure 2-3: Wall mount description

Note: all outdoor units must be installed with a separation distance of at least **2.5 meters** from all persons during normal operation.

2.3.3 Antennas

2.3.3.1 General

Two types of antennas are available for WipAir 6000/3000 system:

- Integrated antenna
- External antenna

The necessary antenna gain depends on the required range and performance.

Note: To comply with the regulation EIRP limits, the outdoor unit-transmit power needs to be adjusted according to the installed antenna gain. Therefore a professional installation of the transmitter is required. The outdoor unit must be configured at the time of installation by qualified personal. Fail to comply with regulation rules may expose the installer to legal liabilities.

2.3.3.2 Tx power

The outdoor unit transmit power is configurable using the Link Manager. The Link Manager limits the max transmit power according to the antenna gain, the regulation and the frequency band. The installer, if needed, can select a lower power.

Regulation of the unit defines the frequency band supported by the units:

FCC: 5.8 GHz.

ETSI: 5.4 GHz and 5.8 GHz.

Non-regulated: 5.x GHz.

The Link Manager supports two levels of privilege password: regular user and administrator user. Since power output levels will affect compliance of the unit with regulation rules, precautions are built into the system to keep the end user from adjusting the power output level above the regulation limits. Therefore, the following parameters are Configurable only by administrator user:

- Antenna gain.
- Tx Power.

Please refer to WipAir_6000_3000_configuration_manual.pdf for more information.

FCC - 5.8 GHz

IMPORTANT! Antennas must be selected from a list of WaveIP approved antennas. Please refer to Appendix C – FCC Approved Antennas.

It is the responsibility of the installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

According to FCC part 15.247(b):

(1) *The maximum peak output power of intentional radiator shall not exceed 1 Watt* (+30 dBm).

(3) *If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the maximum peak power (of +30 dBm) as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi*.

That is to say that the maximum EIRP (Effective Isotropic Radiated Power) shall not exceed +36 dBm.

(ii) *Systems operating in 5.8 GHz exclusively for fixed,* ***point-to-point*** *operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.*

That is to say that the maximum EIRP can exceed +36 dBm in point-to-point applications.

Dynamic range of Tx power in WipAir 6000/3000 is 40 dB.

In Point-to-Multipoint mode, the Link Manager software will automatically reduce the Tx power according to the antenna gain. For example:

- For integrated antenna of 23 dBi, the Max Tx power allowed by the Link Manager is 13 dBm (10 dBm in WipAir 6000) to meet the EIRP limitation of 36 dBm.
- For integrated antenna of 28.5 dBi, the Max Tx power allowed by the Link Manager is 7 dBm (4 dBm in WipAir 6000) to meet the EIRP limitation of 36 dBm.

2.3.3.3 Antenna Polarization

The MU and SU must have same antenna polarization. To verify antenna polarization, refer to the assembly instructions supplied with the antenna set. (The polarization of integrated antenna is marked on the backside).

2.3.4 Alignment

Power up the unit:

1. Plug the AC/DC Power Supply into a wall outlet or other standard AC power source. This is only for use prior to permanent mounting, so any available wall outlet in close proximity to your mounting location is suitable.
2. Connect the Outdoor-to-Indoor cable to the PoE Outlet 'OUTDOOR' port. (This port supplies 48 VDC in addition to the Ethernet data).
3. Plug the DC plug from the AC/DC power supply to the DC jack marked "48VDC".

WipAir 6000/3000 can be aligned using 2 methods:

2.3.4.1 Using the Link Manager

1. Connect a CAT5 Ethernet cable from a PC to the PoE Outlet '10/100 B-T' port.

Note: Do not attach standard CAT5 cable from the Outdoor Unit directly to the PC. Connecting the PC directly to the Outdoor Unit may cause damaged to the PC Ethernet NIC.

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2. Start Link Manager application.
3. Press on the "Start Session" button ("S" symbol).
4. Select the unit from the popup address window.
5. Select "Installation" at the left menu tree.
6. Rotate the antenna until you get maximum RSSI with zero PER on the installation window in the Link Manager.

Note: Do not stand in front of transmitting antenna. Rotate the antenna from the rear side.

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7. Mount and secure the unit by fastening the mounting screws.

2.3.4.2 Using the Built in RSSI buzzer

WipAir 6000/3000 units have a built in RSSI buzzer that indicates the best mounting location.

The buzzer is beeping at four tone levels:

- Fast – highest signal obtained so far.
- Medium – the current alignment is lower than the highest signal obtained so far.
- Slow – the current alignment is much lower than the highest signal obtained so far.
- No sound – no reception of the base station at all (or the buzzer is off).

In order to select the best alignment of the unit, please perform the following steps.

Select the best location:

1. When the unit is first connected to power, the buzzer will be automatically activated in one of the following modes:
   - No sound – there is no reception.
   - Fast beep – there is a reception (which is currently the maximum signal obtained).
2. Take the unit to the selected location and align the antenna in the link's direction. Listen to the buzzer tone level. Any sound (fast, medium or slow) indicates a reception.
3. Change the antenna alignment to the left, right, up and down in order to scan for the maximum reception point.
4. After scan is complete, align the antenna to the location where the buzzer beeps at the fast rate, indication the maximum reception.
5. Mount and secure the unit by fastening the mounting screws.

The buzzer is automatically shut down within 20 minutes. You can reactivate it or shut it down manually using the Link Manager advanced window.

Note: During this procedure, do not disconnect the unit from power.

2.3.5 Sealing

The outdoor unit must be sealed against rain with the rubber grommets.

Note: All Units are factory sealed, seal needed only on Ethernet ports. Opening the unit will void the WipAir 6000/3000 product warranty.

2.3.6 Cables

Straight CAT5 Gauge 24-shielded outdoor rated cable must be installed between Outdoor Unit and Indoor Outlet. The cable should be UV resistant, flame retardant, **UL listed** and contain at least 4 twisted pairs.

The outdoor cables scheme is given in Appendix A – Outdoor Cables Scheme.

The Indoor PoE Outlet side and Outdoor Unit side are crimped using RJ-45 tool.

CAT5 cable must not exceed 300 feet (91 meters).

The Outdoor Unit side will be assembled according to the following steps (Figure 2-4):

- Insert seal bracket (grommet clamping plate) on the cable.
- Insert rubber seal (grommet) on the cable.
- Crimp the RJ-45 Plug.

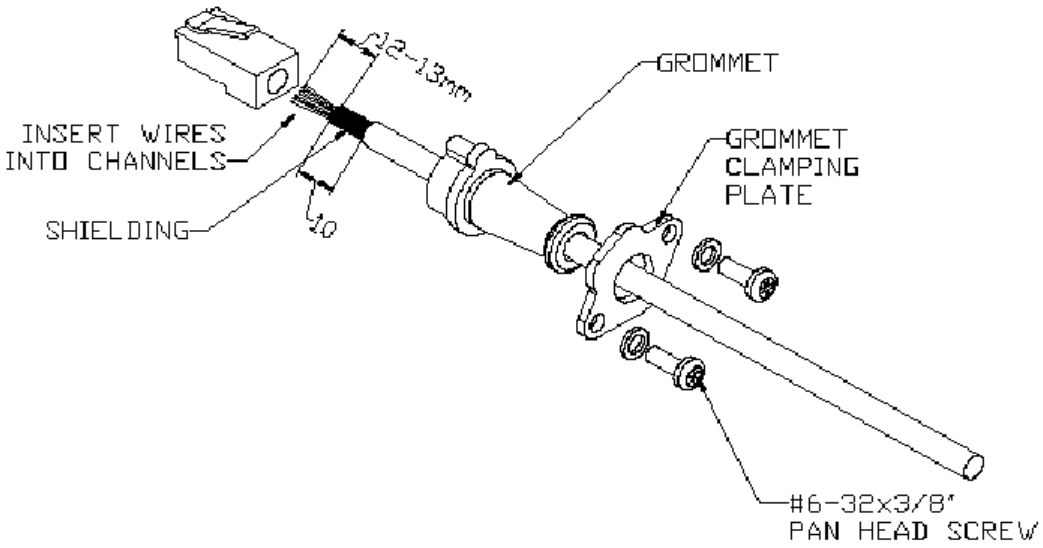

Figure 2-4: Cable preparation for Outdoor Unit

- Insert the RJ-45 to the Outdoor Unit (Figure 2-5).
- Insert *NC-6* screws with spring washer to the seal bracket.

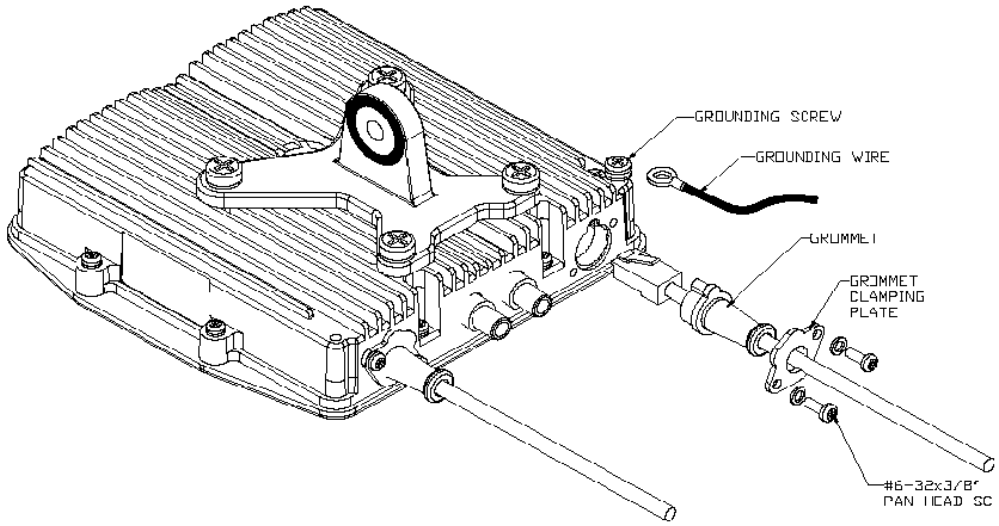

Figure 2-5: Cable assembly to Outdoor Unit

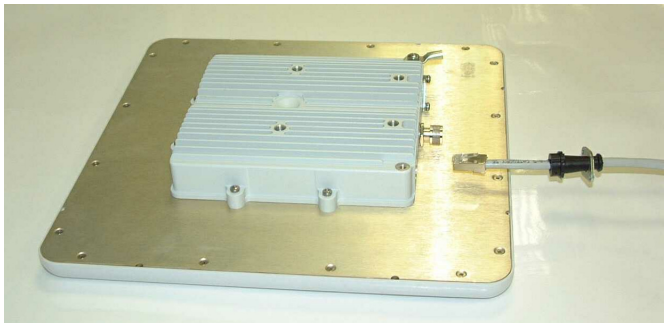

Figure 2-6: Cable insertion to Outdoor Unit.

- Fasten the seal bracket (Figure 2-7).
- The unused port should be left sealed.

Figure 2-7: Cable connection to Outdoor Unit

2.3.7 Indoor Outlet Installation

The Indoor Outlet is wall mounted.

The Indoor Outlet side cables assembled as follows:

1. Crimp the RJ-45 Plugs on cable ends to form the Outdoor Unit cable.
2. Plug the Outdoor Unit cable to the RJ-45 Jack marked *"OUTDOOR"*.
3. Plug standard CAT5 cable from the PC to the RJ-45 Jack marked *"10/100 B-T".*
4. Plug the DC plug from the AC/DC power supply to the DC jack marked *"48VDC"*.

Note: Do not attach standard CAT5 cable from the PC to the Indoor Unit RJ-45 jack marked *"OUTDOOR"*. Connecting the PC directly to the Outdoor Unit may cause damaged to the Ethernet NIC in the PC.

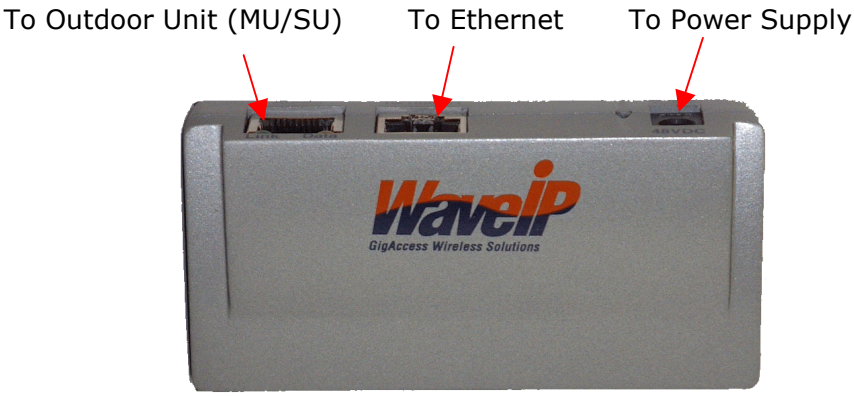

Figure 2-8: Indoor Outlet

The indoor outlet provides the air and Ethernet link status via LEDs:

1. Air link (green LED) – indicates air connectivity of the SU to the MU.
2. Ethernet link (orange LED) – indicates Ethernet connectivity to the unit.

2.3.8 Grounding

2.3.8.1 Grounding the Outdoor Unit (MU /SU)

The outdoor unit shall be connected to a protective earth with not less than 10 AWG conductors having green-yellow insulation. The following figure shows the grounding cable from outdoor unit external screw to adjacent grounding rod. The cable should be long enough to reach from the mounting pole to the grounding rod with 3 to 6 feet extra to allow for strain relief.

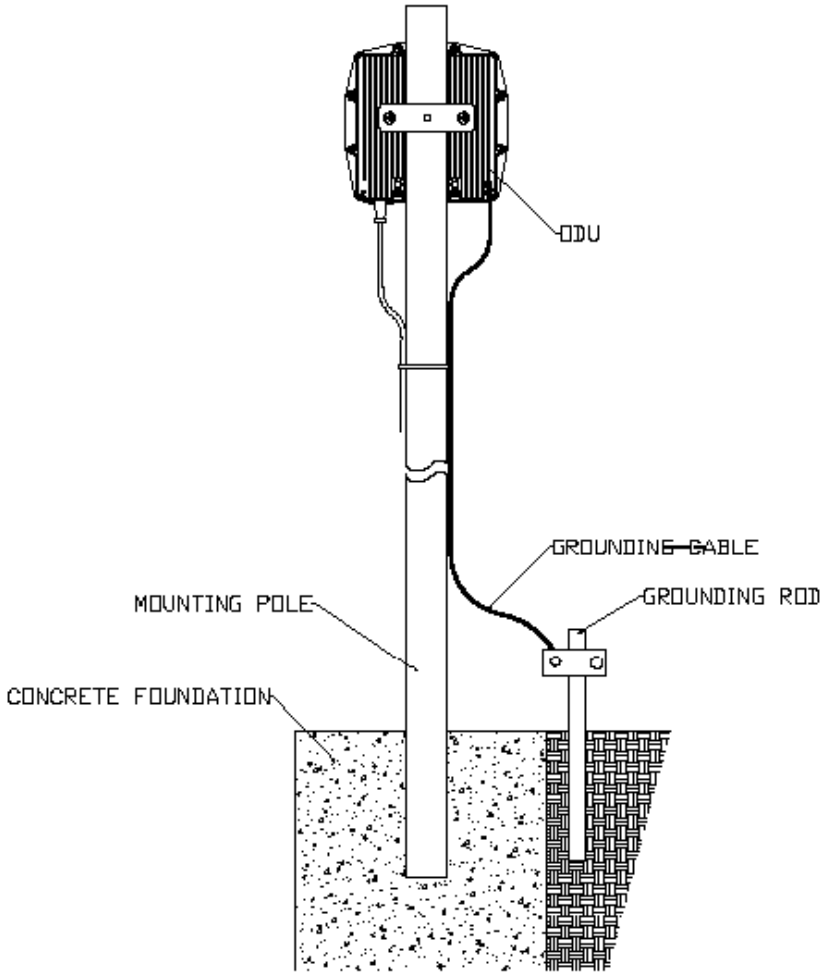

Figure 2-9: Ground Connection to Outdoor Unit

Protection from Lightning

US National Electric Department of Energy Handbook 1996 specifies that radio and television lead-in cables must have adequate surge protection at or near the point of entry to the building. The code specifies that any shielded cable from a detached antenna must have the shield directly connected to a 10 AWG wire that connects to the building ground electrode.

The ground wire shall be terminated with **UL listed** lug with a diameter of 0.2 inch (5.2 mm).

The ground lug will need to be suitable for terminating on aluminum materials, such as the use of an aluminum connector and aluminum ground conductor.

FCC Notice

This equipment has been tested and found to comply with the limits for Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the relocate-receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device must accept any interference received including interference that may cause undesired operation. Any unauthorized modification or changes to this device without the express approval of WaveIP may void the user's authority to operate this device. Furthermore, this device intended to be used only when installed in accordance with the instructions outlined in this manual. Failure to comply with these instructions may also void the user's authority to operate this device and/or the manufacturer's warranty

2.4 Consecutive AP Connection

Consecutive connection is done by plugging **data crossover** CAT5 cable between SU and consecutive MU. This cable will also provide power redundancy to the units.

Total length of all wires should not exceed 300 feet each (91 meters).

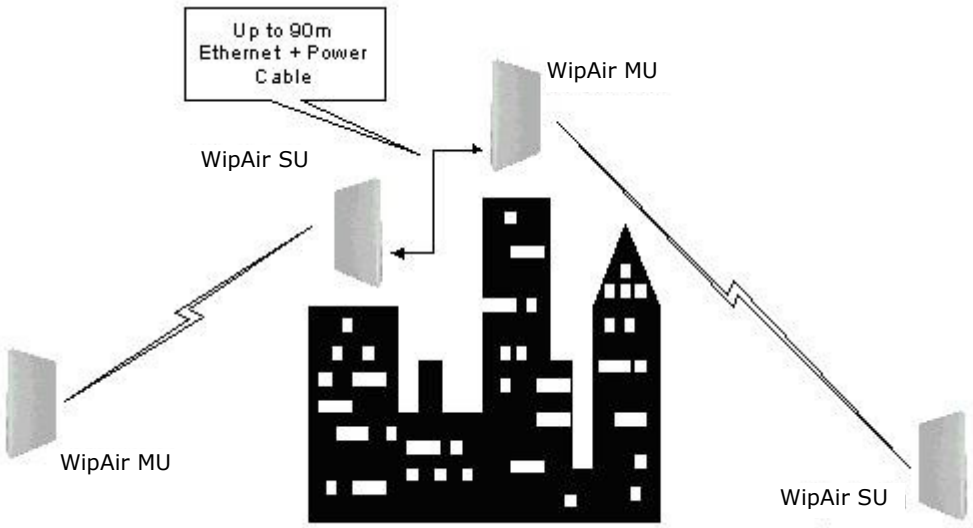

Figure 2-10: Consecutive link principle

2.5 Synchronization

WipAir 6000/3000 was designed to work with co-located antennas. That means that two or more units can be mounted close to each other.

Time synchronization allows reusing frequencies between co-located links and configured with the Link Manager advanced window.

The synchronization signal is generated by an external GPS (1 PPS).

To configure time synchronization, set all MUs to synchronization Enable and Slave mode.

Please refer to WipAir_6000_3000_configuration_manual.pdf for more information.

Note: The distance between any two antennas should be at least 50 cm.

3. WipAir 6000 Technical Specifications

3.1 Radio

Radio Frequency	700–900 MHz, 2.3-2.5 GHz, 3.3-3.8 GHz, 4.9 GHz, 5.x GHz							
Net Throughput	Up to 200 Mbps (100 Mbps Full Duplex)							
PPS	50,000 Packets Per Second							
Range	Up to 130 Km							
Channel Size	Configurable – 5 / 10 / 20 / 40 MHz							
Waveform	Advanced OFDM 2x2 dual polarization MIMO							
Output Power	Configurable up to 26 dBm, 40 dB dynamic range							
Handling Interference	AIS – Automatic Interference Sensibility ACM – Adaptive Coding & Modulation ACS – Automatic Channel Selection FEC – Forward Error Correction, k = 1/2, 2/3, 3/4, 5/6 Fast ARQ – Automatic Retransmit reQuest							
Encryption & Security	128-bit AES & MAC level authentication							
Modulation	BPSK	QPSK		16QAM		64QAM		
FEC	1/2	1/2	3/4	1/2	3/4	2/3	3/4	5/6
Data Rate @ 5 MHz (Mbps)	3.25	6.5	9.75	13	19.5	26	29.25	32.5
Data Rate @ 10 MHz (Mbps)	6.5	13	19.5	26	39	52	58.5	65
Data Rate @ 20 MHz (Mbps)	13	26	39	52	78	104	117	130
Data Rate @ 40 MHz (Mbps)	30	60	90	120	180	240	270	300
Sensitivity @ 20 MHz (dBm)	-87	-85	-83	-80	-78	-72	-70	-67

3.2 Networking and Management

Topology	Point-to-Point (PTP), Point-to-Multipoint (PTMP)
Access Technology	Time Division Duplex (TDD) – Dynamic or Symmetric
Data Latency	1ms typical
Traffic Handling	Layer 2 transparent bridging
VLAN	Transparent or tagging/stripping
QoS	Based on 802.1q & 802.1p
Management	WEB, EMS, SNMP, Telnet, Built in throughput tests and RF Analyzer tools

3.3 Physical and Environmental

Physical Interface	2 X 10/100 Base-T (ODU)
Connector Type	RJ – 45
Mechanical	19 x 19 x 4 cm (external antenna port)
PoE Adapter: • Input Power • Mechanical	 100-240 VAC, 47-63 Hz 10 x 5 x 2.5 cm
Mounting	Wall or pole
Power Consumption	< 6Watt
Operating Temperature	-30°c to 55°c
Operating Humidity	95% non condensing (Rainproof)
Power	Power over Ethernet (PoE) - 48 VDC

4. WipAir 3000 Technical Specifications

4.1 Radio

Radio Frequency	700–900 MHz, 2.3-2.5 GHz, 3.3-3.8 GHz, 4.9 GHz, 5.x GHz							
Net Throughput	Up to 120 Mbps (60 Mbps Full Duplex)							
PPS	50,000 Packets Per Second							
Range	Up to 130 Km Up to 80 Km with integrated antennas							
Channel Size	Configurable – 5 / 10 / 20 / 40 MHz							
Waveform	Advanced OFDM							
Output Power	Configurable up to 26 dBm, 40 dB dynamic range							
Handling Interference	AIS – Automatic Interference Sensibility ACM – Adaptive Coding & Modulation ACS – Automatic Channel Selection FEC – Forward Error Correction, k = 1/2, 2/3, 3/4, 5/6 Fast ARQ – Automatic Retransmit reOuest							
Encryption & Security	128-bit AES & MAC level authentication							
Modulation	BPSK	QPSK		16QAM		64QAM		
FEC	1/2	1/2	3/4	1/2	3/4	2/3	3/4	5/6
Data Rate @ 5 MHz (Mbps)	1.625	3.25	4.875	6.5	9.75	13	14.625	16.25
Data Rate @ 10 MHz (Mbps)	3.25	6.5	9.75	13	19.5	26	29.25	32.5
Data Rate @ 20 MHz (Mbps)	6.5	13	19.5	26	39	52	58.5	65
Data Rate @ 40 MHz (Mbps)	15	30	45	60	90	120	135	150
Sensitivity @ 20 MHz (dBm)	-87	-85	-83	-80	-78	-72	-70	-67

4.2 Networking and Management

Topology	Point-to-Point (PTP), Point-to-Multipoint (PTMP)
Access Technology	Time Division Duplex (TDD) – Dynamic or Symmetric
Data Latency	1ms typical
Traffic Handling	Layer 2 transparent bridging
VLAN	Transparent or tagging/stripping
QoS	Based on 802.1q & 802.1p
Management	WEB, EMS, SNMP, Telnet, Built in throughput tests and RF Analyzer tools

4.3 Physical and Environmental

Physical Interface	2 X 10/100 Base-T (ODU)
Connector Type	RJ – 45
Mechanical	19 x 19 x 4 cm (external antenna port)
PoE Adapter: • Input Power • Mechanical	 100-240 VAC, 47-63 Hz 10 x 5 x 2.5 cm
Mounting	Wall or pole
Power Consumption	< 6Watt
Operating Temperature	-30°c to 55°c
Operating Humidity	95% non condensing (Rainproof)
Power	Power over Ethernet (PoE) - 48 VDC

5. Appendix A – Outdoor Cables Scheme

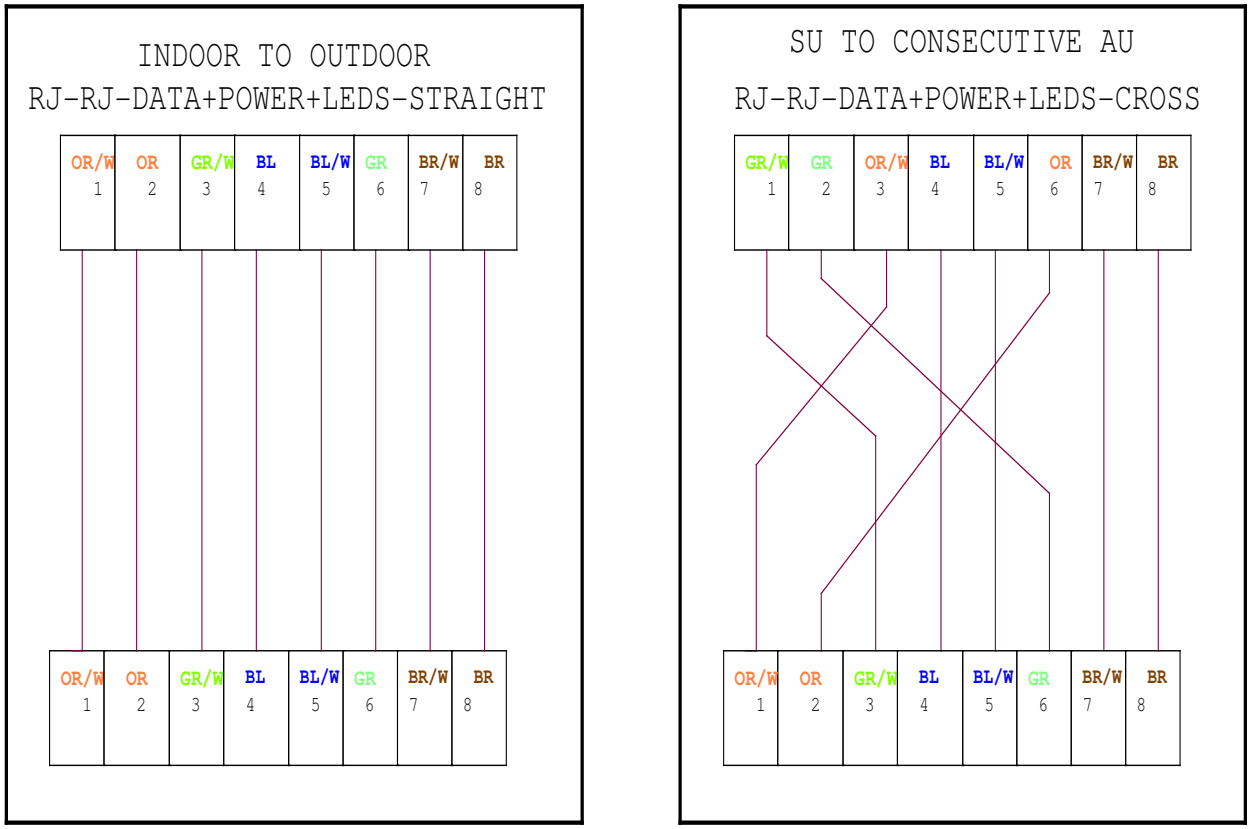

Figure 5-1: Outdoor Cables Scheme

Note: In order to comply with CAT5 91 meters cable
Pins 1,2 must be on a twisted pair wire!
Pins 3,6 must be on a twisted pair wire!

6. Appendix B – RF Channel Lists

6.1 FCC operating Band: 5725 MHz - 5850 MHz.

Channel No.	5 MHz Channel Frequency [MHz]	10 MHz Channel Frequency [MHz]	20 MHz Channel Frequency [MHz]	40 MHz Channel Frequency [MHz]
1	5730			
2	5735	5735	5735	
3	5740	5740	5740	
4	5745	5745	5745	5745
5	5750	5750	5750	5750
6	5755	5755	5755	5755
7	5760	5760	5760	5760
8	5765	5765	5765	5765
9	5770	5770	5770	5770
10	5775	5775	5775	5775
11	5780	5780	5780	5780
12	5785	5785	5785	5785
13	5790	5790	5790	5790
14	5795	5795	5795	5795
15	5800	5800	5800	5800
16	5805	5805	5805	5805
17	5810	5810	5810	5810
18	5815	5815	5815	5815
19	5820	5820	5820	5820
20	5825	5825	5825	5825
21	5830	5830	5830	5830
22	5835	5835	5835	
23	5840	5840	5840	
24	5845			

Figure 6-1: RF channel List

7. Appendix C – FCC Approved Antennas

Antenna Type	Model	Gain [dBi]	Beam Width	Dimension [mm]
Flat panel	SPDB-5159-23V12D	23	10º x 10º	305x305x15
	MT-485025/NVH	23	10º x 10º	371x371x40
	MT-485025/CVH	23	10º x 10º	371x371x40
Dish	DP-5X-285D-005	28.5	5º x 5º	2ft

Figure 7-1: Integrated / external antennas for WipAir 6000/3000