

RADWIN

RADWIN 5000 HPMP

Point to Multipoint Broadband Wireless

USER MANUAL

The information in this User Manual refers to the following products:

RADWIN 5000 HBS –

RW-5200-0250, RW-5200-0249

RADWIN 5000 HSU –

RW-5550-0150, RW-5550-0250, RW-5520-0150, RW-5520-0350, RW-5510-0350

RW-5550-0149, RW-5550-0249, RW-5520-0149, RW-5520-0349, RW-5510-0349

RADWIN IDU (PoE) –

RW-9921-001x

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RADWIN 5000 HPMP

User Manual

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Regulatory Compliance

General Note

This system has achieved Type Approval in various countries around the world. This means that the system has been tested against various local technical regulations and found to comply. The frequency bands in which the system operates may be “unlicensed” and in these bands, the system can be used provided it does not cause interference.

FCC - Compliance

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 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 a 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 or relocate the 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.

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



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 by FCC rules 47 CFR part 15.204.



It is the responsibility of the installer to ensure that when configuring the radio in the United States (or where FCC rules apply), the Tx power is set according to the values for which the product is certified. The use of Tx power values other than those, for which the product is certified, is expressly forbidden by FCC rules 47 CFR part 15.204.



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. 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. The installer should configure the output power level of antennas according to country regulations and antenna type.



- Where Outdoor units are configurable by software to Tx power values other than those for which the product is certified, it is the responsibility of the Professional Installer to restrict the Tx power to the certified limits.
- This product was tested with special accessories - indoor unit (IDU or PoE), FTP CAT-5e shielded cable with sealing gasket, 12 AWG grounding cable - which must be used with the unit to insure compliance.

Indoor Units comply with part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) These devices may not cause harmful interference.

(2) These devices must accept any interference received, including interference that may cause undesired operation.

Canadian Emission Requirements for Indoor Units

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

China MII

Operation of the equipment is only allowed under China MII 5.8GHz band regulation configuration with EIRP limited to 33 dBm (2 Watt).

India WPC

Operation of the equipment is only allowed under India WPC GSR-38 for 5.8GHz band regulation configuration.

Unregulated

In countries where the radio is not regulated the equipment can be operated in any regulation configuration, best results will be obtained using Universal regulation configuration.

Safety Practices

Applicable requirements of National Electrical Code (NEC), NFPA 70; and the National Electrical Safety Code, ANSI/IEEE C2, must be considered during installation.

NOTES:

1. A Primary Protector is not required to protect the exposed wiring as long as the exposed wiring length is limited to less than or equal to 140 feet, and instructions are provided to avoid exposure of wiring to accidental contact with lightning and power conductors in accordance with NEC Sections 725-54 (c) and 800-30.

In all other cases, an appropriate Listed Primary Protector must be provided. Refer to Articles 800 and 810 of the NEC for details.

2. For protection of ODU against direct lightning strikes, appropriate requirements of NFPA 780 should be considered in addition to NEC.

3. For Canada, appropriate requirements of the CEC 22.1 including Section 60 and additional requirements of CAN/CSA-B72 must be considered as applicable.

4. For Brazil, this product is designed for specific application and needs to be installed by a qualified personal who has RF and related rule knowledge.

Regarding the operation on range of 5470 MHz to 5725 MHz, the average output power of the equipments with integrated antenna must be adjusted to the maximum limit of 5,36 dBm (models RW-5550-0150, RW-5520-0150, RW-5520-0350 e RW-5510-0350).

The average output power of the equipments with external antennas can be adjusted to higher output power but it's necessary be aware with the antenna gain. For an average output power of 20,26 dBm must be used an antenna with a maximum gain of 7,86 dBi (models RW-5200-0250 e RW-5550-0250).

Brief

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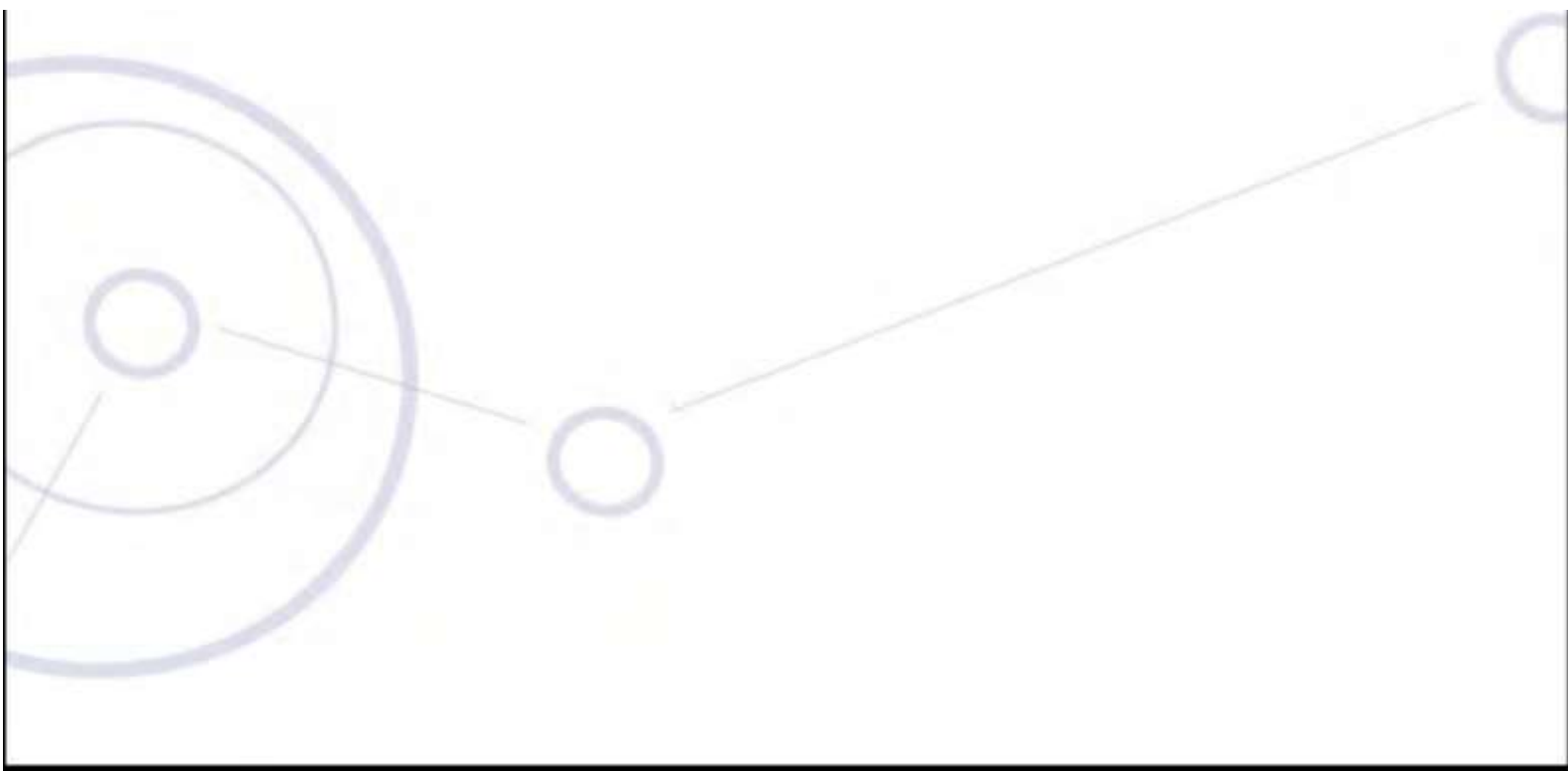
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RADWIN

RADWIN 5000 HPMP

Point to Multipoint Broadband Wireless

USER MANUAL



RELEASE 3.1.00

Part 1: Basic Installation

Introduction

Welcome to RADWIN 5000 HPMP!

RADWIN 5000 HPMP delivers up to 200Mbps and is the ideal choice for last mile enterprise connectivity and high-end applications that demand assured performance with guaranteed bandwidth per subscriber.

RADWIN 5000 HPMP sector base station delivers up to 200Mbps, providing the highest end user capacity in the market to best support voice, data and high resolution video applications, today and tomorrow. By delivering high capacity over a single radio unit, RADWIN solution saves valuable tower space, eases maintenance efforts and reduces the total cost of ownership per megabit. Offering a variety of powerful SUs, RADWIN 5000 HPMP enables service capacity of up to 50Mbps for enterprise customers.

RADWIN 5000 HPMP Highlights

- High capacity per Sector
- 100 Mbps aggregate net throughput, full duplex
- Ethernet connectivity
- High capacity end user equipment - 10, 20, 50Mbps
- Up to 16 Subscriber Units per sector
- Guaranteed SLA and capacity per Subscriber Unit
- Small and constant latency - 4 to 10msec typical under full sector load
- Wide range of frequency bands - 4.8 to 6GHz

Some Terminology

A **Point to Multipoint** network is typically abbreviated to PtMP. The PtMP networks described in this Manual are of course, radio links.

A PtMP link consists of at least one **Base Station** (BS) radio linked to several **Subscriber Unit** (SU) radios. The SUs are sometimes called **Customer Premises Equipment** (CPEs). The terminology comes from the field of telephony.

The radio links are effected by using a **sector antenna** with the BS. The SUs use directional antennas aligned to the BS.

A **Sector** consists of a BS and a group of SUs within the angular sector covered by the BS antenna. A Sector is typically 60° or 90° depending of course on the choice of antenna.

BSs may be collocated to provide sectorial coverage up to 360°.

The RF characteristics of a Sector will be common to each radio: Frequency (regulation), band and channel bandwidth. Adjacent Sectors in a PtMP network will typically use different frequencies and non-overlapping bands to mitigate mutual BS interference.

The RADWIN 5000 HPMP product suite supports considerably higher capacity than other current technologies (such as Wi-Max). We distinguish between generic BSs and SUs and RADWIN units, relabelling the latter, **HBSs** and **HSUs** (H=high capacity).

Key features of RADWIN 5000 HPMP

- » **100 Mbps aggregate net throughput, full duplex**
- » **Configurable Maximum Information Rate (MIR) per HSU**
- » **Long Range** – 40km @ 20Mbps
- » **Advanced OFDM & MiMO 2x2 for nLOS performance**
- » **Enhanced interference mitigation capability**
- » **Inter & intra site sync. to reduce self interference**
- » **Long range** – up to 40 km/ 25 miles
- » **Dedicated traffic bandwidth allocation ensuring SLA & latency**
- » **Low latency** – min < 3ms, typical 4 to 10ms
- » **Channel bandwidth** – 20 MHz
- » **Regulation** - FCC/ETSI/WPC/UNI /MII
- » **Multi band HBSs and HSUs**
- » **Simple to deploy**
- » **Fully integrated with RADWIN Legacy solutions:**
 - Coexists with RADWIN 2000 and WinLink 1000 products
 - Common RADWIN Manager

RADWIN 5000 HPMP Components

RADWIN 5000 HBS High Capacity Base Station



The HBS consists of RADWIN 5000 HBS BS ODU, a sector dual-pole antenna and a PoE device, which provides a LAN interface to user equipment.

A single HBS supports up to 16 HSUs.

Figure 1-1: Single Sector Base Station

RADWIN 55xx HSU High Capacity Subscriber Units



Figure 1-2: Small form factor antenna in connectorized ODU antenna Figure 1-3: High gain integrated antenna in connectorized ODU antenna Figure 1-4: Connectorized ODU antenna

An HSU consists of a RADWIN 55xx HSU ODU. It may be a small form factor (SFF) model with a built in antenna, or a regular integrated or connectorized unit. The latter should use a dual pole antenna for best performance.

The RADWIN Manager

The RADWIN Manager is an SNMP-based management application which manages a complete sector over a single IP address. It can also manage HSUs separately.

The intuitive, easy-to-use RADWIN Manager has a graphical Microsoft Windows interface.

Conventions Used in this Manual

Notifications

Notifications consist of Notes, Cautions and Warnings.



The purpose of a **Note** is to

- Draw your attention to something that may not be obvious or counter-intuitive
 - Emphasize a special feature or peculiarity of the RADWIN 5000 HPMP
 - Offer an external reference for additional information
 - Add a caveat that would not qualify as a full Caution or Warning (see below)
 - Provide additional background to what follows
 - Offer a recommendation
 - Highlight an indication of something to watch out for
 - Advise you if an action has "side effects" i.e. it may disturb something else that would be best left undisturbed
 - Remind you of something that should be kept in mind
-



A **Caution** is a notification of risk of damage to equipment or of service degradation



A **Warning** is a notification of risk of danger to persons operating near the equipment

Typographical conventions

General

Where a term is defined or introduced for the first time, it is shown in **Boldface**. You will have noticed this usage in the Terminology section above.

Software

The RADWIN Manager is a Microsoft Windows application following the user interface conventions of familiar Microsoft Windows programs.

Viewing and Printing

This manual is optimized for viewing online as a PDF file. To this end it uses an 11 point Tahoma typeface for main text. Tables for most part, use 7 or 8 point fonts. Here are a few pointers for hard-copy printing:

- The text and table typefaces used are large enough to print the manual at two pages per sheet
- For good legibility, use a commercial grade laser printer. A color printer is of course best, however a monochrome printer set to use gray-scale gives acceptable results
- Better quality ink jet printers also give good output

Site Preparation

Planning the Sector Site

Overview

Sector site planning consists of a set of surveys, which must be carried out before any equipment is deployed. If for some reason, the outcome of any of these surveys is negative, HBS or HSU re-location will need to be considered.

A Site Survey consists of three stages:

1. Preliminary survey - The proposed sector is analyzed **in the office** using a topographic map. You should use additional tools such as the Link Budget Calculator or the Radio Planner (if available).
2. Physical survey - The locations of the indoor and outdoor equipment are determined **on-site**.
3. Radio Frequency (RF) survey - It is recommended that the installation area be scanned with a spectrum analyzer, to identify RF interference so as to determine a clear channel for radio installation (**on-site**).

The Site Survey

Introduction

RADWIN wireless links must be planned before installation. The designated installation sites must be appraised to determine that the wireless system is able to operate efficiently and provide connectivity without signal degradation.

RADWIN 5000 HPMP offers a wide operating frequency range. A free frequency channel must be determined within the operating range, for optimum performance.

Recommended Equipment

Stage 1: Preliminary Survey

- Topological map of the area
- Urban map of the area
- Compass

- Link Budget Calculator and/or Radio Planner

Stage 2: Physical Survey

- 100 meter tape measure
- Ohmmeter, to check ground connection
- Binoculars
- Map
- Digital camera
- Paper, pencil, and a clipboard
- GPS device (optional)
- Compass (optional)

Stage 3: RF Survey

- Spectrum Analyzer with Max Hold function and screen capture facility that can store multiple images, for documentation purposes
- RF accessories (connectors and cables)
- Communication devices (for example, cellular phones, or a set of walkie-talkies)

Stage 1: Preliminary Survey

A preliminary survey is necessary before visiting potential installation sites. As much detail as possible should be obtained about the designated ODU installation sites and the area between them.

➤ **To perform a preliminary survey:**

1. Mark the designated installation sites on a topographic map of the area.
2. Measure the distance between the sites; check that it is within the specified range of the equipment.
3. On the urban map, check for developed areas situated between the installation sites. Pay attention to these areas when performing the physical site survey; there may be tall buildings, RF towers, or transmitters, which could cause interference to a sector.
4. Check the area between the two sites for obstructions such as:
 - High ground - hills or mountains
 - Lakes or large bodies of water. Water has a reflection effect on RF signals like a building. This type of reflection causes the received amplitude to be reduced. As a rule of thumb, the presence of a large body of water between sector sites may double the required antenna height.
5. Determine and record the compass bearings between HBS and HSU ODUs, relative to north.
6. If there are obstructions between the two sites, calculate the Fresnel Zone (see [Chapter 15](#) for details).
7. If the sites chosen do not meet requirements, consider alternative sites.
8. Use the Link Budget Calculator (on the CD supplied with the equipment or using the RADWIN Manager) to determine the expected performance.

Stage 2: Physical Survey

The physical site survey reviews the environment of the proposed installation location, to ensure that the sector sites are suitable for the wireless network. The results of the physical site survey should be recorded.

**Note**

It is advisable to go on a clear day, so you can more easily see any obstructions between the two sites.

➤ To perform a physical survey:

1. From the compass readings taken in the preliminary survey, find the azimuth (horizontal position) that each HSU ODU should face towards the HBS ODU.
2. Using binoculars, locate any obstructions such as tall trees, high buildings, hills or mountains. Look for other RF towers between the two sites. Mark the locations of the obstructions on the map.
3. Determine the location for the ODU (having regard for existing rooftop installations and tower space). It should be above any obstructions, considering the Fresnel zone (see [Chapter 15](#)).
4. If you need to install an ODU on a tower, make sure that the tower is far enough from overhead electric power lines.
5. Determine a location for the indoor equipment; it should be as close as possible to the ODU. At an existing site, there is probably an equipment room with cable-routing channels.

**Note**

Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT and 75m for 1000BaseT (GbE PoEs)

6. Measure and record the path length of the cable from each ODU position to the indoor equipment room.
7. Determine the ground and lightning connection points of the installation. The ODU and PoE must both be grounded.
8. Using the Ohmmeter, measure and record the resistance of the required installation to the grounding point. The resistance must be less than 10 ohm.
9. Review the results of the physical site survey. Decide if the site is suitable for the wireless network installation.
 - If the site is suitable, continue with stage 3, the RF survey
 - If the site is not suitable, survey another site

Additional Outdoor Site Requirements

The ambient outdoor operating temperature should be -35 to 60°C (-31 to 140°F).

Additional Indoor Site Requirements

The ambient operating temperature should be 0 to 50°C (32 to 122 °F) at a humidity of up to 90%, non condensing

Stage 3: RF Survey

The RF survey examines the wireless environment of the installation site, to determine whether there are available channels within the radio operating frequency band. An RF survey is performed using a spectrum analyzer.

It is advisable to familiarize yourself with the spectrum analyzer before going out on site, specifically the Max Hold and Marker functions.

You should perform the RF survey at each of the proposed sector sites.

The survey should be carried out during a busy time of day, to best judge the worst-case radio interference. Allow 2-4 hours duration for a good RF survey.

RF Planning for Dense Installations and Collocated Sites

Interference may arise from

- Self interference from collocated RADWIN radios
- Other collocated radio devices installed on the same site.

To avoid or minimize interference, follow these recommendations:

- For collocated RADWIN units, use an HSS unit to synchronize between them. Select a different operating channels for each collocated RADWIN unit.
- If one or more collocated units are not RADWIN units, ensure that there is a physical separation of at least three meters between a RADWIN unit and any other collocated radio on the site.
- Use the largest possible frequency gap between these units
- Choose the best frequency channel (as clear as possible from interference). You may be able to change the band used for the sector - depending on HBS model and regulations.
- Decreasing the Tx Power of a sector will reduce collocation interference



Note

Use the Link Budget Calculator to determine the minimum Tx Power required to maintain sector stability.

Hardware Installation

This chapter sets out the requirements and procedures for the hardware installation and alignment of a RADWIN 5000 HPMP sector in accordance with the prior planning as set out in [Chapter 2](#). It is intended to guide qualified field technicians.



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 expose the end user or the service provider to legal and financial liabilities. RADWIN and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.



The material in this chapter is generic to all RADWIN radio products unless stated otherwise.

Safety Practices

Preventing overexposure to RF energy

To protect against overexposure to RF energy, install the ODUs so as to provide and maintain minimal separation distances from all persons.

When the system is operational, avoid standing directly in front of the antenna. Strong RF fields are present when the transmitter is on. The ODU must not be deployed in a location where it is possible for people to stand or walk inadvertently in front of the antenna.

Grounding

All RADWIN products should be grounded during operation. In addition:

- The **ODU** should be earthed by a wire with diameter of at least **12AWG**.
RADWIN 5000 HPMP ODUs must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the Canadian Electrical Code. These codes describe correct installation procedures for grounding

outdoor units, masts, lead-in wiring and discharge units. It also lays down the size of grounding conductors and connection requirements for grounding electrodes.

RADWIN 5000 HPMP ODUs must be grounded to a Protective Earth as described in [Chapter 9](#) and in accordance with the Local Electrical Regulations.

Further, you should -

- Always make the ground connection first and disconnect it last
- Never connect telecommunication cables to ungrounded equipment
- Ensure that all other cables are disconnected before disconnecting the ground

More detailed guidelines are supplied in [Chapter 9](#).

Protection against Lightning

The use of lightning protection is dependent on regulatory and end user requirements. All of RADWIN outdoor units are designed with surge limiting circuits to minimize the risk of damage due to lightning strikes. RADWIN recommends the use of additional surge arrestor devices to protect the equipment from nearby lightning strikes.

See [Chapter 9](#) for detailed installation instructions of lightning protection devices.

General

- It is recommended that installation of the outdoor unit be contracted to a professional installer.
- Before working on equipment connected to power lines or telecommunication lines, you should remove jewelry or any other metallic object that may come into contact with energized parts.
- Use extreme care when installing antennas near power lines.
- Use extreme care when working at heights.
- When using an AC power source for RADWIN 5000 HPMP PoEs always use the AC power adapter supplied by RADWIN.
- Use the right tools. In addition to standard tools required for any kind of ODU or antenna installation, RADWIN 5000 HPMP ODUs require additional specific tools detailed on [page 3-7](#) below.

Package Contents

The RADWIN 5000 HPMP packages include the following items:

HBS and HSU ODU Package Contents

The ODU package contains:

- One HBS or HSU ODU - see [Figure 3-2](#) below for front and rear view
- An ODU mounting kit - see [Figure 3-1](#) below
- A CD containing -
 - the RADWIN Manager
 - Quick Start Guide
 - User Manual - the document you are reading

- Link Budget Calculator
- Label showing the MAC address and the alternative Community string. The label is self-adhesive. You should keep this label safe
- Cable glands (to be used with the ODU-PoE cable)



Figure 3-1: ODU Mounting kit

The ODU comes in two basic form factors as shown in [Figure 3-2](#) below:

	Front	Rear
Connected		
Integrated Antenna		

Figure 3-2: ODU Form Factors

- **Integrated Antenna ODU**

This ODU has an integrated 370mm (1.2ft) flat panel antenna. The ODU contains both the radio and the antenna as a single unit housed in a weatherproof case.

- **Connectorized ODU**

This ODU has 2xN-type connectors for connecting an external antenna

- **HSU only - SFF (Connectorized) ODU**

The SFF ODU is slightly “fatter” and heavier than a regular connectorized ODU since it requires extra space for the built-in antenna.

External Antenna Package Contents

The HBS requires a dual pole sector antenna. HSUs may use any suitable dual pole directional antenna.

External antennas are available for the RADWIN 5000 HPMP radios, varying in operating frequencies, form factor, size and gain.



Figure 3-3: External Antennas for use with RADWIN 5000 HPMP

See the RADWIN products catalog for RADWIN offering of external antennas. External antennas are also available from third party antenna vendors.

Antenna kits contain -

- An antenna
- Two RF cable 1m (3') long
- Mounting kit

Power Over Ethernet (PoE) Devices

GbE PoE

RADWIN's Gigabit Power over Ethernet (GbE PoE) device provides data and power to RADWIN 5000 outdoor units. The PoE device is available with a variety of AC cables with different plug types.

This is the recommended unit for use with a HBS.

It differs externally from the regular PoE in [Figure 3-4](#) below, having an extra LAN port for management.

Basic PoE Device



The basic PoE device provides Ethernet service only, with power for the ODU. The PoE device is extremely compact, having one Ethernet port, one ODU port and a standard 3 pin male AC power socket. The unit is supplied with a standard three pin power cable.

It may be used for both the HBS and the HSUs. It will not support Gigabit performance on the HBS.

Figure 3-4: Basic PoE device - showing the radio Ethernet port

Outdoor (Ruggedized) DC PoE Device



This unit may be used or both the HBS and the HSUs. It will not support Gigabit performance on the HBS.

Figure 3-5: Ruggedized DC-PoE Device: Input is -20 to -60 VDC (single input)

Hub Site Synchronization (HSS) Unit

The HSS unit synchronizes collocated ODUs to prevent self interference. It is particularly useful at a multi-sector base station employing several HBSs.

A single HSS unit supports up to ten collocated ODUs. In addition to each unit being connected to its PoE device, the collocated unit has an additional cable that is connected to the HSS Unit. The HSS Unit is a compact, weatherproof (IP67) connector box that is installed on the same mast as the ODUs. All collocated units connect to this box using CAT-5e cable. Cables in prepared lengths are available for purchase.

The HSS unit is supplied with ten protective covers; any port not in use must be closed with a protective cover.



Figure 3-6: HSS Interconnection Unit

See [Chapter 7](#) for further details about the use of HSS.

GSU

The GPS-based synchronization unit (GSU) is designed to handle inter-site interferences under large-scale deployment scenarios.

The GSU is an outdoor unit consisting of a standard WinLink 1000 enclosure, a GPS antenna and a PoE device.

The GSU is connected to the HSS Unit using a standard HSS cable. It synchronizes the transmission timing of multiple Hub-Sites to the same clock source thus eliminating mutual interference (see [Chapter 11](#)).

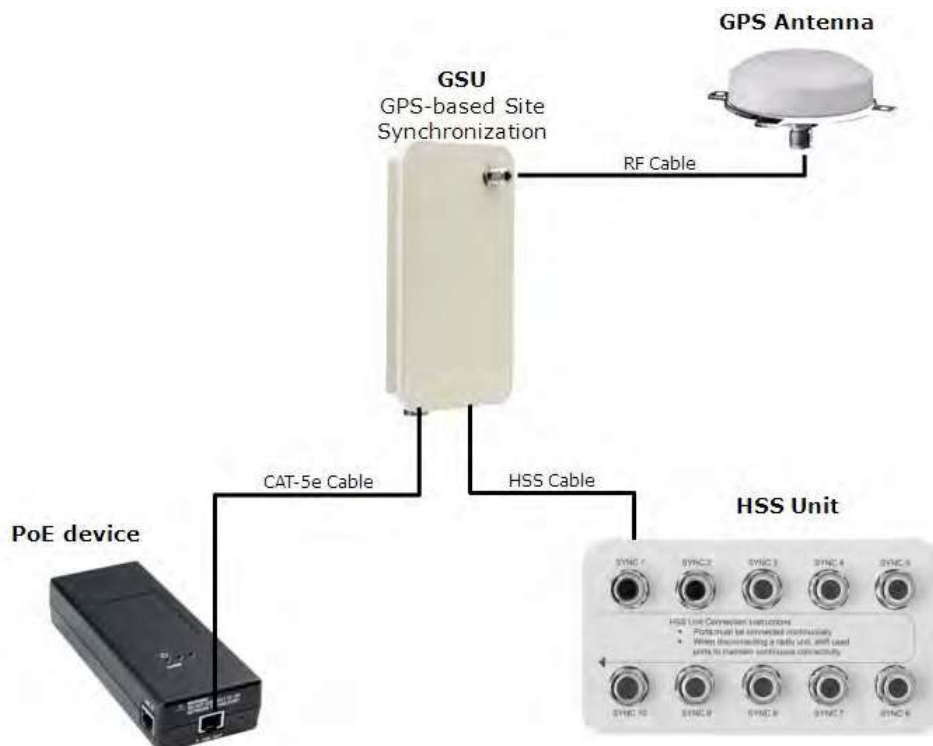


Figure 3-7: General GSU configuration

See [Chapter 8](#) for further details about the use of GSU.

Additional Tools and Materials Required

The following is a list of the equipment and materials required to install RADWIN 5000 HPMP hardware.

Tools and Materials

- Crimping tool for RJ-45 (if the ODU-PoE cable is without connectors)
- Spanner/wrench 13 mm (1/2")
- Drill (for wall mounting only)
- Cable ties
- Sealing material

Cables and connectors

- ODU grounding cable 12AWG
- ODU-PoE cable (outdoor class, CAT-5e, 4 twisted pairs, 24AWG), up to 100 m. for 100BaseT connection. For a 1000BaseT connection (HBS only) use an ODU-PoE cable no longer than 75m.



Note

For 1000BaseT, you should use RADWIN supplied ODU-PoE cables, which guarantee 1Gb performance. RADWIN cannot guarantee 1Gb performance if you use third party cables.

- A crossed Ethernet LAN cable is required if you set up ODUs using the "Local Connection" method.

Hardware Installation Sequence

The following steps are required to install a RADWIN 5000 HPMP system:

1. Mounting the ODUs, page [page 3-8](#).
2. Mounting the external antennas (if used), page [page 3-9](#).
3. Mounting the Lightning Protection devices (if used), page [page 3-9](#).
4. Outdoor connections, page [page 3-9](#).
5. Connecting the PoEs, page [page 3-10](#).
6. Other Indoor connections, page [page 3-10](#).
7. Aligning the HSUs to the HBS, page [page 3-10](#).

See [Figure 3-8](#) below, which illustrates a typical installation of a RADWIN 55xx HSU with an external antenna.

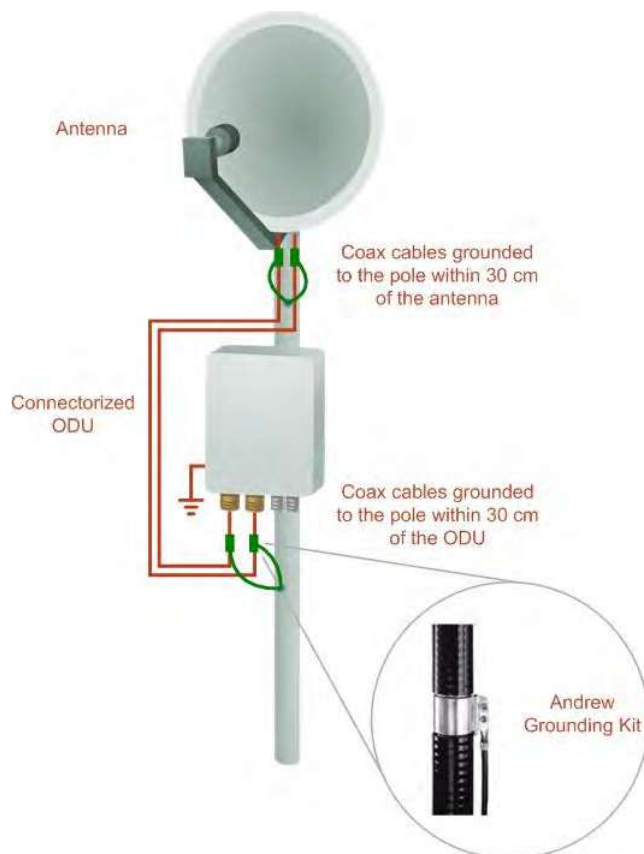


Figure 3-8: Typical HSU installation with external antenna

The HBS installation differs only in the antenna type: The HBS uses a sector antenna. The installation steps are detailed in the following sections.

Outdoor installation

Preparing the ODU before Deployment

Each ODU should be pre-loaded with an IP address. This may be done prior to deployment in the field, or on-site using a Laptop computer. The process is quite straight-forward and described in [Chapter 4](#).

Mounting the ODU

The ODU can be mounted on a pole or a wall. In both installations, the supplied mounting kit is used to secure the ODU.



Note

A mast-sited ODU typically uses a pole attached to the mast.

➤ **To mount the ODU on a pole or a wall:**

1. Ensure that the ODU is properly grounded.
2. Mount the ODU onto the pole or wall. Ensure that the unit is oriented so that the cable connectors are at the bottom. **(If they are on top, water may penetrate**

**Warning**

Prior to connecting cables to the ODU, the protective earth terminal (screw) of the ODU must be connected to an external protective ground conductor or to a grounded pole.

- Only a qualified person using the proper safety equipment should climb the antenna mast
- Only qualified professional personnel should install or dismantle ODUs and masts

into the unit causing damage.) It is possible to mount an ODU horizontally. See [Chapter 17](#) for details.

3. Refer also to [Chapter 17](#) for detailed ODU mounting kit contents and schematics.

**Note**

- Do not tighten the ODU to its mounting brackets until the alignment process of the antenna is complete.
- Ensure that there are no direct obstructions in front of the ODU or interference from man-made obstacles.

Mounting external antennas

If you are using ODU with an integrated antenna, skip to [Mounting the Lightning Protection Devices](#) below.

The supplied mounting kit is used to mount the antenna onto a pole. The antennas must be aligned for maximum throughput.

**Warning**

Never stand in front of a live antenna!

➤ To mount an external antenna:

1. To mount an external antenna, ensure that the antenna is properly grounded and then mount the antenna onto the pole. Refer to [Chapter 17](#) for detailed antenna mounting instructions.
2. Follow the mounting instructions supplied with the antenna.

Mounting the Lightning Protection Devices

The use of lightning protection is dependent on regulatory and end user requirements. The RADWIN 5000 HPMP ODU is designed with surge limiting circuits to minimize the risk of damage due to lightning strikes. RADWIN recommends the use of additional surge arrestor devices to protect the equipment from nearby lightning strikes.

Refer to [Chapter 18](#) for detailed installation instructions of lightning protection devices.

Outdoor Connections

➤ To complete the outdoor connections:

1. Connect the ground cable to the ODU chassis as marked on the ODU.

2. Connect the lightning protection device to the ODU (see [Chapter 18](#)).
3. Attach the ODU-PoE cable to the ODU RJ-45 connector (see [Appendix B](#) for the connector pinout)
4. Screw in the cable glands to ensure hermetic sealing of the ODU.
5. Secure the cables to the pole, mast or brackets using UV-rated cable ties.

Installing a Sector using PoE Devices

A typical PoE device is a very simple unit having a power input connector and two Ethernet ports. It is AC powered, and has a power LED.

➤ To prepare a sector using PoE devices:

1. To connect the ODU to the PoE device, route the cable from the ODU to the PoE device, secure the cable along its path and connect the cable to the LAN-OUT RJ-45 connector on the PoE device.
2. Connect it to AC power.
3. Repeat steps 1 to 2 for all ODUs in the sector.

Connecting User Equipment

➤ To connect user equipment to a PoE device:

- Connect a user switch, router or any other compatible device to the PoE device RJ-45 port designated LAN-IN. Refer to [Appendix B](#) for connector pinouts.

Aligning HSUs to a HBS

You perform HSU antenna alignment to a HBS using the HSU ODU's audible tone.

➤ To align a HSU to its HBS:

1. Ensure that the sector antenna of the HBS is aligned precisely to the sector it is intended to cover. Use a compass and topographical maps to do this.
2. For both the HBS and HSUs: Using a coax cable with N-Type connectors, connect the vertical polarization connector of the antenna to the ANT 1 connector of the ODU. Then, using a second coax cable with N-Type connectors, connect the horizontal polarization connector of the antenna to the ANT 2 connector of the ODU.



Note

There is no particular reason to use ANT 1 and ANT 2 in that order: They just have to be the same for each ODU in the sector. Further, adopting a convention like "ANT 1 is always vertical" avoids mistakes across a large sector.

3. Ensure that power is connected to the site PoEs across the sector.
4. Provided that an HSU detects the signal from the HBS, the ODU starts beeping 20 seconds after power up, and continues beeping until the HSU is aligned to the HBS, and the alignment is complete.

The details are described in the next two steps. "Antenna" refers both to an external antenna and an integrated antenna. The two steps should be carried out for each HSU in the sector.



Warning

Never stand in front of a live antenna!

5. Make a horizontal sweep of 180 degrees with the HSU antenna so that the strongest signal from the HBS can be detected.
6. Slowly turn the HSU antenna back towards the position of the HBS, listening to the tone until the best signal is reached. See the following figure for audible signal variations.

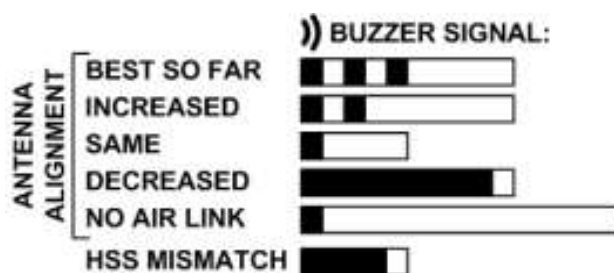


Figure 3-9: Beep Sequence for antenna alignment



Note

- Three beeps and a pause is 'best signal so far'
- Two beeps and a pause is 'signal quality increased'
- One beep and pause is 'no change in signal'
- Long beep and short pause is 'signal quality decreased'
- One beep and a long pause is 'no air link'
- Any other signal does not relate to antenna alignment

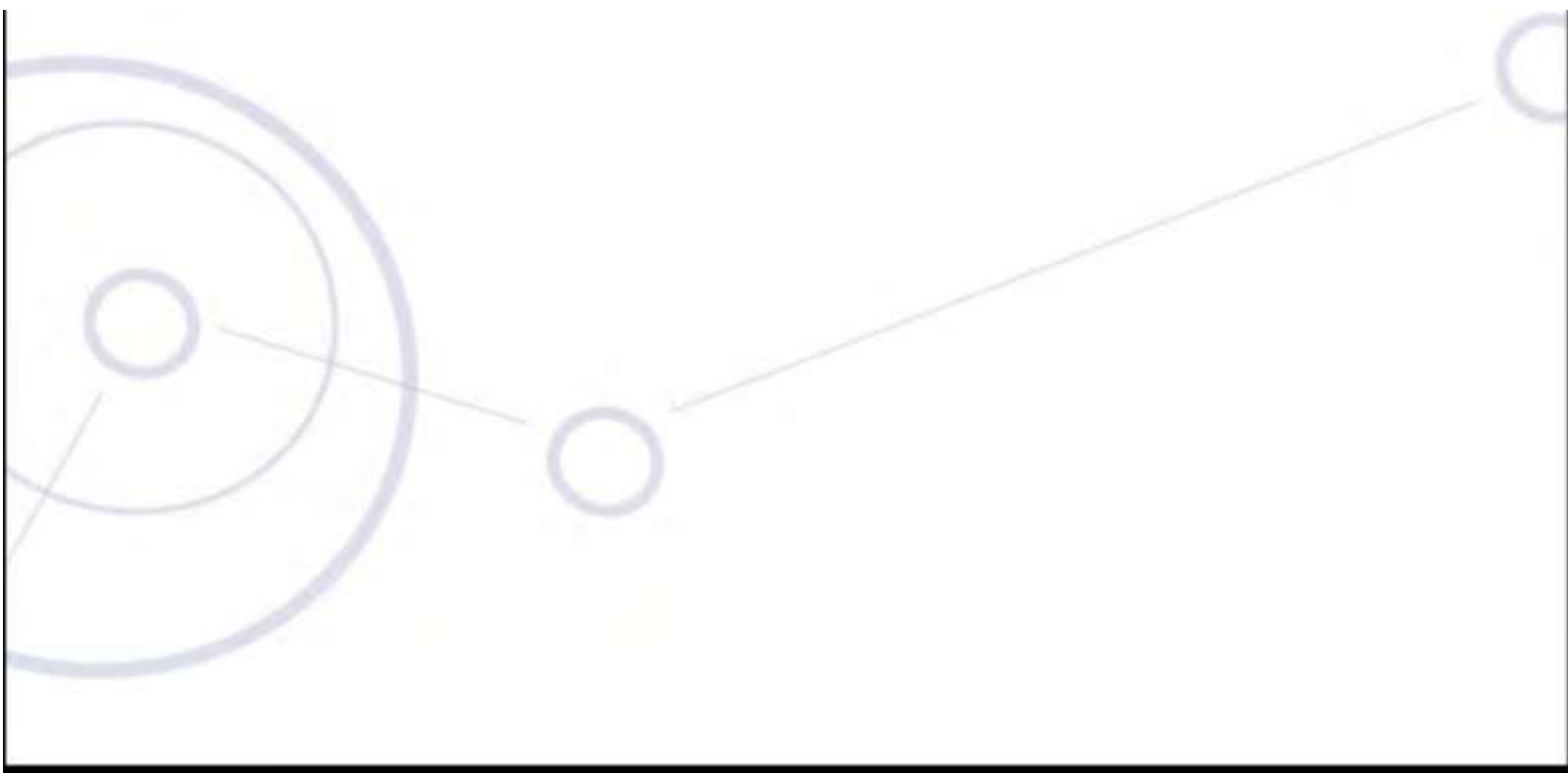
7. Secure the HSU antenna to the pole/wall.

RADWIN

RADWIN 5000 HPMP

Point to Multipoint Broadband Wireless

USER MANUAL



RELEASE 3.1.00

Part 2: Sector Installation

Getting Started with the RADWIN Manager

What we will do here

This chapter is a quick “hands-on” tour of a running c sector. We show you how to install the RADWIN Manager software on your managing PC, connect it to an operating base station and then log on. We then explain the use of the various object on the RADWIN Manager main window.

The background acquired here will enable you to understand the direction and purpose of the detailed procedures (described in later chapters) required to build a RADWIN 5000 HPMP sector from the ground up.

Installing the RADWIN Manager Application

Minimum System Requirements

The RADWIN Manager application is distributed on a CD. Operating system specific PC resources required by the application are set out in [Table 4-1](#) below:

Table 4-1: PC Requirements for the RADWIN Manager Application

	Windows Version	
	XP Pro	Vista/7
Memory	512 MB	1 GB
Processor	P IV	P IV Dual Core

Requirements common to all systems are:

- Hard disk: 1 GB free space
- Network: 10/100BaseT NIC
- Graphics: 1024x768 screen resolution with 16 bit color
- Any modern Web browser to view additional material or get help from the RADWIN Web site.

Installing the Software

Any PC running the RADWIN Manager application can be used to configure a RADWIN 5000 HPMP sector.

➤ To install the RADWIN Manager application:

1. Insert the CD into the CD/DVD drive of your computer.
2. Choose **Install** RADWIN Manager and follow the on-screen instructions of the installation wizard to complete the setup of the RADWIN Manager application.

If the installation program fails to start, browse to your CD/DVD drive, chose the setup.exe program and run it.

Getting Started with the RADWIN Manager

We will look at a preconfigured setup as follows:

Table 4-2: Preconfigured setup

Unit	Name	Attribute	Value	Remark
HBS	Sector_01	IP Address	10.103.15.7	All communicating HSUs and HBS in the same subnet
		Net Mask	255.255.255.0	
		Default Gateway	0.0.0.0	
		Sector ID	EBG_20560554	Inherited by all communicating HSUs
		Contact	J.S. Bach	Optional
		Location	PM_DAF	Location of Contact - optional
		Band	5.730 - 6.845 GHz FCC/IC	Inherited by all communicating HSUs
		Channel Bandwidth	20MHz	Inherited by all communicating HSUs
HSU	PM_AT_02	IP Address	10.103.15.6	All communicating HSUs and HBS in the same subnet
		Net Mask	255.255.255.0	
		Default Gateway	0.0.0.0	
		Contact	J. Btahms	
		Location	North 02	
	PM_AT_01	IP Address	10.103.15.8	All communicating HSUs and HBS in the same subnet
		Net Mask	255.255.255.0	
		Default Gateway	0.0.0.0	
		Contact	L. van Beethoven	
		Location	North 01	

➤ To start the RADWIN Manager:

1. Connect the managing computer to the HBS PoE LAN port.

2. Check that you have connectivity to the HBS ODU. You can do this by opening up a command line session (**Start | Run** and then type, **cmd**). At the command prompt, type

ping 10.103.15.7

You should see something like this:

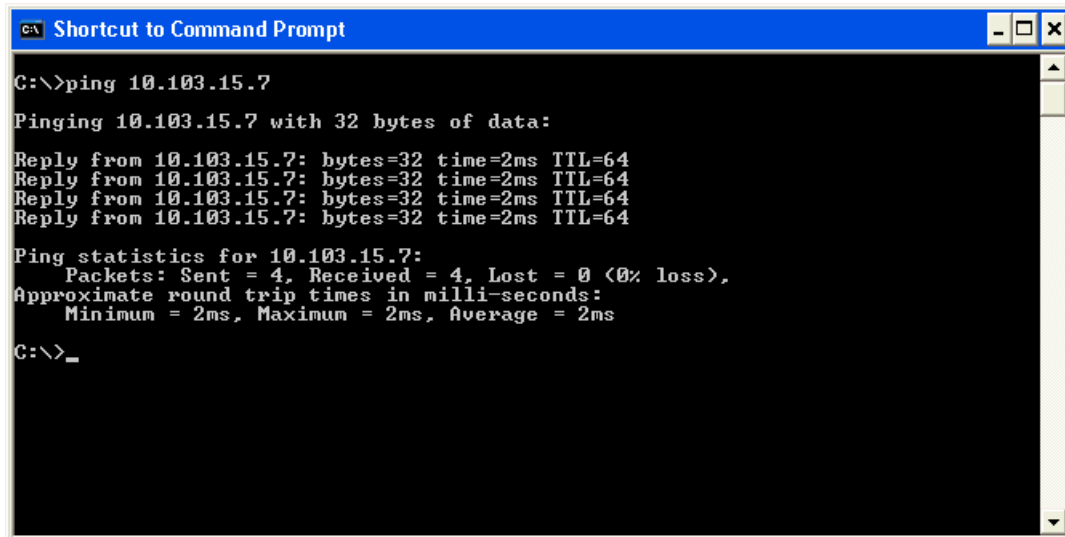


Figure 4-1: Pinging the base station.

Any other response from ping means that the HBS ODU is not responding. Check your Ethernet connection and that both the PoE and ODU are switched on and then try again. If you do not succeed, seek assistance from RADWIN Customer Support.

Pinging the HSUs should yield similar responses.

3. Dismiss the command line session.
4. Open the RADWIN Manager from the desktop icon, or click **Start | Programs | RADWIN Manager | RADWIN Manager**.

The Log-on dialog box appears.



Figure 4-2: Log-on window

The RADWIN Manager log-on Concept

The RADWIN Manager provides three levels of access in one of two entry modes. To see them, click **Options** at any time in the Log on window (Figure 4-2 above). You are offered an **extended** log-on window:



Figure 4-3: Extended log-on window

At the User Type field, click the list button:



Figure 4-4: Log on window exposing the user types.

There are three user types:

- An **Observer** has read-only access to the sector. An Observer can monitor the sector, generate reports, but may not change any sector parameters.
- An **Operator** can install and configure the sector.
- An **Installer** can, in addition to functioning as an Operator, also change the operating frequency band (or regulation). The latter function has legal ramifications, requiring familiarity with local regulations.

If you are connecting through the RNMS server check the RMNS connect button and enter your server IP address.

The following table summarizes these options:

Table 4-3: User types, default passwords and function

User Type	Default Password	Function	Community	Community String
Observer	admin	Monitoring	Read-Only	public
Operator	admin	Installation, configuration	Read-Write	netman
Installer	wireless	Operator plus set band	Read-Write	netman

The Network Manager should change the default passwords as soon as possible.

➤ **Continuing the log-on procedure:**

5. If your User Type is not Operator, then choose it now.
6. Enter the password.
7. If you are a user with Read-Write permission, click **Options** to enter the Community options if required.



- Leave the default Community passwords, **netman** for read-write, and **public** for read-only.
- If you are a user with read-only permission, then you may only log on as Observer.

The RADWIN Manager main window is displayed:

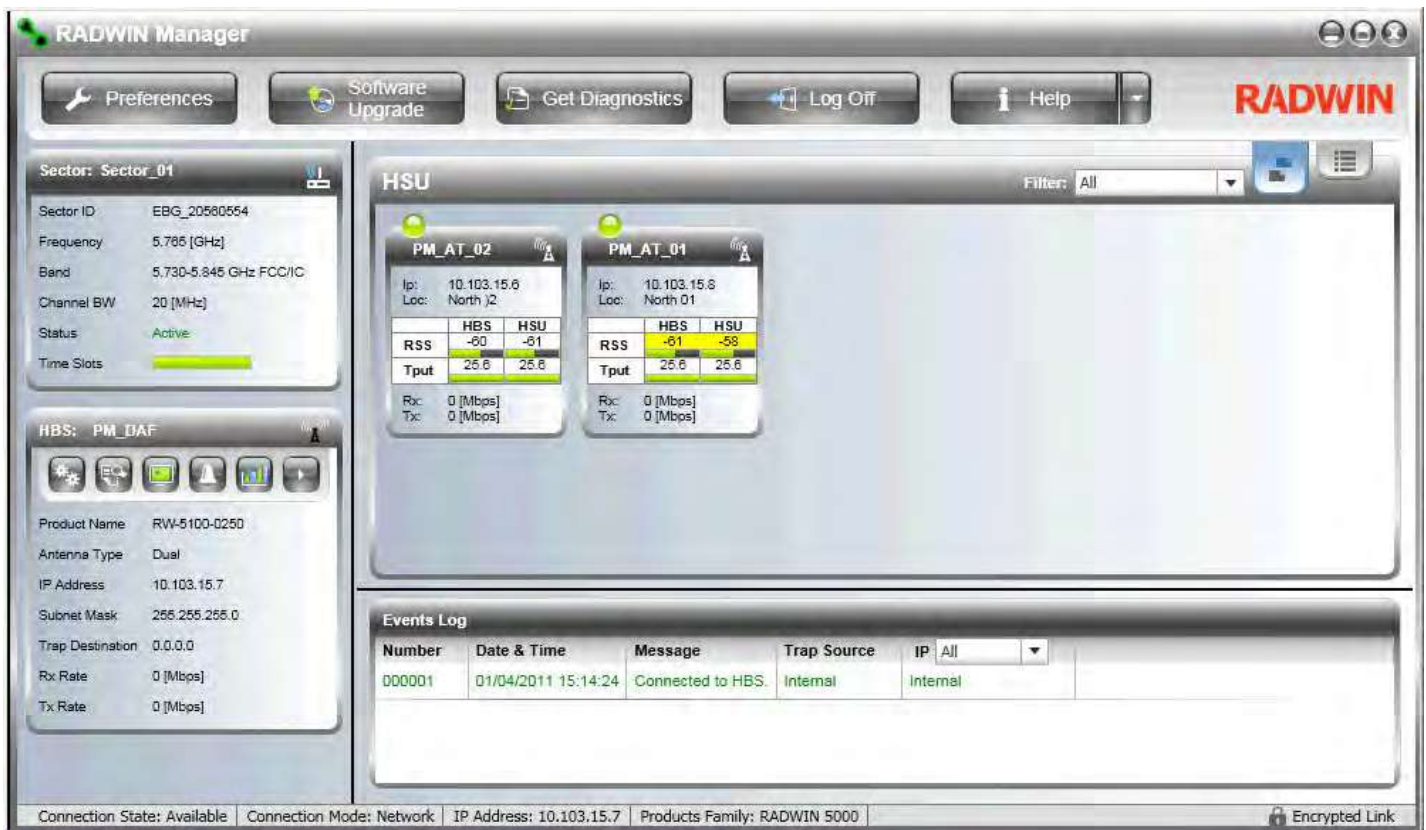


Figure 4-5: Opening RADWIN Manager window - HBS

Log-on Errors and Cautions

Unsupported Device

Attempting to connect to an unsupported device on an otherwise valid IP address (for example, a LAN printer) will result in the following error message:



Figure 4-6: Unsupported device message

Incorrect IP Address

If the IP address chosen is invalid or the sector is unreachable, the following error message will be displayed:



Figure 4-7: Unreachable device message

In both of the above situations, if you click **No**, you will see a warning graphic  alongside the IP Address field.

Incorrect Password

If you type an incorrect password in the Login window, you will see a warning graphic  alongside the password field.

Invalid Read/Write Community String

This will result in the following message:

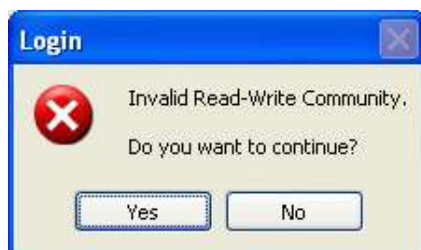


Figure 4-8: Invalid Community String message

Exploring the RADWIN Manager Main Window - HBS

The following sections describe the panels of main window shown in [Figure 4-5](#).

HBS Main Button Menu



Figure 4-9: HBS main button menu

Table 4-4: HBS main button bar functions

Menu Item	Purpose	Reference
Preferences	Monitor - File location, interval and throughput units	
	Events - Color coding for events log and events log file location	
	Advanced - Enable/disable check for updates, monitoring interval and time-out	
Software Upgrade	Perform software upgrade for a sector	
Get Diagnostics	Run and store diagnostics for all or some members of a sector	
Log Off	Return to log-on window	
Help	Link Budget Calculator	
	Check Updates	
	About	

Sector Status Panel

The sector level information is shown here. There is nothing that can be changed for an active sector. The parameters are set before the base station is activated and are duplicated for each HSU in the sector.

**Figure 4-10: Sector Status panel**

The last two items are of special interest: The **Status** (shown as Active) indicates whether the HBS has been activated or not. The **Time Slots** bar indicates how many out of 16 time slots, have been allocated to HSUs. Allocation of time slots between HSU provides a basic form of prioritization between them. Normally you would not leave unallocated time slots unless you intended to add more HSUs. Every HSU requires at least one time slot.

Base Station Panel

The displayed items in the Base Station panel are straight forward.



Figure 4-11: Base Station detail Panel

The Rx and Tx rates are the traffic receive and transmit rates through the HBS ODU under load.

The button bar provides the necessary functionality to configure and manage the HBS.

Table 4-5: HBS Detail Panel button bar functions

Menu Icon	Purpose	Reference
	HBS Configuration	page 6-1
	Recent Events Log	
	Performance Monitor	
	Reserved	
	Reserved	
	Estimated Throughput	
	Change Band	
	SU Connection Table	
	Reset	
	Deactivate	

The foregoing description relates to an activated HBS. The Detail Panel title bar for an inactive HBS looks like this:



Clicking the Activate button initiates an activation Wizard. The Activate button in the title bar is hidden, leaving it looking like this:



The Activation process is covered in detail in [Chapter 5](#).

At any time, the current status of the HBS is shown in the Sector Status Panel, [Figure 4-10](#).

HBS Events Log

The Events Log records system failures, loss of synchronization, loss of signal, compatibility problems and other fault conditions and events.



The foregoing event types include events from all links for which this managing computer has been defined as the traps address. Only events from RADWIN equipment will be shown.

Alarms (traps) are displayed in the Events Log in the lower panel of the main window. The Events Log may be saved as a text file.

The Events Log includes the following fields:

- » **Sequential number (ID)**
- » **Date and time stamp**
- » **Message**
- » **Trap source**
- » **IP address of the ODU that initiated alarm.**

For complete information about traps and alarms see [Appendix E](#).

The events are displayed in the Events Log in the lower right-hand panel of the RADWIN Manager main window:

Number	Date & Time	Message	Trap Source	IP
000001	22/03/2011 11:29:28	Connected to HBS.	Internal	Internal

Figure 4-12: Events Log panel

The events log provides a color coded event list. Green items (like the one in [Figure 4-12](#)) are informational. You can set the color coding for critical, cautionary and informational messages from the **Preferences** button

HBS Main Window**Figure 4-13: HBS Main Window (Reduced) - up to 16 HSUs**

Colored fields indicate a problem requiring your attention. The if you mouse-over the colored RSS area, you will receive a tool tip telling you that RSS for Radio 1 is higher than for Radio 2, or something similar.

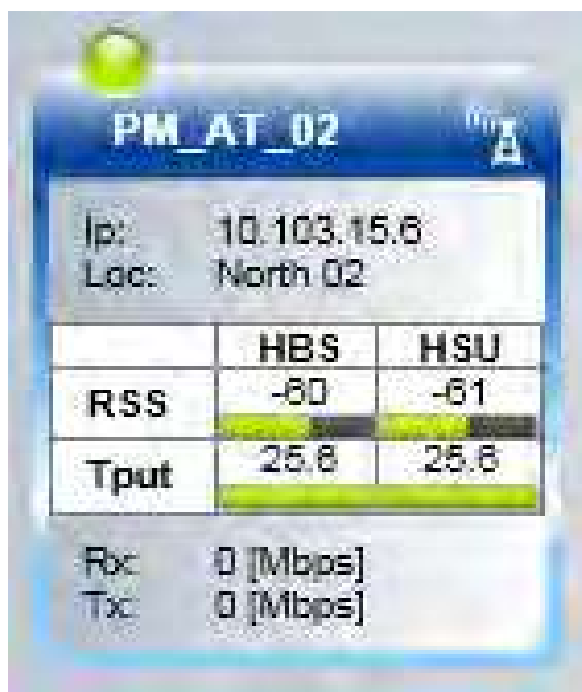
**Figure 4-14: HSU display - detail**



Figure 4-15: HSU display - context menu (right click)



Figure 4-16: HSU display - detail. Scroll right for more fields

The button bar in [Figure 4-16](#) follows the same pattern as the context menu in [Figure 4-15](#).

Table 4-6: HSU main window detail display button bar functions

Menu Item	Menu Icon	Purpose	Reference
Configure		Site configuration for the HSU	
Recent Events		Recent events log per HSU	
Performance Monitoring		Performance Monitoring per HSU	
Estimated Throughput		Estimated Throughput per HSU	
Update Service		Service evaluation and Time Slot allocation per HSU	
Reset		Return to log-on window	
Deregister		Deregister an HSU	

Exploring the RADWIN Manager Main Window - HSU

You may log on to an HSU over the air from a HBS or by directly connecting a Managing Computer to the HSU PoE. You can log on over the air to any HSU, which has been powered up and has “discovered” its HBS even if it has not been registered. The HSU main window is different from the HBS main window, however it uses the same GUI and the same names for common fields.

Logging on to an HSU

You can log on to a SU of an established sector. The log on procedure is the same as for a HBS. Suppose we log on to HSU with IP address 10.103.7.6: We initially receive the following caution:



Figure 4-17: Logging on to an HSU

Upon clicking **OK** to dismiss the caution, we get a variation of the previous main window:

RADWIN Manager

Configure Preferences Get Diagnostics Log Off Help **RADWIN**

Link: PM_AT_01

Sector ID: EBG_20680554
 Frequency: 5.780 [GHz]
 Band: 5.730-5.845 GHz FCC/IC
 Channel BW: 20 [MHz]
 Status: Active

	HSU	HBS
Ip Address	10.103.15.8	10.103.15.7
Location	North 01	PM_DAF
Subnet Mask	255.255.255.0	255.255.255.0
RSS	-59	-82
T-put	25.6	25.6
Rx Rate	0 [Mbps]	0 [Mbps]
Tx Rate	0 [Mbps]	0 [Mbps]

Events Log

Number	Date & Time	Message	Trap Source	IP	All
000001	06/04/2011 12:28:33	Connected to PM_AT_01	Internal	Internal	

Connection State: Available | Connection Mode: Over the air | IP Address: 10.103.15.8 | Products Family: RADWIN 5000 | Encrypted Link

Figure 4-18: Opening RADWIN Manager window - HSU

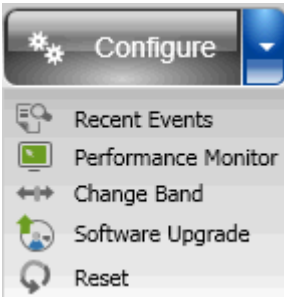
HSU Main Button Menu

The HSU main button menu is similar to the HBS main button menu. The only new item in the **Configure** button.



Figure 4-19: HSU main button menu

Table 4-7: HSU main button bar functions

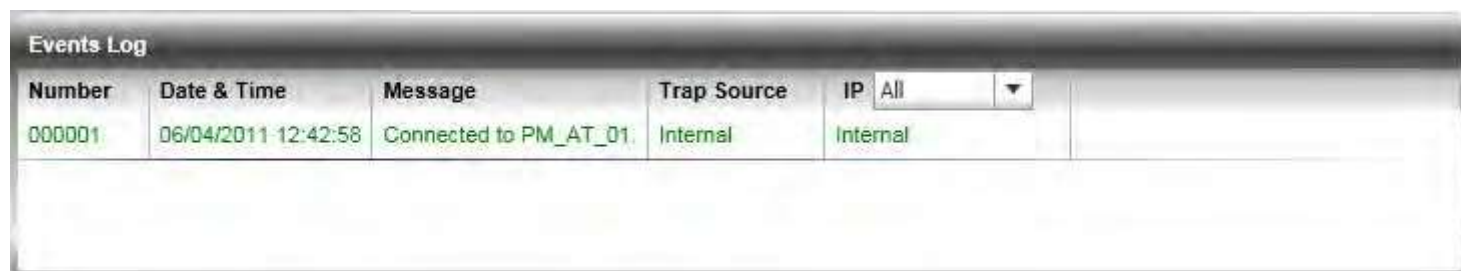
Menu Item	Purpose	Reference
Configure	The Configure button opens HSU site configuration. The additional functions in the detail menu work in the same way as the corresponding functions for the HBS. 	
Preferences	Monitor - File location, interval and throughput units	
	Events - Color coding for events log and events log file location	
	Advanced - Enable/disable check for updates, monitoring interval and time-out	
Get Diagnostics	Run and store diagnostics for all or some members of a sector	
Log Off	Return to log-on window	
Help	Link Budget Calculator	
	Check for updates	
	About	

HSU Link Status



HSU Events Log

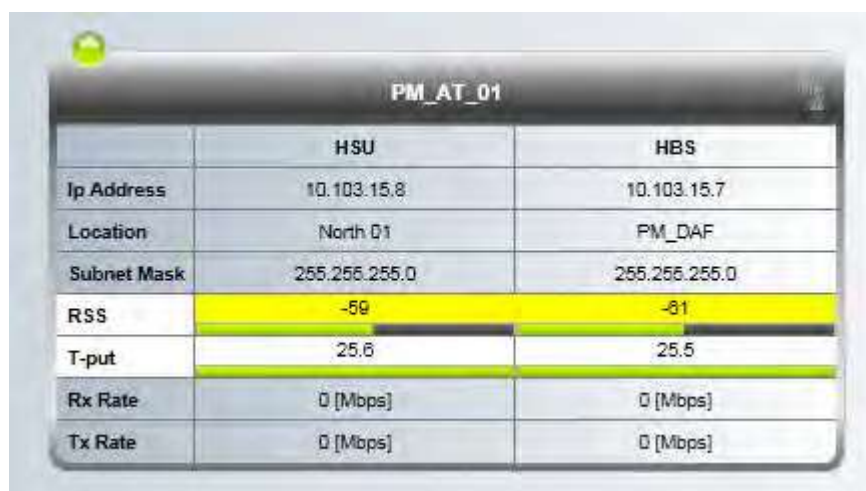
The HSU events display is functionally identical to that of the HBS.



The screenshot shows the 'Events Log' window with a table containing one event. The event details are as follows:

Number	Date & Time	Message	Trap Source	IP
000001	06/04/2011 12:42:58	Connected to PM_AT_01	Internal	Internal

HSU Link Performance



The screenshot shows the 'PM_AT_01' link performance panel. It compares parameters for the HSU and HBS. The RSS values are highlighted in yellow.

	HSU	HBS
Ip Address	10.103.15.8	10.103.15.7
Location	North 01	PM_DAF
Subnet Mask	255.255.255.0	255.255.255.0
RSS	-59	-81
T-put	25.6	25.5
Rx Rate	0 [Mbps]	0 [Mbps]
Tx Rate	0 [Mbps]	0 [Mbps]

The HSU Link Performance panel shows the same things as in [Figure 4-14](#). For convenience we also display the corresponding parameters for the HBS.

What Comes Next?

The purpose of this chapter was to offer an overview of a running RADWIN 5000 HPMP a sector. The next two chapters will cover respectively, detailed sector setup considerations, and monitoring and diagnostics. The foregoing background should provide sufficient "signposts" to ensure that you do not become lost in the plethora of details required to commission a fully operational sector.

Installing the Sector

Scope of this Chapter

Chapter 4, offered an overview of a running Sector as motivation for the technical installation details set out below.

Assuming that the Sector equipment is in place as described in earlier chapters, sector installation has two phases:

- Configuring and activating the HBS
- Bringing up the HSUs - configuration and registration

The same RADWIN Manager program is used for both the HBS and the HSUs. Much of the process is common to both types of ODU. We will cover the HBS in detail; for the HSUs we will concentrate on those items which are different. In any event, where setup procedures are common we will point them out.

Concepts

A HBS out of the package, must be configured with

- Basic RF parameters such as frequency band, channel bandwidth and Sector ID
- Networking parameters such as IP address, Subnet mask and default gateway

At this point, the HBS ODU is in an **inactive** state, powered up, configurable but not transmitting anything.

Upon **activation**, the HBS will commence transmitting and receiving packets related to sector management only - that is no service. Activation and Deactivation are effected quite simply by clicking a toggle button.

Assuming that the Sector HSUs are mounted aligned and powered up, the HSUs will **discover** the HBS establishing links for management only. At this point the HSUs may be managed over the air.

As soon as the HSUs are configured to your satisfaction, you must **register** them on the HBS. Registration of an HSU enables service traffic between the HSU and the HBS.

During the registration process, you assign **time slots** to each HSU. A total of 16 time slots are available to each HBS to be distributed among the HSUs in the sector. The relative number of time slots determines the relative amount of service each HSU will receive. Each HSU

receives at least one time slot. To disable an HSU you must deregister it. (A **suspend** mechanism is also available, to suspend service on an HSU for a fixed period.)

For each registered HSU, you can set separately, the Uplink and Downlink **Maximum Information Rate** (MIR) in Mbps or leave it at **Best Effort**.

You may also manage an **HSU Connection table** to enable and disable connectivity between HSUs in a sector.

Workflow

In this chapter, we assume that you are familiar with the material of [Chapter 4](#). We will concentrate on setup workflow assuming that you are familiar with GUI.

Prior to commencing, you should have written sector plan along the lines of [Table 4-2](#).

Configuring the Sector out of the Box - IP Addresses

The default log-on IP address for all ODUs in the sector is the same: 10.0.0.120, Netmask 255.0.0.0 and default gateway 0.0.0.0. To get the process started, set up the IP address on the network card on the managing computer to something like 10.0.0.100, Netmask 255.255.255.0 and default gateway 0.0.0.0.

Ensure that you have a direct LAN connection to the ODU, run the RADWIN Manager and log-on to it.



Figure 5-1: Logging on with factory default IP address

Here is the main display:

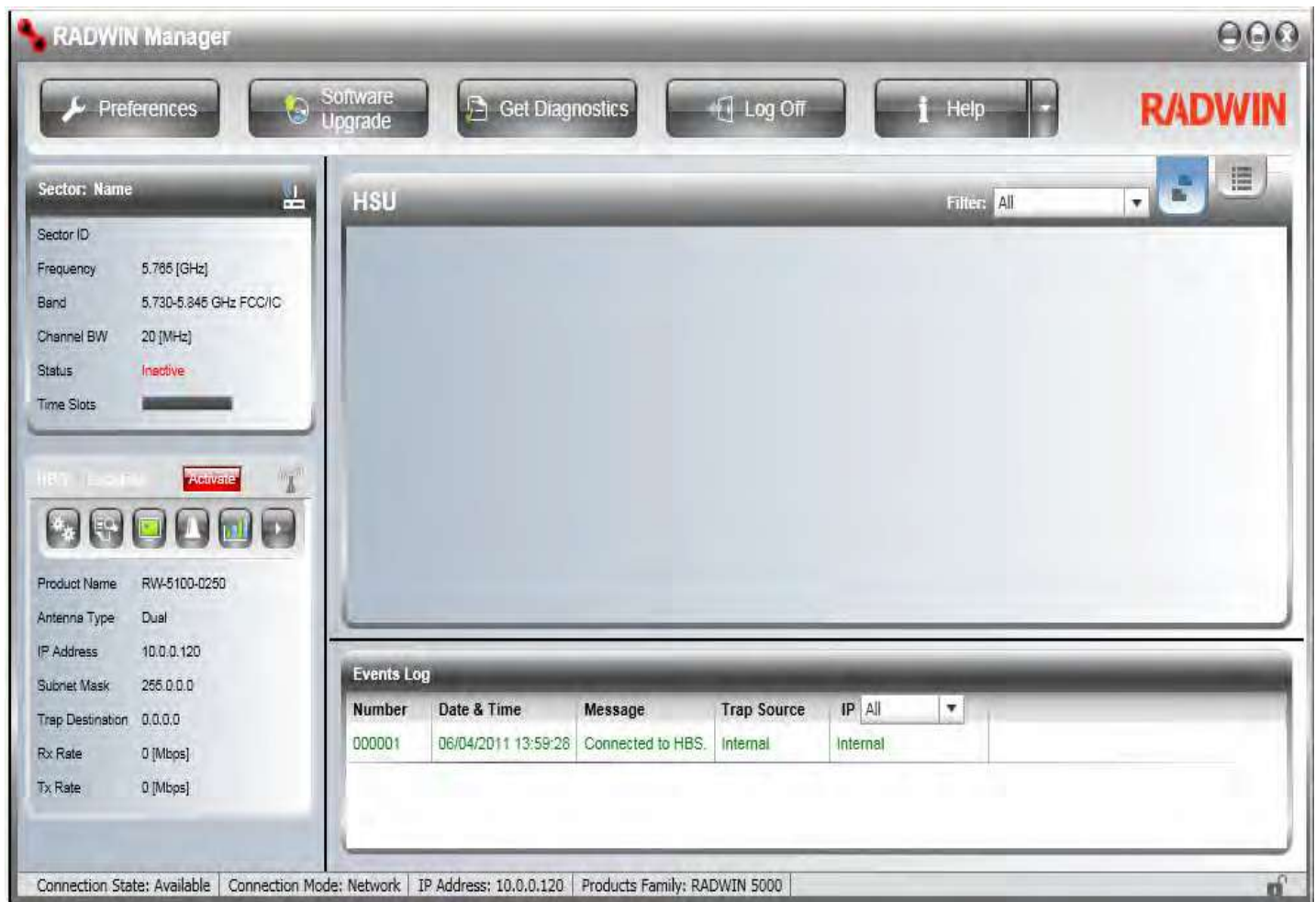


Figure 5-2: Main window for un-configured HBS ODU

Notice the red icon on the top left corner of the window. It will change to green as soon as the HBS is configured and activated.

➤ **To configure the HBS for use:**

1. Click the configuration button . The Base Station site configuration window opens:

The screenshot shows the 'HBS Configuration Sector_01' window. At the top, there are three buttons: 'Backup', 'Restore', and 'Refresh'. Below these is a sidebar with several tabs: 'System', 'Air Interface', 'Tx & Antenna', 'Hub Site Sync', 'Management', 'Inventory', 'Security', 'Date & Time', 'Ethernet', and 'Operations'. The 'Air Interface' tab is currently selected. The main area displays configuration details for a 'Wireless Link'. It includes a 'Description' field with the value 'Wireless Link', an 'ObjectID' field with the value '1.3.6.1.4.1.4458.20.5.1.2', and three input fields for 'Name', 'Contact', and 'Location'. The 'Name' field contains the text 'Name', the 'Contact' field contains 'Person', and the 'Location' field contains 'Location'. Below these fields is a 'Last Power Up' field showing the date and time '4/6/2011 12:09:22 PM'. At the bottom of the window are three buttons: 'OK', 'Cancel', and 'Apply'.

Description	Wireless Link
ObjectID	1.3.6.1.4.1.4458.20.5.1.2
Name	Name
Contact	Person
Location	Location
Last Power Up	4/6/2011 12:09:22 PM

Figure 5-3: Site Configuration prior to definition

2. Enter the Name, Contact and Location field. For what follows we will use the values used in [Chapter 4](#). To ensure that your data is captured use the Apply button after each step.
3. Click the **Air Interface** tab.

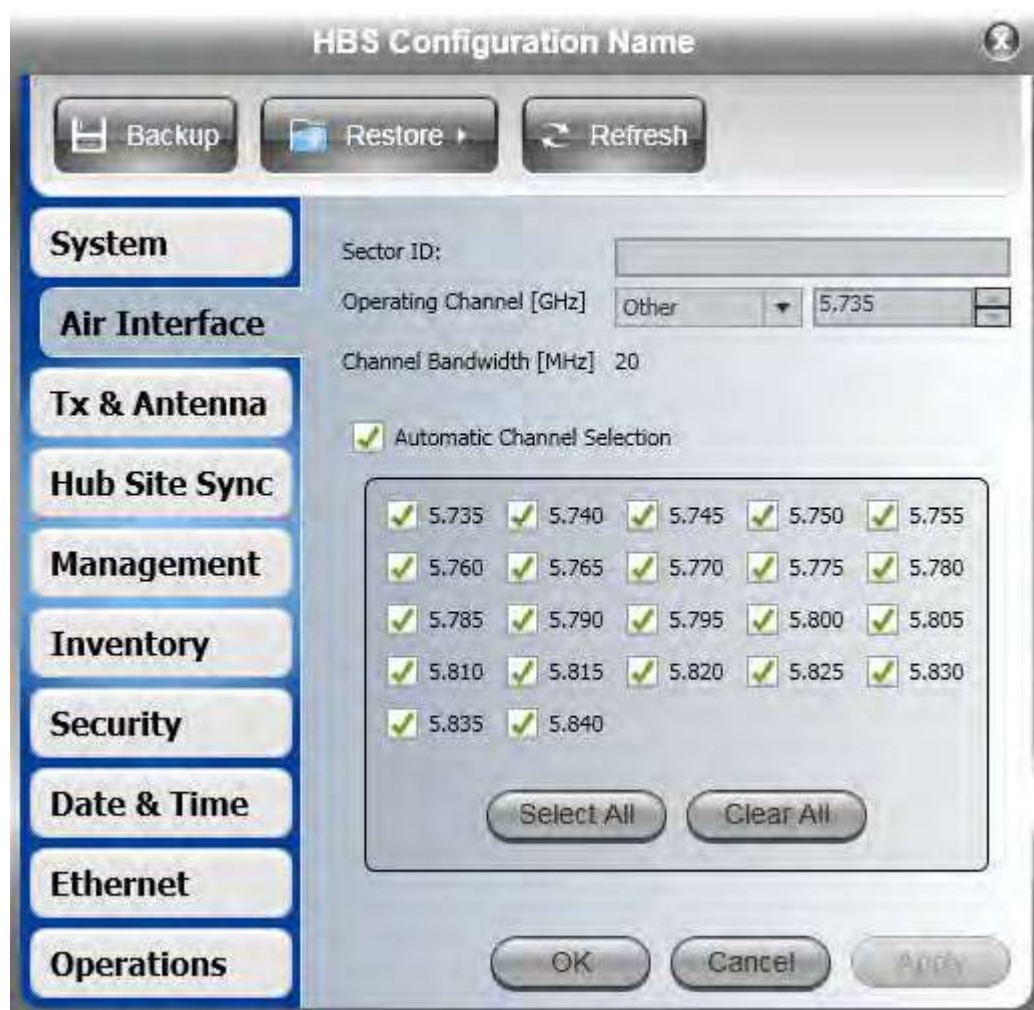


Figure 5-4: Setting the Sector ID and RF parameters

4. The Sector ID may appear blank or some inappropriate default value. You will be able to set it during the Activation process.
5. Click the **Management** tab.

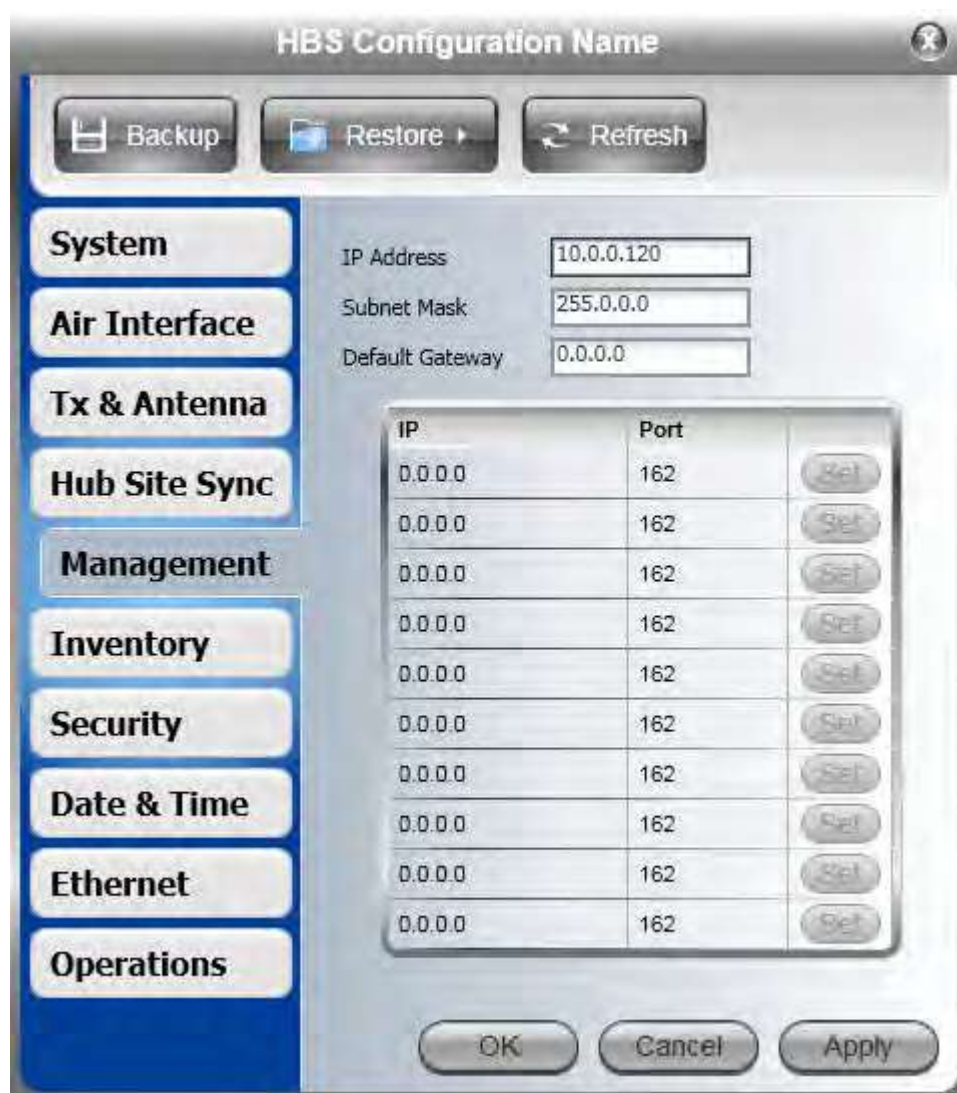
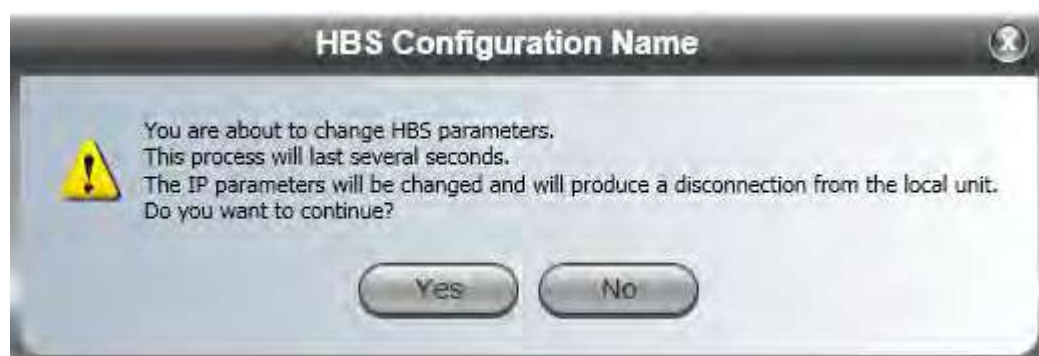


Figure 5-5: Definition of IP address done here

6. Enter the IP address, Subnet Mask and default Gateway and then click **OK**. You are offered a warning:



7. Click **Yes**. The dialog is dismissed and you are returned to the main window. The Sector Status panel indicated (as expected), Device unreachable.
8. Disconnect the HBS ODU and repeat steps 1 to 6 for each HSU in the sector. The opening windows will look different, but the HSU site configuration dialogs will be the same.

At this point you should field-install the units according to the guidelines in [Chapter 3](#). You should now revert your network card to the Sector Subnet.

Activating the HBS

With all the units in place, log on to the HBS using the new IP address. The main window looks like this:

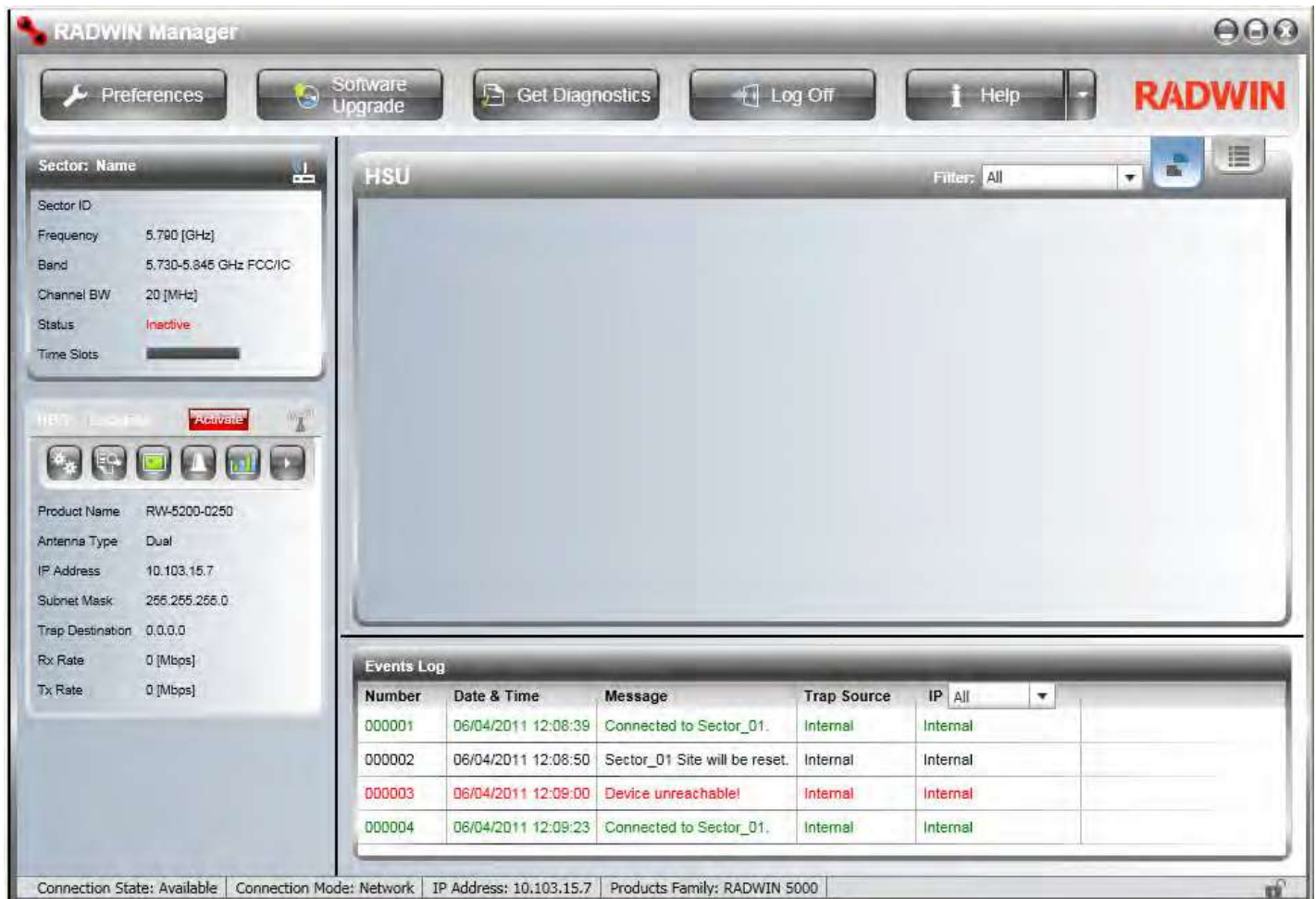


Figure 5-6: HBS ready for configuration and activation

Activating the HBS enables it to be discovered by the HSUs. An Activation Wizard will guide you through the process.

➤ To activate an HBS:

1. Click the **Activate** button. The Activation Wizard opens.



2. Click **Next**:

The screenshot shows the 'HBS Activation Wizard' window at the configuration step. The title bar says 'HBS Activation Wizard'. The form contains the following fields: 'Sector ID' with the value 'EBG_20560554', 'Sector Name' with the value 'Sector_01', 'Location' with the value 'PM_DAF', and 'Link Password' with a masked password '*****'. To the right of the 'Link Password' field is a 'Change...' button. At the bottom, there are three buttons: 'Prev', 'Next', and 'Cancel'.

Enter the **Sector ID**. Choose it carefully particularly if you are using collocated HBSs for extra coverage. The Sector Name and Location are convenience items but should be used to ensure that the sector is documented and easily identifiable in your RF planning. The Link Password may also be changed:

A dialog box titled "Change Link Password" with a close button in the top right corner. It contains three text input fields labeled "Current:", "New:", and "Confirm:". Below these fields is a checkbox labeled "Hide Characters" which is checked. At the bottom are three buttons: "Forgot Link Password?", "OK", and "Cancel".

Change Link Password

Enter current Link Password

Current:

New:

Confirm:

☒ Hide Characters

Forgot Link Password? OK Cancel

It is best left as is if there is no pressing need to change it.

3. From the previous Activation Wizard window, click **Next**.

A dialog box titled "HBS Activation Wizard" with a close button in the top right corner. It contains three text input fields labeled "IP Address", "Subnet Mask", and "Default Gateway". The "IP Address" field contains "10.103.15.7", the "Subnet Mask" field contains "255.255.255.0", and the "Default Gateway" field contains "0.0.0.0". At the bottom are three buttons: "Prev", "Next", and "Cancel".

HBS Activation Wizard

IP Address

Subnet Mask

Default Gateway

Prev Next Cancel

Here you may enter the IP details if didn't do it earlier. Click **Next**.

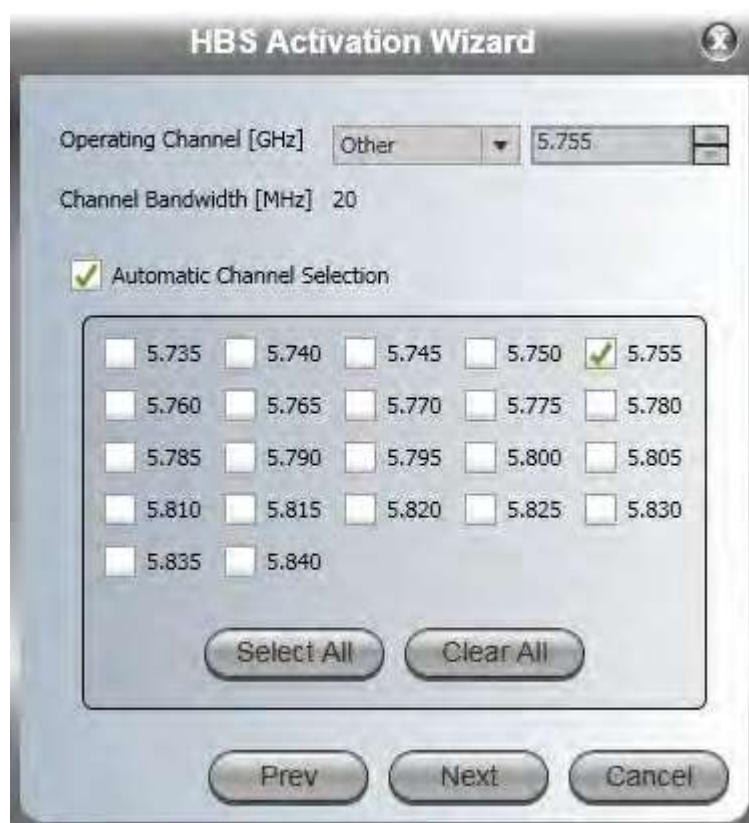
4. The next window is used to set the frequency and channels.y



Choosing **Other** allows you to choose a frequency by hand. Otherwise, you may choose from a drop-down list of available frequencies:



5. Click the Automatic Channel Select box:



You make a manual choice of channels or Select All as shown.



6. Click Next. The Antenna and Tx Power is presented:



The screenshot shows the 'HBS Activation Wizard' window. At the top, there are two radio buttons: 'External' (selected) and 'Integrated'. Below this, the 'Antenna Type' is set to 'Dual'. A series of fields with spinners are listed: 'Required Tx Power (Per radio)' is 25 [dBm], 'Tx Power (Per radio)' is 25 [dBm], 'Tx Power (System)' is 28 [dBm], 'Antenna Gain' is 15.0 [dBi], 'Cable Loss' is 0.0 [dB], 'Max EIRP' is 43 [dBm], and 'EIRP' is 43 [dBm]. At the bottom, there are three buttons: 'Prev', 'Next', and 'Cancel'.

Parameter	Value	Unit
Antenna Connection Type	External	
Antenna Type	Dual	
Required Tx Power (Per radio)	25	[dBm]
Tx Power (Per radio)	25	[dBm]
Tx Power (System)	28	[dBm]
Antenna Gain	15.0	[dBi]
Cable Loss	0.0	[dB]
Max EIRP	43	[dBm]
EIRP	43	[dBm]

When setting Required Tx Power, it is your responsibility to choose a value in compliance with your local regulations. Click **Next**.

7. The Summary window of the Wizard is displayed.



The screenshot shows the 'HBS Activation Wizard' window at the summary stage. The title is 'Completing the HBS Activation Wizard.' Below the title, it says 'You have successfully completed the HBS Activation Wizard.' A list of parameters is displayed: 'Sector ID' is EBG_20560554, 'Channel [GHz]' is 5.755, 'Channel BW [MHz]' is 20, and 'Antenna Type' is Dual. At the bottom, it says 'To activate HBS, click Activate.' and there are two buttons: 'Activate' and 'Cancel'.

Parameter	Value
Sector ID	EBG_20560554
Channel [GHz]	5.755
Channel BW [MHz]	20
Antenna Type	Dual

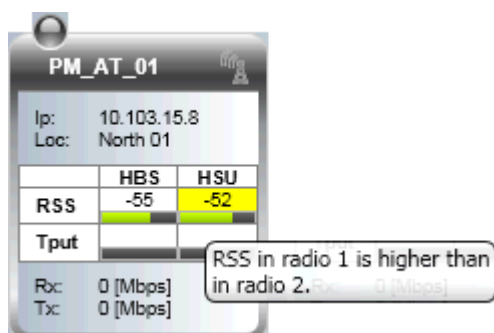
If everything looks correct, click the Activate button. After a few moments you will see the sector.



Figure 5-7: The sector showing HSUs configured but unregistered

At this point, the HSUs can communicate for management but not for service.

Observe that both HSUs have the RSS entry for the HSU shaded yellow. Shading of this type indicates a problem. To see what it is, mouse-over the shaded area. A tool tip appears displaying a message:



You should correct the problem before proceeding.

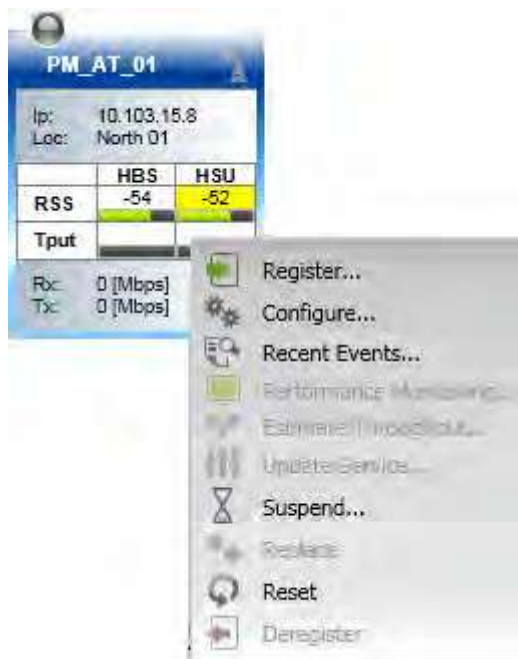
Further, you may have observed that operating frequency 5.760 GHz shown, is not what we chose. The HBS tries to optimize the frequency to minimize the kind of problem displayed above. If in fact with the "setup" we are using, trying different frequencies, eventually removes the problem. The remaining screen captures in this chapter are merely for illustration and are not from a consistent activation run.

Registering the HSUs for Service

We continue our illustration using HSU at PM_AT_01.

➤ **To register an HSU for service:**

1. Right click an HSU to get its context menu:



2. Click **Register...** The Registration window opens:



- Click the **Evaluate** button. Service evaluation takes a few seconds during which the window is darkened and inactive. Upon completion you may assign time slots to the HSU:

HSU Registration - 1234567890123456

Name:

Location:

Evaluating...

Time Slots	Uplink [Mbps]	Downlink [Mbps]
1	3.2	3.2
2	6.4	6.4
3	9.6	9.6
4	12.8	12.8
5	16	16
6	19.2	19.2
7	22.4	22.4
8	25.6	25.6

Maximum Information Rate

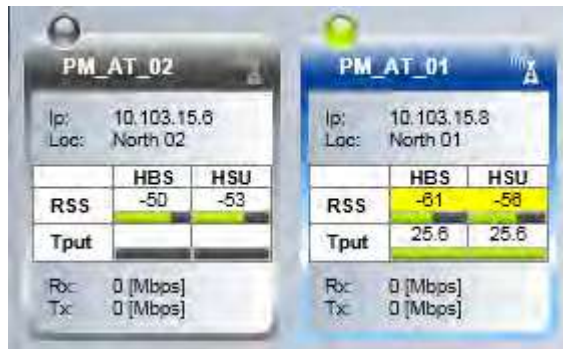
Down Link [Mbps] ☒ Best Effort
 0.5 100

Up Link [Mbps] ☒ Best Effort
 0.5 100

- Click the number of time slots to be allocated to the HSU.

Time Slots	Uplink [Mbps]	Downlink [Mbps]
1	3.2	3.2
2	6.4	6.4
3	9.6	9.6
4	12.8	12.8
5	16	16
6	19.2	19.2
7	22.4	22.4
8	25.6	25.6

- The **Register** button is enabled. Click it to complete the process. Here is the result:



6. Repeat the process for all other HSUs in the sector. Here is the final result for our example:



Figure 5-8: Fully functional sector

Managing the Sector

Scope of this Chapter

A Configuration window is available for both the HBS and the HSUs to change setting without necessarily dropping service. Nevertheless care must be exercised when changing them. By way of example, changing an IP address will possibly make a unit unreachable. It is necessary however to have this function in the Configuration window since it is required to initially set up the unit.

Configuring the HBS/HSU

Open the configuration window. We will work through each of the tabs in turn.

System (HBS and HSU)

HBS Configuration Sector_01

Backup Restore Refresh

System

Description: Wireless Link

ObjectID: 1.3.6.1.4.1.4458.20.5.1.2

Name: Sector_01

Contact: J.S. Bach

Location: PM_DAR

Last Power Up: 4/6/2011 12:09:22 PM

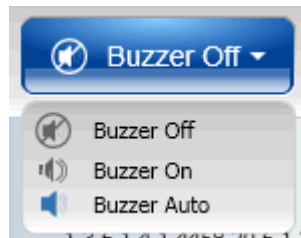
OK Cancel Apply

These items may be changed both for the HBS and HSUs. They are convenience fields.

The HSU button bar has an extra item:



The Buzzer button may set or mute the buzzer.



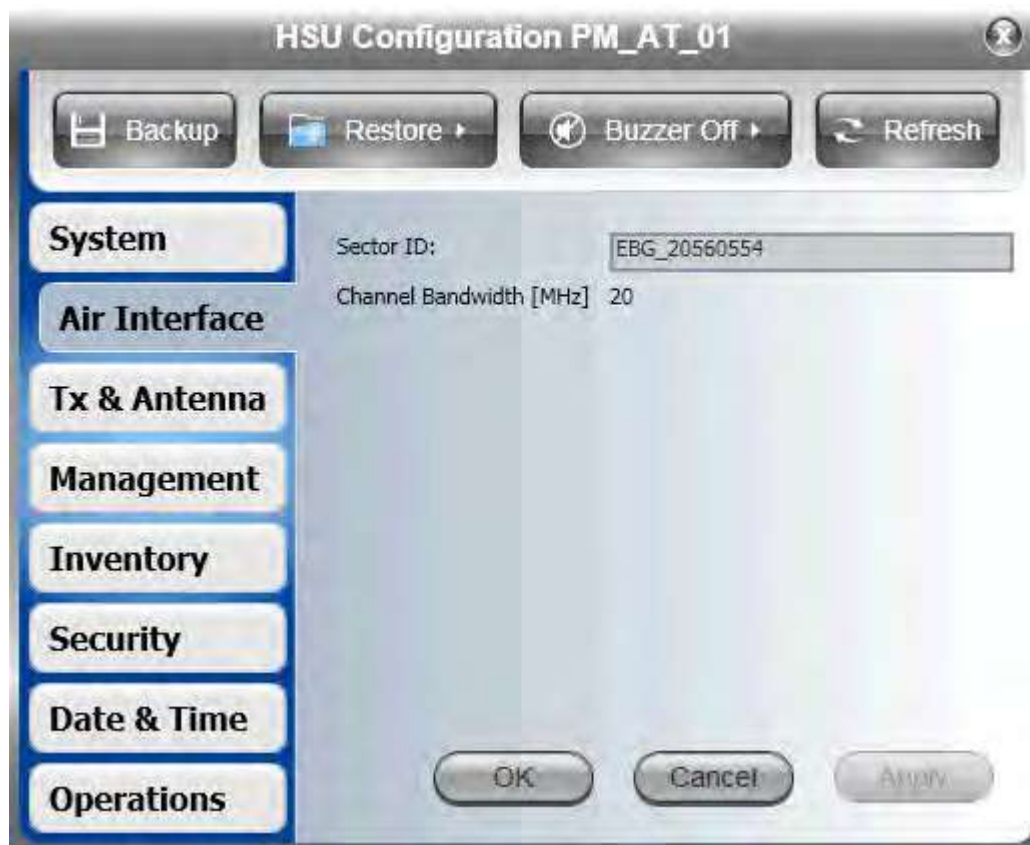
Recall that the buzzer tone is used for antenna alignment.

Air Interface (HBS)

The screenshot shows the 'HBS Configuration Sedor_01' window. On the left is a vertical menu with buttons for 'System', 'Air Interface' (which is highlighted), 'Tx & Antenna', 'Hub Site Sync', 'Management', 'Inventory', 'Security', 'Date & Time', 'Ethernet', and 'Operations'. The main area contains configuration options for the selected 'Air Interface' section. At the top of the main area are three buttons: 'Backup', 'Restore', and 'Refresh'. Below these, the 'Sector ID' is set to 'EBG_20560554'. The 'Operating Channel [GHz]' is set to 'Other' with a dropdown arrow and '5,740' in a text box. The 'Channel Bandwidth [MHz]' is set to '20'. There is a checked checkbox for 'Automatic Channel Selection'. Below this is a grid of checkboxes for various frequency channels. The channel 5.770 is selected with a green checkmark. At the bottom of the grid are 'Select All' and 'Clear All' buttons. At the very bottom of the window are 'OK', 'Cancel', and 'Apply' buttons.

Frequency [GHz]	Selected
5.735	☐
5.740	☐
5.745	☐
5.750	☐
5.755	☐
5.760	☐
5.765	☐
5.770	☒
5.775	☐
5.780	☐
5.785	☐
5.790	☐
5.795	☐
5.800	☐
5.805	☐
5.810	☐
5.815	☐
5.820	☐
5.825	☐
5.830	☐
5.835	☐
5.840	☐

For the HBS this panel has the same functionality as the corresponding window in the Activation Wizard (see [Chapter 5](#)). For the HSU, this panel is read only.



Tx and Antenna (HBS and HSU)

HBS Configuration Sedor_01

Backup Restore Refresh

System

Air Interface

Tx & Antenna

Hub Site Sync

Management

Inventory

Security

Date & Time

Ethernet

Operations

Antenna Connection Type: ☒ External ☐ Integrated

Antenna Type	Dual	
Required Tx Power (Per radio)	25	[dBm]
Tx Power (Per radio)	25	[dBm]
Tx Power (System)	28	[dBm]
Antenna Gain	15.0	[dBi]
Cable Loss	0.0	[dB]
Max EIRP	43	[dBm]
EIRP	43	[dBm]

OK Cancel Apply

Hub Site Sync [HSS] (HBS)

See [Chapter 7](#).

Management (HBS and HSU)

If you set the IP and related addresses correctly, there should be nothing to change here.

Inventory (HBS and HSU)

You might like to capture or copy the information here:



The Inventory information will be required by Customer Support should you require assistance.

Security (HBS and HSU)

Here you may change the SNMP Community strings and the Link password.

Date and Time (HBS and HSU)

The screenshot shows the 'HBS Configuration Sedor_01' window. On the left is a vertical menu with buttons for 'System', 'Air Interface', 'Tx & Antenna', 'Hub Site Sync', 'Management', 'Inventory', 'Security', 'Date & Time' (which is highlighted), 'Ethernet', and 'Operations'. At the top of the main area are three buttons: 'Backup', 'Restore', and 'Refresh'. The 'Date & Time' configuration section includes three rows: 'NTP Server' with a text box containing '0.0.0.0' and a 'Clear' button; 'Offset [Minutes]' with a spinner box set to '0' and a '00:00 [HH:mm]' label; and 'Date & Time' with a text box showing '9/1/2005 1:20:58 AM' and a 'Change' button. At the bottom of the window are 'OK', 'Cancel', and 'Apply' buttons.

Ethernet (HBS only)

The only field you may change here is the HBS aging time.

Operations (HBS and HSU)



When you are satisfied with your configuration parameters, click **OK** to save them and dismiss the Configuration window.

HSU Connection Table

From the HBS button bar, click the right hand button followed by **SU Connection Table**.



The following table is displayed:



Figure 6-1: HSU Intercommunication

The green shaded squares show intercommunicating elements within the sector. MNG refers to management traffic which should always be open between HSUs and the HBS. LAN refers to service traffic between the HBS and the HSUs. As shown, the two HSUs may not communicate between themselves. Clicking the top white square would enable communication (via the HBS) between them.

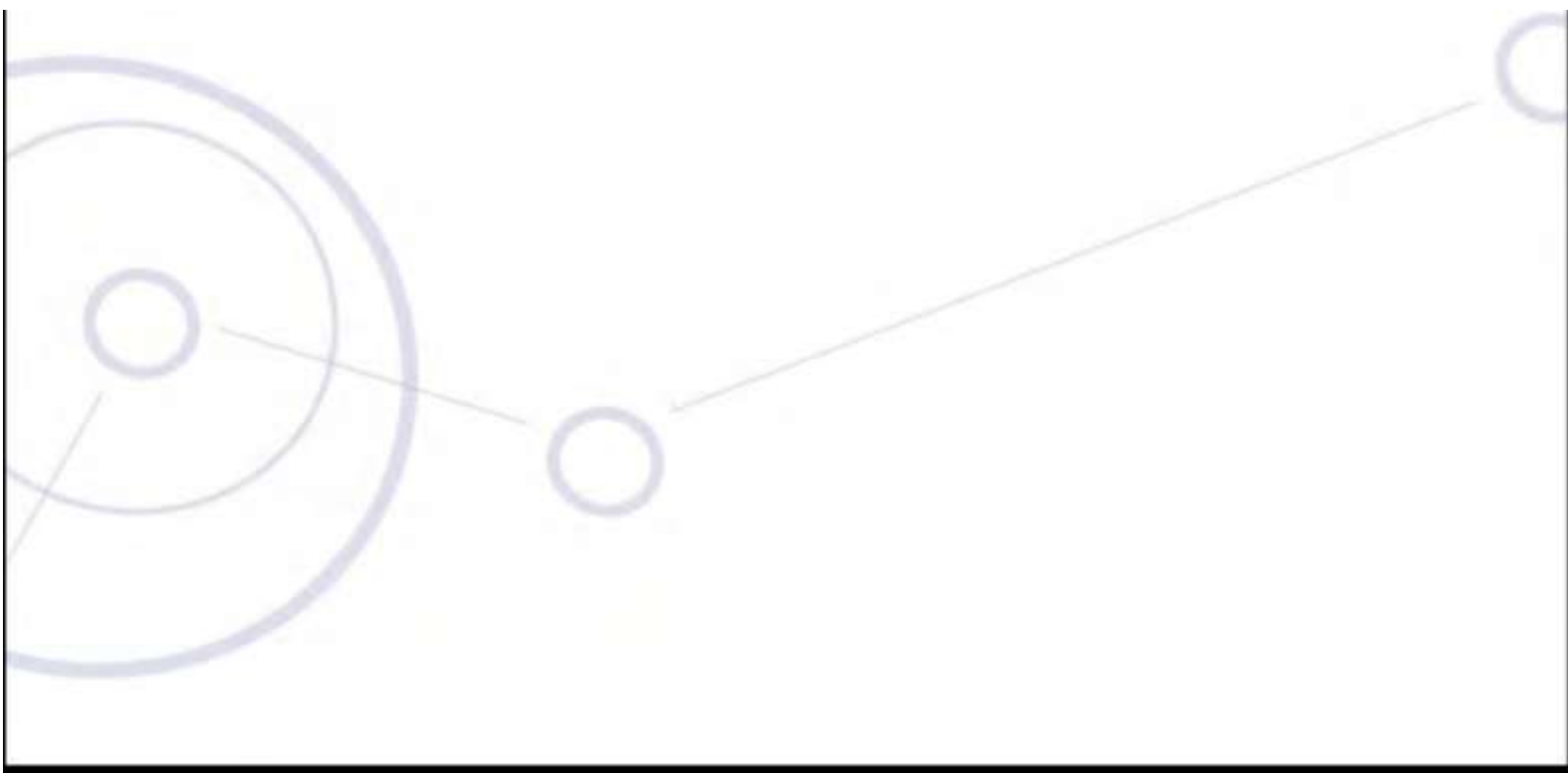
You may in fact disable all traffic between the HBS and the HSUs and restore it using this device.

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Part 3: Site Synchronization

Hub Site Synchronization

Scope of this Chapter

This chapter is specific to collocating HBSs. Should you require to collocate with other radio models, you should consult with RADWIN Customer Service.

What is Hub Site Synchronization?

When several units are collocated at a common hub site, interference may occur from one unit to another. RADWIN ODU units support the collocation of more than two units at a central site. Like any other RF deployment, the wireless operation is highly dependent on factors such as available frequencies, the physical spacing between radios, other interfering radios, and whether WinLink 1000, RADWIN 2000 or RADWIN 5000 HPMP units are installed.



Note

HSS does not eliminate the need for careful RF planning to ensure the design will work as planned. See [Chapter 2](#) for information on installation site survey.

The RADWIN Hub Site Synchronization (HSS) method uses a cable connected from the master ODU to all collocated ODUs; this cable carries pulses sent to each ODU, which synchronize their transmission with each other. The pulse synchronization ensures that transmission occurs at the same time for all collocated units. This also results in all of the hub site units receiving data at the same time, eliminating the possibility of interference that could result if some units transmit while other units at the same location receive.

Figure 7-1 illustrates interference caused by non-synchronized collocated units.

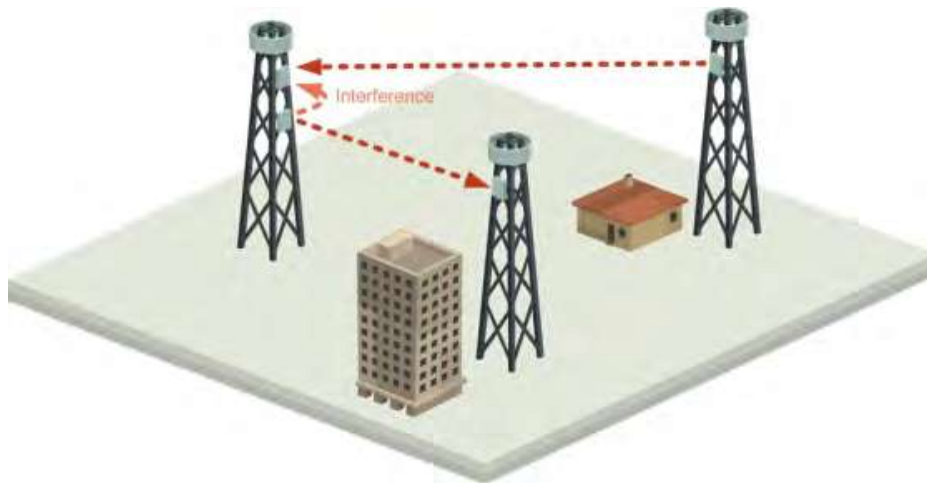


Figure 7-1: Interference caused by collocated units

Adding HSS removes interference as shown in the next two figures:

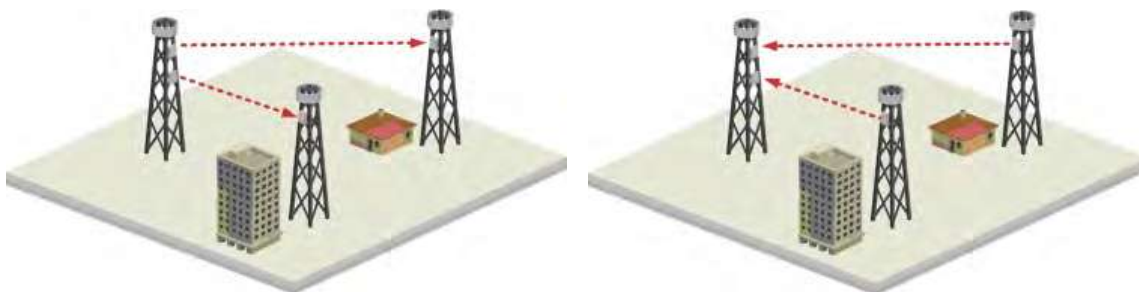


Figure 7-2: Collocated units using Hub Site Synchronization (1)

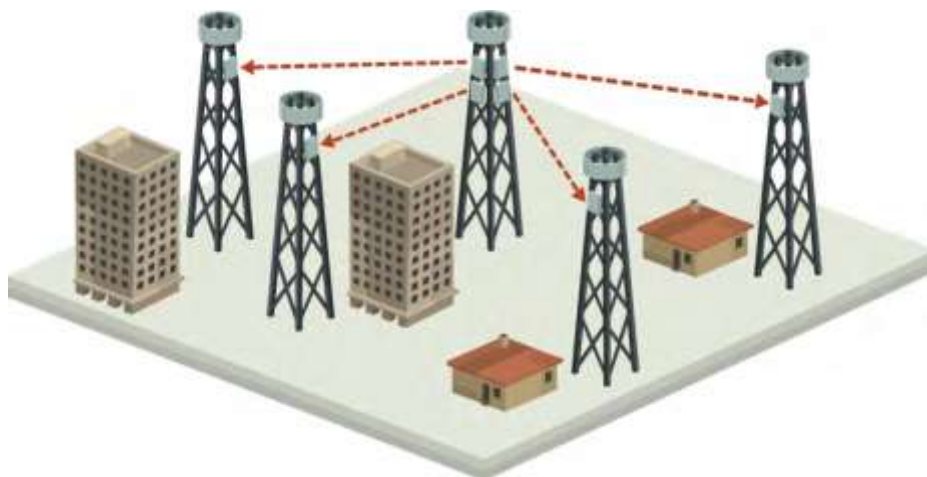


Figure 7-3: Collocated units using Hub Site Synchronization (2)

The units are connected to each other with HSS cables and HSS Distribution Units.

One of the radios in the site is defined as HSS Master and generates synchronization pulses.

The other collocated radios in the site - the HSS Clients, are connected to the HSS Master and synchronize their transmission to the pulses. An HSS Client can be configured to work in one of two modes:

- **HSS Client-Continue Transmission (HSC-CT):** If the unit loses synchronization with the HSS Master, the link remains active. However, without synchronization pulses, it is possible that this unit will cause interference.
- **HSS Client-Disable Transmission (HSC-DT):** If the unit loses synchronization with the HSS Master, the link is dropped until the synchronization pulses resume. This setting prevents the unit from causing interference.

The remote ODUs that are not located at the hub site, are called Independent Units.

Hardware Installation

Connecting an HSS Unit

A single HSS unit supports up to ten collocated ODUs. In addition to each unit being connected to its IDU or PoE device, the collocated unit has an additional cable that is connected to the HSS Unit. The HSS Unit is a compact, weatherproof (IP67) connector box that is installed on the same mast as the ODUs. All collocated units connect to this box using CAT-5e cable. Cables in prepared lengths are available for purchase.

The HSS unit is supplied with ten protective covers; any port not in use must be closed with a protective cover.



Figure 7-4: HSS Interconnection Unit



Note

- For a single HSS unit, ensure that the collocated units are connected in sequence from SYNC 1. If an ODU is removed from the hub site, then all remaining ODUs must be reconnected to maintain the connectivity.
- You may cascade (daisy-chain) two or more HSS Units with an HSS cable. The method is described in detail below.

➤ To connect an ODU to an HSS unit:

1. Unscrew the protective cover from the port marked SYNC 1.
2. Connect the RJ-45 connector from one end of the prepared CAT-5e cable to SYNC 1.
3. Connect the other end of the CAT-5e cable to the ODU connector labeled SYNC.
4. Tighten the protective seal that is on the prepared cable over the RJ-45 connector.
5. Repeat for all ODUs that are to be collocated at the hub site. The next ODU to be connected is inserted in SYNC 1, SYNC 2, followed by SYNC 3 and so on.

Using a Single HSS Unit

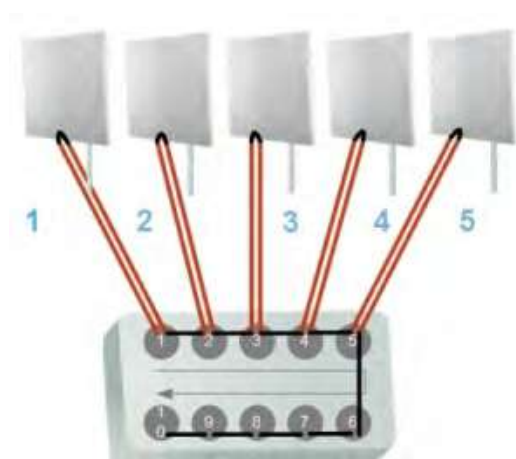


Figure 7-5: HSS Wiring schematic

The wiring, as shown in [Figure 7-5](#) is self explanatory. The Sync signal path is less self evident. If we set ODU 1 (on SYNC 1) to HSS Master, then the Sync signal path is as shown in [Figure 7-6](#). The signal travels from ODU 1 to SYNC 1, from SYNC 1 to SYNC 2, from SYNC 2 to ODU 2 and back again. The back and forth paths repeat for the second to fourth ODU, from left to right. The signal exits the HSS unit at SYNC 5 and terminates in ODU 5.

The choice of the ODU on SYNC 1 as HSS master is not mandatory, but is good practice. If for example we were to use ODU 3 as HSS master, the Sync signal path would be ODU 3 to SYNC 3, then left and right to SYNC 2 and SYNC 4. It would then propagate to ODUs 2 and 4, terminating at both ODUs 1 and 5.

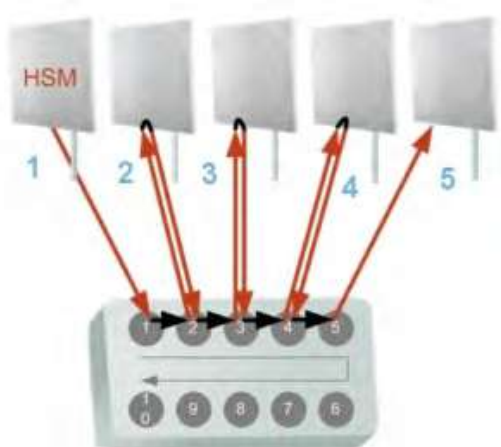


Figure 7-6: HSS sync signal path with ODU 1 as HSS Master

Using More than One HSS Unit

In a large collocation site, several HSS units may be cascaded (daisy-chained) subject to the following conditions:

Condition 1: Cabling Sequence

1. Up to nine ODUs may be connected to the first HSS unit using HSS ports SYNC 1, SYNC 2, SYNC 3,... up to SYNC 9 in order without leaving empty ports.

2. The next available SYNC port of the first HSS unit should be connected to SYNC 10 of the second HSS unit as shown in **Figure 7-7**. In the illustration, the next available port on the first HSS unit is SYNC 6.
3. The second HSS unit may be filled out with up to nine more ODUs in **reverse** order. That is, connect SYNC 9, SYNC 8, SYNC 7... as shown in **Figure 7-7**.

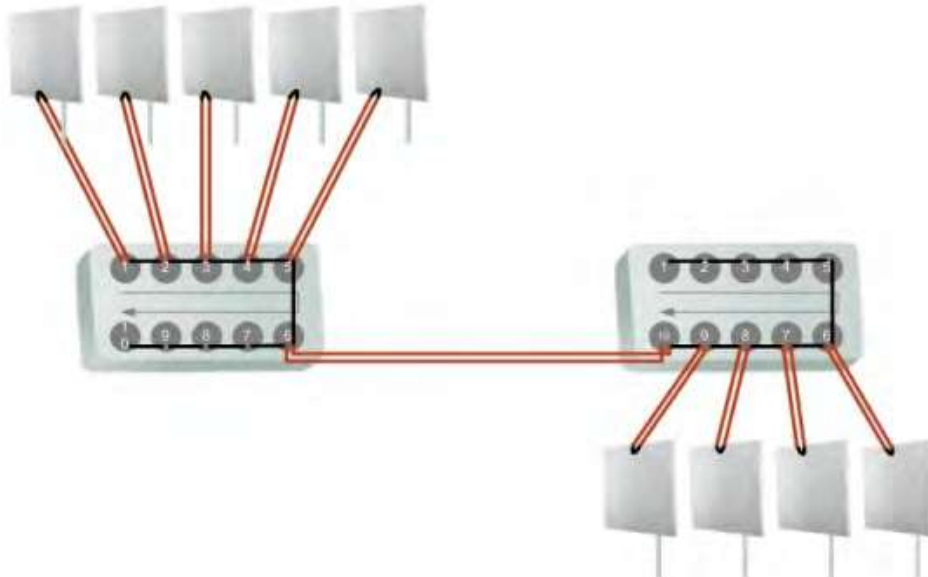


Figure 7-7: Cascading two HSS units

4. To add a further HSS unit: Connect the next available SYNC port from the second HSS unit in **descending order** (SYNC 5 in **Figure 7-7**) to SYNC 1 of the third HSS unit.
5. ODUs are connected to the third HSS unit from SYNC 2 as shown in **Figure 7-8**, in **ascending order**:

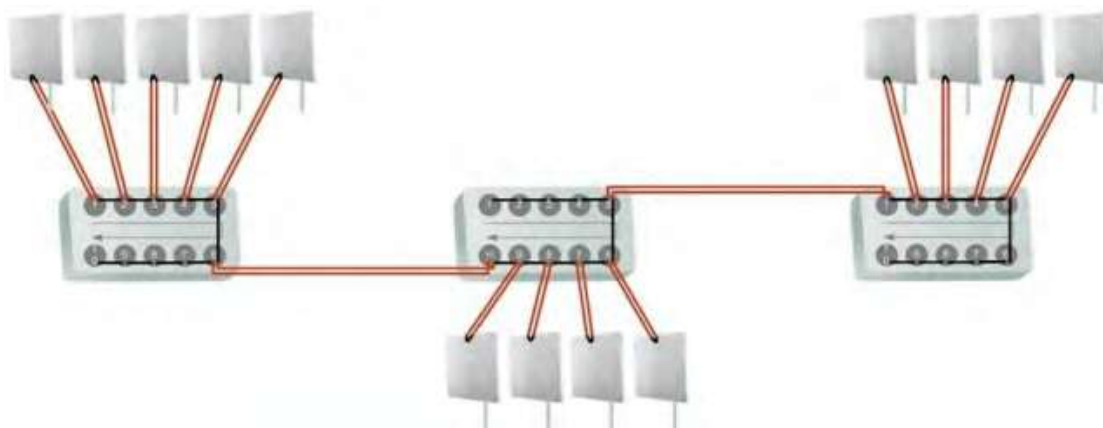


Figure 7-8: Cascading three HSS units

6. If further ODUs are required, observe the convention that additional even numbered units are populated in **descending order** from SYNC 9 and odd numbered HSS units are populated in **ascending order** from SYNC 2.



If an ODU is disconnected from an HSS unit, then all remaining ODUs must be moved up or down to maintain the connectivity.

Condition 2: Total HSS Cable Length

The total path of the HSS sync pulse must not exceed 300m. This applies no matter how many HSS units are used. To illustrate the method for calculating the sync pulse path length we show three examples. For our purpose, let:

L_{mn} denote the length of the ODU-HSS unit cable at SYNC n on HSS unit m

H_m be the length of the cable joining HSS unit m to HSS unit m+1

One HSS unit with five collocated ODUs

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + L_{15}$$

Two cascaded HSS units as shown in Figure 7-7

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + 2 \times L_{15} + H_1 + 2 \times L_{29} + 2 \times L_{28} + 2 \times L_{27} + L_{26}$$

Three cascaded HSS units as shown in Figure 7-8

$$PathLength = L_{11} + 2 \times L_{12} + 2 \times L_{13} + 2 \times L_{14} + 2 \times L_{15} + H_1 + 2 \times L_{29} + 2 \times L_{28} + 2 \times L_{27} + 2 \times L_{26} + H_2 + 2 \times L_{32} + 2 \times L_{33} + 2 \times L_{34} + L_{35}$$

ODU/HSS Unit Connection Pinout

Table 7-1: ODU/HSS Unit Connection Pinout

Color	ODU RJ-45	HSS UNIT RJ-45
White/Green	1	1
Green	Not connected	
White/Orange		
Orange	6	6
Blue	4	4
White/Blue	5	5
White/Brown	7	7
Brown	8	8

Radio Frame Pattern (RFP)

A Radio Frame Pattern (RFP) is the cycle duration of transmit and receive of the air-frame.

Without HSS

When selecting Ethernet services, the system automatically and transparently chooses the optimal RFP.

RFP and HSS

When HSS is used, the RFP for the collocated radios must be selected manually.

RADWIN 5000 HPMP radios use the Time Division Duplex (TDD) mechanism.

Under HSS, TDD enables synchronization of transmission for the collocated units as shown in **Figure 7-9**:

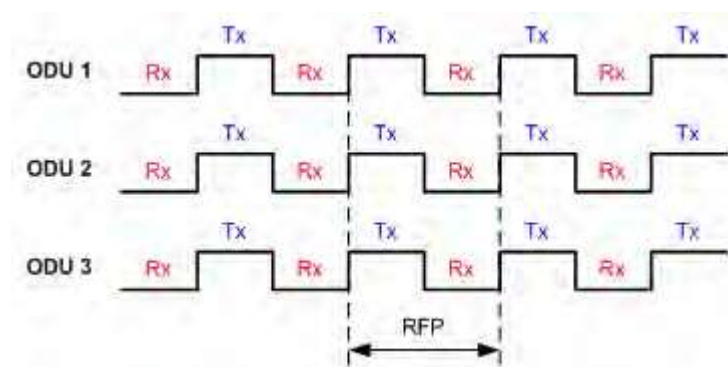


Figure 7-9: Radio Frame Pattern

Five RFP types (A to E) are available. Under HSS the RFP must be configured by the user depending on the type of the radio products, services and channel bandwidth in accordance with the **Table 7-3** and **Table 7-4**.

The tables describe the efficiency of the air interface according to the RFP type, radio products mix, services and channel bandwidth. The tables may also be viewed in the RADWIN Manager and in the Link Budget Calculator. The efficiency of the air interface will vary according to the product used.

Table 7-2: Radio Frame Pattern Table - RADWIN 5000 HBS

RFP	20 MHz	
	TDM	Ethernet
E	N/A	Best fit

Table 7-3: Radio Frame Pattern Table - RADWIN 2000

RFP	40 MHz		20 MHz		10 MHz		5 MHz	
	TDM	Ethernet	TDM	Ethernet	TDM	Ethernet	TDM	Ethernet
B	Available	Available	Available	Available	Available	Available	Best fit	Best fit
E	Best fit	Best fit	Best fit	Best fit	Best fit	Best fit	Available	Available

Table 7-4: Radio Frame Pattern Table - WinLink 1000

RFP	20 MHz		10 MHz		5 MHz	
	TDM	Ethernet	TDM	Ethernet	TDM	Ethernet
A	Best fit	Best fit	Available	Available	N/A	N/A
B	N/A	N/A	Best fit	Available	Best fit	Available
C	N/A	N/A	N/A	Best fit	N/A	Available
D	N/A	N/A	N/A	N/A	N/A	Best fit
E	Available	Available	Available	Available	N/A	N/A

Legend:

Best fit - optimal RFP choice for TDM and Ethernet services.

Available - available RFP for TDM and Ethernet services, but not optimal.

N/A - service unavailable

Select the RFP that gives you the **Best Fit** or **Available** for required system services and select the channel bandwidth accordingly.



The RFP must be the same for each link within the collocated system.

RFP: General Radio Frame Pattern

When setting the RFP, the following considerations should be borne in mind:

- When synchronizing RADWIN 5000 HBS units you must use RFP E
- When synchronizing RADWIN 5000 HBS with RADWIN 2000 or WinLink 1000 units you must use RFP E
- RFP influences capacity and latency.
- Using the Link Budget Calculator, you can see the affect of the RFP on the Ethernet throughput.

Sector Configuration and HSS

The Hub Site Synchronization Settings dialog box appears in both the HBS Site Configuration window.



Figure 7-10: HSS Settings window

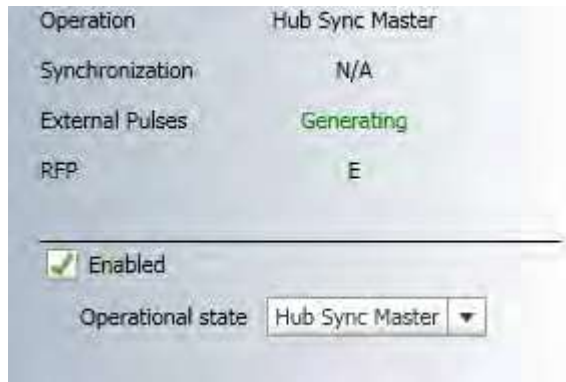
If you click the Enabled box, the central display (with **Operational state** opened) will look like this:



Figure 7-11: Setting HBS as HSM or HSC

Continue Tx means that the HBS as a client to continue to work if there is no HSM pulse.

If you select **Hub Sync Master** and click **Apply**, the display changes again:

**Figure 7-12: HBS as HSM**

The possible External Pulses conditions are shown in the following table:

Table 7-5: External Pulse Status

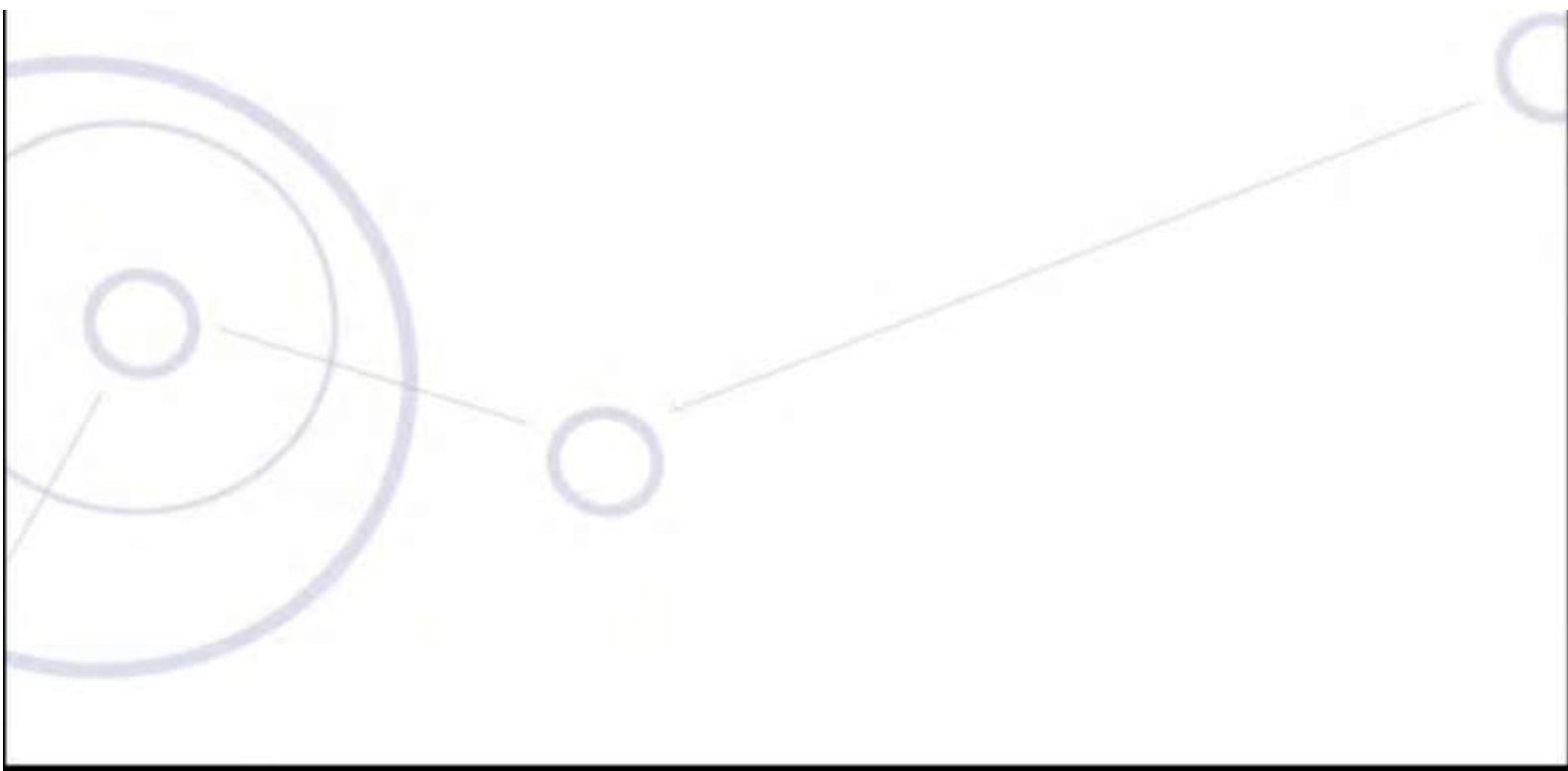
HSS Sync Status	Meaning	Color code
Generating	ODU is HSM and generates the sync pulse	Green
Detected	ODU is HSC and detects the sync pulse	
Not detected	ODU is independent	
Generating and detected	HSM, but other HSM present	Orange
Generating and Improperly Detected	RADWIN 2000 ODU is HSM, but detects a WinLink 1000 HSM signal that is not RFP E	
Not detected	HSC but no HSM present	
Improperly detected	HSC but HSM pulse doesn't fit the HSC as configured. Occurs only for RADWIN 2000, which stops transmitting.	Red

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Part 4: Field Installation Topics

Pole and Wall Installation

ODU Mounting Kit Contents

Table 8-1: Bill of Materials: ODU mounting kit

Item	Qty
Large Clamp (see Figure 8-1)	1
Small Clamp (see Figure 8-2)	1
Arm (see Figure 8-3)	1
Screw hex head M8x40	4
Screw hex head M8x70	2
Washer flat M8	4
Washer spring M8	3
M8 Nuts	2

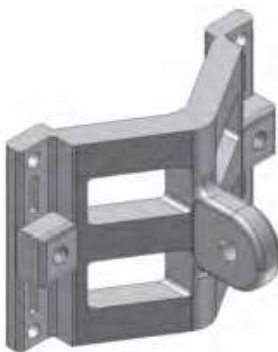


Figure 8-1: Large Clamp



Figure 8-2: Small Clamp



Figure 8-3: Arm

Mounting an ODU on a Pole

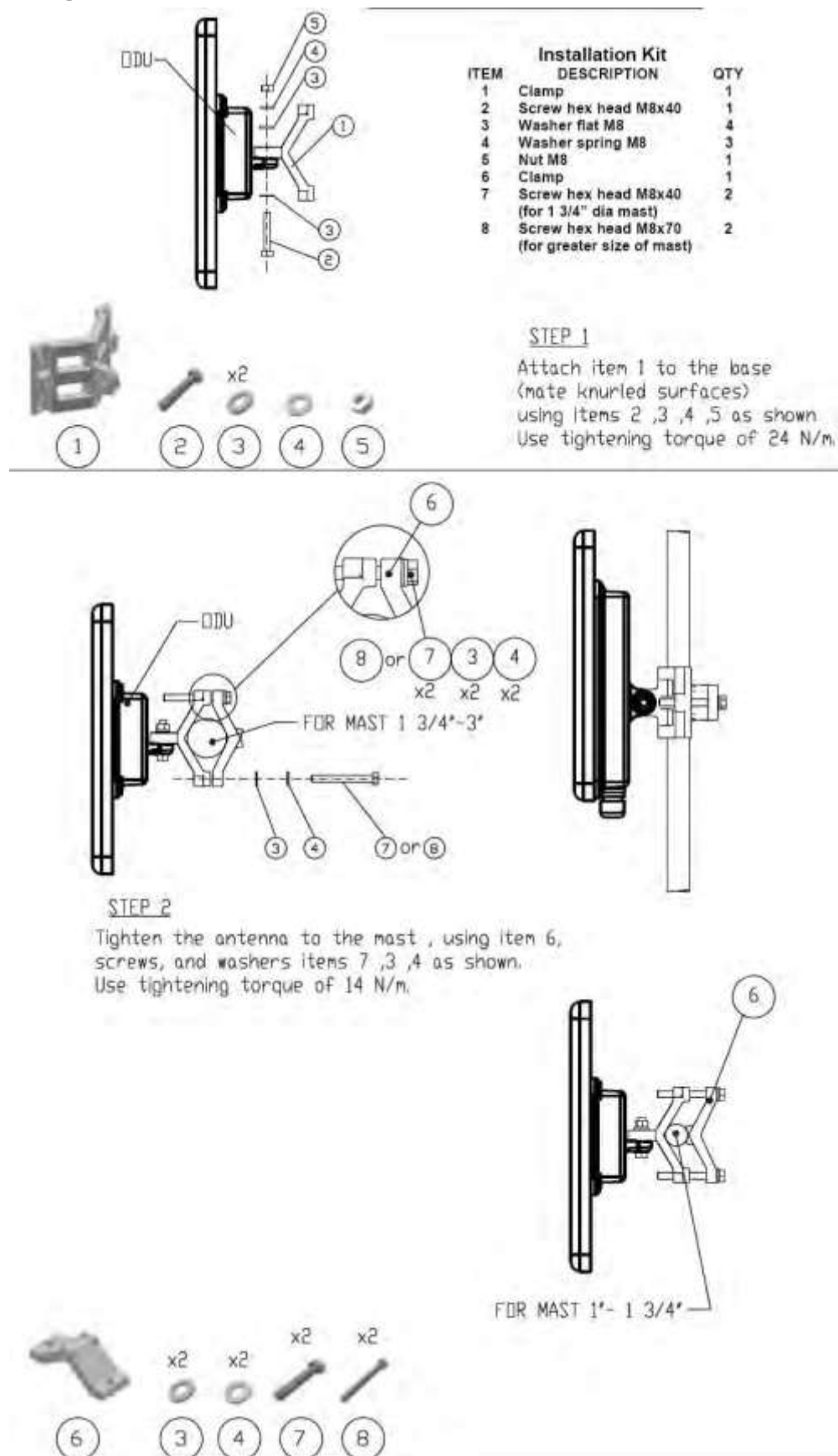


Figure 8-4: Mounting on a pole

Mounting an ODU on a Wall

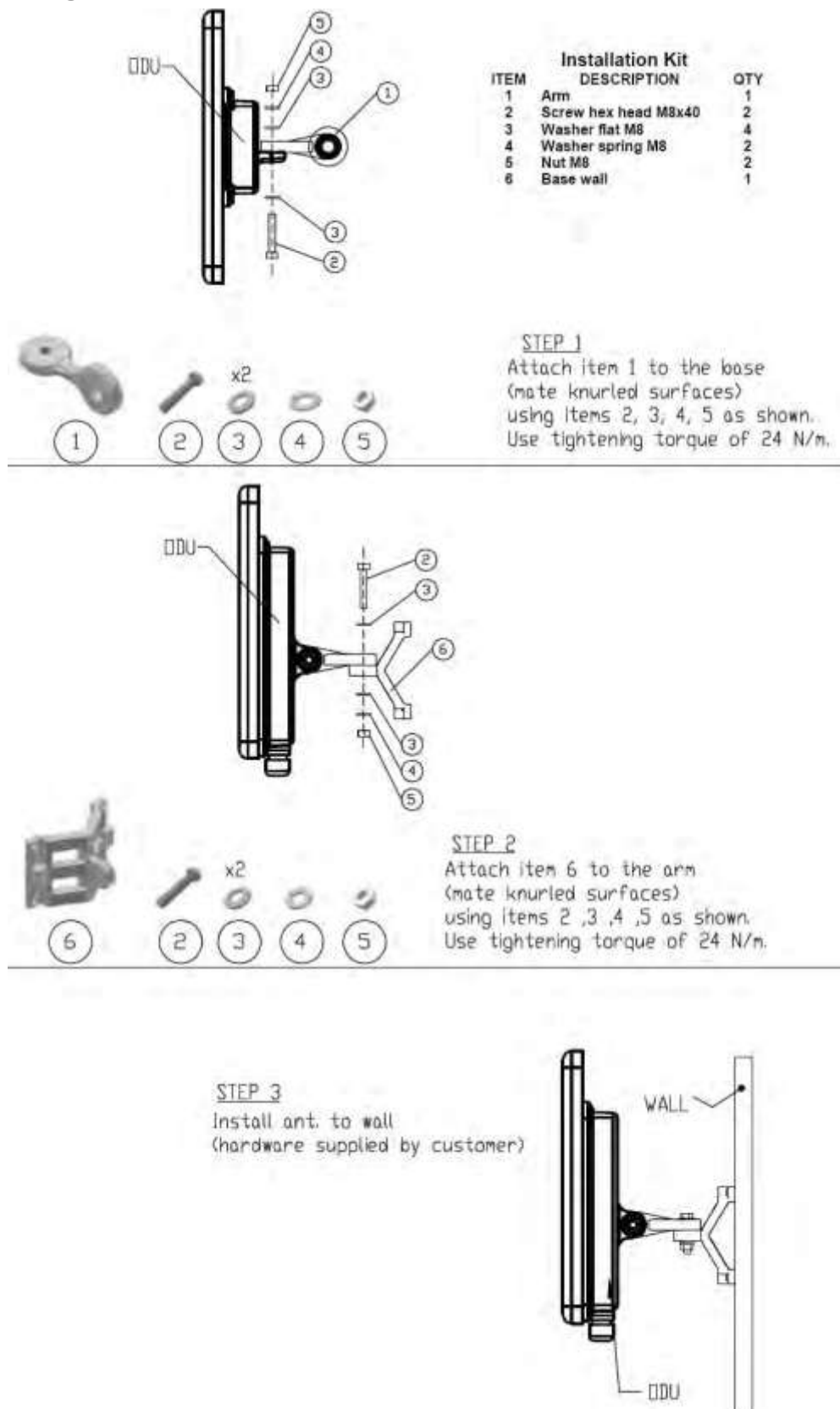


Figure 8-5: Mounting on a Wall

Mounting an External Antenna

Optional external antennas can be mounted on a pole. The external mounting kit varies according to the specific antenna model.

Mounting a Connectorized ODU Horizontally

What follows applies to both WinLink 1000 and RADWIN 2000 with obvious differences.

An ODU may be mounted horizontally as shown in [Figure 8-6](#).

➤ **To mount an ODU horizontally, observe the following cautions:**

1. To ensure your warranty rights for horizontally installed ODUs, make sure that the four ports ANT1, ANT2, HSS and ODU are firmly secured or moisture sealed with the supplied caps.
2. Further, ensure that cables are connected using a “water nose” as shown in [Figure 8-6](#).



Figure 8-6: Mounted ODUs with correct “water nose”

Do **not** do this:



Figure 8-7: Incorrectly mounted ODU (No “water nose”)

3. If you attach an external PoE device near the ODU, the same considerations apply.

Lightning Protection and Grounding Guidelines

Meticulous implementation of the guidelines in this chapter will provide best protection against electric shock and lightning.



100% protection is neither implied nor possible.



This chapter is at best a guide. The actual degree of lightning protection required depends on local conditions and regulations.

The RADWIN Lightning Protection System consists of the following components:

- Grounding for the antenna coax cable
- Grounding for each IDU and ODU
- External Primary Surge Suppressor units and grounding for the outdoor cable
- Internal ESD protection circuits over the Power/Telecom lines

Grounding for Antenna Cable

A Grounding Kit must be connected to the coax antenna cable and reliably grounded. The grounding kit is an Andrew Type 223158-2 (www.andrew.com). See **Figure 9-1** below.

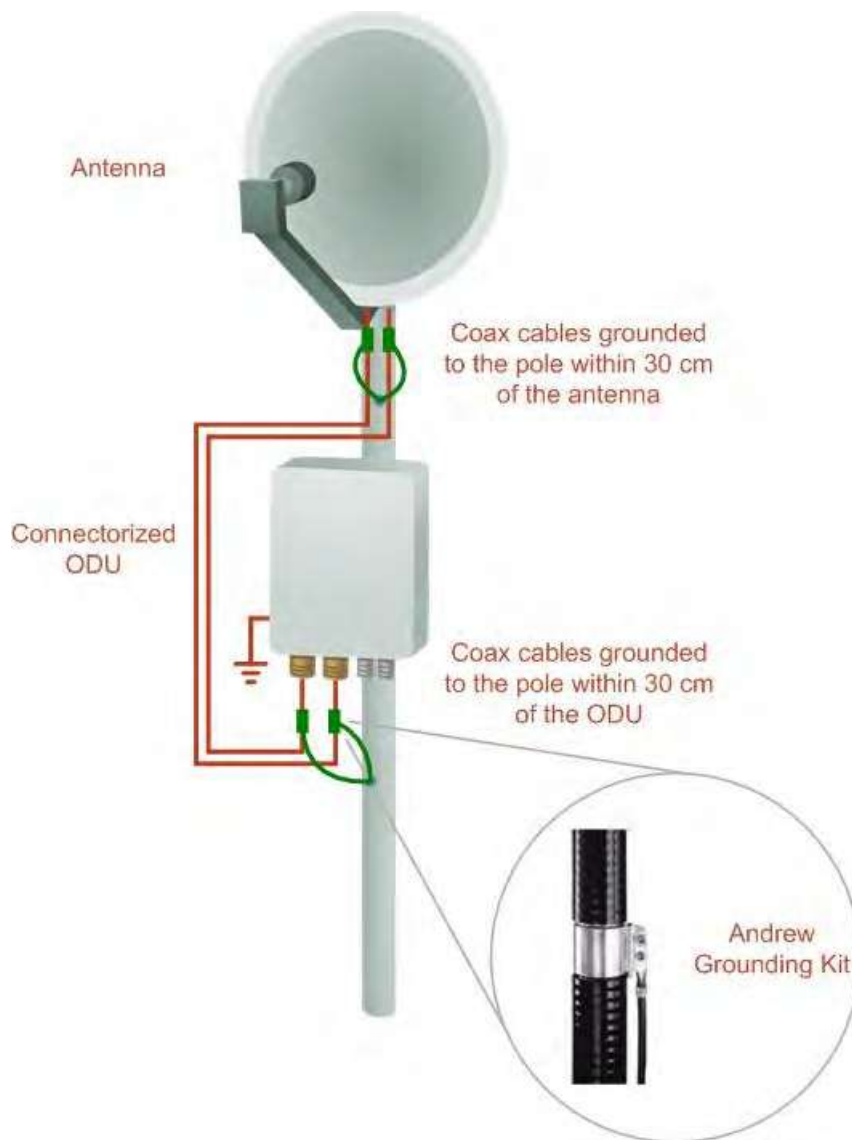


Figure 9-1: Grounding antenna cables

Grounding for Indoor/Outdoor Units

ODU Grounding

RADWIN Lightning Protection System uses a Shielded CAT-5e cable to interconnect the Outdoor (ODU) and Indoor (IDU) units.

However, this shielding does not provide a good lightning discharge path, since it can not tolerate the high Lightning Current surges.

To provide an alternate Lightning Discharge path, the ODU and antenna grounding posts should be connected to ground point by a 10 AWG short copper wire.

The device should be permanently connected to ground.

IDU Grounding

The IDU's grounding post should be connected to the internal ground point, using a grounding wire of at least 10 AWG. The grounding wire should be connected to a grounding rod or the building grounding system.

The device should be permanently connected to ground.

External Lightning Surge Suppressors and Grounding

A Grounding Kit and Surge Arrestor Unit must be located near the ODU and properly grounded as illustrated in Figures 9-2 and 9-3 below:

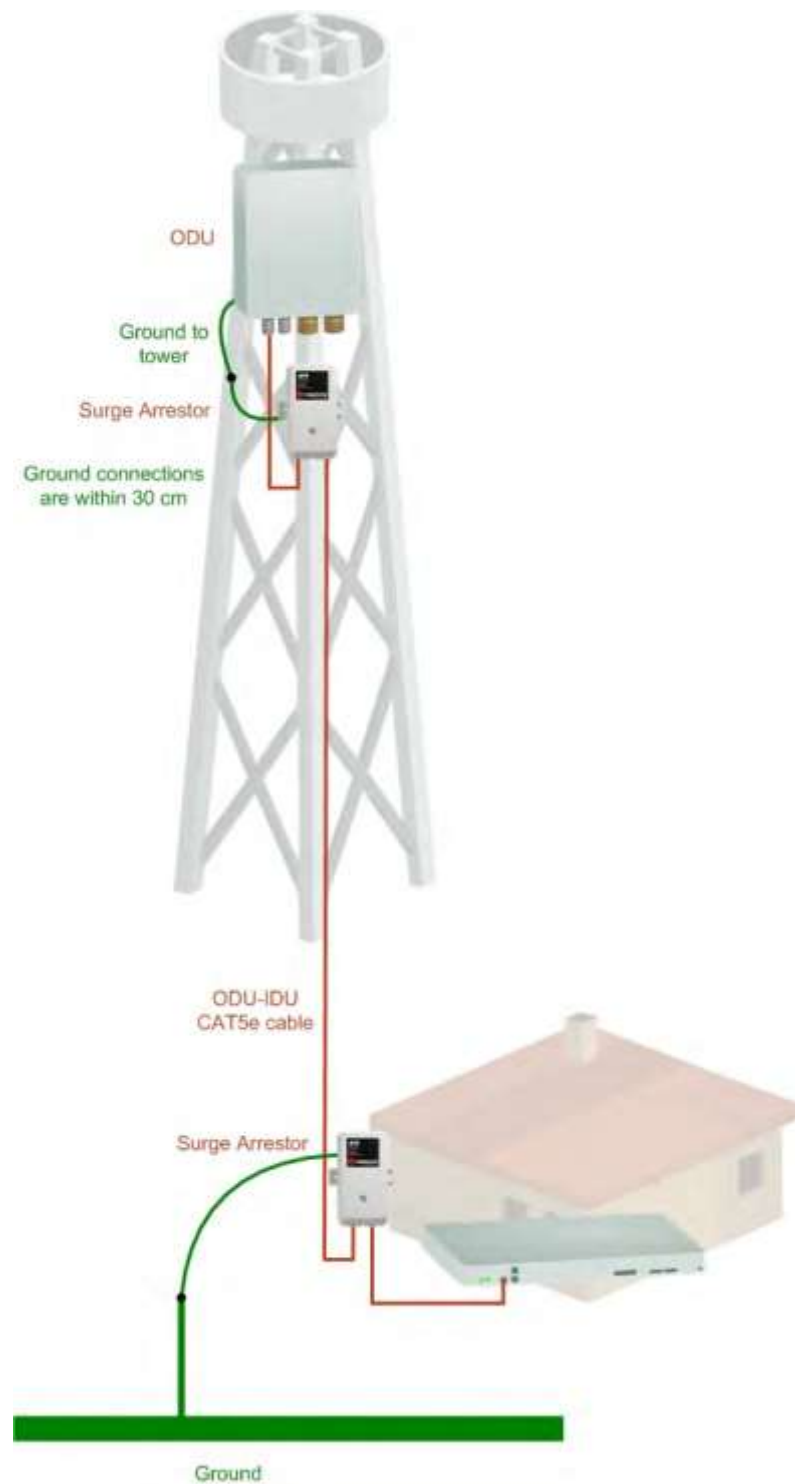
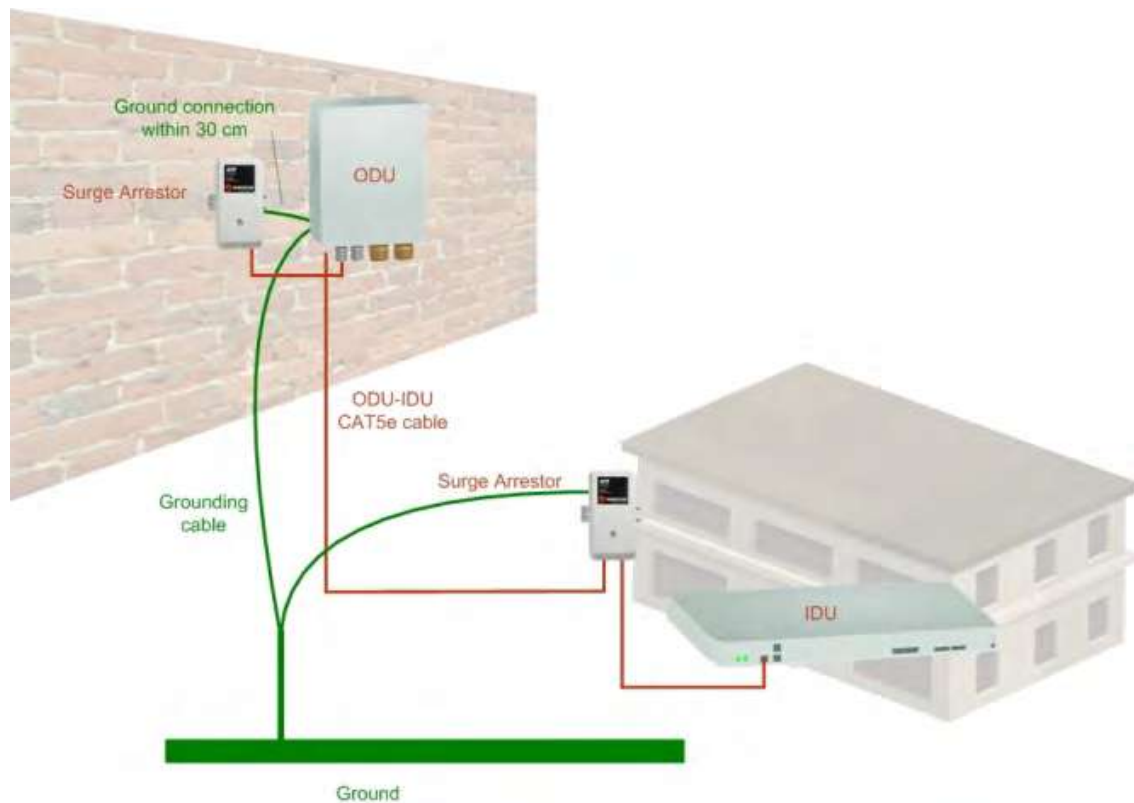
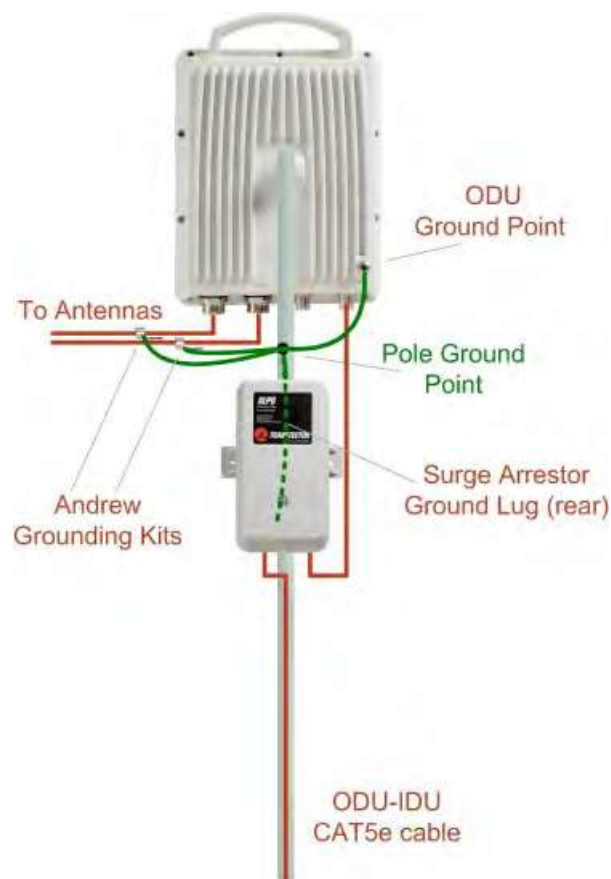


Figure 9-2: Grounding a typical pole installation

**Figure 9-3: Grounding a typical wall installation**

The next figure shows a close-up of the rear of grounded ODU:

**Figure 9-4: ODU Surge Suppressor and grounding**

The Transtector protection circuits shown in **Figure 9-5** below, utilize silicon avalanche diode technology. The unit consists of an outdoor rated NEMA 3R type enclosure with easy mounting flanges, ground stud attachment and easy wiring.

The ALPU-POE features RJ-45 protection circuits for the ODU-PoE data pairs (pins 1,2 & 3,6) and DC power (pins 4,5 & 6,7 with the pairs bonded).

The unit is designed to be wall mounted. An optional set of bracket is available from the manufacturer to allow a wide range of pole mount applications. A dedicated ground stud is provided inside the unit that must be bonded to the nearest grounding system (or Master Ground bar) for proper surge protection.

The system wiring is installed with RJ-45 type connectors that can feed directly into the chassis without having to cut, splice or route through awkward strain relief holes.



Figure 9-5: Transtector's Surge Suppressor

➤ **To mount the lightning protection devices:**

1. Mount the device as close to the ODU as possible. Mount the unit so that the cable connectors are at the bottom (to prevent water from penetrating), with the strain reliefs facing the ground.
2. Remove the cover by unscrewing the front of the unit.
3. Mount the unit to an outside surface using the two mounting holes.
4. Connect the ODU-PoE cable using the RJ-45 jack.
5. Connect one cable between the ODU and the suppressor using an RJ-45 jack.
6. Connect the suppressor's ground stud to a grounding point. Use the appropriate wire gauge and type, keeping the wire as short as possible, less than 1m (3'), between the stud and the site grounding point.
7. Replace the cover.



There may also be regulatory requirements to cross bond the ODU-PoE CAT-5e cable at regular intervals up the mast. This may be as frequent as every 10 meters (33 feet).

A second Surge Arrestor Unit should be mounted at the building entry point and must be grounded, as shown in **Figure 9-3** above.

➤ **To mount the lightning protection at the building entry point:**

1. Mount the device outside the building, located as near as possible to the entrance of the CAT-5e ODU-PoE cable. Mount the unit so that the cable connectors are at the bottom (to prevent water from penetrating), with the strain reliefs facing the ground.
2. Remove the cover by unscrewing the front of the unit.
3. Mount the unit to an outside surface using the two mounting holes.
4. Connect the ODU-PoE cable using the RJ-45 jack.
5. Connect one cable between the IDU and the suppressor using an RJ-45 jack.
6. Connect the suppressor's ground stud to a grounding point. Use the appropriate wire gauge and type, keeping the wire as short as possible, less than 1m (3'), between the stud and the site grounding point.
7. Replace the cover

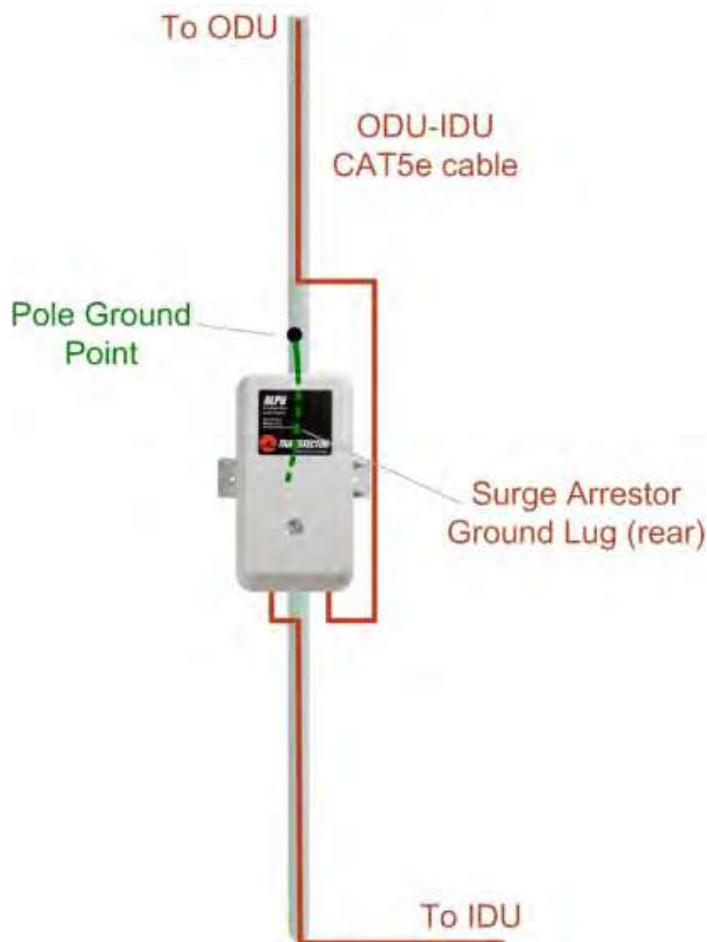


Figure 9-6: Surge Suppressor and grounding at building entry point

Internal ESD Protection circuits

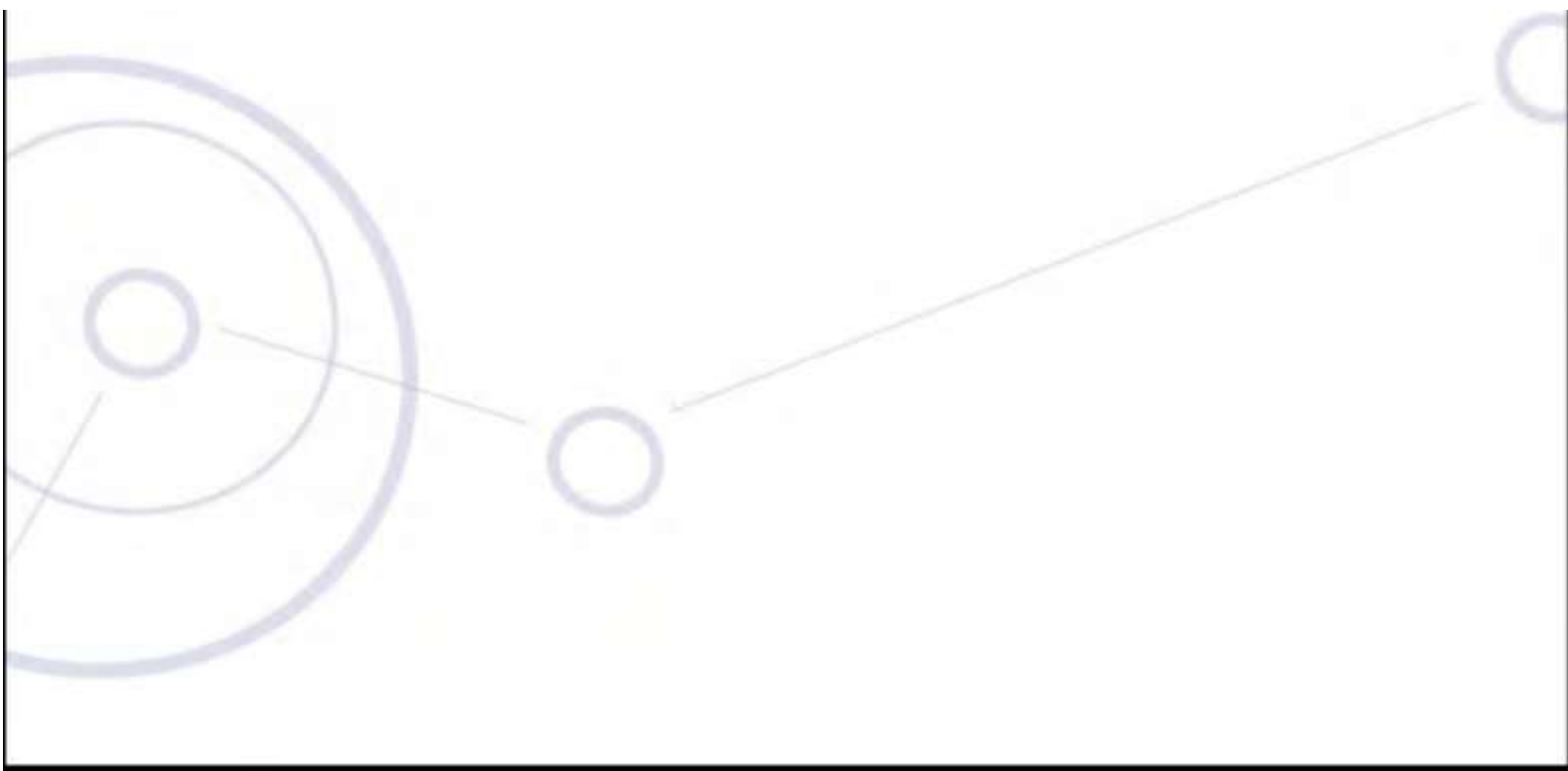
RADWIN equipment is designed to meet the ETSI/FCC/Aus/NZ/CSA EMC and Safety requirements. To fulfill these requirements, the system's Telecom lines at the ODU/IDU are Transformer-isolated and include internal ESD (Electro-Static-Discharge) Protection circuits.

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Part 5: Product Reference

Appendix A

Technical Specifications

Scope of these Specifications

This appendix contains technical specifications for the major link components appearing in this User Manual. They are correct at the date of publication, but are intended for general background only. The latest authoritative and most up to date technical specifications are available as Data Sheets obtainable from RADWIN Customer Service.

In any event, RADWIN reserves the right to change these specifications without notice.

ODU - HBS and HSU

Capacity	100Mbps aggregate net throughput full duplex, hardware ready for 200Mbps							
Range	Up to 40 km / 25 miles							
Radio Modulation	2x2 MIMO-OFDM (BPSK/QPSK/16QAM/64QAM)							
Adaptive Modulation & Coding	Supported							
Automatic Channel Selection	Supported							
DFS	Supported							
Diversity	Hardware ready							
Spectrum View	Hardware ready							
Duplex Technology	TDD							
Error Correction	FEC k = 1/2, 2/3, 3/4, 5/6							
Rate – Dual Antenna [Mbps]	13	26	39	52	78	104	117	130
Modulation	BPSK	QPSK		16QAM		64QAM		
FEC [k=]	1/2	½	3/4	1/2	3/4	2/3	3/4	5/6
Max Tx Power [dBm] for 5.8 – GHz	25			24	21	19	18	
Max Tx Power [dBm] for 5.4 – GHz	20			20	20	19	18	
Max Tx Power [dBm] for 4.9 – GHz	20			20	20	19	18	
Sensitivity (dBm) @BER <10e-11 (20MHz)	-88	-86	-83	-81	-77	-72	-70	-67
Encryption	AES 128							

Band	Occupied Frequency range [GHz]	Compliance	Channel Bandwidth			
			5 MHz	10 MHz	20 MHz	40 MHz
FCC/IC 5.8	5.725 - 5.850	FCC 47CFR, Part 15, Subpart C and IC RSS-210			Yes	
FCC 5.4	5.480 - 5.715	FCC 47CFR, Part 15, Subpart E			Yes	

ODU - HBS and HSU

Appendix A

Band	Occupied Frequency range [GHz]	Compliance	Channel Bandwidth			
			5 MHz	10 MHz	20 MHz	40 MHz
IC 5.4	5.480 – 5.590 5.660 – 5.715	IC RSS-210			Yes	
FCC/IC 5.3	5.260 - 5.340	FCC 47CFR, Part 15, Subpart E and IC RSS-210			Yes	
FCC/IC 4.9	4.940 - 4.990	FCC 47CFR, Part 90, Subpart Y and IC RSS-111			Yes	
WPC India 5.8	5.825 – 5.875	GSR-38			Yes	
MII China 5.8	5.730 – 5.845	MII China			Yes	
ETSI 5.8	5.735 – 5.865	ETSI EN 302 502			Yes	
ETSI 5.4	5.480 – 5.715	ETSI EN 301 893			Yes	
ETSI 5.3	5.160 – 5.340	ETSI EN 301 893			Yes	
Universal 6.0	5.690– 6.060	N/A			Yes	
Universal 5.9	5.730 – 5.960				Yes	
Universal 5.4	5.490 – 5.710				Yes	
Universal 5.3	5.140 – 5.345				Yes	
Universal 4.9	4.890 - 5.010				Yes	

ODU with Integrated Antenna	37.1/14.84(W) x 37.1/14.84(H) x 9.00/3.6(D) cm/in; 3.5 kg / 7 lbs
ODU Connectorized	19.5/7.7(W) x 27.0/10.8(H) x 5.5/2.2(D) cm/in; 1.8 kg / 3.6 lbs
ODU HSU SFF (Embedded antenna)	19.5/7.7(W) x 27.0/10.8(H) x 7/2.8(D) cm/in; 1.8 kg / 3.6 lbs

Power Feeding	Dual feeding, -20 to -60 VDC (AC/DC converter is available)
Power Consumption - alone	HBS: <2W, HSU: <20W

Architecture	ODU: Outdoor Unit with Integrated Antenna, Connectorized for External Antenna or Embedded PoE device for Ethernet only
ODU to PoE Interface	HBS: - Outdoor RADWIN CAT-5e cable. maximum cable length: 100m for 10/100BaseT. - Outdoor RADWIN CAT-5e cable. maximum cable length: 75m for 1000BaseT. HSU: Outdoor CAT-5e cable; maximum cable length: 100 m (10/100BaseT)

Management Application (per link)	RADWIN Manager
Protocol	SNMP and Telnet
NMS	RADWIN NMS

Operating Temperatures	HBS/HSU: -35°C to +60°C / -31°F to +140°F
Humidity	HBS/HSU: Up to 100% non-condensing, IP67

FCC/IC (cTUVus)	UL 60950-1, UL 60950-22, CAN/CSA C22.2 60950-1, CAN/CSA C22.2 60950-22
ETSI/IEC	EN/IEC 60950-1, EN/IEC 60950-22

GbE PoE Device - Indoor, AC for HBS only

AC Input Voltage	100-240VAC nominal, 90-264VAC max range
Input Frequency	47-63Hz
Input Current	2.0A (rms) 115VAC at Max. load 1.2A (rms) 230VAC at Max. load
Output Voltage	56VDC
Protection	Short circuit protection Auto recovery Over voltage protection
Indication	Green led for normal operation

PoE output	RJ-45 connector
PoE to ODU Interface	Outdoor CAT-5e; Maximum cable length: 75m for 1000BaseT or 100m for 10/100BaseT.
Ethernet input	RJ-45 connector
AC input on device	Standard socket IEC320 C14 type
AC cable	Variety of AC plugs available (see below)
Ethernet / ODU	RADWIN RJ-45 connector

Case	Plastic
Dimensions	16cm(W) x 6.3cm(D) x 3.33cm(H)
Weight	250g

Operating Temperatures	0°C - 40°C
Humidity	90% non-condensing

UL	60950
C-UL	60950
TUV/GS	IEC/EN 60950

ESD	61000-4-2
RS	61000-4-3
EFT	61000-4-4
Surge	61000-4-5
CS	61000-4-6
DIPS	61000-4-11
EMI	FCC part 15 class B, CISPR Pub 22 class B

PoE Device - Indoor, AC

AC Input Voltage	100-240VAC nominal, 85-265VAC max range
Input Frequency	47-63Hz
Input Current	1.5A max at 90VAC, 0.75A max at 265VAC
Output Voltage and Current	55VDC, 0-1A Range 50-58VDC
Protection	Short circuit protection Auto recovery Over voltage protection
Indication	Green led for normal operation

Ethernet LAN interface type	RJ 45, 10/100BaseT Interface (Line Impedance -100Ω)
PoE to ODU Interface	Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT
AC	Standard socket IEC320 C14 type
ODU (PoE Port)	RJ-45 connector

Case	Plastic
Dimensions	16cm(W) x 6.3cm(D) x 3.33cm(H)
Weight	250g

Operating Temperatures	0°C - 40°C
Humidity	90% non-condensing

UL	60950
C-UL	60950
TUV/GS	IEC/EN 60950

ESD	61000-4-2
RS	61000-4-3
EFT	61000-4-4
Surge	61000-4-5
CS	61000-4-6
DIPS	61000-4-11
EMI	FCC part 15 class B, CISPR Pub 22 class B

PoE Device - Outdoor, DC

Input voltage range	-20 to -60 VDC (single input)
Output voltage	48VDC / 0.6A

Power Consumption	0.5W (not including radio)
Protections	Differential - 15KW Common – 3KW

Ethernet LAN interface type	RJ 45, 10/100BaseT Interface (Line Impedance -100Ω)
DC input	2 pins connector
PoE to ODU Interface	Outdoor CAT-5e; Maximum cable length: 100m for 10/100BaseT
ODU (PoE Port)	RJ45

Dimensions	24.5cm(H) x 13.5cm(W) x 4.0cm(D)
Weight	1.0kg/2.2lbs

Enclosure	All weather cases
Operating Temperatures	-35°C - 60°C / -31°F - 140°F
Humidity	Up to 100% non-condensing
Standards	IEC 60721-3-4 Class 4M5 IP67

FCC/IEC/ CAN/CSA	60950-1, 60950-22
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ETSI	EN 300 386 V1.3.2; EN 301 489-1 V1.4.1
FCC	CFR47 Class B, Part15, Subpart B
CAN/CSA	ICES-003:2004 Class B
AS/NZS	CISPR 22:2006 class B

GSU

Architecture	Outdoor Unit Connectorized for External GPS Antenna
GSU to PoE Interface	Outdoor CAT-5e cable; Maximum cable length: 100 m

Dimensions	24.5cm(H) x 13.5cm(W) x 4.0cm(D)
Weight	1.0kg/2.2lbs

Power Feeding	Power provided by PoE device
Max Power Dissipation	10Watt

Operating Temperature Range	-35°C to + 60°C / -13°F to 140°F
Humidity	Up to 100% non-condensing

EN/IEC	Designed to meet EN/IEC 60950-1, 60950-22
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FCC	Designed to meet 47 CFR Class B, Part15, Subpart B
ETSI	Designed to meet EN 300 386 V1.3.3; EN 301 489-4 V1.3.1; EN 301 489-1
CAN/CSA-CEI/IEC	Designed to meet CISPR 22-02
AS/NZS	Designed to meet CISPR22: 2006 Class B

Antenna Characteristics

An antenna is the radiating and receiving element from which the radio signal, in the form of RF power, is radiated to its surroundings and vice versa. The transmission range is a function of the antenna gain and transmitting power. These factors are limited by country regulations.

The RADWIN 5000 HPMP may be operated with an integrated antenna attached to the ODU unit, or with an external antenna wired to the ODU via a N-type connectors. All cables and connections must be connected correctly to reduce losses. The required antenna impedance is 50Ω.

Wiring Specifications

ODU-PoE Cable

The ODU-PoE cable is shielded/outdoor class CAT-5e, 4 twisted-pair 24 AWG terminated with RJ-45 connectors on both ends. A cable gland on the ODU side provides hermetic sealing.

The following table shows the connector pinout:

Table B-1: ODU-PoE RJ-45 Connector Pinout

Function	Color	IDU	ODU
Ethernet (RxN)	White/Green	1	1
Ethernet (RxT)	Green	2	2
Ethernet (TxT)	White/Orange	3	3
Ethernet (TxN)	Orange	6	6
Power (+)	Blue	4	4
Power (+)	White/Blue	5	5
Power (-)	White/Brown	7	7
Power (-)	Brown	8	8

ODU/HSS Unit Connection Pinout

Table B-2: ODU/HSS Unit Connection Pinout

Color	ODU RJ-45	HSS UNIT RJ-45
White/Green	1	1
Green	Not connected	
White/Orange		
Orange	6	6
Blue	4	4
White/Blue	5	5

Table B-2: ODU/HSS Unit Connection Pinout (Continued)

Color	ODU RJ-45	HSS UNIT RJ-45
White/Brown	7	7
Brown	8	8

User Port Connectors

LAN Port

The LAN 10/100BaseT interface terminates in an 8-pin RJ-45 connector, wired in accordance to [Table B-3](#).

Example for connecting the alarm connector

Table B-3: Fast Ethernet Connector Pinout

Function	Signal	Pin
Transmit Data (positive)	TD (+)	1
Transmit Data (negative)	TD (-)	2
Receive Data (positive)	RD (+)	3
Receive Data (negative)	RD (-)	6

DC Power Terminals

DC PoE

Table B-4: Terminal Block 2-pin -48VDC

Function	Pin
+	Right
-	Left

Appendix C

RF Exposure

The antennas used for the following transmitters must be installed so as to provide a minimum separation distance from bystanders as specified in the following tables:

Table C-1: Safety Distances for RADWIN 5000 HPMP FCC and IC Products

Frequency Band [GHz]	FCC ID	IC ID	Antenna gain [dBi]	Min. Safety Distance [cm]
5.8	Q3KRW2058	5100A-RW2054	28	223
5.8	Q3KRW2058	5100A-RW2054	24	141
5.8	Q3KRW2058	5100A-RW2054	17	63
5.3/5.4	Q3KRW2054	5100A-RW2054	23.5 / 28	20
4.9	Q3KRW2049	5100A-RW2054	28	225
4.9	Q3KRW2049	5100A-RW2054	21	113
4.9	Q3KRW2049	5100A-RW2054	15	57
2.4	Q3KRW2024	5100A-RW2054	19	39
2.4	Q3KRW2024I	5100A-RW2024I	17.5	40
3.5	N/A	5100A-RW2030	25	92
3.6/3.7	Q3KRW2030	5100A-RW2030	25	86

Table C-2: Safety Distances for RADWIN 5000 HPMP ETSI

Frequency Band [GHz]	Antenna gain [dBi]	Min. Safety Distance [cm]
5.8	24 / 28	20
5.4	23.5 / 28	20
5.3	23.5 / 28	20
2.4	19 / 17.5	20
3.5	25	200

Regional Notice: French Canadian

Procédures de sécurité

Généralités

Avant de manipuler du matériel connecté à des lignes électriques ou de télécommunications, il est conseillé de se défaire de bijoux ou de tout autre objet métallique qui pourrait entrer en contact avec les éléments sous tension.

Mise à la terre

Tous les produits RADWIN doivent être mis à la terre pendant l'usage courant. La mise à la terre est assurée en reliant la fiche d'alimentation à une prise de courant avec une protection de terre. En outre:

- La cosse de masse sur l'IDU-C doit être constamment connectée à la protection de terre, par un câble de diamètre de 18 AWG ou plus. Le matériel monté sur rack doit être installé seulement sur des racks ou armoires reliés à la terre
- Une ODU doit être mise à la terre par un câble de diamètre de 12 AWG ou plus
- Il ne doit pas y avoir de fusibles ou d'interrupteurs sur la connection à la terre

De plus:

- Il faut toujours connecter la terre en premier et la déconnecter en dernier
- Il ne faut jamais connecter les câbles de télécommunication à du matériel non à la terre
- Il faut s'assurer que tous les autres câbles sont déconnectés avant de déconnecter la terre

Protection contre la foudre

L'utilisation de dispositifs de protection contre la foudre dépend des exigences réglementaires et de l'utilisateur final. Toutes les unités extérieures RADWIN sont conçues avec des circuits de limitation de surtension afin de minimiser les risques de dommages dus à la foudre. RAD-

WIN conseille l'utilisation d'un dispositif de parafoudre supplémentaire afin de protéger le matériel de coups de foudre proches.

Matériel supplémentaire requis

L'équipement requis pour l'installation du matériel est le suivant:

- Pince à sertir RJ-45 (si un câble pré-assemblé ODU/IDU n'est pas utilisé)
- Perceuse (pour le montage sur mur seulement)
- Câbles de terre IDU et ODU
- Clef 13 mm (1/2")
- Câble ODU - IDU si non commandé (type extérieur, CAT-5e, 4 paires torsadées, 24 AWG)
- Colliers de serrage
- Ordinateur portable avec Windows 2000 ou Windows XP.

Précautions de sécurité pendant le montage de ODU

Avant de connecter un câble à l'ODU, la borne protectrice de masse (visse) de l'ODU doit être connectée à un conducteur externe protecteur ou à un pylône relié à la terre. Il ne doit pas y avoir de fusibles ou d'interrupteurs sur la connection à la terre.

Seulement un personnel qualifié utilisant l'équipement de sécurité approprié doit pouvoir monter sur le pylône d'antenne. De même, l'installation ou le démontage de ODU ou de pylônes doit être effectuée seulement par des professionnels ayant suivi une formation.

➤ Pour monter l'ODU:

1. Vérifier que les supports de fixation de l'ODU sont correctement mis à la terre.
2. Monter l'unité ODU sur le pylône ou sur le mur; se référer à la [Installation sur pylône et mur](#) au dessous.
3. Connecter la câble de terre au point de châssis sur l'ODU.
4. Relier le câble ODU-IDU au connecteur ODU RJ-45.
5. Visser les presses-étoupe de câbles pour assurer le scellement hermétique des unités ODU.
6. Attacher le **câble au pylône ou aux supports en utilisant des colliers classés UV**.
7. Répéter la procédure sur le site distant.



Ne pas se placer en face d'une ODU sous tension.

Connecter la terre à IDU-C

Connecter un câble de terre de 18 AWG à la borne de masse de l'appareil. L'appareil doit être constamment connecté à la terre.

Installation sur pylône et mur

L' ODU ou l'O-PoE peuvent être montés sur un pylône ou un mur.



- Les appareils sont prévus pour être installés par un personnel de service.
- Les appareils doivent être connectés à une prise de courant avec une protection de terre.
- Le courant CC du IDU-C doit être fourni par l'intermédiaire d'un disjoncteur bipolaire et le diamètre du câble doit être de 14 mm avec un conduit de 16 mm.

Contenu du kit de montage ODU

Le kit de montage ODU comprend les pièces suivantes:

- une grande clame (voir **Figure D-1**)
- une **petite clame** (voir **Figure D-2**)
- un bras (voir **Figure D-3**)
- quatre vissex hex tête M8x40
- deux vissex hex tête M8x70
- quatre rondelles plates M8
- trois rondelles élastiques M8
- deux écrous M8.

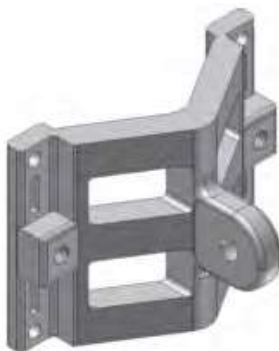
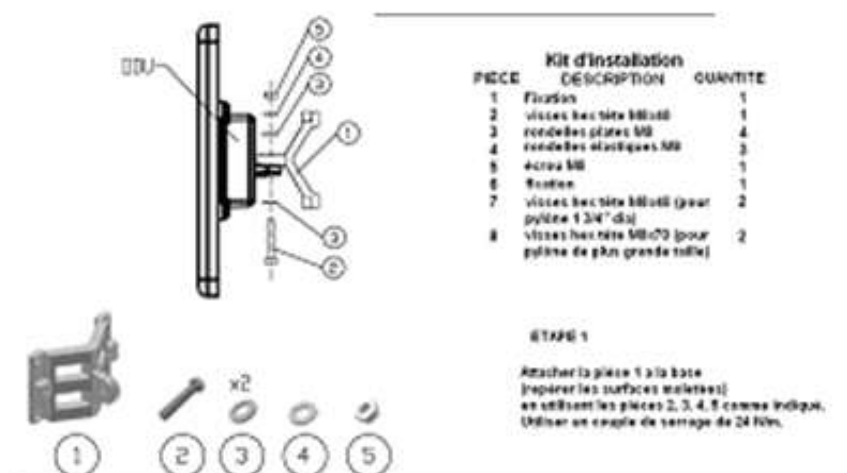


Figure D-1: grande clame

Figure D-2: petite clame

Figure D-3: bras

Montage sur un pylône



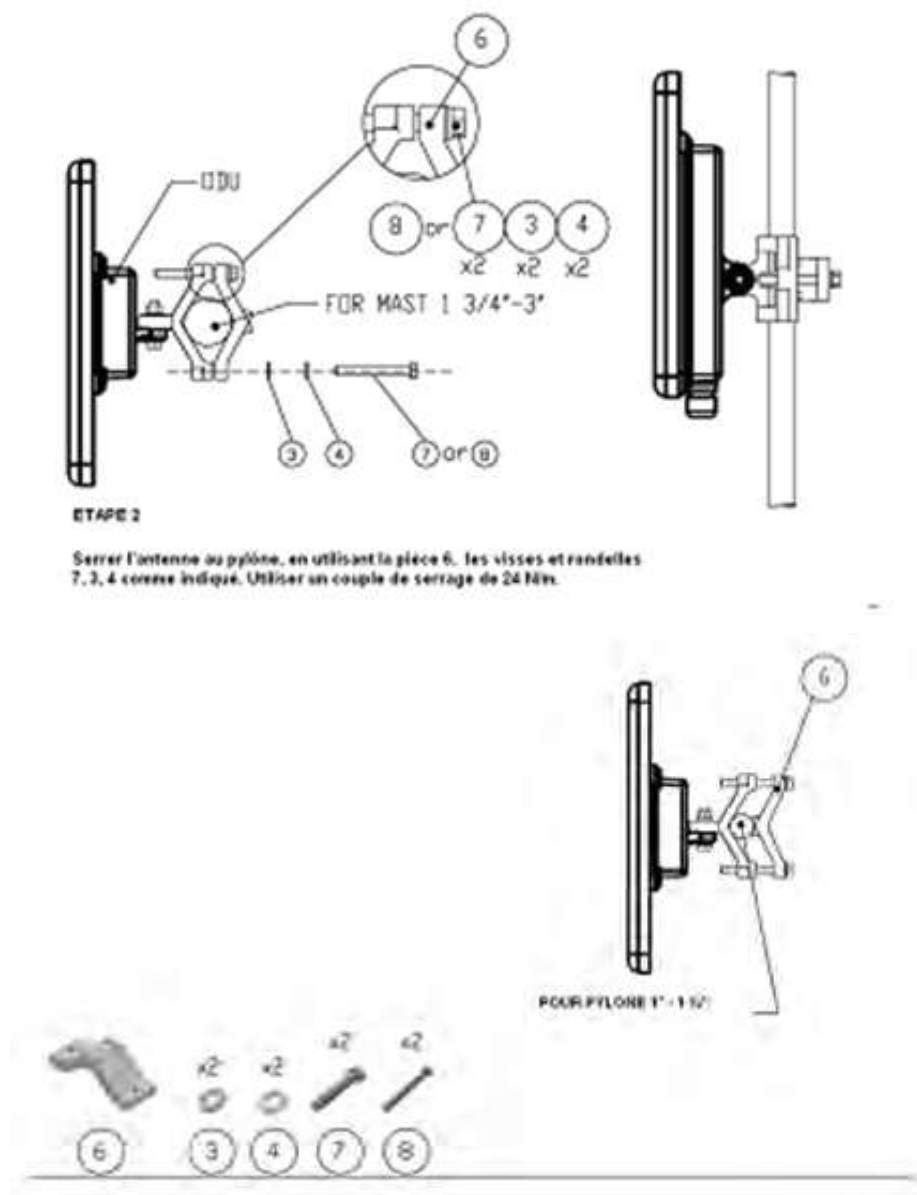
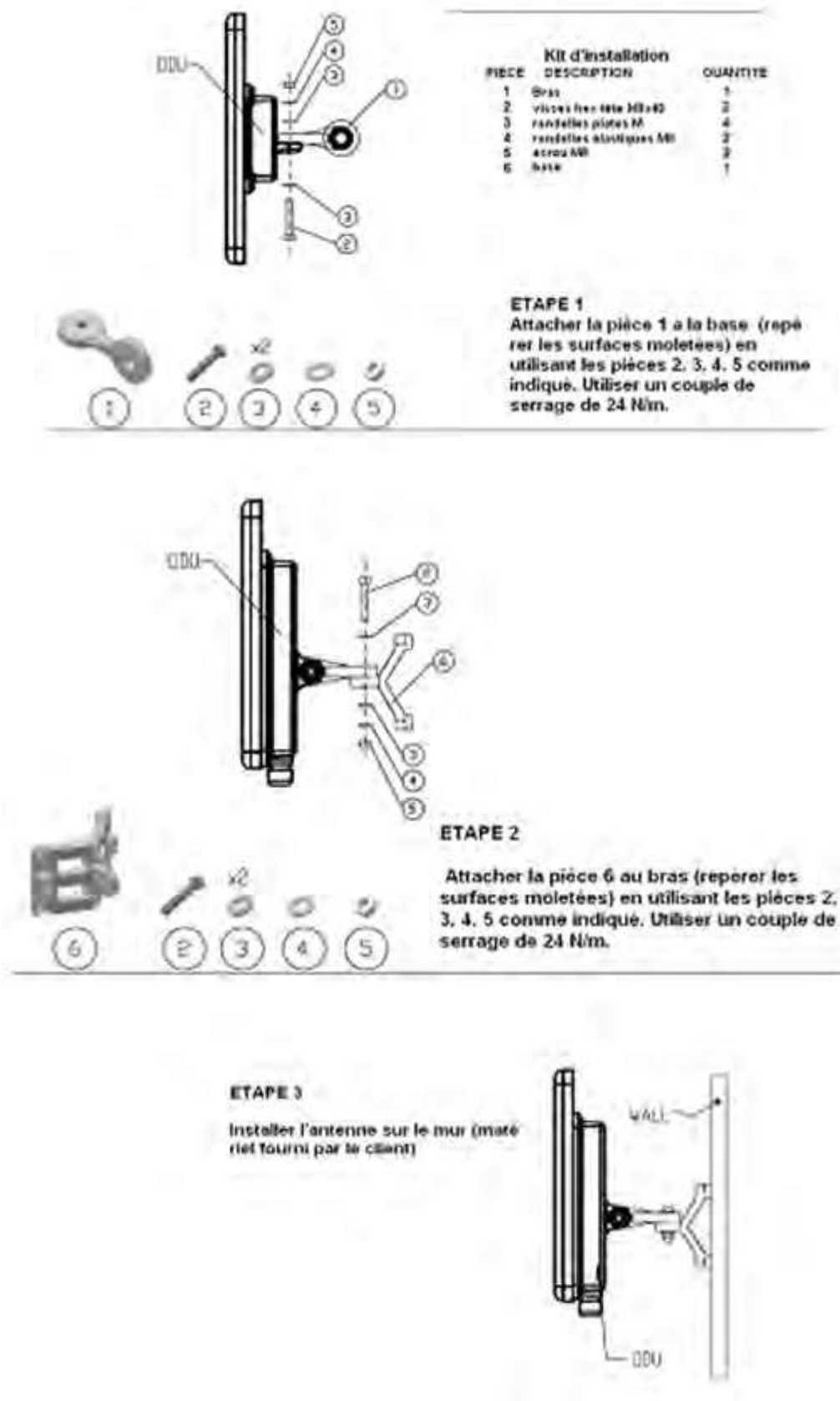


Figure D-4: Montage sur un pylône

Montage sur un mur**Figure D-5: Montage sur un mur**

Montage d'une antenne externe

L'antenne externe optionnelle peut être montée sur un pylône.

Contenu du kit de montage d'une antenne externe

Le kit de montage d'une antenne externe comprend les pièces suivantes

- Douze rondelles plates
- Huit rondelles élastiques
- Huit écrous hex
- Quatre boulons
- Un support en U
- Un support à pivotement
- Deux courroies de fixation en métal

➤ Pour installer une antenne externe sur un pylône:

1. Attacher le support en U à l'arrière de l'antenne en utilisant quatre rondelles plates, quatre rondelles élastiques et quatre écrous hex.
2. Attacher le support à pivotement au support en U en utilisant huit rondelles plates, quatre rondelles élastiques, quatre écrous hex et quatre boulons.
3. Passer les deux courroies de fixation par les fentes verticales dans le support à pivotement.
4. Attacher l'antenne au pylône en utilisant les deux courroies de fixation .

Ajuster l'inclinaison nécessaire en utilisant l'échelle angulaire et serrer tous les boulons et écrous à la position requise.

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