ASWipLL and AS3010 Systems

Wireless IP-Based Local Loop System
Release 4.6

Hardware Installation Guide

Leading the World in Wireless DSL

The ASWipLL product bears the CE marking. This CE marking demonstrates ASWipLL's full compliance with applicable European Union (EU) directives:

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About this Guide

This section discusses the purpose, targeted audience, references, organization, and technical support of the ASWipLL Hardware Installation Guide.

Purpose

This guide describes the procedures for installing Airspan's **ASWipLL** devices. These devices include the Base Station Radio (BSR), Base Station Distribution Unit (BSDU), Base Station Power Supply (BSPS), Global Positioning System antenna (GPS), Subscriber Premises Radio (SPR), Subscriber Data Adapter (SDA), and Indoor Data Radio (IDR).

Referenced Documentation

Although this guide provides software configuration information for certain ASWipLL devices, it is not comprehensive. For detailed software configuration, see the, , and The following documentation is referenced in this guide:

- *ASWipLL System Description:* provides an overview of the entire ASWipLL system.
- *WipConfig User's Guide:* Airspan recommends that you refer to this manual for performing serial initial configuration.
- *WipManage User's Guide:* Airspan recommends that you refer to this guide for descriptions on managing the ASWipLL devices.
- *ASWipLL Commissioning Manual:* Airspan recommends that you refer to this guide for descriptions on managing the ASWipLL devices.

Targeted Audience

This guide is intended for the person who is responsible for installing the ASWipLL system. This person should be familiar with electronic circuitry and wiring.

Organization of this Guide

This guide is organized into the following chapters and parts:

- Chapter 1, "**Overview**": provides a brief overview of the ASWipLL devices.
- Chapter 2, "**Safety Guidelines**": lists the safety guidelines for handling cables and electricity during the installation.
- Chapter 3, "**Package Contents**": lists items provided in standard ASWipLL kits.
- Chapter 4, "**Required Tools**": lists the tools required for installing the system.
- Chapter 5, "**Radio Site Planning**": describes radio issues for planning the site before installation.
- Part 1, "**Base Station Installation**": includes the following chapters concerned with installing ASWipLL equipment at the Base Station:
  - Chapter 6, "**Basic Design of Devices**"
  - Chapter 7, "**Mounting the Devices**"
  - Chapter 8, "**Network Cabling**"
  - Chapter 9, "**Serial Cabling**"
  - Chapter 10, "**Connecting Third-Party External Antennas**"
  - Chapter 11, "**Power Cabling**"
- Part 2, "**CPE Installation - SPR**": includes the following chapters concerned with installing an SPR (interfacing with subscriber's network through an SDA) at the subscriber's premises:
  - Chapter 12, "**Basic Design of Devices**"

- Chapter 13, "**Mounting the Devices**"
- Chapter 14, "**Network Cabling**"
- Chapter 15, "**Serial Cabling**"
- Chapter 16, "**Connecting Third-Party External Antennas**"
- Chapter 17, "**Antenna Alignment using RSS LED Adapter**"
- Chapter 18, "**Power Cabling**"

- Part 3, "**CPE Installation - IDR**": includes the following chapters concerned with installing an IDR at the subscriber's premises:
  - Chapter 19, "**Basic Design**"
  - Chapter 20, "**Mounting**"
  - Chapter 21, "**Network Cabling**"
  - Chapter 22, "**Serial Cabling**"
  - Chapter 23, "**Connecting Third-Party External Antenna**"
  - Chapter 24, "**Antenna Alignment using RSS LEDs**"
  - Chapter 25, "**Power Cabling**"
- Appendix A, "**Glossary**": glossary of terms used in this guide
- Appendix B, "**Installing the BSPS**": describes the procedures for installing an optional third-party Base Station Power System.
- Appendix C, "**Cable Crimping**": describes the crimping procedure for 15-Pin D-type, N-type, and GPS connectors.
- Appendix D, "**Connector Pinouts for SPR with DB9 Port**": describes connector pinouts for SPR-to-RSS LED Adapter cabling when the old SPR model that provides a 9-pin D-type port is used.
- Appendix E, "**Evaluating Link Quality**": describes the procedures for evaluating quality of the BSR-SPR link.

- Appendix F, "**Technical Specification**": lists the technical specifications of the ASWipLL devices.
- Appendix G, "**Third-Party External Antenna Specifications**": lists the technical specifications of third-party external antennas.
- Appendix H, "**FCC Declaration of Conformity for IDR**": provides a declaration of FCC conformity for the IDR.

Conventions

This guide uses the following bulletin conventions:

Warning: Provides information that can prevent and avoid bodily or mechanical harm.

Note: Provides useful information.

Customer Service

For service and support for your ASWipLL system, contact your regional Airspan representative, or Airspan's Technical Assistance Center (TAC) at:

- **E-mail: WipLL.tech_support@Airspan.com**
- **Boca Raton Call Center:** (+1) 561 893-8679
- **UK Call Centre:** (+44) 1895 467 467

Overview

This chapter provides a brief overview of the ASWipLL system.

1.1. Introduction

Airspan's **ASWipLL** system provides a low-cost, high-performance point-to-multipoint IP-based Broadband Fixed Wireless (BFW) Access solution. ASWipLL provides wireless local-loop (last-mile) connectivity designed to deliver high-speed data, Voice over IP (VoIP), and multimedia services to residential, SOHO (small office/home office), and SME (small medium enterprise). **ASWipLL** offers service providers an integrated access solution, providing quick-to-market deployment and low-market entry cost for broadband services.

ASWipLL operates in the licensed band (700 MHz, 925 MHz, 1.5 GHz, 2.3 GHz, 2.5 GHz Multichannel Multipoint Distribution Services - MMDS, 2.8 GHz, and 3.*x* GHz - ranging from 3.3 to 3.8 GHz), and unlicensed band (900 MHz, 2.4 GHz ISM, and 5.8 GHz).

Each **ASWipLL** Base Station, at maximum configuration, supports up to 3,024 subscribers, providing connectivity speeds of up to 4 Mbps.

ASWipLL enables interconnection with the Public Switched Telephone Network (PSTN) by the use of an IP-to-PSTN gateway. **ASWipLL** provides VoIP by its interoperability with a wide range of third-party products such as residential gateways (RGW), access gateways, gatekeepers, and softswitches.

ASWipLL utilizes air protocol technology for wireless packet switching using Frequency Hopping technology. **ASWipLL**'s in-house Preemptive Polling Multiple Access (PPMA) Air MAC protocol technology, which recognizes transmission type and allocates bandwidth, is highly efficient—80% throughput (e.g. 80% of 4 Mbps = 3.2 Mbps net capacity)—allowing multiple concurrent subscribers to utilize bandwidth.

ASWipLL provides bandwidth management by supporting both asymmetric and aggregated Committed Information Rate (CIR) and Maximum Information Rate (MIR), guaranteeing bandwidth levels to subscribers. In asymmetric CIR/MIR, different values are defined for uplink and downlink traffic: in aggregated CIR/MIR, values are defined as the sum of the uplink and downlink traffic.

ASWipLL supports VLANs and VPNs based on IEEE 802.1Q/p. **ASWipLL** supports IP routing and PPPoE bridging, as well as transparent bridging.

ASWipLL provides embedded security features such as IP (packet) filtering based on addresses, protocols, and applications.

The **ASWipLL** system provides SNMP-based management, allowing remote and local management, configuration, and monitoring of ASWipLL equipment.

1.2. System Architecture

The ASWipLL system architecture is composed of the following three basic areas:

- **Base Station site:** consists of ASWipLL access units that interface between the provider's backbone and the ASWipLL subscriber sites.
- **Subscriber site:** consists of ASWipLL customer premises equipment (CPE) that interfaces between the Base Station and the subscriber's network.
- **Network management tools:** consists mainly of Windows- and SNMP-based programs, providing fault, configuration, performance, and security management for the ASWipLL system.

Figure 1-1 displays a block diagram of the main areas of the ASWipLL system.

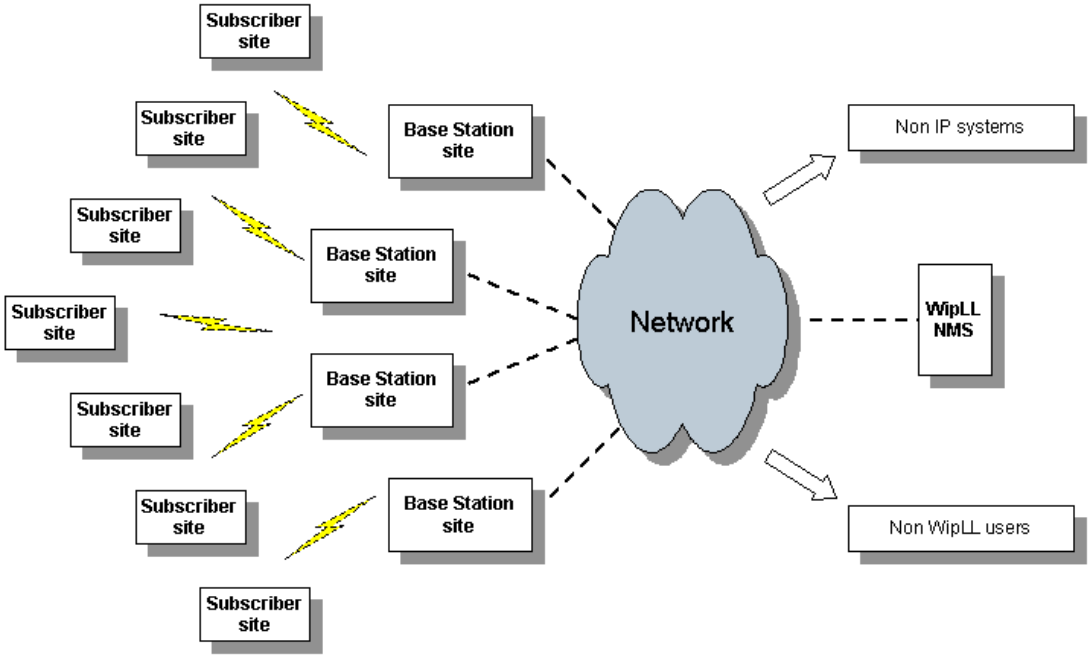

Figure 1-1: ASWipLL System Architecture

1.3. Base Station Units

The ASWipLL Base Station interfaces between the subscriber sites and the service provider's backbone, providing subscribers with high-speed data, Internet, and VoIP services.

The ASWipLL system provides various devices (some optional) for the Base Station site. The implementation of these devices depends on the desired network (e.g. point-to-point radio link), number of outdoor radios and power source at the Base Station, and required synchronization type (i.e. by GPS).

Figure 1-2 shows a fully populated ASWipLL Base Station at maximum configuration (24 BSRs, 4 BSDUs, 1 BSPS, and a GPS).

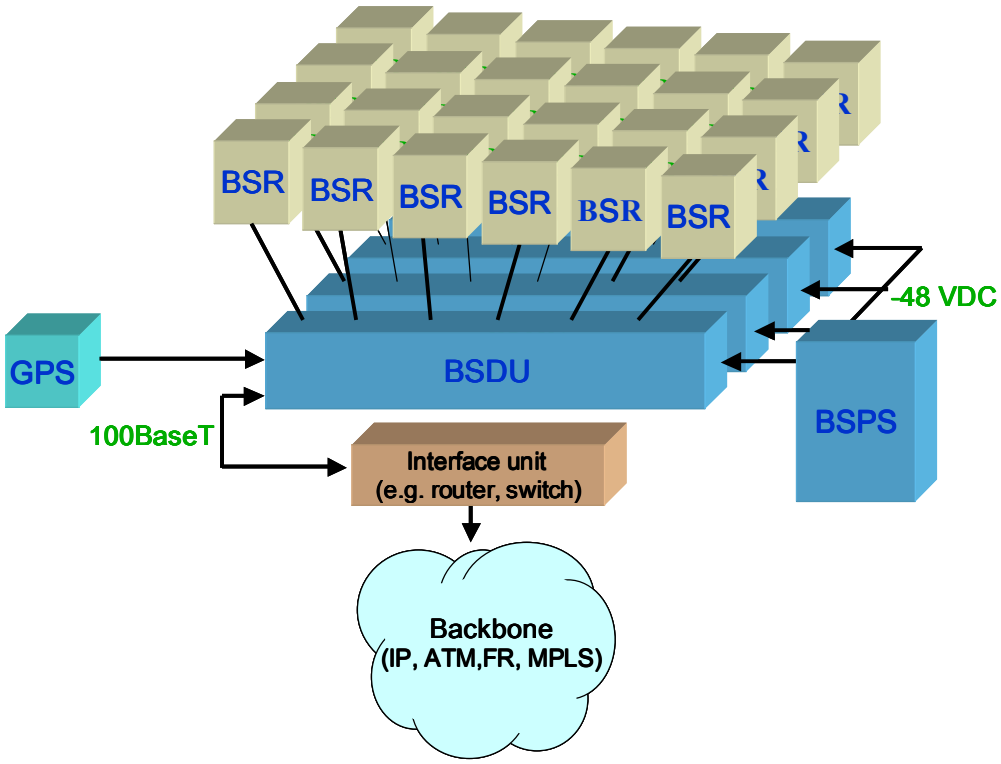

Figure 1-2: ASWipLL Base Station units (maximum configuration)

1.3.1. Base Station Radio (BSR)

The BSR is an outdoor radio unit, typically mounted on a pole or wall, involved in providing a wireless link between the Base Station and subscribers. The standard BSR provides 60-degree radio coverage, serving up to 126 subscribers in a sector.

The BSR is available in the following models:

- BSR with a built-in antenna
- BSR with one N-type port for connecting an optional third-party external antenna
- BSR with two N-type ports for connecting two optional third-party external antennas for dual antenna diversity

For Base Stations consisting of multiple BSRs, the BSRs are powered, and interface with the provider's backbone by the ASWipLL Base Station Distribution Unit (BSDU). For a Base Station consisting of a single BSR, the BSR is typically powered and connected to the provider's backbone by the ASWipLL Subscriber Data Adapter (SDA).

1.3.2. Point-to-Point Radio (PPR)

The PPR device is similar to the BSR, but implemented in a point-to-point radio configuration, providing wireless communication with a single remote subscriber ASWipLL radio unit (i.e. SPR or IDR).

1.3.3. Base Station Distribution Unit (BSDU)

The BSDU is an Ethernet switch implemented at Base Stations consisting of multiple BSRs. The BSDU provides 100Base-T interface between the BSRs and the provider's backbone. The BSDU is also responsible for providing BSRs with –48 VDC power supply and frequency hop synchronization between BSDUs, BSRs, and Base Stations (when a GPS is implemented).

The BSDU is installed indoors in a standard 19-inch cabinet, and connects to the BSRs by standard CAT-5 cables. Each BSDU can connect to a maximum of six BSRs. In addition, up to four BSDUs can be daisy-chained to support a maximum of 24 BSRs. Therefore, a Base Station at maximum configuration can serve up to 3,024 subscribers.

Note: At a Base Station consisting of a single BSR, the BSR typically interfaces with the provider's backhaul through the SDA instead of the BSDU. (See Section 1.4.1, "Outdoor Radio (SPR) with Indoor Switch/Hub").

1.3.4. SDA-1/48V

The SDA-1/48V is a compact indoor adapter, especially designed for use when available power source is 48VDC (i.e. no AC power supply), and when no synchronization is required (i.e. in licensed bands). The SDA-1/48V provides the BSR with Ethernet connectivity to the backhaul.

1.3.5. Global Positioning System (GPS) - Optional

The GPS antenna is a rugged, self-contained GPS receiver and antenna that receives a universal GPS satellite clock signal. The GPS is an optional unit that connects to the BSDU. The GPS synchronizes frequency hopping of multiple Base Stations, ensuring that the entire ASWipLL network operates with the same clock based on a universal satellite clock signal, and, thereby, eliminating radio frequency ghosting effects.

1.3.6. Base Station Power Supply (BSPS) - Optional

The BSPS is an optional third-party unit that is implemented at Base Stations to provide –48 VDC power supply and power redundancy. The BSPS is installed in a standard 19-inch cabinet and connected to the BSDU.

The BSPS provides the BSDUs and BSRs with the following:

- Power supply of –48 VDC.
- Power redundancy in case of power failure. The BSPS charges a battery bank that provides this power redundancy during mains failure. Thus, the BSPS acts as a DC-uninterruptible power supply (UPS) with a battery connected to it. The size of the battery determines the backup and charging time. Since the system is current limited, the maximum battery size is based on that limit.
- Remote power management and monitoring (by ASWipLL's WipManage program).

The BSPS consists of the following basic components:

- **Main unit:**
  - **DC Rectifier modules:** converts AC current to DC. The BSPS can house up to four rectifiers. The rectifiers are "hot plugged" and operate in parallel. This enables the user to define an N+1or N+2 redundant system. Each rectifier has its own current sharing system, satisfying a complete sharing among rectifiers.
  - **System controller:** provides BSPS management control and BSPS operating information.
  - **Electronic Low Voltage Detector (ELVD):** disconnects the battery from the load, avoiding damage to the battery when over-discharged.
  - **Load and battery circuit breakers:** provide DC protection and distribution.
- **DC Distribution unit:** provides circuit breakers for distributing the output current to multiple BSDUs. It also contains a bypass switch to bypass the LVD.
- **Battery:** provides the BSPS system with back-up power.

1.4. Subscriber Site Units

The ASWipLL subscriber units are located at the subscriber's premises. The ASWipLL subscriber site consists of a radio transceiver that receives and transmits signals from and to the Base Station. The radio transceiver provides the subscriber with high-speed data access, Internet access, and VoIP at up to 4 Mbps. The ASWipLL radios interface with the subscriber's Ethernet network either through a hub or switch, or directly, depending on ASWipLL radio model.

Note: For VoIP support, Airspan can provide a third-party residential gateway (RGW). The RGW typically provides two POTS ports for telephony, a 10BaseT LAN port for subscriber PC/network, and a 10BaseT port for connecting to the SDA or IDR (depending on subscriber site configuration).

The ASWipLL system provides two different subscriber site configurations:

- Outdoor radio (i.e. SPR) with indoor Ethernet switch/hub (i.e. SDA)
- Indoor radio only (i.e. IDR device)

1.4.1. Outdoor Radio (SPR) with Indoor Switch/Hub (SDA)

The outdoor radio with indoor Ethernet switch/hub configuration consists of the ASWipLL Subscriber Premises Radio (SPR) and the ASWipLL Subscriber Data Adapter (SDA), respectively.

1.4.1.1. Subscriber Premises Radio (SPR)

The SPR is an outdoor radio transceiver that provides a wireless link between the subscriber's network and the Base Station.

The SPR connects to the subscriber's network through the SDA Ethernet hub/ switch. The SDA provides the SPR with DC power, lightening protection, and Ethernet (10Base-T and/or 100Base-T) interface with the subscriber's PCs/network (up to four PCs depending on SDA model).

The SPR is mounted outside on an external wall or on a pole. The SPR connects to the SDA by a standard CAT-5 cable.

The SPR is available in the following basic models:

- **SPR with Standard Gain Antenna:** includes a built-in antenna with 15-dBi antenna gain, covering an area of 23 degrees.
- **SPR with High-Gain Antenna:** includes a built-in antenna with 18-dBi antenna gain, covering 15 degrees.
- **SPR with External Antenna:** includes an N-type connector port for attaching a third-party external antenna.

1.4.1.2. Subscriber Data Adapter (SDA)

The SDA is a switch or hub (depending on model), providing the SPR with -48 VDC power supply, lightening protection, and 10/100BaseT interface to the subscriber's PCs/network.

The SDA is installed indoors and can be mounted on a wall or simply placed on a desktop. The SDA connects to the SPR by a standard CAT-5 cable.

The SDA is available in the following models:

- **SDA-1:** hub providing one 10BaseT interface with the subscriber's computer (or LAN network if connected to another hub or a switch).
- **SDA-1/DC:** adapter that provides Ethernet (one 10BaseT) and regulated –48 VDC power to the SPR. This model can be powered from a voltage of 10 – 52 VDC (e.g. from a **solar panel** that typically provides 12 VDC). This model is typically implemented in mobile wireless applications, e.g. in a car or truck. (This model can also be implemented at a Base Station with a BSR.)
- **SDA-4H:** hub providing four 10BaseT interfaces with the subscriber's computers and/or networks. One of the 10BaseT ports provides crossover cabling for interfacing with another hub or LAN switch. Alternatively, it may be connected to another PC via a crossed Ethernet cable.

- **SDA-4S:** integrated LAN switch, providing four 10/100BaseT interfaces with the subscriber's PCs/network. The ports of the SDA-4S models support **Auto Negotiation**, allowing automatic configuration for the highest possible speed link: 10BaseT or 100BaseT, and Full Duplex or Half Duplex mode. In other words, the speed of the connected device (e.g. a PC) determines the speed at which packets are transmitted through the SDA-4S port. For example, if the device to which the port is connected is running at 100 Mbps, the port connection will transmit packets at 100 Mbps. If the device to which the port is connected is running at 10 Mbps, the port connection will transmit packets at 10 Mbps.

  The SDA-4S ports also support automatic **MDI/MDI-X** crossover detection, allowing connection of straight-through or crossover CAT-5 cables to any port.

  The SDA-4S is available in the following models:

  - **SDA-4S (standard):** standard integrated LAN switch, providing four 10/100BaseT interfaces with the subscriber's computers. This model is ideal for SOHO implementation.
  - **SDA-4S/VL:** provides VLANs between ports and the SPR, ensuring privacy between LAN users of the different ports. For example, all users connected to Port 1 do not "see" users connected to Port 2. This model is ideal for multi-tenant (VLAN security) implementation.
  - **SDA-4S/VLtag:** ideal for multi-tenant applications where traffic engineering and privacy is required. SDA-4S/VLtag assigns a specific VLAN ID to traffic, based on the SDA-4S/Vltag port at which the traffic arrives. The VLAN IDs are fixed (since SDA-4S/VLtag is not user configurable). SPR converts the four VLAN IDs tagged by SDA-4S/VLtag to four VLAN IDs configured through ASWipLL's network management system (WipManage). The tag conversion is performed by SPR before sending the traffic to the air (i.e. to the BSR) and vice versa when coming from the air.

- **SDA-4S/1H3L:** provides a high priority port (left-most port) for VoIP traffic.
- **SDA-4S/VL/1H3L:** combines the functionality of the SDA-4S/VL and SDA-4S/1H3L models (i.e. VLAN for each port and a high priority port for VoIP).

Figure 1-3 displays a typical subscriber site setup implementing an SPR and SDA.

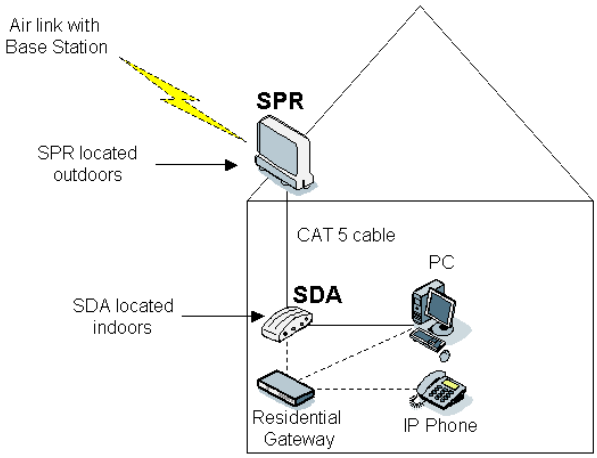

Figure 1-3: Subscriber site with SPR and SDA units (optional RGW)

1.4.2. Indoor Radio Unit (IDR) Only

The indoor radio unit configuration consists of the ASWipLL Indoor Data Radio (IDR). The IDR combines the functionality of the SPR and SDA, functioning as a transceiver and a hub. The IDR provides one 10BaseT Ethernet interface to the subscriber's network. The IDR receives its power from a separate power supply unit (AC-DC power adapter).

The IDR is available in two models:

- IDR with a built-in internal antenna
- IDR with a TNC connector for attaching a third-party external antenna

The IDR with a built-in antenna is typically mounted on an interior wall or on a desktop with line-of-site with the Base Station. The antenna of the IDR model with an external antenna is typically mounted outdoors to provide line-of-site with the Base Station.

The IDR can be used for data and voice transmissions. In the case of voice, the IDR uses a third-party RGW to interface with the subscriber's IP phone. Figure 1-4 displays a typical setup for data and voice at a subscriber site implementing the IDR.

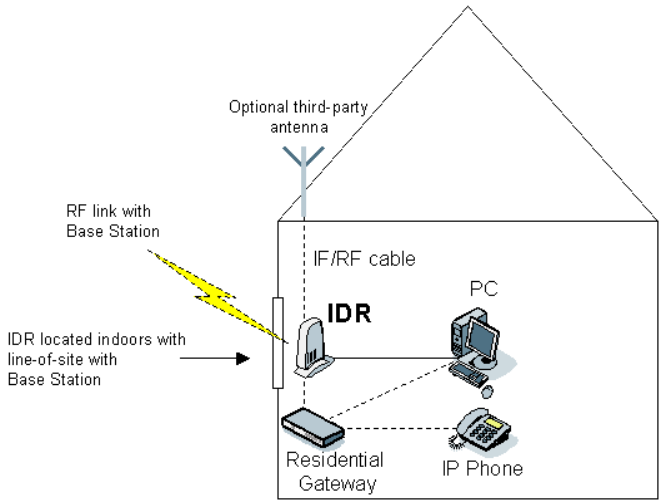

Figure 1-4: Subscriber site with IDR and third-party external antenna (optional RGW)

2

Safety Guidelines

This chapter outlines safety guidelines when installing the ASWipLL system.

Warning: The user and the installer should be aware that changes and modifications not expressly approved by Airspan Networks could void the user's authority to operate the equipment.

Warning: Never install equipment that is damaged.

Warning: Only qualified personnel should be allowed to install, replace, and service the ASWipLL equipment.

2.1. ASWipLL Radios and Third-Party External Antennas

Warning: Do not connect and disconnect antennas while the power is on. This can cause irreversible device damage.

Warning: The digital portion of the transceiver 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 on and off, the user is encouraged to try correct the interference by performing one or more of the following measures:

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

Warnings:

1) The device cannot be sold retail, to the general public or by mail order. It must be sold to dealers.
2) Installation must be controlled.
3) Installation must be performed by licensed professionals.
4) Installation requires special training.

Warning: The ASWipLL radio devices 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 Airspan's ASWipLL product warranty and may expose the end user or the service provider to legal and financial liabilities. Airspan and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

Warning: For **unlicensed** bands, it is the responsibility of the person installing the ASWipLL system to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), that only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance with FCC rules CFR47 part 15.204. The installer should configure the output power level of antennas according to country regulations and per antenna type.

Warning: For **unlicensed** bands, in accordance with FCC regulations, ensure that the external antennas provide an EIRP of less than or equal to **36 dBm** to prevent interference with other radios operating in the unlicensed band. The EIRP is defined by the following formula:

Max. Power Output + Antenna Gain - Cable Loss ≤ 36 dBm (EIRP)

Airspan does not supply cables for connecting external antennas. It is the responsibility of the installer to provide the cable and ensure the cable characteristics (e.g. length and cable loss) enables adherence to FCC's regulations concerning maximum EIRP.
The table below lists **examples** of cable loss per cable (not supplied by Airspan) for maximum antenna gains, based on the formula above. Note that the EIRP is either equal to or less than 36 dBm.

Cable type	Cable length (ft)	Tx power (dBm)	Cable loss (dB)	Max. Antenna gain (dBi)	Max. EIRP (dBm)
BELDEN - 9913	10	21.1	0.6	15.5	36
	30	22	1.5	15.5	36
	100	23	4.4	15.5	34.1
BELDEN - 89907	10	22.4	1.9	15.5	36
	30	23	5.2	15.5	33.3
	100	23	16.3	15.5	22.2

Warning: The ASWipLL transceivers emit microwave radiation. Therefore, a minimum distance must be maintained from the front of the ASWipLL radios:
- **Unlicensed bands (e.g. 5.8 GHz):** 200 mm
- **Licensed bands:**
  - 700 MHz (i.e. ASWipLL 700) = 800 mm
  - 2.5 GHz (i.e. ASWipLL 2.5) = 500 mm

Warning: To avoid RF interference between BSRs operating in the 700 MHz where four BSRs are installed at a Base Station, a 1-meter separation must be provided between the BSRs' antennas operating in the lower frequencies (i.e. 711.5 and 714.5 for 1 Msps mode; 712 and 714 for 1.33 Msps mode) and the BSRs' antennas operating in the upper frequencies (i.e. 741.5 and 744.5 for 1 Msps mode; 742 and 744 for 1.33 Msps mode).

Warning: When using external antennas, the external antennas must not be co-located or operating in conjunction with any other antenna or transmitter.

Warning: ASWipLL radios using an external antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Warning: Inherent risks exist in operating equipment in license-exempt bands (i.e. 900 MHz). Airspan recommends that you do not purchase or deploy any equipment that operates in license-exempt bands without first analyzing the interference environment at each of your proposed deployment locations. Please contact your Authorized Airspan System Integrator or Distributor if you have any questions or require assistance regarding interference analysis. Airspan Networks will not be held responsible for product performance issues related to interference.

Warning: In environments that produce disturbances such as paging systems, Airspan recommends using a narrow-band cavity filter and implementing the appropriate frequency bands (within the filter's capabilities), i.e. building an NVRAM frequency table using only these frequencies.

Warning: Mount outdoor radios so that their front panel ports face down to prevent water from settling on the ports. This avoids damage to the units such as corrosion and electrical short-circuiting.

Warning: Do not mount outdoor radios and external antennas in weather such as rain or lightening that may increase risk of electrocution.

2.2. Electrical Safety Guidelines

Warning: Connect the power only after all network and antenna cable connections are performed. Powering the device before connecting, for example, the external antenna, can lead to irreversible device damage.

Warning: To prevent short-circuiting and electrical shocks, cables with exposed ends (i.e. not yet crimped) should be covered with protective polythene bags during external cable installation processes.

2.2.1. Handling Electrostatic Devices

Warning: To prevent ESD damage to ASWipLL devices, always wear an ESD wrist strap when handling these devices or coming into contact with internal components.

Electrostatic devices are those devices that may be damaged by the inadvertent discharge of static electricity from a charged body. The risk of damage, due to electrostatic discharge (ESD) to a device, may cause the device to fail suddenly, or it may induce a partial defect within the device, which will cause subsequent premature failure. Static electricity can result from operators walking on floors, moving around on chairs, from the movement of operator's clothing or even casual brushing against racks, benches or walls.

Airspan recommends the following guidelines to be adopted to minimize the risk of component failure due to electrostatic discharge to the device:

- ASWipLL devices are provided typically in see-through anti-static bags. Wherever possible, checking and inspection of a unit should occur without removing it from the bag.
- All operators shall wear the approved conductive overall.
- Where operators come into direct contact with any piece of electronic hardware, operators must wear an **ESD-preventive wrist strap**. All straps and cords should be tested using a Wrist Strap Tester prior to use. The wrist strap cords shall have a 2 Meg Ohm resistor fitted at either end. Wrist straps should be worn in direct contact with bare skin and not over clothing.

2.2.2. Grounding

Only certain ASWipLL devices require additional grounding. ASWipLL devices that do not require additional grounding have grounding at the main supply outlet. The following table lists the ASWipLL devices' grounding requirements.

Table 2-1: ASWipLL grounding requirements

Site	ASWipLL device	Grounding
Base Station	BSR	Through the mains (via BSDU) i.e. no additional grounding required
	BSDU	Additional grounding required (grounding lug at rear end of chassis)
	BSPS	Additional grounding required (grounding lug at rear end of chassis)
CPE	SPR	Through the mains (via SDA), i.e. no additional grounding required
	IDR	Through the mains, i.e. no additional grounding required

2.2.3. Lightening Protection

Warning: Never install the equipment during stormy weather and lightening.

ASWipLL devices comply with the **Surge Immunity standard: EN 61000-4-5**. ASWipLL devices are protected from lightening surges as the outdoor devices (BSRs and SPRs) are encased in a plastic chassis. Therefore, if lightening strikes the device, an electrical circuit cannot be completed, and hence, no electrical surge can occur.

In addition, ASWipLL outdoor and indoor (SDA) devices provide high-speed data line protection against direct and induced transient over-voltages surges on the cables. This capability is provided by the fact that all ASWipLL devices are designed with TVS (transient voltage suppressor) components that maintain potential differences.

However, for geographical areas that have above normal lightening activity, Airspan can supply a surge protector composed of a 15-pin D-type adapter with a grounding wire.

2.3. Cabling

Warning: The maximum cable length between the radio transmitters (i.e. BSR and SPR) and terminating equipment is 100 meters.

Warning: Cables with exposed ends (i.e. not yet crimped) should be covered with protective polythene bags during external cable installation processes.

Warning: Prior to the commencement of any installation, commissioning work at 'live' sites it is the responsibility of the Airspan engineer to advise the customers representative before any activity commences. If in doubt assume equipment is 'live'.

Warning: Disturbance of cables on an In-Service exchange can cause loss of service. Extreme care must be taken when installing cables at any customer or subscriber premises.

2.3.1. Considerations

The following issues should be considered during cabling at the ASWipLL Base Station and customer premises:

- Cable routes are to be defined in the site-specific documentation.

Note: A minimum separation of 200 mm should exist between power and data cables. However, it is permissible to allow these cables to cross each other at right angles.

- Observe recommended minimum bend radii when installing copper cables. Wherever a cable changes direction, ensure that it does so in a smooth curve with a radius of at least 50 mm to prevent damage.

- Plastic ties and wraps are to be used to secure cables at regular intervals to trays, guides, and mounting pole/bracket. Ensure all trimmed ends are disposed of safely and at regular intervals.
- Data cables of less than 20 pairs shall be mixed in bundles not exceeding 50 mm in diameter.
- Ensure cables are not trapped in cabinet doors, by slide-in equipment or support metalwork.
- Excessive stress on cable terminations caused by taught cables should be avoided. Connector strain relief, if not built into the connector used, shall be provided by means of a strategically located cable tie. A maintenance loop or a generous amount of cable slack shall be provided just before the cable reaches the ASWipLL device to allow for equipment removal without disturbance to adjacent cables.
- When installing network cables, ensure they are not damaged by friction or sharp edges.
- Data cables providing connection to the customers network shall be run in protective conduits. Cable conduits should be secured to the wall in accordance with manufacturers instructions.
- External data cables are to be protected in metal conduits, which are to be secured to the building structure in accordance with manufacturers recommendations.
- Wiring conduits must be placed in areas to prevent a trip hazard (e.g. don't install on roof walkways)
- Cables should be carefully fed through conduits and not pulled by means of any attached connector.
- Sufficient space should be provided in cable conduits, trunking or trays (where possible) to allow for future cabling growth.
- Data cables threaded into holes drilled in walls are to be covered by a waterproof sheath to prevent water penetration.

- Silicone sealant should be used to plug any holes on both internal and external wall surfaces once cables are in place.
- Cables not housed in conduits must be placed in a manner to avoid a trip hazard. (Avoid trailing wires across passageways.)

2.3.2. Labeling

The following labels are required to be fitted to ASWipLL equipment:

- Voltage Warning
- High Earth Leakage Current
- Signal Cable Designation

2.3.2.1. Voltage Warning

Warning: Voltages over 30 Volts AC and 50 Volts DC are categorized as hazardous. Hazard warning labels should be fitted where required. Certain countries require equipment warning and instruction labels to appear in the local language. When installing ASWipLL equipment ensure that local requirements regarding labels are given consideration.

- Where mains power is fed from separate phases, appropriate warning labels must be fitted to warn of the increased danger.
- The AC equipment used in the BSPS cabinet must carry a relevant voltage warning label specific to the country in which it is being installed. The label will be fitted to the cabinet doors displaying an electrical hazard symbol, the local operating voltage and the letters ‘AC’.
- A power feed identification label (e.g. PWR ‘A’) shall be applied in the following locations:
  - On the rear of the main power rack adjacent to the terminal block
  - Attached to BSPS AC mains power plug or lead
  - Attached to the customer mains power socket or distribution rail
  - On the BSPS power circuit connection at the fuse board

2.3.2.2. High Earth Leakage Current

If equipment earth leakage current exceeds 3.5 mA, a warning label as shown in Figure 2-1 must be fitted to the rear of the main power rack alongside the AC inlet terminal block.

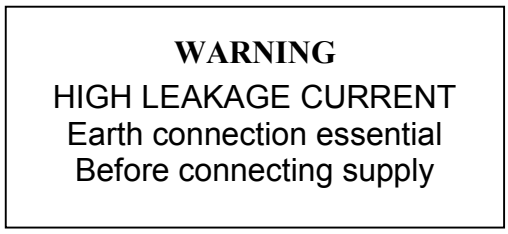

Figure 2-1: Warning label if earth leakage current exceeds 3.5 mA

2.3.2.3. Signal Cable Designation

All data cables should be labeled with both the source and destination at each end. A wrap around identification label, similar to that shown in Figure 2-2, is to be fitted to both ends of ASWipLL data cables. Care should be taken to ensure that the cable identification information is clearly visible. Fit the label 100 mm from the cable end. Wrap the label ensuring good adhesion to cable and itself.

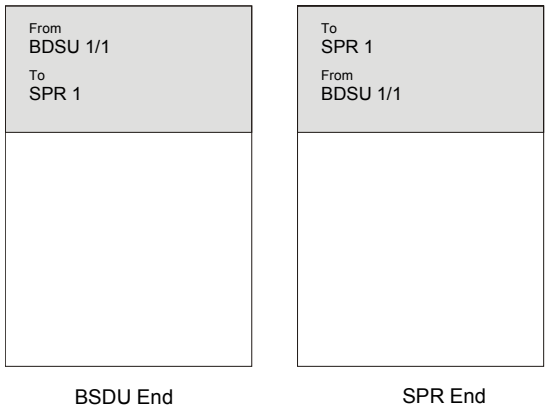

Figure 2-2: Typical signal cable identification label