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Overview

This chapter provides a brief introduction to the WipLL system and a brief overview of the WipLL system architecture.

1.1. Introduction

Airspan's **AS WipLL** system (hereafter referred to as WipLL) provides a low-cost, high-performance point-to-multipoint IP-based Broadband Fixed Wireless (BFW) Access solution. WipLL 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). **WipLL** offers service providers an integrated access solution, providing quick-to-market deployment and low-market entry cost for broadband services.

WipLL operates in the licensed 2.8 GHz, 3.x GHz, and Multichannel Multipoint Distribution Services (MMDS), and unlicensed 900 MHz, 700 MHz, 2.4 GHz (ISM), and 5.8 GHz radio frequency bands.

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

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

WipLL utilizes air protocol technology for wireless packet switching using Frequency Hopping technology. **WipLL**'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.

WipLL 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.

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

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

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

1.3. System Architecture

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

- **Base Station site:** consists of WipLL access units that interface between the provider's backbone and the WipLL subscriber sites.

- **Subscriber site:** consists of WipLL 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 WipLL system.

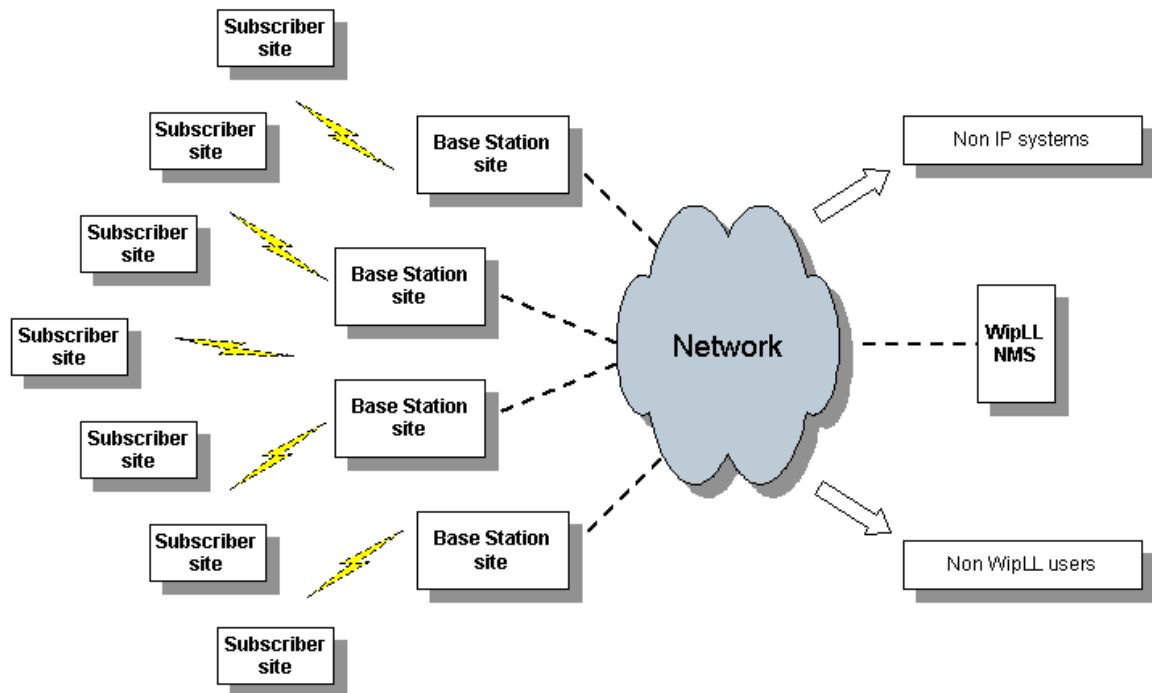Figure 1-1 displays a block diagram of the main areas of the WipLL system.

Figure 1-1: WipLL System Architecture

1.3.1. Base Station Site

The WipLL Base Station interfaces between the subscriber sites and the service provider's backbone, providing subscribers with high-speed data, Internet, and VoIP services. The WipLL Base Station is comprised of the following units (some optional):

■ **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 to the provider's backbone, by the WipLL 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 WipLL Subscriber Data Adapter (SDA).

■ **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 WipLL radio unit (i.e., Subscriber Premises Radio).

■ **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 and between BSRs.

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.

■ **Subscriber Data Adapter** (SDA)**:**

The SDA is implemented at Base Stations consisting of a single BSR. The SDA provides the BSR with -48 VDC power supply and Ethernet connectivity to the provider's backbone.

The SDA is installed indoors and connected to the BSR by a CAT-5 cable.

■ **Base Station Power Supply** (BSPS)**:**

The BSPS is an optional WipLL unit that is implemented at Base Stations that do not provide –48 VDC power supply or 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 WipLL'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.

■   **Global Positioning System (GPS) antenna:**

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 WipLL network operates with the same clock, based on a universal satellite clock signal, and, thereby, eliminating radio frequency ghosting effects.

The optional WipLL GPS features include:

■   WAAS DGPS accuracy

■   RTCM-104 DGPS corrections output derived from the WAAS DGPS system

■   T-RAIM for timing applications

■   Carrier phase measurements at 1 Hz

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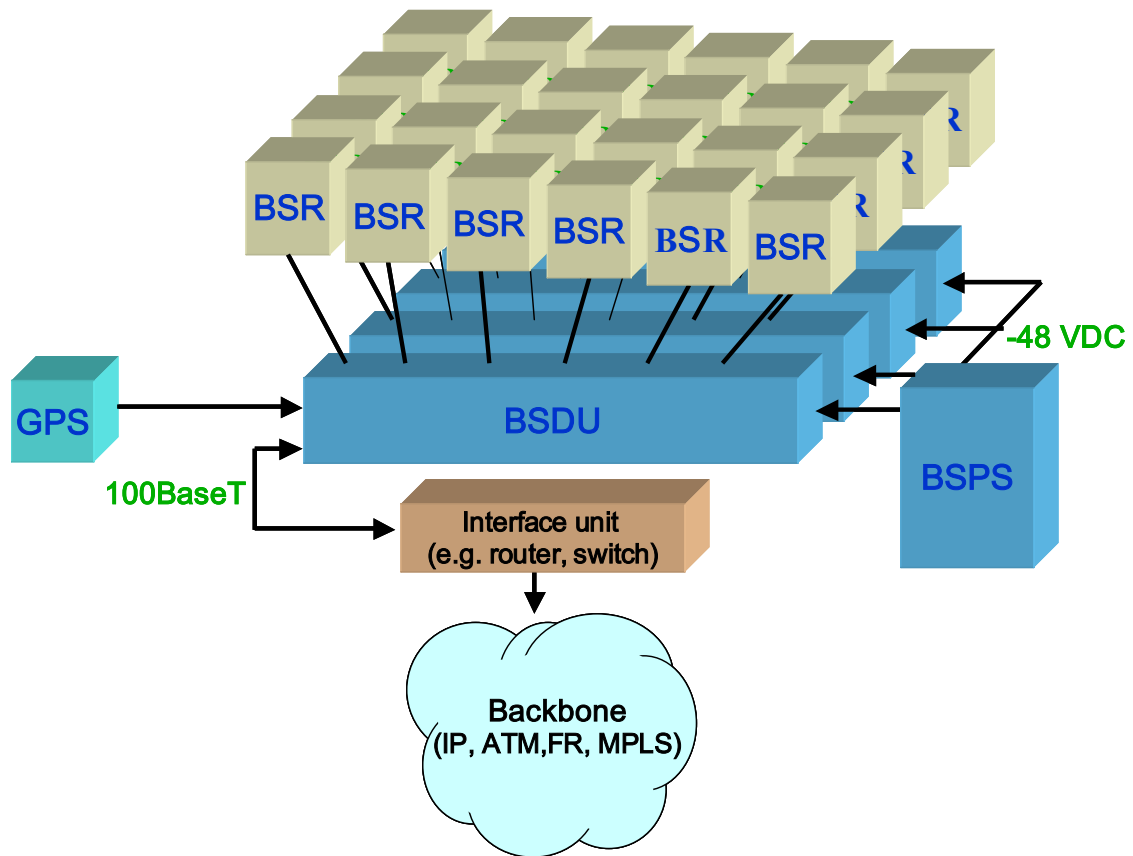
Figure 1-2: WipLL Base Station units (maximum configuration)

1.3.2. Subscriber Site

The WipLL subscriber site is located at the subscriber's premises. The WipLL 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 WipLL radios interface to the subscriber's Ethernet network either through a hub or switch, or directly, depending on WipLL 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 WipLL system provides two different subscriber site configurations:

■ Outdoor radio with indoor Ethernet switch/hub

■ Indoor radio only

1.3.2.1. Outdoor Radio with Indoor Ethernet Switch/Hub

The outdoor radio with indoor Ethernet switch/hub configuration consists of the WipLL Subscriber Premises Radio (SPR) and the WipLL Subscriber Data Adapter (SDA), respectively. These two devices are described below:

■ **Subscriber Premises Radio (SPR):**

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

The SPR can be 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 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.

■ **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 10/100Base-T 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 that provides one 10BaseT interface to the subscriber's computer or LAN network if connected to another hub or a switch.

■ **SDA-4H:** hub that provides four 10BaseT interfaces to the subscriber's computers and/or networks. One of the 10BaseT ports provides crossover cabling for interfacing to another hub or LAN switch. Alternatively, it may be connected to another PC via a crossed Ethernet cable.

■ **SDA-4S:** integrated LAN switches, providing four 10/100BaseT interfaces to 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 to 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 WipLL's network management system (WipManage). The tag conversion is performed by SPR before sending the traffic to the air 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 setup at a susbcriber site implementing a WipLL outdoor radio unit (SPR) and a WipLL indoor Ethernet switch /hub (SDA).
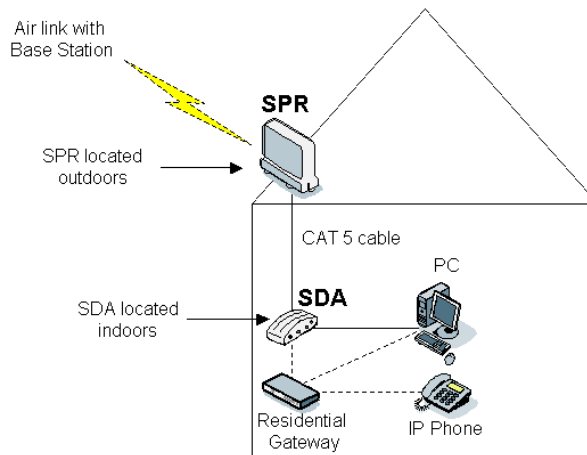
Figure 1-3: Subscriber site with SPR and SDA units (optional RGW)

1.3.2.2. Indoor Radio Unit Only

The indoor radio unit configuration consists of the WipLL 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 10Base-T 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 susbcriber site implementing a the IDR.
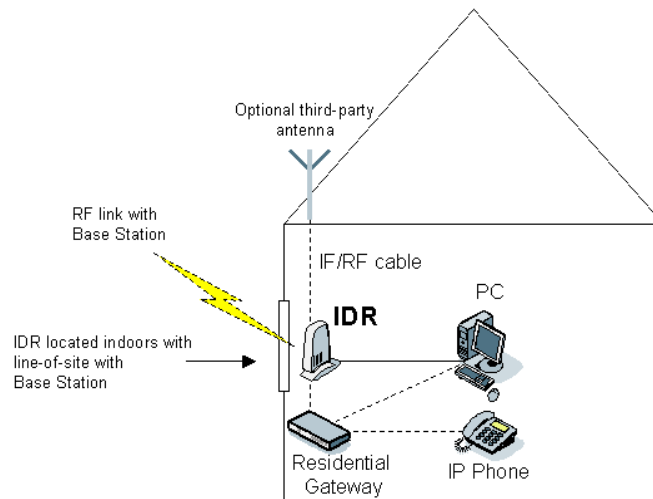
Figure 1-4: Subscriber site with IDR and third-party external antenna (optional RGW)

1.3.3. Management Tools

Airspan's WipLL system provides comprehensive set of state-of-the-art, use-friendly management tools for configuring and managing the WipLL system. These management tools provide fault, configuration, performance, and security management for the WipLL system.

The WipLL system provides the following configuration and management tools:

■ **WipManage™:**

WipManage is the WipLL network (element) management system (NMS) providing fault, configuration, performance, and security management. WipManage is a Windows-based, stand-alone program that provides a user-friendly and intuitive graphic user interface (GUI).

WipManage provides local and remote network management, which is based on Simple Network Management Protocol (SNMP).

■ **WipConfig™:**

WipConfig is an easy-to-use, Windows-based program that provides local and remote initial configuration (such as defining IP addresses) for WipLL devices.

WipConfig is typically used to perform first-time configuration at the factory or during installation.

■ **WipConfig PDA™:**

WipConfigPDA is designed to run on personal digital assistants (PDA), and provides an alternative tool to WipConfig (described above) for performing initial configuration.

■ **WipAD™:**

WipAD is a Windows-based program, providing quick-and-easy automatic, simultaneous downloading of software version files to multiple WipLL devices.