



# Understanding Silver Spring Networks Access Points

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### Revisions

Number	Date	Revision
2	December 2012	Added FCC and Government Guidelines section, revised EU regulatory information. Added 2.4 GHz to Specifications. Updated standards compliance specifications and corrected voltage range information.
1	10 Aug 2012	Updated supported frequencies for Luxembourg, United Kingdom, Portugal, and New Zealand; added EU regulatory information.

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United States		1-888-SSN-9876 (1-888-776-9876)	
Worldwide		+1-650-298-4298	
Contact us on the Web	<a href="http://www.silverspringnet.com/services/customer-support.html">http://www.silverspringnet.com/services/customer-support.html</a>		

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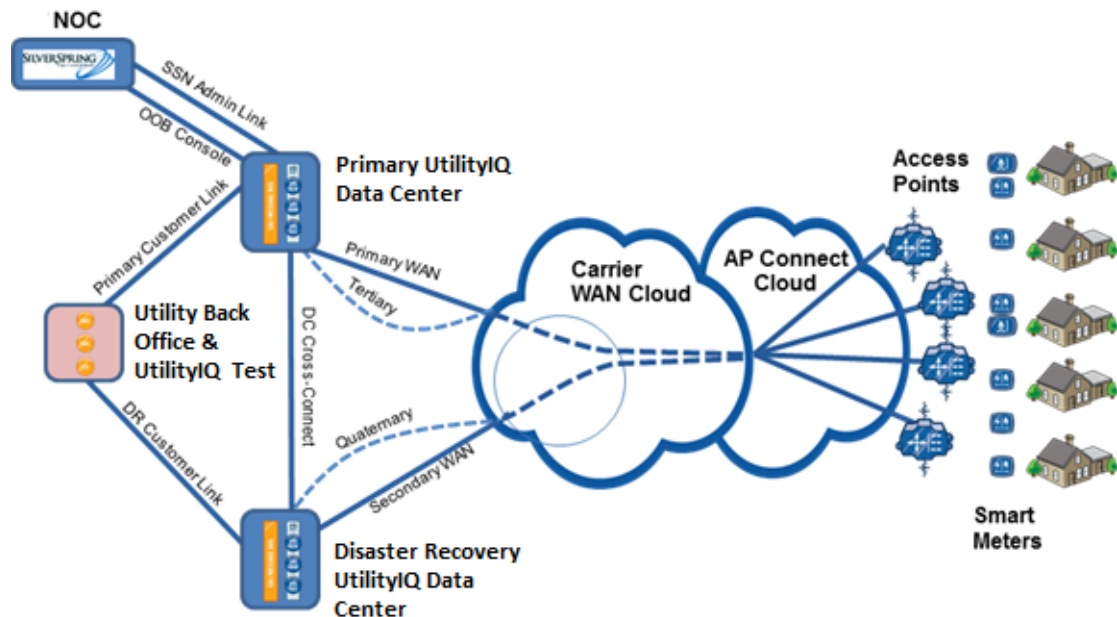
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# 1 About Access Points

## Overview

The Silver Spring Access Point (AP) provides the central link between endpoint devices and network control and monitoring. It is the connectivity between intelligent endpoints and the utility's back office. Its flexible communication features extend the reach and coverage of the network to thousands of customer premises, through scalability that lowers ownership costs. Since it has a backup battery, the AP can reliably route scheduled read and management tasks, even during an outage. [Figure 1](#) illustrates how APs connect endpoints to the utility back office (UtilityIQ data centers).

**Figure 1.** The AP in the network



The Access Point can be mounted on power poles or street lamps. All outbound communications (requests for data) pass through the AP. All inbound data packets (data, alarms) pass through the AP.

The AP can serve as the take-out point for network management traffic in a stand-alone communication network (or also for Advanced Metering Infrastructure—AMI, Distribution Automation—DA, or Demand Response Manager—DRM traffic in a joint AMI/DA/DRM installation). In certain cases, the AP can be the take-out point for traffic.

It is worth noting that the Silver Spring architecture differs from most others in that the AP is not what utility companies typically call a collector or concentrator—it is a router. This means that memory limits and data vulnerability issues typical of “collector” architecture are eliminated resulting in a more robust, scalable, simpler and higher performance network.

The Access Point comes with a 902-928 MHz-based radio Neighborhood Area Network (or NAN) interface which can be configured with any cellular technology (for example, Code

Division Multiple Access, Long Term Evolution, High Speed Packet Access, single carrier Radio Transmission Technology) Wide Area Network (WAN) interface, or with a 10/100 Ethernet interface. The Access Point provides a method for implementing the last mile utility information and control network.

## Features

The features of the Silver Spring Access Point are:

- Full two-way, 870-876 and 902-928 MHz FHSS
- One-watt transmitter
- Dynamic network discovery and self healing
- Robust security from the endpoint through to the wide area network
- “Over-the-air” network firmware upgrades
- Sophisticated routing functions ensure multiple paths to each endpoint
- Automated scheduling and network management tasks
- Long-reach, multi-hop networks, providing high endpoint-to-Access Point deployment ratios
- Weather-resistant outdoor enclosure, for longer life and greater durability
- Battery backup option (highly recommended) for fault-tolerant operation

## AP Product Description

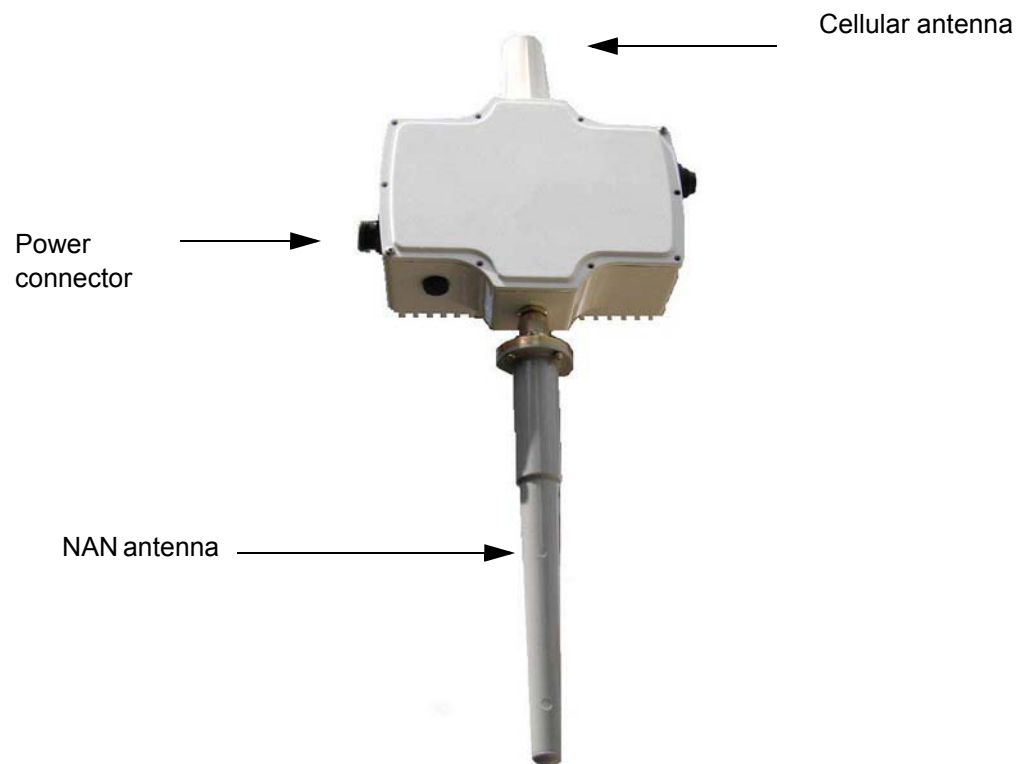
The types of APs available are:

Cellular APs, Satellite APs, Pad-mount APs, and Ethernet APs. The Ethernet APs can be configured with 10/100BaseT, and Fiber interfaces.

Cellular and Ethernet Access Points are shipped pre-configured. For cellular Access Points, Silver Spring will work with the chosen cellular provider to facilitate Access Point turn-up. For Ethernet Access Points, Silver Spring will work with the client on IP addressing to allow Silver Spring to pre-configure field devices for quick field implementation.

Figure 2 shows an Ethernet AP.

**Figure 2.** Silver Spring Networks Access Point (AP)



## Battery Backups

APs can be configured with battery backups. In the event of a power failure, the battery backup can provide continuous operation for at least eight hours.

Silver Spring Networks suggests as a best practice, a battery backup within the Access Point. When operating on battery backup, Access Points maintain full operational features. The Infrastructure Battery Pack (IBP) uses sealed lead-acid battery technology, which will deliver energy over a -40 to +85C temperature range. Silver Spring operates the Infrastructure Battery Pack on a *float* (that is, the usage model is defined as long periods of topped-off charge states followed by sporadic deep discharge events (outage events)).

UtilityIQ®, GridScape, or Demand Response Manager applications can actively monitor status. Events range in severity from informational (for example, export job succeeded) to warning (for example, the gap filler has started running because an interval gap was detected), to error (for example, the DC Detection flag on the meter was set), to emergency. These include an alarm when the backup battery on an Access Point is critically low.

For more information on battery backup devices, refer to [www.enersys.com](http://www.enersys.com). The key documents are:

- *Cyclon Application Manual*
- *Cyclon Selection Guide*

The design *float* life of Silver Spring-IBP products is up to eight (8) to ten (10) years at room temperature (25°C/77°F) and under proper charging conditions. This design life has been confirmed by the use of accelerated testing methods that are widely accepted by both manufacturers and users of sealed-lead batteries. High temperatures are used to accelerate the aging process of the battery under test.

## Read Storage

The Access Point has 8MB of RAM and 8MB of Flash. No reads are stored within the Access Point.

## Power Requirements

The Access Point and Relay require 96 to 250 VAC (50 to 60 Hz).

Power can be tapped directly from the power line or from a street light receptacle.

## Rebooting or Recycling APs

Silver Spring Networks APs will run steady state for an indefinite period of time. Reboots are not contingent upon any inherent tendency for the AP to reboot itself. The only conditions that would manifest a reboot are:

- Power failure in the absence of battery backup
- WAN dialer reaches a “high water count” that induces a firmware reboot – this happens when cellular coverage is intermittent
- Upgrade of firmware
- Deliberate reboot instruction issued from field technician or from back-office

## Standards Compliance

APs comply with:

- Operating Vibration standard ANSI C12.20, IEC 60068-2-8
- Operating Shock standard ANSI C12.20, IEC 60068-2-27
- Humidity standard ANSI C12.20, IEC 60068-2-6
- Operating Temperature standard ANSI C12.20, IEC 60068-2-1, IEC 60068-2-2
- Electromagnetic Susceptibility standard ANSI C12.20, IEC 61000-4-3
- Surge Withstand Capability standard ANSI C12.20, IEC 61000-4-5
- Electrostatic Discharge standard ANSI C12.20, IEC 61000-4-2
- Electrical Fast Transients per ANSI C12.20, IEC 61000-4-4
- Conducted Immunity per IEC 61000-4-6
- Magnetic Immunity IEC 61000-4-8
- Voltage Dips & Interrupts IEC 61000-4-11
- Safety Standard for Information Technology Equipment, IEC 60950-1, IEC 60950-22

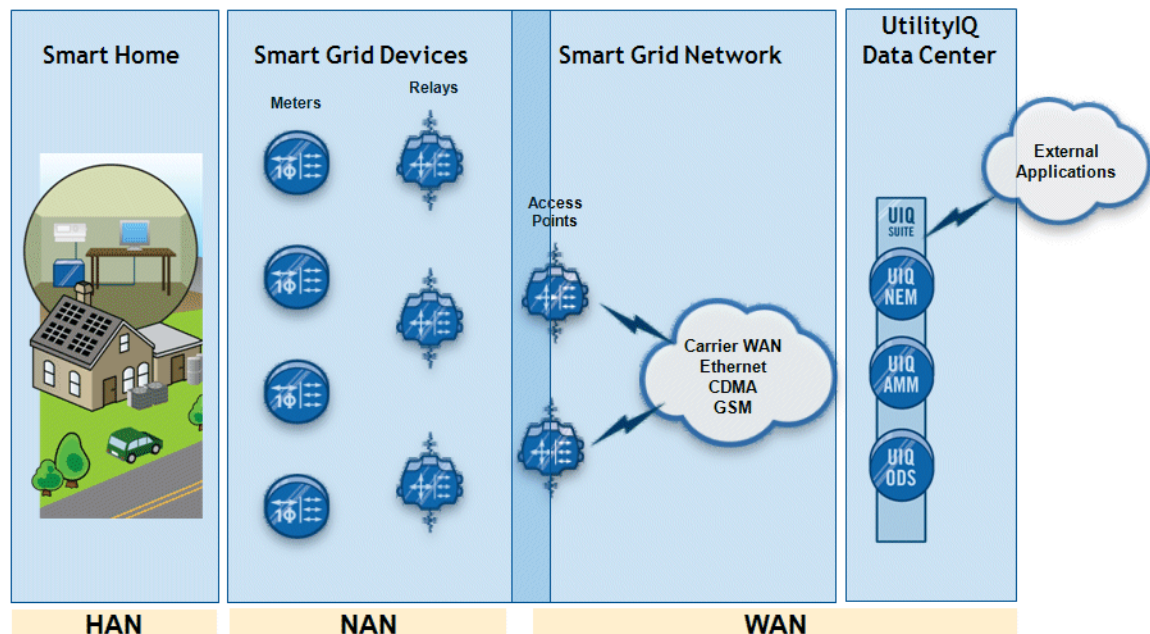
## Cellular Modem

Currently, the modem is a Sierra Wireless AirLink, RavenX, RavenXT, or RavenXE depending on AP model and country location.

## Addressing Schemes

Silver Spring's addressing scheme is based on the Internet Protocol (IP) suite. Each network device has one or more IPv6 addresses within the LAN. The Access Point will typically have an IPv4 address assigned to the WAN side. A 6in4 tunnel carries the data over a cellular carrier or Ethernet-based backhaul to the head end, where the tunnel is terminated, and IPv6 traffic is carried through to UtilityIQ, GridScape, or DRM. A high-level conceptualization of the NAN-to-WAN networks that AP traffic traverses is shown in [Figure 3](#).

**Figure 3.** APs in the Silver Spring Network



The Access Point is the central link between the utility's enterprise management systems and the endpoint devices such as Silver Spring-enabled electricity, water, gas meters, bridges, External Communications Modules, and Fault Circuit Indicators.

The Access Point is a vital part of the smart grid network, which extends secure, real-time measurement and control interfaces (with full, two-way communications) throughout the network and to the customer premises.

The Access Point provides a highly reliable connection to RF devices over a NAN. It communicates with intelligent endpoints, including meters and Bridges. The Access Point can also pass information through multiple Silver Spring Relays or through Silver Spring-enabled electricity meters or Master Bridges. And it offers multiple paths to each endpoint, through sophisticated mesh network routing that ensures greater reliability and redundancy. The Access Point also provides WAN connectivity to your utility's mission-critical applications through digital cellular or Ethernet connections.



## Specifications

The AP hardware specifications are listed in [Table 1](#).

**Table 1.** Access Point specifications

Feature	Description
<b>900 Mhz Communications:</b>	
Data rate	100Kbps
Frequencies	902-928 MHz North America 915-928 MHz Australia 902-907.5, 915-928 MHz Brazil 870-876 MHz Luxembourg & United Kingdom 870-873 MHz Portugal 922-928 MHz New Zealand
Spread Spectrum technology	FHSS
Transmitter output	30 dBm
Output impedance	50 ohms
Receiver sensitivity	-97 dBm for 1% PER
WAN	Cellular, Ethernet, Satellite
<b>2.4 GHz HAN Transceiver:</b>	
Frequency range	2.4 GHz, ISM Band
Data rate	100Kbps - 1Mbps FHSS, 250kbps DSSS
Spreading technique	DSSS, FHSS
MAC/Channels	802.15.4 - DSSS
Transmitter output	Output Power: 20-23dBm DSSS; 20-27dBm FHSS
Receiver sensitivity	-97 dBm for 1% PER
Power Draw TX	1.8 W typ. (2.0 W max.)
<b>Physical Interfaces:</b>	
Antenna connector	N Type, Female
NAN antenna	Omni antenna with gain not to exceed 3.6dBi on 2.4GHz and 3.0dBi on 900MHz
Cellular antenna	Mobile Mark antenna RMM-UMB-1S-WHT-7
<b>Protocols/Security:</b>	
Addressing	Internet Protocol Version 6 (IPv6)
Security	Secure Hash Algorithm 256 bit (SHA-256) RSA-1024 and /or ECC-256
Encryption	AES-128 or AES-256
<b>Mechanical:</b>	
Cellular	24cm (9.5") L x 25cm (10") W x 13cm (5.2") H, 2.38kg (5.1 lbs.) weight, IP65, white, aluminum housing
Ethernet	23cm (9") L x 20cm (8") W x 10cm (4") H, 1.8kg (4 lbs.) weight, IP65, white, aluminum housing
Underground (cellular)	34cm (13.5") L x 29cm (11.5") W x 15cm (6") H, 6.2kg (13.6 lbs.) weight, IP67, fiberglass reinforced polyester (FRP) housing

**Table 1.** Access Point specifications (Continued)

Feature	Description															
<b>Environmental:</b>																
Operating Temperature:	-40°C to +70°C (-40°F to +158°F)															
Humidity:	0% to 95%, non-condensing															
<b>Power</b>																
Voltage Range:	96 to 250 VAC, ~ 1A, 50 to 60Hz															
Power Consumption	<table border="1"> <thead> <tr> <th></th> <th>Idle</th> <th>Maximum</th> </tr> </thead> <tbody> <tr> <td>Ethernet</td> <td>2.5W,</td> <td>7W</td> </tr> <tr> <td>Ethernet with battery</td> <td>2.5W,</td> <td>8W</td> </tr> <tr> <td>Cellular</td> <td>2.5W,</td> <td>12.5W</td> </tr> <tr> <td>Cellular with battery</td> <td>2.5W,</td> <td>13.5W</td> </tr> </tbody> </table>		Idle	Maximum	Ethernet	2.5W,	7W	Ethernet with battery	2.5W,	8W	Cellular	2.5W,	12.5W	Cellular with battery	2.5W,	13.5W
	Idle	Maximum														
Ethernet	2.5W,	7W														
Ethernet with battery	2.5W,	8W														
Cellular	2.5W,	12.5W														
Cellular with battery	2.5W,	13.5W														
Battery Backup Option:	> 8 hour operation															
Receive Sensitivity	Receive sensitivity is -102 dBm @ 10 <sup>-6</sup> BER.															
<b>Mounting Kit Options:</b>																
Pole	Wooden, concrete, light															
Other	Wall, pad															
<b>Approvals:</b>																
FCC	Part 15.247															
Industry Canada	RSS-210															

## European Union Compliance

This section describes Silver Spring Networks' compliance with the EU R&TTE Directive.

The Access Point 1.5i uses a one Watt FHSS radio. Licenses have been issued as follows:

- Luxembourg  
A license has been obtained from ILR (Institut Luxembourgeois de Regulation) to operate in Luxembourg in the 870-876 MHz band.
- United Kingdom  
A license has been obtained from Ofcom to operate in UK in the 870-876 MHz band.
- Portugal  
A license has been obtained from ANACOM to operate in Portugal in the 870-873 MHz band.

This device has been designed to operate with and certified for antennas that have a maximum gain of 3.0dBi on 900MHz and 3.6dBi on 2.4GHz. Antennas that have a gain greater than specified are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Installation of all antenna radiating elements shall have a minimum separation distance of 20 cm from all persons and must not be co-located or operating in conjunction with any other transmitter.

## Declaration of Conformity with regard to the R&TTE Directive 1999/5/EC

This declaration is only valid for configurations (combinations of software, firmware, and hardware) provided and supported by Silver Spring Networks Inc. The use of software or firmware not provided and supported by Silver Spring Networks Inc. may result in the equipment no longer being compliant with the regulatory requirements.

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**Note:** The equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

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The following standards were applied:

- EMC: EN 55022 (2010), EN 55024(2010), EN 61000-3-2 (2006)  
EN 61000-3-3 (2008), ETSI EN 301 489-3 v1.4.1
- Safety: EN 60950-1:2006, EN 60950-22:2006, BS-EN 62311 (2008)
- Radio: ETSI EN 300 220-1 v2.3.1 (2010-02), ETSI EN 300 220-2 v2.3.1 (2009-12),

The conformity assessment procedure referred to in Article 10 and detailed in Annex IV of Directive 1999/5/EC has been followed.

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**Note:** This equipment is intended to be used in Luxembourg, United Kingdom, and Portugal in conjunction with licenses. For more details, contact Silver Spring Networks Compliance.

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The product carries the CE Mark:



A copy of the Declaration of Conformity may be obtained with formal request to:

Silver Spring Networks, c/o Hardware Engineering  
555 Broadway Street  
Redwood City, CA 94063, USA

## Declaration of Conformity for RF Exposure

This system has been evaluated for RF exposure for Humans in reference to EN 62311(2008) Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz). The minimum separation distance from the antenna to general bystander is 20cm (7.9 inches).

## Installation Note

Since APs do not have a power on/off switch for disconnecting AC power before servicing, AC power is provided through an AC mains disconnect switch or breaker. Therefore, the electrical installation of this product is under the control of the power utilities or their authorized subcontractors. Refer to their procedures for further instructions.

Only certain types of batteries can be used for battery replacements. Contact Silver Spring Networks for information about equivalent battery types that can be used for replacement.

## Maintenance Procedures

If an Access Point experiences an outage, all end point devices and Relays that were associated with it will converge on their secondary Access Point as found within their NodeQs. This alleviates outages due to Access Point failure. UtilityIQ-Network Element Manager (NEM), GridScape, or Demand Response Manager is then alerted of an Access Point outage, and forwards this message to the operator. Spare pre-configured Access Points are kept on hand, and are scheduled for network insertion within the utilities work order management system. Within NEM, GridScape, or DRM, the failed Access Point is flagged for RMA, and the device is replaced.

## Surge Protection

APs comply with up to 20kV for combination wave and up to 6kV for ring waves (reflects the current Ethernet AP and projected assembly.)

## Redundant WAN Option

WAN redundancy is inherent to the routed Mesh being offered by Silver Spring Networks. Access Points have the ability to identify WAN outages and forward traffic to secondary Access Points via their 902-928 FHSS interface. There is no downtime realized and as routes to the WAN become unavailable, those routes age out of the route tables of adjacent nodes as would be expected in a full-mesh network that continuously updates node queues and route tables. When an AP becomes unavailable, the routed Mesh dynamically reconfigures to available APs. When the AP comes back online, the routed Mesh dynamically reconfigures to include the AP in the Mesh network.

It is the suggestion of Silver Spring that multiple cellular carriers be spread across the territory to reduce the impact of a wide scale cellular outage. In addition, the co-mingling of private backhaul such as private network found within substations is also an option. The Silver Spring Networks Access Point can use public or private backhaul technologies to communicate to the host system (UtilityIQ, GridScape, or DRM) at the Utility head end. An AP can have a cellular modem (such as those approved for use on CDMA or General Packet Radio Service (GPRS) systems from Sprint, AT&T, Telus or other carrier) or any broadband technology that is Ethernet/IP compatible (such as Wi-Fi, fiber, private microwave or WiMAX). Current Silver Spring customers are using cellular modems, fiber backhaul, and private licensed and unlicensed wireless backhaul technologies. Additionally, some customers are currently experimenting with satellite backhaul connections and will be deploying this technology where needed.

## Mounting Options

The Access Points can be mounted on a utility pole or light pole. They can be pad mounted as well as wall mounted. (For additional information, refer to the *Silver Spring Networks Infrastructure Hardware Guide*.) Silver Spring recommends that the units be mounted at a height of 7 to 9 meters.

## WAN Options

Any WAN backhaul that can interface with the Access Point's Ethernet port and provide IPv4 connectivity to the HES with a minimum of 40kbps can be used as backhaul.

Customers have used the following alternative backhaul technologies:

- Distribution Substation Backhaul (for example, fiber)
- WiMAX
- Satellite Radios

The design rule for Access Point to RF devices is 1 to 5,000. At this ratio, the maximum data throughput required from a WAN solution is 40kbps per Access Point.

Based on real-world data on a network of this size, the average wireless speed is measured at 2.6Mbps downstream and 700Kbps upstream, which is well in excess of requirements.

The backhaul is fairly insensitive to latency (that is, in remote locations, Silver Spring already proven successful connection using satellite radios which have a ~1.5s RTT - or Round Trip Time).

Silver Spring recommends that the network design for a particular deployment limit exposure to single points of failure and proactively design for redundancy by allowing each RF device to be reached from more than one Access Point. In all but rural densities, having up to 5,000 RF devices per AP generally results in most RF devices being able to reach more than one Access Point.

## Throughput Performance

Typical data packet sizes observed in Smart Grid systems is between 150 bytes for DA or other simple command and control applications. A normal DRM and AMI meter read packet is approximately 350 bytes including full measurement intervals, event logs, and instantaneous register reads. At 100 Kbps (10 bytes / mS), delivery of 150 byte packets occurs at 10 full transactions per second.

The larger AMI/DRM packets are delivered at 3-5 transactions per second. These are typical observed rates and it should be mentioned that for reliability reasons all transactions are completely acknowledged four-way confirmed events.

Though final data is not available, raising on-air data rates from 100 Kbps to 300 Kbps will roughly double the PPS rates at the aggregation points (Access Points). This moves the daily capacity of an Access Point from approximately 400,000 transactions per day to nearly a million.

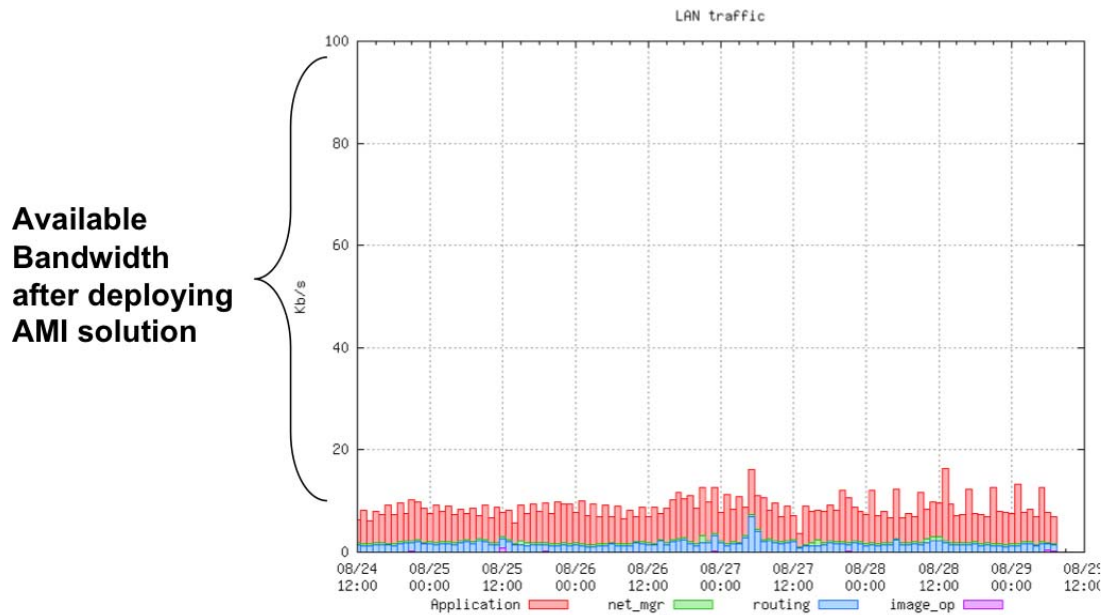
The bandwidth being fed to the WAN side of the Access Point is determined by what backhaul is being used.

With the Access Point being a router and not a collector, data is constantly being transmitted through the WAN, eliminating the need to store data for later transmission (Store and Forward). The Access Point, using 100Kbps on the NAN side, aggregates 3000-5000 meters, bridges, or other RF devices, while processing approximately 5 transactions per second and delivering upwards of 500,000 transactions per day to the back office.

The raw throughput in the RF NAN in the Silver Spring smart grid solution is 100 Kbps node-to-node. This means that between each device, there is 100 Kbps of available bandwidth. On average, the amount of traffic is relatively low with respect to the amount of available bandwidth.

Figure 4 illustrates data collected from a live customer network over a period of one week. As shown, the average bandwidth consumed by Advanced Metering traffic is approximately 15 Kbps or 15%, leaving 85% for other smart grid solutions such as DA or DR (disaster recovery).

**Figure 4.** Average bandwidth consumed by AMI traffic



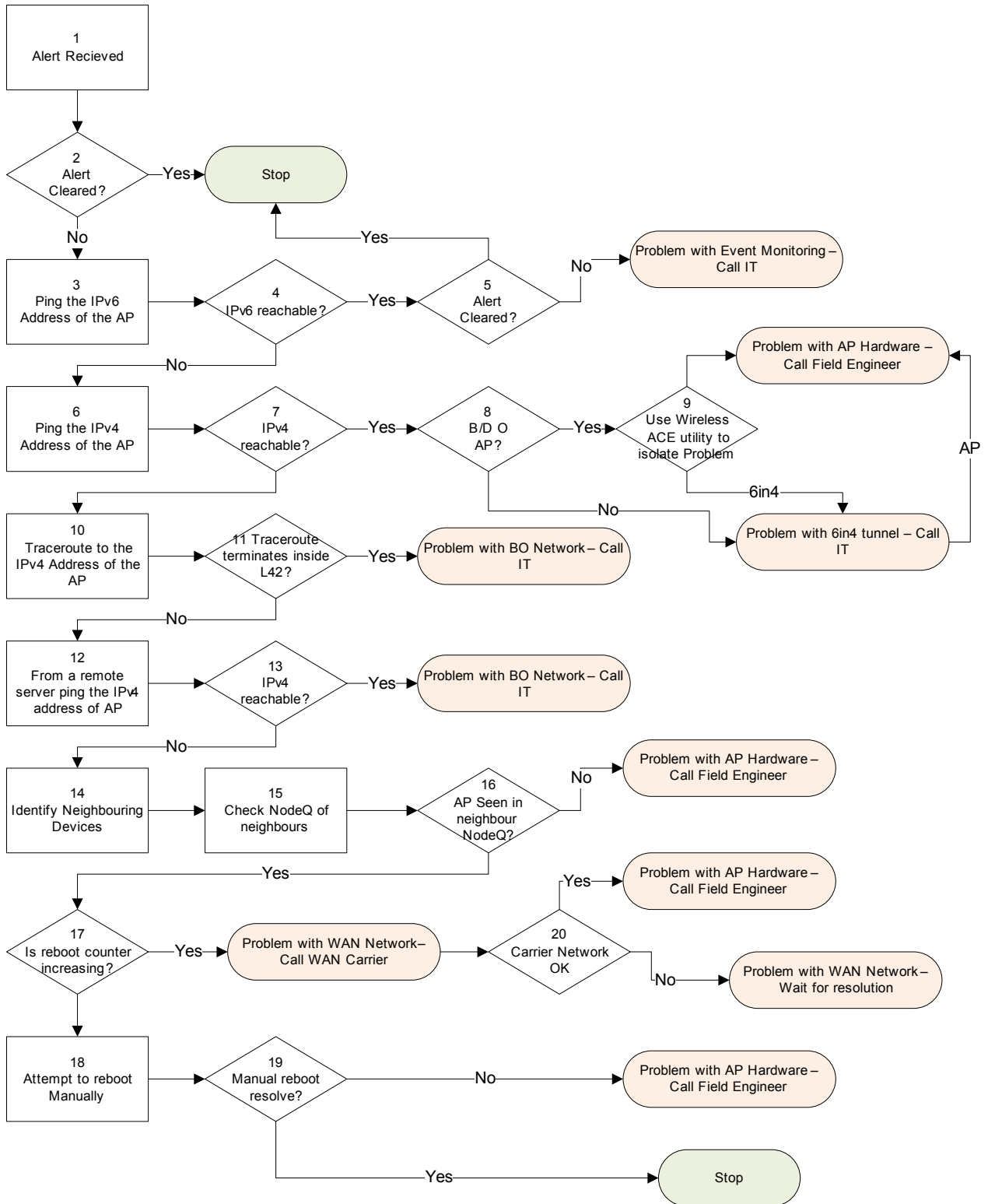
It is worth noting that there are a number of factors that impact each RF Mesh link between any two nodes including but not limited to: scheduled jobs (such as meter reads), path selection from an RF device to an Access Point, failures or outages, etc. An effective method to monitor network performance (data transmission, bandwidth utilization, etc.) is at an Access Point as the AP is the take out point for all associated RF devices. Meaning RF devices and Relays in the Silver Spring NAN are constantly retuning to, optimizing their paths and reporting into their Access Points.

All traffic flowing in and out of the RF Mesh network must traverse the Access Point. While it is fairly simple to monitor a single Access Point, it is important to realize that there are typically many Access Points in a commercially deployed smart grid system. The Silver Spring solution enables all Access Points to operate independently and in parallel, effectively increasing throughput and reducing latency.

The Silver Spring UtilityIQ NEM, GridScape, and DRM enable the configuration of policies for bandwidth utilization for both the WAN and the NAN. Once configured, the monitoring applications generate alerts for any bandwidth utilization policy violations. The network statistics report provides detailed insight into potential network load issues.

The monitoring applications can measure and report on RF characteristics in the NAN, including the identification of devices associated with areas of poor coverage. Having such data enables Silver Spring to assess whether such areas require the deployment of additional Relays or Access Points. This is especially useful in the early phases of a deployment.

Figure 5. AP Failure management



## Responding to a WAN Failure

An AP might not be reachable because the device cannot dial out on the WAN. The device continues to try dialing out until it is either able to connect, or it has dialed 308 times. If it can connect, the device notifies the event management program that it has successfully recovered. If it cannot, then the modem resets itself. The behavior of an AP repeatedly becoming unreachable, and then recovering shortly after, is called flapping.

A small amount of flapping is normal. Because a device can recover on its own, wait for one day of downtime, or one to two days of frequent flapping before investigating further. Filtering and reviewing the event management program mail alerts regularly can help to identify devices that need attention. The standard operating procedure regarding collector failure/management is shown in [Figure 5](#) on page 15.

## Multicast / Unicast Communications

Commands sent from head-end monitoring applications (NEM, GridScope, or DRM) via the Access Point (AP) are unicast, as the receipt of each packet must be acknowledged. However, in similar fashion to multicast, commands can be sent to a statically or dynamically defined group of RF devices for ease of manageability. In addition, the HES sends “Jobs” out in parallel to Access Points, that then in turn, send commands out to endpoints. The resulting effect is parallel processing that accomplishes a multicast-like service.

## Networking

Each NIC in Silver Spring RF devices registers with two IPv6 addresses – one for each of two APs: a primary and secondary AP. When one dies, another is found. From a topology perspective, each AP is its own IPv6 subnet. So NICs are in two different subnets - one for each AP.

The end-to-end protocol within the NAN is AES 128/256 bit, crypto IPv6. As the Access Point understands the full topology of the underlying mesh, the IPv6 packet is source routed from the AP to each end device – meaning that the full communication path from the Access Point to the device is specified, hop by hop, in the packet. The NAN endpoint to Access Point routing decisions are made hop-by-hop (that is, the NAN endpoint will send the IPv6 packet to its neighbor that has the least cost route to the Access Point. Then this neighbor will forward the packet to its neighbor with the best route until the packet reaches the Access Point. (The Access Point acquires its understanding of the full mesh topology because it sends route advertisement messages at randomized intervals.)

NAN system one way latency is measured at 50ms per hop between any points in the NAN. The Silver Spring network design expects on average, no more than 6 hops to any end point (such as a meter or Data Link Control, DLC, device). This would typically yield 300ms of NAN latency to any RF or DLC device. In addition, an Access Point can process up to 10 packets per second. Each DLC command consists of a single packet, with one associated ACK packet. With no other AMI traffic traversing an Access Point, an Access Point could process 100 DLC commands and ACKs, in approximately 30 seconds.

The cellular modem has store-and-forward GPS reporting capability with accuracy no less than 10 meters.



## Address Management

For the LAN, a DDNS (Dynamic DNS) system is used. Each device has one or more IPv6 addresses assigned to it, based on its location in the network and route out of the LAN. These addresses are then stored at the head end and used for all communications with the devices (ping, trace, reads, etc.), giving the customer a true, native end-to-end IP network.

## Administration

This section discusses administrative issues about Access Points.

The RavenX modem in each AP has a TELNET port that is used for internal communications support purposes. The RavenX modem on the AP uses port 6543 for TELNET. Do not disable this port as doing so will prevent the Sierra Wireless application from communicating.

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**Note:** Silver Spring does not support end users accessing the AP's modem TELNET port.

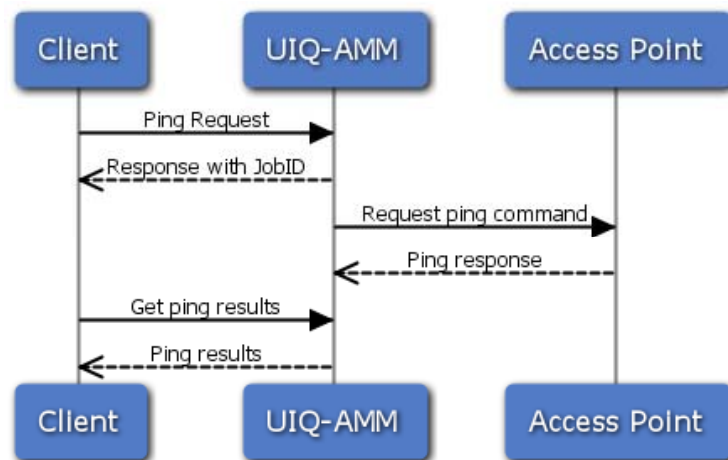
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Just like a meter, it is possible to ping an Access Point. The Silver Spring solution uses IPv6, so it is simply a matter of invoking an on-demand ping. This can be accomplished via the UtilityIQ-AMM user interface, via web services, through GridScape, or via DRM.

You should get two ping responses for each AP. One is from the RavenX modem. The other is from the NIC in the AP.

To invoke an on-demand ping against an Access Point, navigate to the appropriate Device Details page and click on the On Demand Ping link (location varies with each monitor application). [Figure 6](#) illustrates the ping sequence for UtilityIQ's AMM application.

**Figure 6.** Ping sequence



Also, UtilityIQ AMM exposes a web services API for invoking on-demand pings against Access Points.

## Configuration

To facilitate the configuration and remove the chance for human error (for example, typos) a simple shell script is generated and run from a Unix-based laptop which has a Silver Spring Field Service Unit attached to the USB port.

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**Note:** All Silver Spring APs are configured during the manufacturing process to ensure that the proper profile (Network ID, etc.) is included. Additionally, the software tool, net\_mgr, required to configure an AP, is not a user facing tool.

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## 2 FCC and Government Guidelines

### Silver Spring Networks NIC

**FCC ID: OWS-NIC40 IC: 5975A-NIC40 M/N: NIC40**

The AP/Relay NIC is REQUIRED to be professionally installed by a properly trained technician. Improper installation could void the user's authority to operate the equipment.

The device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. The device may not cause harmful interference.
2. The device must accept any interference received, including interference that may cause undesired operation.

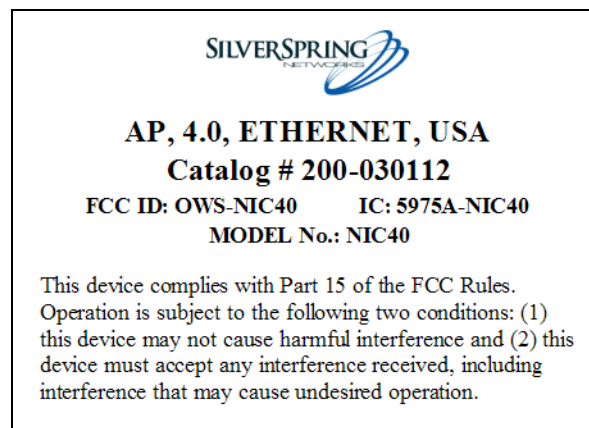
The antenna of this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

The device should be installed so that people will not come within 20 cm (8 in.) of the antenna.

This equipment has been tested and found to comply with Part 15 of the FCC Rules. 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 disconnected.
- Consult the dealer or an experienced radio/TV technician for help.

**Figure 7.** Sample FCC ID label for NIC PCA





**CAUTION:** Changes or modifications not expressly approved by Silver Spring Networks could void the user's authority to operate the equipment.

## FCC Guidelines for Devices Containing a Transmitter Module

The following is an extract from FCC PART 15 UNLICENSED MODULAR TRANSMITTER APPROVAL, DA 00-1407, Released: June 26, 2000, Section 6 describing labeling requirements for devices containing a modular transmitter.

Section 6. The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: XYZMODEL1" or "Contains FCC ID: XYZMODEL1." Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement.

In the latter case, a copy of these instructions must be included in the application for equipment authorization.

**Figure 8.** Sample FCC ID label for devices containing a NIC



## External Antenna Integration

This radio transmitter 5975A-NIC40 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

- Antenne omnidirectionnelle, 3.0dBi sur 900 MHz et 2,4 GHz sur 3.6dBi

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

## Safety Information



**WARNING:** Severe shock and explosion hazard! Touching energized parts can result in massive equipment damage, and severe injury or death. Short-circuiting energized parts will result in blinding flash and explosion. Opening and closing electrical circuits can also produce dangerous and explosive arc flashes. Involuntary muscular reactions associated with electrical shock may result in other injuries. Observe the following safety guidelines.

Careful planning of every job is essential. Nothing should be taken for granted. Do not take chances!

- Read and follow all approved policies and procedures provided by your employer associated with the procedures in this manual.
- The procedures in this manual must only be performed by qualified workers in accordance with local utility safety practices, utility requirements, and applicable OSHA and NFPA standards.
- The information contained in this document is intended to aid qualified personnel, and is not a replacement for the proper training required to make a person qualified.
- Silver Spring Networks assumes no liability for the customer's failure to follow these safety guidelines.

## General Electrical Safety

- Perform the procedures in this manual in accordance with applicable workplace standards established by the following agencies:
  - Occupational Safety and Health Act (OSHA).
  - The National Electrical Code published by the National Fire Protection Association (NFPA-70).
  - National Electrical Manufacturers Association (NEMA).
  - Electronics Industries Association (EIA).
  - Insulated Power Cable Engineers Association (IPCEA).
- American National Standards Institute (ANSI). Whenever possible, de-energize all circuits or equipment before working on them.
- Maintain a minimum clearance of 10 feet (3 meters) between line potential and all unqualified persons at all times.
- Keep unauthorized people out of the work area. Be especially cautious of children, who tend to be drawn to work activity.
- Determining if a circuit is OFF can be difficult in some instances. Check for circuit voltage with an appropriate voltmeter before working on equipment presumed to have been de-energized. Tiebreakers, double throw disconnect switches, automatic transfer switches and emergency generators can supply power through an alternate circuit or from another source.

- 120V current can be just as lethal as higher voltages because current flow through a body depends upon the body's resistance.
- Do not trust insulation and/or weatherproofing on a wire as protection from shock.
- Use electrically insulated tools. Inspect portable electrical equipment or tools for defects and remove any defective devices from service immediately. All portable electrical equipment must have Ground Fault Circuit Interrupter (GFCI) protection.
- Select the right tool for the job. Use tools properly. Keep tools in good working order.
- Make sure the work area is free of any flammable material. Flammable vapors can be ignited by an arc flash.
- Keep the work area clean and dry. Cluttered work areas cause accidents and injuries.
- Provide good lighting in the work area. You cannot work safely if you cannot see what you are doing.
- Report unsafe conditions or defective equipment to your immediate supervisor.
- Handle material carefully. Lift and carry properly.

## Personal Protective Equipment (PPE)

- Always wear Personal Protective Equipment (PPE), in accordance with OSHA and ANSI standards.
- Wear eye protection and electrically insulated gloves. Test gloves in accordance with ANSI standards before use. Do not use gloves that do not pass appropriate test procedures.
- Wear protective clothing such as long sleeve shirts and long pants made of flame resistant materials.
- Remove all jewelry.
- Do not pass any objects to or from other persons not protected by insulating platforms or tested, electrically insulated gloves.

## Fall Protection

When performing work at any elevation:

- Always use a fall protection system, in accordance with OSHA standards, whenever performing work at any elevation.
- Never use conductors, guy wires, pins, or cross-arm braces, etc. to support your weight.
- Whenever using aerial lift devices such as hoists, man-lifts, vehicle-mounted work platforms and overhead lifts, read and follow the manufacturer's guidelines for safe and proper operation.
- Use ladders and scaffolding only in accordance with the manufacturer's guidelines and/or according to OSHA standards.

- Only use ladders made of non-metallic, non-conductive material. They should be the proper size and type for the work intended. Inspect ladders for wear and breakage. Remove any oil, grease, or other slippery materials.
- Do not set the ladder at too steep or too shallow of an angle. A rule of thumb is to stand erect with your toes against the bottom rails of the ladder, with your arms extended straight out. If you can set your palms on top of the rung that is at eye level, the ladder should be at the proper angle. If a ladder angle label is provided, follow its recommendations.
- If the ladder is to remain in place for an extended period, secure it at the top. The support point at the top of the ladder should be at least 24 inches (60 centimeters) wide to maintain support in the event of sideways movement. For jobs of short duration, have a fellow worker support the ladder at the base.
- Evaluate all tasks to be performed from a ladder for potential fall hazards, such as complex tasks or situations that require leaning from the side of the ladder.
- The use of scaffolding or a work platform should be considered as an alternative solution in such cases.

## Shock Accident First Aid

- Do not touch the victim with your bare hands; use something non-conductive to separate the victim from the energy source.
- Call for emergency medical help immediately. Keep the victim lying down, warm, and comfortable until help arrives. Avoid moving the victim in case of injury to neck or back. Position an unconscious victim on a side to let fluids drain.
- Check the victim's breathing and heartbeat. If properly trained, apply mouth-to-mouth resuscitation and/or CPR if necessary.
- Remove constricting items from the victim, such as shoes, belts, jewelry, and tight collars; they could cut off circulation if the victim experiences swelling.
- Apply water or saline for a few minutes to any burns until the skin returns to normal temperature. Do not attempt to remove clothing that is stuck to a burn. If possible, elevate burned areas to reduce swelling.
- Make sure the victim receives professional medical attention, even if they feel fine. Electric shock can cause heart failure hours after the shock is received.

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