soma
NETWORKS

Booster Antenna Installation Guide

Document ID: OPN-USER.0018
Date: May 13, 2002

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Revision History

Status	Version	Date	Changes Made
Draft	0.01	July 13, 2001	Document created.
Draft	0.02	January 25, 2002	Document modified by author.
Initial Draft	0.03	February 20, 2002	Comments from subject matter expert review and substantive edit incorporated.
Initial Draft	0.04	May 13, 2002	Added RF warnings.

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Important Safety Instructions

For your safety and protection, read this entire guide before you attempt to install the booster antenna. In particular, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

WARNING: One milliampere of current flowing through your body can kill you. Voltage as low as 15 volts can kill under the right conditions. Treat energized equipment with respect.

Heed warnings – Adhere to all warnings on the product and in the operating instructions.

Follow instructions – Follow all operating instructions.

Attachments – Do not use attachments unless recommended by SOMA Networks as they may cause hazards.

Power lines – Do not locate the booster antenna in the vicinity of overhead power lines or other electric light or power circuits. When installing the booster antenna, take extreme care to keep from touching power lines or circuits as contact with them might be fatal.

Weather conditions – Do not install the booster antenna while it is raining, if there is threat of lightning, or if winds are over 40 km/h (25 miles per hour).

Outdoor antenna grounding – The booster antenna must be grounded to prevent voltage surges and buildup static charges. Follow Section 810 of the National Electric Code (NEC) which provides guidelines regarding proper grounding of the antenna and supporting structure, grounding of the lead-in wire to an antenna discharge unit, size of grounding conductors, location of antenna discharge unit, connection to grounding electrodes, and requirements for the grounding electrode. In Canada, follow Section 10 of the Canadian Electrical Code (CEC). For other countries, be sure to meet the requirements of the electrical codes of that country.

Grounding electrode system – Effective earth grounding is required to protect personnel and equipment from shock and fire hazard. Follow the guidelines in the following NEC articles. Article 250-53 provides guidelines for the grounding path to the grounding electrode. Article 250-81 provides guidelines for a ground electrode system. Article 250-83 provides guidelines for other individual grounding electrodes. In Canada, follow Section 10 of the Canadian Electrical Code (CEC). For other countries, be sure to meet the requirements of the electrical codes of that country.

Coaxial cable – Coaxial cable should be fire-resistant and follow the guidelines in NEC 820-49, NEC 820-50, and NEC fire requirements. Cable should not be marked with voltage markings. Installation of the coaxial cable should also comply with NEC requirements.

Alerts used in this guide

WARNING: Where you see this symbol and the WARNING heading, strictly follow the instructions to avoid personal injury or damage to the product.

WARNING: Where you see this symbol and the WARNING heading, strictly follow the instructions to avoid electric shock.

Preface

This document describes how to install the booster antenna, ground it, and connect it to the SOMAport.

Related Documentation

The following table lists the SOMA Networks consumer documents that cover SOMAport installation

Component	Description	Audience
SOMAport Setup Guide	Installation and maintenance guide for the SOMAport	Subscribers
SOMAport Quick Setup	Quick installation reference card	Subscribers

Conventions

This section outlines the conventions used in this guide.

Measurement Conventions

Measurements in this guide are expressed according to the Systeme International d'Unites standards for metric units and abbreviation. Equivalent Imperial measurements (used in the United States) are provided in parentheses, except when Imperial is the international standard.

Bits and bytes are not abbreviated, though their prefixes are; for example, "kbits" for kilobits, "Gbytes" for gigabytes.

Trademark Identification

The following SOMA Networks trademarks are used without notation in the rest of this document:

- SOMAport™

Tell Us How We Are Doing

If you have any feedback about this document, e-mail Technical Communications at SOMA Networks: **docs@somanetworks.com**

Contents

Introduction

This chapter is an introduction to the SOMA Networks booster antenna that is used to increase the signal received and transmitted by the SOMAport.

Contents

Overview

The SOMAport has an internal antenna that provides sufficient levels of performance in the majority of cases. However, certain subscribers may be located too far away from the nearest base station and, as a result, the RF signal may be too weak. Under these conditions, the booster antenna amplifies the strength of the received and transmitted signal, thus enhancing the operational range and performance of the SOMAport.

The booster antenna connects to the SOMAport using a single coaxial cable and is powered through this cable. No additional power supply is needed.

The booster antenna contains no moving parts. It has non-line-of-sight functionality and automatically adjusts itself electronically for the best possible signal.

The booster antenna Model BA-100-000 is designed for use with the SOMAport Model CPE-100-200. The booster antenna cannot be used as an antenna for other devices. It will not radiate unless it is connected to a SOMAport.

WARNING: The long term characteristics or the possible physiological effects of radio frequency electromagnetic fields have not been investigated by UL.

Antenna detection

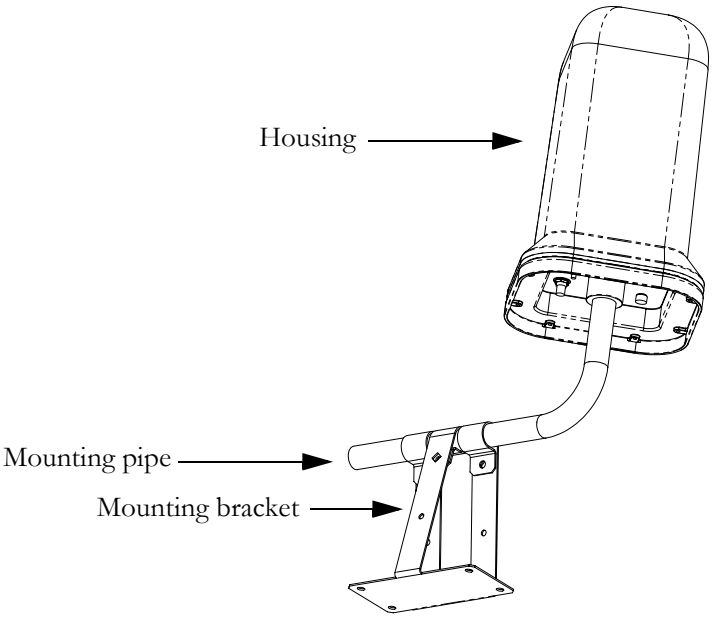
Each time the SOMAport is turned on, it automatically detects the booster antenna. If the booster antenna is detected, the SOMAport will use the booster antenna as an external antenna until the power to the SOMAport is turned off. If no booster antenna is detected, the SOMAport will use its own internal antenna until the SOMAport is turned off. The SOMAport decides which antenna to use each time the SOMAport is turned on, and does not change antennas until the SOMAport is turned off.

WARNING: Do not connect or disconnect the booster antenna cable to or from the SOMAport or the booster antenna while the SOMAport is on. 28VDC may be present. This will not damage the equipment, but may be dangerous. If the SOMAport (when first turned on) does not detect the booster antenna, the voltage through the booster antenna cable is turned off.

The booster antenna assembly

The booster antenna comes in three pieces:

- the mounting bracket
- the mounting pipe
- the booster antenna housing



Do you have everything?

Before you begin, make sure you have everything you will need during the installation on hand.

Parts that are supplied with the booster antenna

Verify that you received the following parts:

- Booster antenna (encased in housing)

- Mounting pipe
- Mounting bracket
- Four 5/16-inch x 2-inch lag screws
- Seven 4/15-inch flat washers
- Three 5/16-inch x 1-inch carriage bolts
- One #10 screw
- One #10 flat washer
- One #10 lock washer

Additional materials and tools

In addition, you need the following materials and which are not supplied with the booster antenna:

- RG-6/U coaxial cable
- Grounding block
- Carpenter's level
- Electric drill
- 11 mm (7/16-inch) open end/box end wrench or small adjustable wrench to loosen and tighten cable connectors
- Cable clips (recommended) HOW MANY?
- Grounding wire
- 3/16-inch drill bit
- Pencil or chalk
- Silicone sealant
- 13 mm (1/2-inch) socket to tighten the mounting bracket carriage bolts and nuts

Safety precautions

In addition to the safety instructions on page 3, follow these guidelines when installing the booster antenna.

- Carefully survey the job site before beginning the installation to locate secure handholds, dangerous conditions (such as power lines and weak roofs), and the safest and most convenient placements for ladders.
- Do not climb on a wet or icy roof.
- Do not attempt high installations on windy days.
- Use only the sturdiest commercial-grade ladders—those with wide, slip-preventative rungs and bases.
- Do not position ladders at an angle steeper than 70°. Steeper angles can cause a ladder to slip sideways.
- Dig the base of the ladder into the ground if possible.
- Do not place ladders on slate that is wet or hot.
- Wear rubber-soled, low-heeled shoes or boots.
- Wear a pair of durable but flexible protective gloves whenever they won't interfere with the installation process.
- Perform as many installation steps as possible on the ground.

WARNING: The installer must keep a minimum distance of 20 cm (8 inches) from the antenna. The installation should be made to insure a minimum of 20 cm separation from all persons that may come in close proximity to the antenna.

WARNING: The booster antenna must not be used indoors. It must be mounted on an outdoor permanent structure.

INSTALLING THE BOOSTER ANTENNA

This chapter describes how to install the booster antenna outdoors using a variety of mounting options. It also describes how to route and ground cables, ground the antenna, and connect the antenna to the SOMAport. Be sure to read the important safety information in the front of this manual before beginning an installation.

Contents

Installation overview

Install the booster antenna yourself only if you have performed or are comfortable performing the following tasks.

- Climbing a ladder and working on a roof
- Using a power drill
- Determining if there are water pipes, electrical wiring, or gas lines hidden in the walls near where drilling will occur
- Routing coaxial cable through the foundation wall, under floors, and through interior walls
- Grounding an antenna and coaxial cable as recommended in the National Electrical Code (NEC), Canadian Electrical Code (CEC), or the electrical code of the country in which you are installing the booster antenna

ATTENTION: Take care not to bump or bang the booster antenna against anything.

Installation tasks

Installing the booster antenna involves the following tasks:

Step	See
1 Choosing a site.	page 17
2 Estimating cabling requirements.	page 19
3 Installing the antenna on one of the following surfaces:	
■ rooftop	page 21
■ external wall with a wood or lap siding surface	
■ external wall with a brick or poured concrete surface	
■ external wall with a cinder block or masonry surface	
■ a metal pole	
4 Routing and grounding the exterior cables.	page 29
5 Running the cable into the building and connecting it to the SOMAport.	page 32

Installation requirements

The booster antenna works best when it has a line-of-sight view of the basestation. However, you do not have to manually point it at a basestation.

Install the booster antenna at the highest point available. Examples of optimal locations include the apex of a roof, the top of a chimney, or a tall pole mounted on a chimney.

The installation must meet the following requirements:

- The booster antenna must not be used indoors. The booster antenna must be installed on an outdoor permanent structure such as a roof or an external wall.
- All four sides of the booster antenna must be unobstructed. Leave a clear zone of at least 12 inches around the antenna. Because of this requirement an under-the-eaves installation is usually not possible.
- Make sure the installed height of the booster antenna is at least 3 m (10 feet) to ensure that it is safely out of reach. For example, if the booster antenna is installed on the side of a building, it should be at least 3 m (10 feet) off the ground to maintain a safe distance from both children and adults. If installed on a rooftop that is accessible, the antenna must be installed 3 m (10 feet) above the rooftop.

WARNING: Do not install the booster antenna near power lines. You can be killed if the booster antenna comes into contact with electric power lines.

- Do not contact overhead power lines.
- Check the distance to any nearby power lines before starting installation. Stay at least 6 m (20 feet) away from all power lines.
- If any part of the booster antenna or mast assembly comes into contact with a power line, call your local power company. Do not try to remove it yourself. They will remove it safely.

WARNING: While this device is in operation, a separation distance of at least 20 cm (8 inches) must be maintained between the radiating antenna and the body of all persons exposed to the transmitter in order to meet the FCC RF exposure guidelines. No change to the antenna or device is permitted. Doing so may result in the installed system exceeding RF exposure requirements. This device must not be co-located or operating in conjunction with any other antenna or radio transmitter. Installers and end users must follow the installation instructions provided in this guide.

Estimating cable requirements

Once you have selected the installation site, you must decide where you want the cable to enter the house and approximately how much cable you are going to need.

The following diagram shows an example of an installation.

INSERT DIAGRAM - Shows the booster antenna mounted on a rooftop, a cutaway view of a house and a grounding block. The coax cable goes from the booster antenna to the grounding block and then the SOMAport. The grounding wire goes from the grounding block to the central building ground.

Considerations

You must use RG-6/U coaxial cable from the booster antenna to the SOMAport. The total length of the coaxial cable from the booster antenna to the SOMAport must not exceed 25 m (82 feet). You cannot use a line amplifier.

WARNING: Do not connect any third-party devices to the booster antenna, booster antenna cable, or SOMAport F jack. Damage may occur.

To estimate how much cable is required

1. Identify where the SOMAport is located.
2. Locate the central building ground.

   The following ground points are acceptable:

   - Grounded interior metal cold water pipe within five feet of the point where it enters the building
   - Grounded metallic service raceway
   - Grounded electrical service equipment enclosure
   - A 2.5-m (8-foot) grounding rod driven into the ground (only if bonded to the central building ground by #6 or heavier bonding wire)
   - Other acceptable grounding electrodes that comply with sections 250 and 810 of the NEC, Section 10 of the CEC, or the electrical code of the country in which you are installing the antenna.

3 Choose a location to mount the grounding block.

The block should be as close as possible to the point where the cable will enter the house.

4 Estimate the amount of cable required for each of the following:

Cable run	Distance
One RG-6/U coaxial cable with ground wire to run from the booster antenna to the grounding block.	_____
One RG-6/U coaxial cable to run from the grounding block to the SOMAport.	_____
#10 copper or #8 aluminum grounding wire to run from the grounding block to the central building ground. (QUESTION: Are the wires listed correct for our use?)	_____

Installing the booster antenna on a roof

When installing the booster antenna on a roof, install it in the highest possible location to maximize the signal you receive.

Tools and materials

Have the following tools and materials on hand during this process.

- Carpenter's level
- Electric drill
- 4 5/16-inch washers
- 11 mm (7/16-inch) open end/box end wrench or small adjustable wrench
- 4 5/16-inch x 2-inch lag screws
- Pencil or chalk
- Silicone sealant
- 3/16-inch drill bit
- 13 mm (1/2-inch) socket for the three mounting bracket carriage bolts and nuts

To install the mounting assembly on a roof

COMMENT: These procedures assume that the mounting bracket and mounting pipe come assembled. If not, I will have to change the procedures.

1. Locate the center of a rafter where you want to place the mounting bracket and pipe assembly.

   INSERT Cutaway diagram showing rafters under a rooftop.

2. Hold the mounting bracket against the roof so the center line of the bracket is centered on a rafter.
3. Use a carpenter's level to make sure the center line of the bracket is perfectly vertical.

   Diagram showing level against mounting foot indicating a "level" reading and a "not level reading".

4. Use a pencil or a piece of chalk to mark the position of the four holes in the mounting bracket.

   These marks indicate where you will be drilling.

5. Remove the mounting bracket and pipe assembly.
6. Drill a 3/16-inch hole in each of the four locations you marked.

7. Fill all four holes with silicone sealant.
8. Hold the mounting bracket and pipe assembly over the holes.
9. Insert a 5/16-inch x 2-inch lag screw in each of the holes to attach the mounting bracket to the roof.
10. Tighten the screws enough to hold the mounting bracket and pipe assembly in place.
11. Adjust the mounting pipe so that it points straight up.
    i. Use a socket to loosen the three carriage bolts on the mounting bracket near the pipe, as shown in the following illustration.

    Insert Diagram

    ii. Hold the mounting pipe and twist it until the short end of the pipe (on which the booster antenna will rest) is vertical.
    iii. Tighten the three bolts to hold the mounting pipe securely in a vertical position.

    Diagram showing a correct installation with the booster antenna pointing straight up.
12. Tighten the screws that secure the bracket to the roof.
13. Seal the mounting bracket with roof sealant.

    When applying the sealant, make sure you seal the areas shown in the figure below.

    Diagram showing where sealant goes.
14. Attach the booster antenna to the mounting assembly.

    For more information, see “Attaching the booster antenna to the mounting assembly” on page 28.

Installing the booster antenna on solid wood or lap siding

Follow these guidelines when installing the booster antenna on an external wall with a surface of solid wood or lap siding.

- Make sure the wooden surface is structurally sound.
- Do not mount the booster antenna on any type of aluminum or vinyl siding.
- Do not mount the booster antenna on any type of composite paneling, such as fibre board, particle board, or strand board.
- Do not mount the booster antenna under an eave or overhang that may block the antenna.

WARNING: Take extreme care to avoid contact with overhead power lines, electric lights, and power circuits. Contact with power lines, electric lights, or power circuits may be fatal. Locate the booster antenna more than 6 m (20 feet) from overhead power lines.

To install the mounting assembly on wood or lap siding

1. Locate the center of a stud.

   ATTENTION: Do not mount the booster antenna near the edge of a stud. Make sure you mount it on the center of a stud.

2. Hold the mounting bracket and pipe assembly in a position so that the center line is centered on a stud or solid wood surface.
3. If you are mounting the booster antenna on a sloped or vertical surface, use a level to verify that the center line is perfectly vertical.

   INSERT DIAGRAM that shows level vs. not level readings

4. Use a pencil or a piece of chalk to mark the position of the four holes in the mounting bracket.

   These marks indicate where you will be drilling.

5. Remove the mounting bracket and pipe assembly.
6. Drill a 3/16-inch hole in each of the four locations you marked.

7 Hold the mounting bracket and pipe assembly over the holes so that the short end of the mounting pipe points up.

If the mounting bracket spans two pieces of siding, use a spacer.

The mounting bracket should be positioned so that most of it is on the top board. A spacer should be installed to help hold the bottom of the mounting bracket in place. The spacer can be made of either solid wood or plastic.

INSERT Diagram

8 Insert a 5/16-inch x 2-inch lag screw in each of the holes to attach the mounting bracket to the roof.

9 Tighten the screws enough to hold the mounting bracket and pipe assembly in place.

10 Adjust the mounting pipe so that it points straight up.

i Use a socket to loosen the three carriage bolts on the mounting bracket near the pipe, as shown in the following illustration.

Insert Diagram

ii Hold the mounting pipe and twist it until the short end of the pipe (on which the booster antenna will rest) is perfectly vertical.

iii Tighten the three bolts to hold the mounting pipe securely in a vertical position.

Diagram showing a correct installation with the booster antenna pointing straight up.

11 Tighten the screws that secure the bracket to the side of the building.

12 Attach the booster antenna to the mounting assembly.

For more information, see “Attaching the booster antenna to the mounting assembly” on page 28.

To install a spacer

1

Installing the booster antenna on brick or poured concrete

Installing the booster antenna on cinder block or masonry

Installing the booster antenna on a metal pole

Attaching the booster antenna to the mounting assembly

Once the mounting bracket and pipe assembly are securely attached to the mounting surface and the mounting pipe is pointing straight up, you are ready to attach the booster antenna in its housing to the mounting assembly.

To attach the booster antenna

1. Attach the booster antenna to the mounting pipe.
   i. QUESTION: WHAT ARE THE STEPS TO DO THIS?
2. Attach the ground wire to the booster antenna.
   i. Insert a #10 screw into the hole close to the RF cable connection.
   ii. Slide a #10 flat washer over the screw.
   iii. Slide a #10 lock washer over the screw.
   iv. Tighten the screw.

   INSERT Diagram showing where the wire is attached.

   QUESTION: Where is the wire attached?

Routing and grounding the exterior cables

Grounding the booster antenna to the central building ground helps protect it and the SOMAport from lightning damage.

The booster antenna must be grounded in accordance with Section 810 of the NEC, Section 10 of the CEC, or the electrical code of the country in which you are installing the booster antenna. The following diagram depicts the grounding requirements.

INSERT DIAGRAM showing NEC grounding requirements

CAUTION: It is extremely important to ground the booster antenna and the coaxial cable to a single point in the central building ground. A nearby lightning strike can easily damage an ungrounded antenna, the SOMAport, and any attached equipment. Connecting both wires to the same point in the central building ground meets code requirements and provides the best protection for your equipment.

Burying the cable

Depending on the location of the booster antenna and the grounding block, you may choose to route the coaxial cable between them underground.

When normal coaxial cable is buried, its outer cover decays in the soil, and the cable's life is shortened. Cables that are suitable for burial have a special outer cover that resists breakdown. Some of these cables also have a special coating on their ground shields. This coating resists corrosion if water gets into the cable. If you choose to bury the coaxial cable, use appropriate cable. Doing so will help prevent problems.

Protecting the cable from damage

If you are routing the wire or cable above the ground, use cable clips to secure it to a wall or surface. Make sure you route the grounding wire in an area where people or animals are not likely to come in contact with the cable.

Prevent moisture penetration by using weatherproof connectors, or by sealing any connection that is exposed to the elements. Drip loops provide additional protection by preventing moisture from traveling down the cable and entering the connection.

Tools and materials

Have the following tools and materials available:

- TYPE OF screwdriver(s)
- #??? insulated grounding wire
- Hammer
- Silicone grease

To install the cable between the booster antenna and the grounding block

1. Attach the grounding block to the side of the building close to the point you have chosen as the entry point for the RG-6/U coaxial cable.

ATTENTION: The United States National Electrical Code (NEC) and the Canadian Electrical Code (CEC) specifiy that coaxial cable that is exposed to lightning must be connected to the grounding system of the building as close to the point of cable entry as possible.

You may have to use anchors, togglers, or wood screws, depending on the surface on which you are mounting the grounding block.

INSERT DIAGRAM HERE

2. Route the RG-6/U coaxial cable and ground wire from the booster antenna to the grounding block.
3. Make a drip loop of 8–13 cm (3–5 inches) using cable clips at the grounding block as shown below.

   This will prevent water from running into the connection at the grounding block.

   INSERT DIAGRAM HERE
4. Place some silicon grease on the connector and connect the RG-6/U coaxial cable to the grounding block.
5. Connect the ground wire to the ground terminal of the grounding block in accordance with NEC section 820-33, CEC section 10, or the appropriate section of the electrical code of the country in which you are installing the booster antenna.
6. Locate the central building ground.
7. Locate the ground wire (type???) that will extend from the grounding block to the central building ground.
8. Attach the ground wire to the grounding block by placing it through the wire hole in the grounding block and tightening the screw.

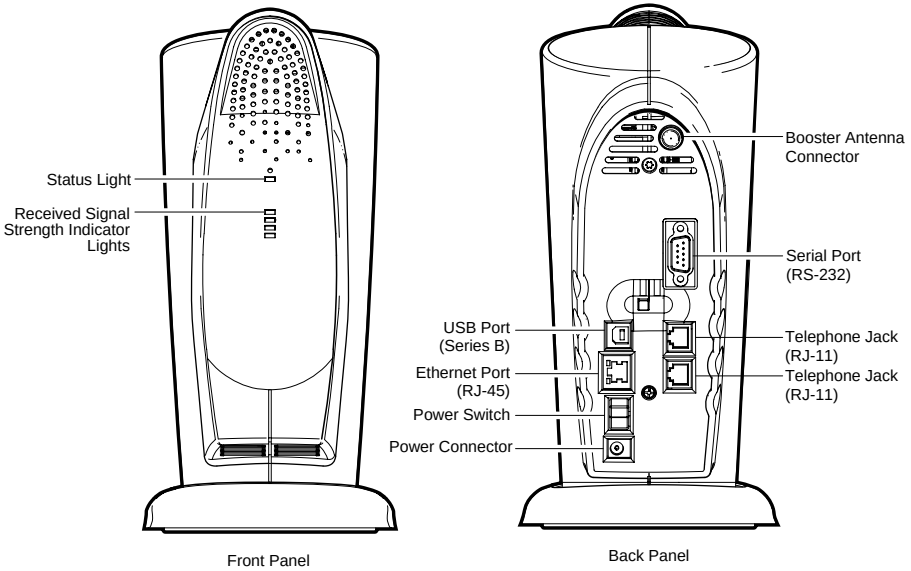
9 Route the ground wire to the central building ground and connect it to the central building ground.

Running cable to the SOMAport

When routing cable to the SOMAport, you should select the shortest possible path and always protect the cable from physical damage. Depending on the installation site, you could run the cable through a floor or wall, or directly to the rear of the SOMAport. If the cable goes straight through a wall, you can use a wall plate at the access point.

The SOMAport

The following diagram shows the location of the booster antenna connector on the back panel of the SOMAport. It also indicates the location of the LEDs on the front panel. These LEDs should be checked once the booster antenna has been connected and the SOMAport turned on to ensure that the SOMAport is functional.



To install the cable from the grounding block to the SOMAport

1. Verify that there are no wires or pipes blocking the location where you will be feeding the RG-6/U coaxial cable into the building.
2. Drill a hole in the wall.
3. Insert the connector in the access hole of the grounding block.
4. Make a drip loop of 8–13 cm (3–5 inches) using cable clips.

   INSERT DIAGRAM HERE
5. Secure the drip loop and cable to the wall using cable clips.
6. Make sure the SOMAport is off.

   ATTENTION: The SOMAport must be off before you connect the coaxial cable to it.
7. Route the RG-6/U coaxial cable through the building and insert it into the booster antenna connector on the back of the SOMAport.
8. Seal the access point into the building with silicone sealant.
9. Turn on the SOMAport.

   The SOMAport takes a few minutes to start and connect to the network.

   Make sure the SOMAport is operational. When the Status LED turns solid green, the SOMAport has acquired a radio channel and is operational. Between one and four signal strength LEDs will be lit (solid green) to indicate how strong the signal is.
10. Test the equipment that is attached to the SOMAport.

QUESTION: The booster antenna has some self-diagnostic capability. Do I need to document any diagnostics? Are there diagnostics the installer can run, say through a PC?

QUESTION: Steve Fielding commented: We need to be absolutely sure that the SOMAport is using the booster antenna. If it fails to detect the booster antenna, it uses the internal antenna. How can the installer/user know?

Troubleshooting

COMMENT: This section is under construction. Need more information.

Problem	Corrective Actions
The cable connections are poor.	■ Secure the cable connections.
The booster antenna was not detected.	■ Check the cable connections to make sure they are secure. ■ Check to see if the cable is shorted. If it is, connect another cable and check again. ■ Turn off the SOMAport and then turn it back on. Booster antenna detection is performed only when the SOMAport powers up. **ATTENTION:** To disconnect or reconnect the booster antenna, make sure the SOMAport is off.
The signal strength is poor.	■ Reposition the booster antenna following the guidelines on page 17. ■ Try another booster antenna.
The total length of the coaxial cable from the booster antenna to the SOMAport is more than 25 m (82 feet).	■ Check the connections and make sure they are secure. Poor connections make be reported as excessive cable length. ■ Use a line amplifier to compensate for the longer cable length. ■ Reposition the booster antenna or the SOMAport to reduce the amount of cable required.