

# SPICE HARDWARE GUIDE

a guide to installing and using SPICE hardware

littlefeet™, inc.

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# ZERO

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### about Littlefeet, Inc.

Littlefeet Inc., based in San Diego, California, provides wireless telecommunications equipment for operators around the world. We are a dynamically growing company with regional offices in the U.S. and the Asia-Pacific region. For more information, visit [www.littlefeet-inc.com](http://www.littlefeet-inc.com).

### about this documentation

SPICE documentation includes the *SPICE Hardware Guide*, *SPICE Software Guide*, and the *Cisco® Element Manager Framework (CEMF) User Guide*. Not all features described in the CEMF documentation are used by Littlefeet. Other Littlefeet documentation includes the Quick Start pamphlets included with each unit and with the OMC.

The documentation produced by Littlefeet contains the formatting conventions described in Table 1.

table 1. formatting conventions

| Format                   | Meaning                                                                  |
|--------------------------|--------------------------------------------------------------------------|
| <i>Italic</i>            | Variable or document title                                               |
| <b>Bold</b>              | Menu option or button, or short text on screen or to be entered          |
| <b><i>BoldItalic</i></b> | Variable menu option or button, or short text on screen or to be entered |
| Monotype                 | Text on screen or to be entered                                          |

For example, to choose the name of a profile from a list shown in a menu, the directions would be, “Choose **Edit > Apply Profile > ProfileName**.” Substitute the name of the profile that you want to apply for **ProfileName**.

---

note Important notes are separated from the text.

---

Lists of operations are also separated from the text.

list of operations

page

---

operation name..... page number of operation





# TWO

## system overview

Ideally, a base station would provide coverage that tapers off uniformly (A, Figure 1). Variations in propagation make the actual coverage irregular (B, Figure 1). This leads to dropped calls due to excessive interference and low signal strength.

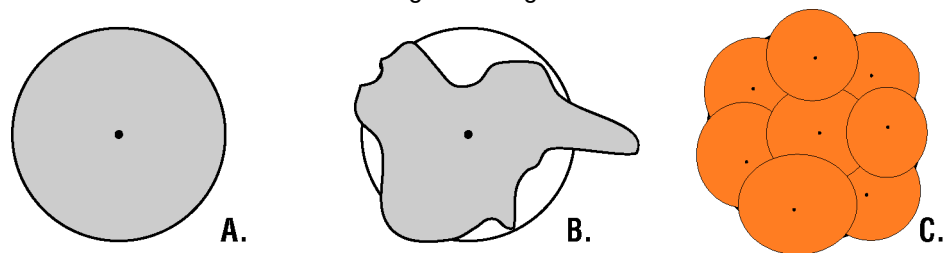


figure 1. ideal versus actual coverage

Littlefeet provides a way for base stations to communicate with mobiles using low-power SPICE units. SPICE handle the coverage functions of a traditional base station. The units have smaller footprints, and can be configured to provide more uniform coverage (C, Figure 1) by adjusting parameters such as the height of each unit's antenna and the RF output of each unit.

The SPICE system is transparent to the network.

## concepts and terminology

The following concepts and terms are used in this chapter:

|                  |                                                                                                                                      |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>bSPICE</b>    | Base SPICE; unit that directly couples to an existing BTS.                                                                           |
| <b>cSPICE</b>    | Coverage SPICE; unit that provides RF to the coverage area.                                                                          |
| <b>OMC-SPICE</b> | SPICE Operation and Maintenance Center.                                                                                              |
| <b>SPICE</b>     | Small Profile Intelligent Coverage Element. SPICE also refers to a network of SPICE units maintained by a central operations system. |
| <b>SST</b>       | SPICE Support Tool; software tool used for field configuration and maintenance of SPICE units.                                       |

## system components

A sample cell area of Littlefeet's SPICE system is shown in Figure 2. Note that F1 and F2 represent a set of frequencies, and that the BTS should not be broadcasting to air for the sector.

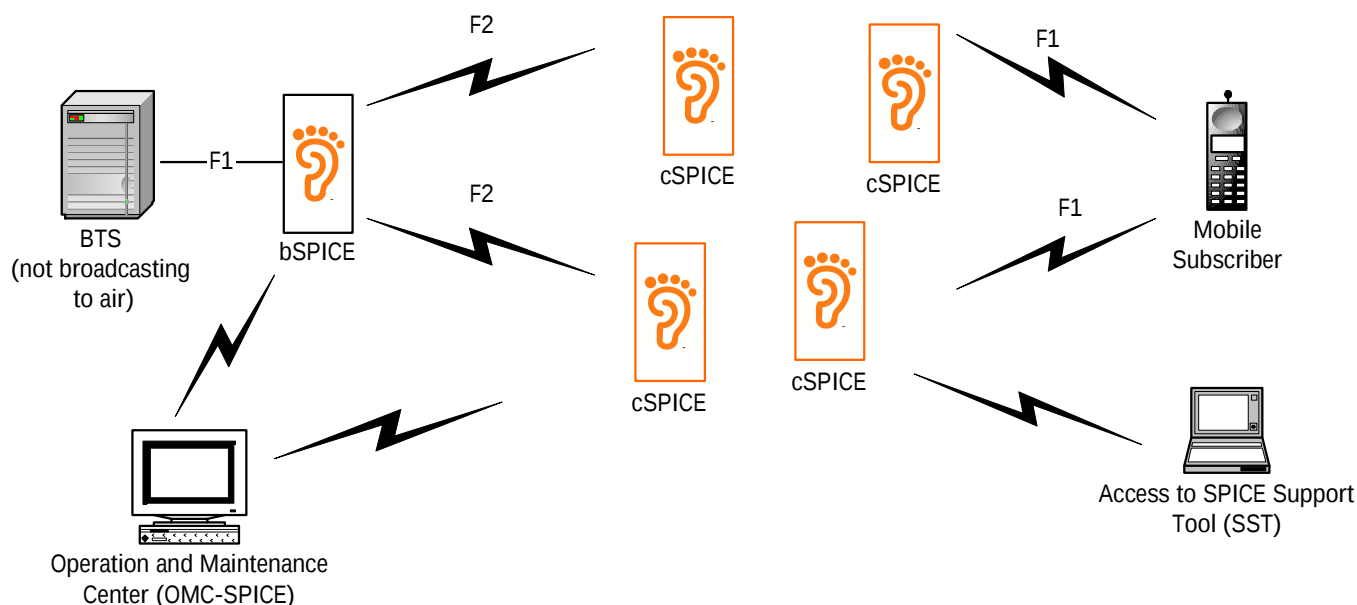


figure 2. overview of SPICE

On the downlink path, the Base SPICE (bSPICE) translates signals from a BTS (F1) and broadcasts the signals on a set of link frequencies (F2). The Coverage SPICE (cSPICE) units receive the signals from the bSPICE and broadcast to the coverage area on the original set of coverage frequencies (F1).

The opposite translations occur on the uplink path. The cSPICE units receive signals from mobile subscribers, translate them to the link frequency, and send the signals to the bSPICE. The bSPICE translates these signals to the original coverage frequency and sends them to the BTS.

SPICE units are controlled over an in-system wireless link from an Operation and Maintenance Center SPICE (OMC-SPICE) unit, which is placed in the central office or Network Operations Center (NOC). Monitoring and control functions are performed over a wireless modem, which is an integral part of SPICE units. Alarms on SPICE units are reported over the wireless modem to the OMC.

Field configuration and maintenance is performed with the SPICE Support Tool (SST), which can be accessed using a laptop or other personal computer via wireless modem or an Ethernet port. In addition, remote software download is available from the SST and the OMC.

The SST and the OMC are able to view and modify more than 50 system parameters that make up the Management Information Base (MIB). Over 30 of these parameters can be modified from the OMC and/or SST. These include basic functions such as link and coverage frequencies and output power.



# THREE

## installing SPICE

This chapter describes how to install a SPICE unit at a predetermined location. You will need the configuration information from the Installation Form.

Units to be installed must already have a data-enabled Subscriber Identity Module (SIM) card inserted into the internal modem. See the Quick Start guide that accompanies new units for details.

### WARNING



**SPICE units must be properly connected to earth ground. See the Safety and Standards chapter (page 41) for other warnings.**

## concepts and terminology

The following concepts and terms are used in this chapter:

### Coverage Antenna

The antenna on a cSPICE unit that broadcasts and receives on the coverage frequency.

### H-BTS

Hub-BTS; the BTS used as a donor for the bSPICE signal.

### Link Antenna

The antenna on a bSPICE or a cSPICE that broadcasts and receives on the link frequency.

# installation overview

Radio planning and site selection are not addressed in this manual, nor are software operations (Figure 3).

---

**n o t e** This chapter assumes that the site for the unit has already been determined.

---

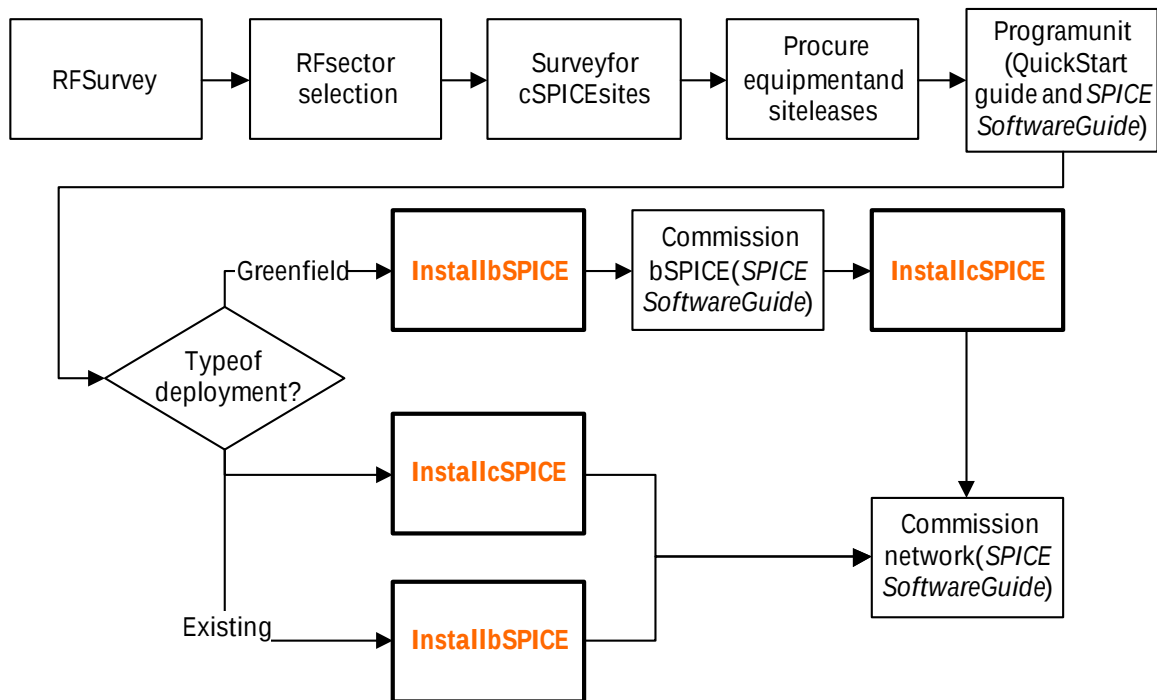


figure 3. installation flow chart

Once a site has been chosen and a power supply obtained and properly installed, mount the bracket and hang the SPICE unit. Check the power supply and connect it to the unit.

On the bSPICE, the external link antenna will need to be installed separately and aligned toward the coverage area. You can also use an existing H-BTS antenna.

For cSPICE units, antenna alignment will usually be needed to maximize the link signal strength from the bSPICE, or to minimize an interfering signal. Align the link antenna so that the unit receives the maximum possible RF input from the bSPICE (in a greenfield deployment) or from the BTS (in existing networks).

## installation equipment

In order to install the SPICE unit, you will need the following equipment, which is provided by Littlefeet:

1. *SPICE Hardware Guide*
2. SPICE unit (including the external link antenna (if necessary) if the unit is a bSPICE)
3. Littlefeet external power supply, including a 3-conductor high-voltage cable and 3-conductor low-voltage cable
4. Mounting hardware and bracket for pole or wall
5. Waterproof bulkhead fittings (provided with unit)
6. M4 x 10 mm tamper-proof mounting screws (provided with unit)
7. BTS-bSPICE interface box and cables if the unit is a bSPICE (if necessary)

The following equipment is also recommended for the installation of the unit, but is not provided by Littlefeet:

1. Pole installation hardware, either a hose clamp (recommended) or a banding tool kit, buckles, and 3/8" (9.5 mm) stainless steel strapping
2. 5/16" hex driver with tamper-proof bit
3. Assorted hand tools (#2 Phillips screwdriver, 8" crescent wrench, 1/4" chisel, wire cutters, 2.5 mm Allen wrench, other site-specific tools)
4. Coaxial cabling and appropriate connectors if the unit is a bSPICE

If you are going to program the unit using the SST, you will also need configuration information, a laptop computer, and the *SPICE Software Guide*. Use the installation form to transfer information you need from and to the network operations center.

installing bSPICE

The bSPICE unit will usually be installed at the site of the existing BTS. To install the bSPICE unit, perform the following steps:

| step                            | page |
|---------------------------------|------|
| install modem antenna . . . . . | 9    |
| install dessicant . . . . .     | 9    |
| install power supply . . . . .  | 9    |
| mount the unit . . . . .        | 11   |
| connect power . . . . .         | 11   |
| notify OMC . . . . .            | 13   |

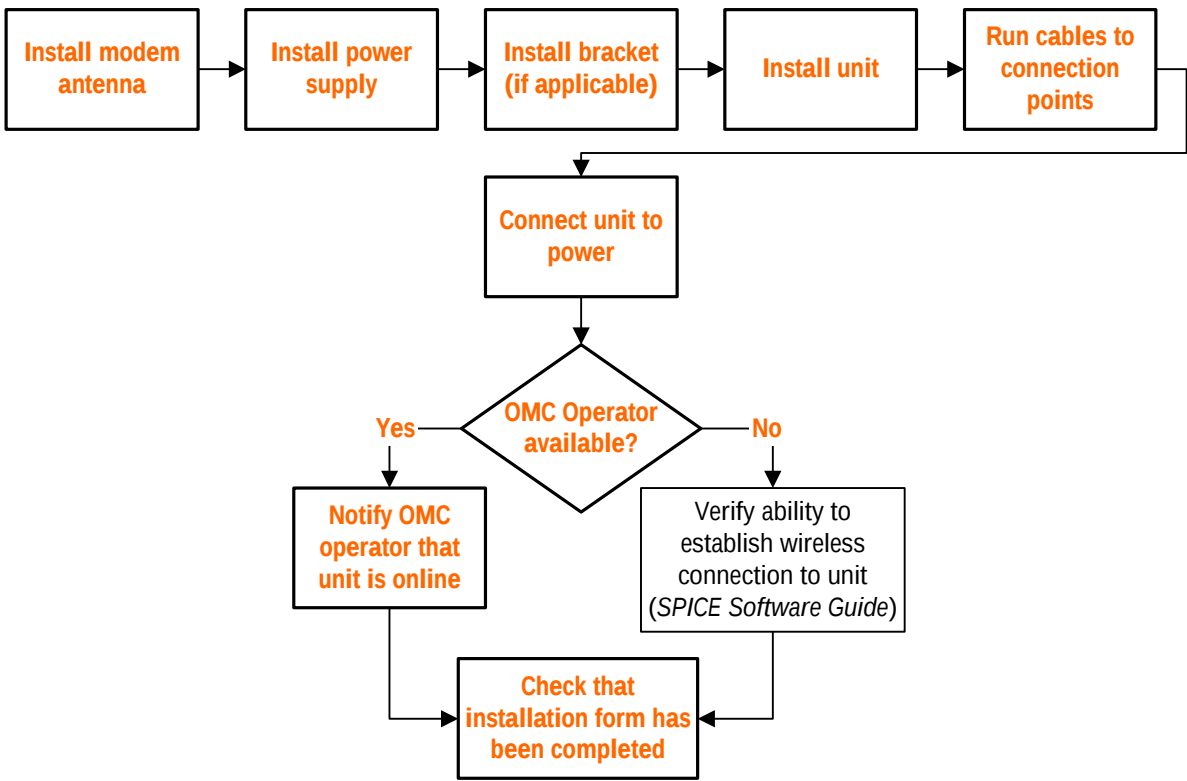


figure 4. bSPICE installation flow chart

## install modem antenna

Install the modem antenna onto the unit (Figure 5, Figure 6).

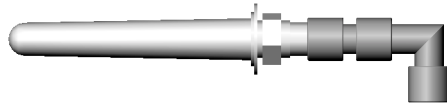


figure 5. modem antenna

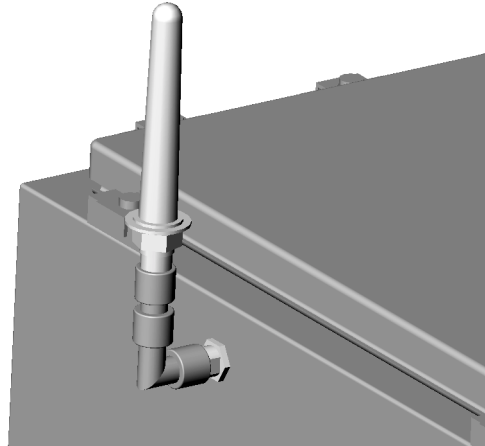


figure 6. modem antenna on bSPICE

## install dessicant

Install dessicant packs as shown in Figure 7. If the packs are already installed, check that they are in the proper locations.

figure 7. bSPICE dessicant locations

## install power supply

Table 2 contains specifications for the power supply provided with the unit. Power supplies must also meet safety regulations for the country in which the unit is to be installed.

table 2. Littlefeet power supply specifications

| Parameter                          | Minimum  | Maximum  | Comment                                                                                                                                |
|------------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------|
| Input to Power Supply              | 100 V AC | 240 V AC | The input to the power supply automatically adjusts to the supplied voltage (no jumping required). The maximum current input is 6.5 A. |
| Output from Power Supply - Voltage | 28 V DC  |          | The input is non-polarized and fully-floating.                                                                                         |

table 2. Littlefeet power supply specifications (continued)

| Parameter                             | Minimum | Maximum                                          | Comment      |
|---------------------------------------|---------|--------------------------------------------------|--------------|
| Input to unit -<br>Current            |         | 9 Amps for<br>bSPICE<br><br>6 Amps for<br>cSPICE |              |
| Frequency of input<br>to Power Supply | 50 Hz   | 60 Hz                                            | Single-phase |

WARNING

!!!

The enclosure will reach the operating temperature of the power supply, which may cause a burn. Handle the power supply and enclosure with caution once it is connected to power.

The power supply must be installed within 4 m (12 ft.) of the unit (Figure 8).

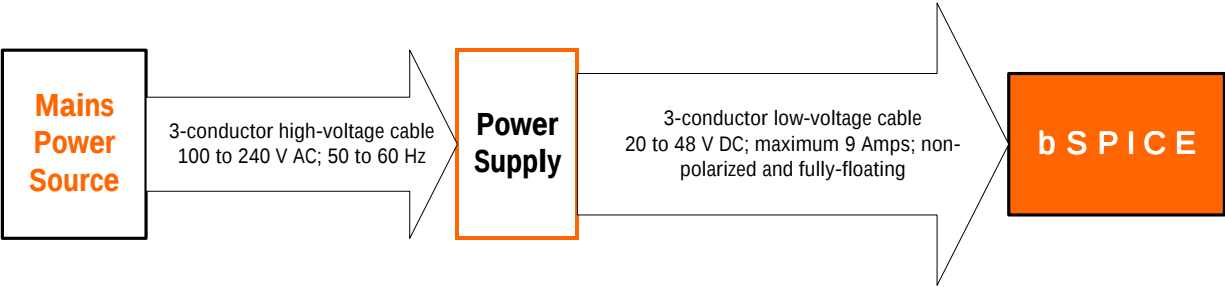


figure 8. power supply connections

Mount the power supply (Figure 9), making sure that the output of the power supply is oriented toward the unit.



figure 9. power supply installation - pole

**WARNING**



**Dangerous voltages are present inside the power supply. Do not remove the cover of the power supply.**

## mount the unit

bSPICE mounting varies from site to site. If the site will use a bracket, first mount the bracket where the unit is to be located. Hang/connect the unit to the bracket.

## connect power

Connect the unit (Figure 10) to the external power supply using the connector shown in Figure 11. Do not force the connector. Connect the power cable from the external power supply to mains power.

**WARNING**



**The power supply must be connected to the power source in accordance with local codes.**

**WARNING**  
!!!  
The green safety ground wire from the power supply cable **MUST** be connected to earth ground.

**WARNING**  
!!!  
An external disconnect device must be provided at time of installation. The disconnect device is not provided by Littlefeet.

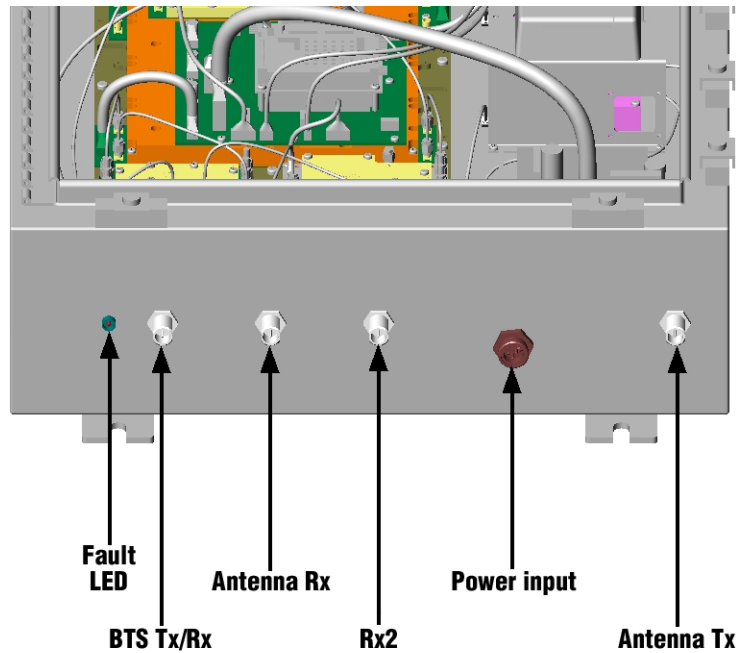


figure 10. bSPICE connections

**WARNING**  
!!!  
Dangerous voltages are present inside the power supply. Do not remove the power supply cover. Also note that the power supply enclosure may be extremely hot.

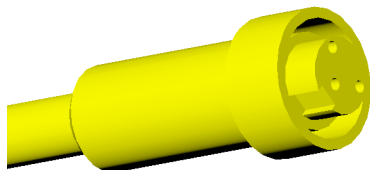


figure 11. power cable connector

The unit is active once the power is connected. Check that the fault LED on the bottom of the unit illuminates.

## notify OMC

Call the OMC operator and ask the operator to dial into the unit. After a successful call, the bSPICE is on-line. If the OMC operator is not available, call the unit using a laptop computer equipped with a wireless modem as described in the *SPICE Software Guide*.

Make sure that the installation form is completed.

# installing cSPICE

In order to align the cSPICE link antenna, the bSPICE (greenfield deployment) or BTS (existing network) must be radiating. In addition, the data-enabled SIM card must have been previously installed in the wireless modem, and the antennas must have been installed. To install the cSPICE unit, perform the following steps (Figure 12):

| step                                    | page |
|-----------------------------------------|------|
| install coverage antennas.....          | 20   |
| install dessicant.....                  | 21   |
| install power supply.....               | 22   |
| determine link antenna orientation..... | 22   |
| mount the unit.....                     | 24   |
| check alignment.....                    | 27   |
| ground unit.....                        | 27   |
| connect power.....                      | 28   |
| notify OMC.....                         | 29   |

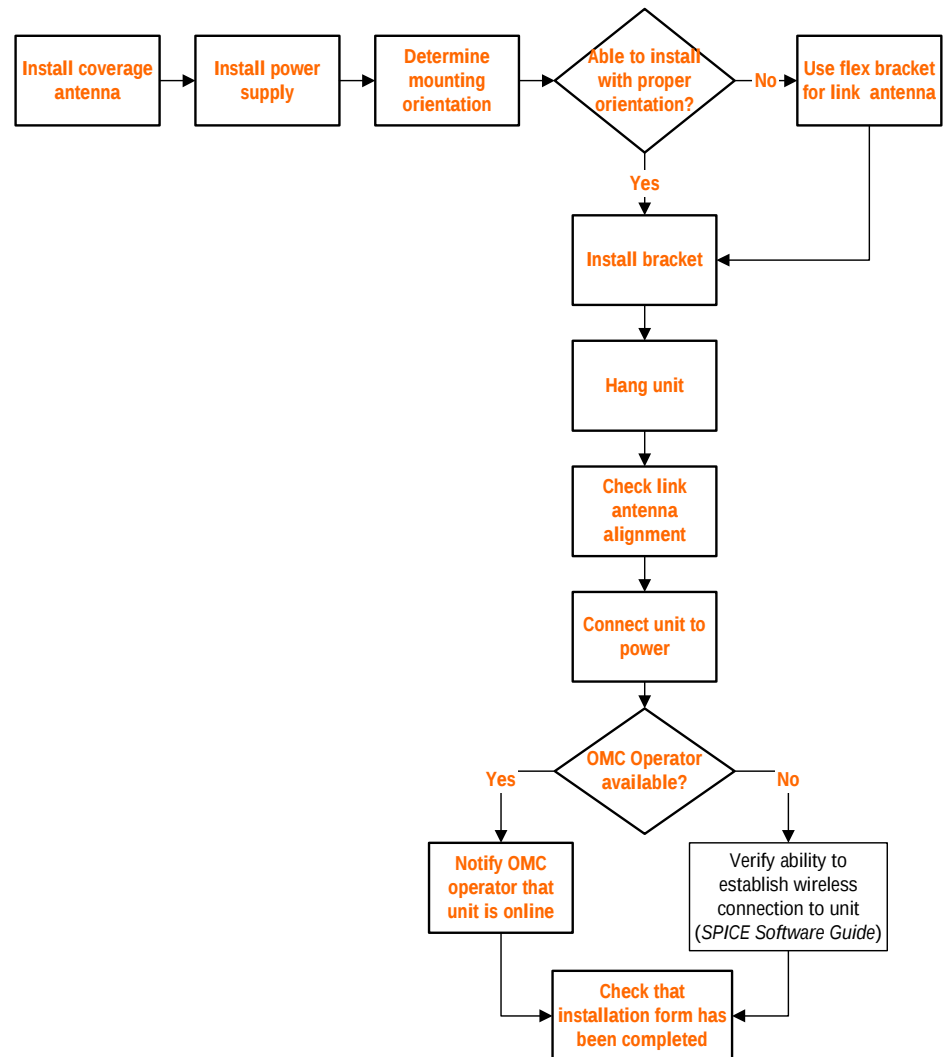


figure 12. cSPICE installation flow chart

---

**n o t e** Do not handle the unit by the antennas.

---

## verify site

Before beginning installation, make sure that the site chosen is suitable for cSPICE installation. The site must meet the criteria described below. If the site that has been chosen doesn't meet these criteria, contact the people responsible for site selection and tell them why the site won't work.

## power source

An appropriate power source must be available at the site.

## clutter

Both the link and coverage antennas of the cSPICE must be clear of obstructions. Additionally, reflective surfaces (buildings, hills, etc.) should not be located in the RF path between the link antenna and the bSPICE (Figure 13).

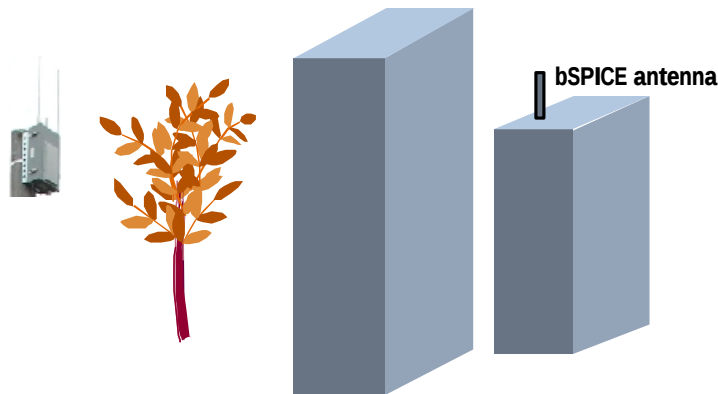


figure 13. clutter in link path

With some effort in installation and optimization, it is possible to bounce the link signal off surfaces such as buildings and hills. This should only be attempted if trained personnel and specialized equipment (such as a spectrum analyzer) are available.

The coverage antennas should be mounted such that they are above immediate obstructions. The pole on which the unit is mounted can also cause interference with the coverage antennas. When an antenna has nothing else next to it, its output is even (Figure 14, left). Next to a wooden pole, however, the output becomes uneven, which causes problems (Figure 14, right).

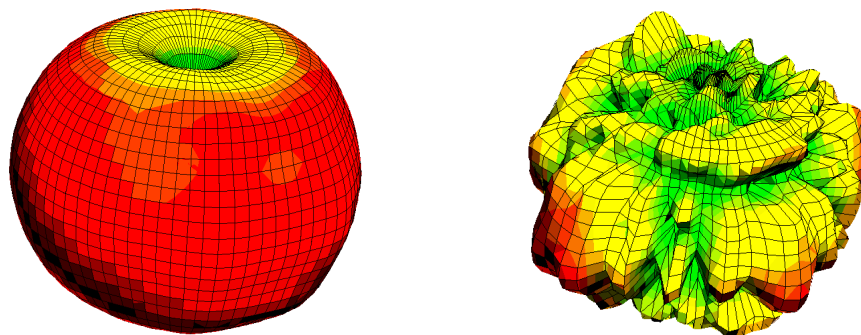


figure 14. coverage from an antenna in isolation (left) and next to wooden pole

In addition, cSPICE units should not be colocated on poles with power transformers or other potential sources of RF interference.

### examples

Some examples of sites are shown below. Figure 15 shows a good site. The site shown in Figure 16 is acceptable, but could be improved by moving the unit along the rooftop if the poles interfere with the link. A site that will work if no better sites are available in the desired area is shown in Figure 17. Figure 18 shows a site that will experience problems caused by interference (transformer, pole) and clutter (wires in front of the link antenna) and shouldn't be used as a cSPICE site.



figure 15. good site



figure 16. pretty good site



figure 17. iffy site



figure 18. bad site

Units should be mounted as high as possible on poles. Ideally, the coverage antennas should be above the pole, as shown in Figure 15. Figure 19 shows a site that could be improved by mounting the unit higher on the pole.



figure 19. unit that should be mounted higher

## safety

SPICE sites must be located such that the units can be safely installed and maintained. A list of considerations can be found in the safety chapter (page 41). Other considerations include:

- Year-round availability of access to the site. For example, if the site is covered with ice in the winter, it is not appropriate.
- Access to earth ground. Since the SPICE units **MUST** be connected to earth ground, access to earth ground is essential. If no access is currently available at an otherwise desirable site, you will need to provide it.

## install coverage antennas

Install the coverage antennas included with the unit. Remove the nut from the antenna connector, slide the washer over the connector, and place the antenna into the appropriate hole in the chassis. Tighten the nut onto the end of the connector, and plug the connector from the board into the end of the antenna.

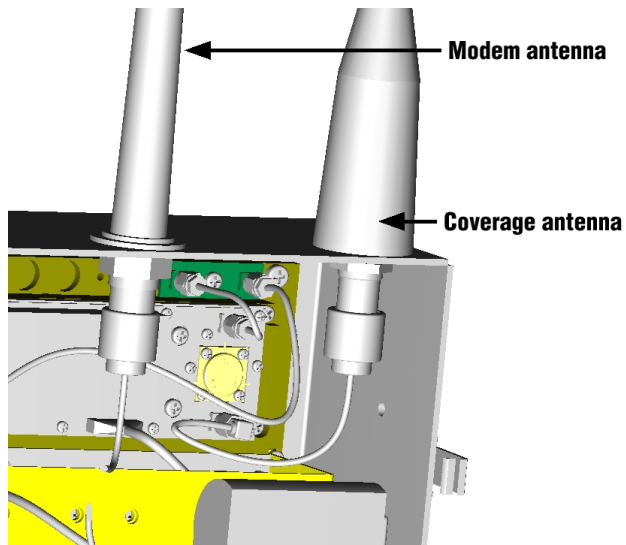


figure 20. coverage antenna installation

## install dessicant

Install dessicant packs as shown in Figure 21. If the packs are already installed, check that they are in the proper locations. The dessicant will need to be replaced once a year in humid conditions, and once every two years in dry climates.



figure 21. cSPICE dessicant locations

## install power supply

Install the power supply as described in the bSPICE installation.

## determine link antenna orientation

The link antenna is found on the door of the cSPICE. Use a compass or other tool to determine the direction of the bSPICE from the cSPICE site.

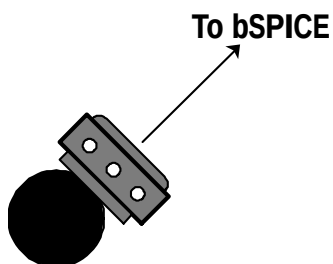


figure 22. cSPICE alignment

If the bracket cannot be mounted so the unit is facing the bSPICE, remove the link antenna from the front of the unit and mount it on the link antenna bracket (Figure 23).



figure 23. link antenna mounted on door with adjustable bracket

This “flex bracket” will allow you to point the link antenna toward the bSPICE even if the unit cannot be installed facing the bSPICE (Figure 24).

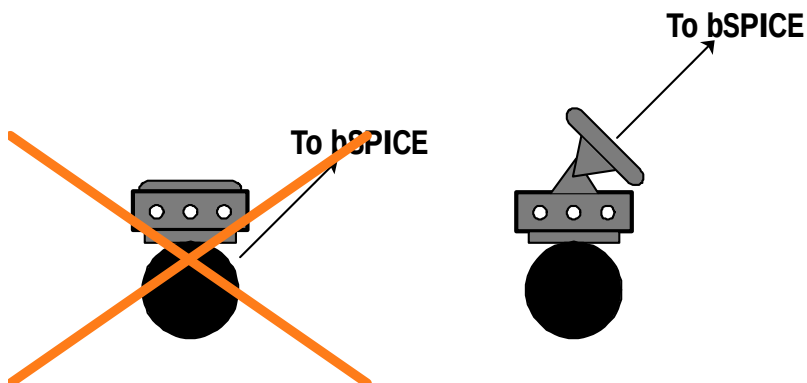


figure 24. cSPICE link antenna alignment

## mount the unit

To mount the unit, first mount the bracket where the unit is to be located, using the orientation determined above.

---

**note** Make sure to mount the bracket so that the unit is roughly facing the bSPICE as described above. Line-of-sight to the bSPICE is not required.

---

The bracket can be mounted using a hose clamp (preferred) or banding tool if the unit is to be placed on a pole (Item 1) (Figure 25, Figure 27, Figure 26, Figure 28). If using banding, double wrap the strapping (720). Attach the pole mount bracket using two bands through the top and bottom slots (Item 4).

---

**note** Do not attach the bracket tightly until you have checked the link antenna alignment (page 27).

---

The mounting plate can also be attached directly to a flat surface such as a wall (Figure 29). Mount the wall mount using four M5 stainless steel bolts (Item 4).

Hang the unit on the bracket by installing two M4 x 10 mm tamper-proof fasteners (Item 6) and torquing.

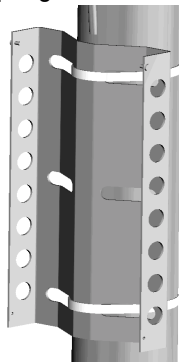


figure 25. pole bracket

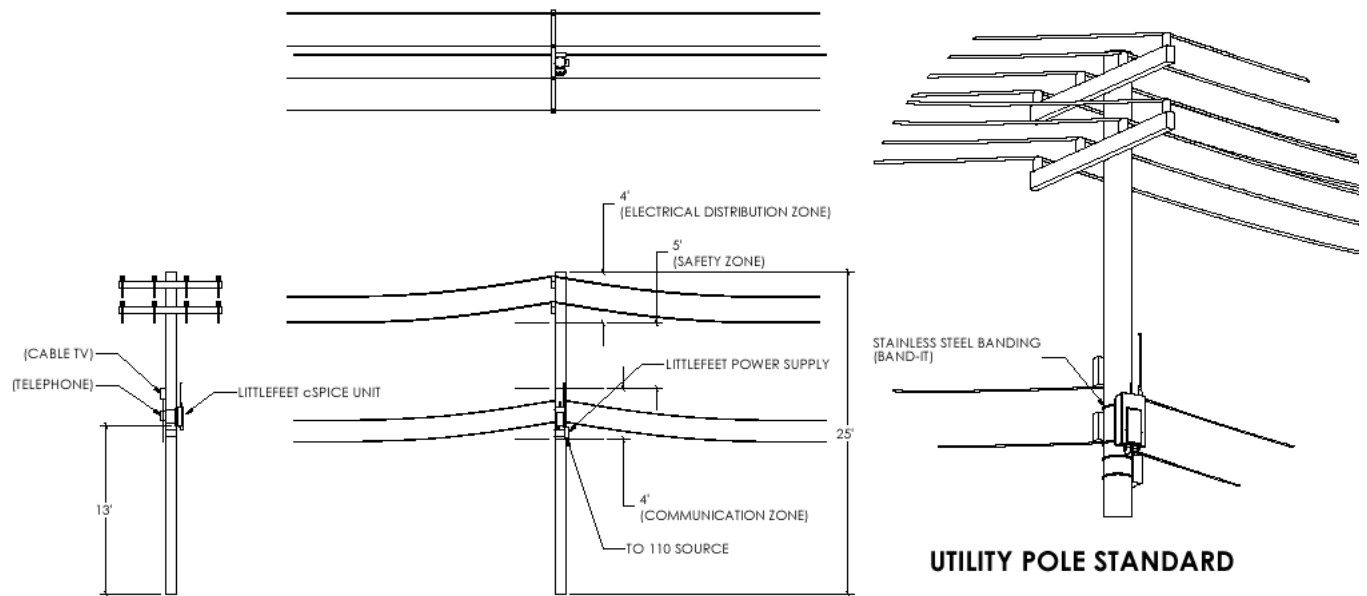


figure 26. utility pole installation

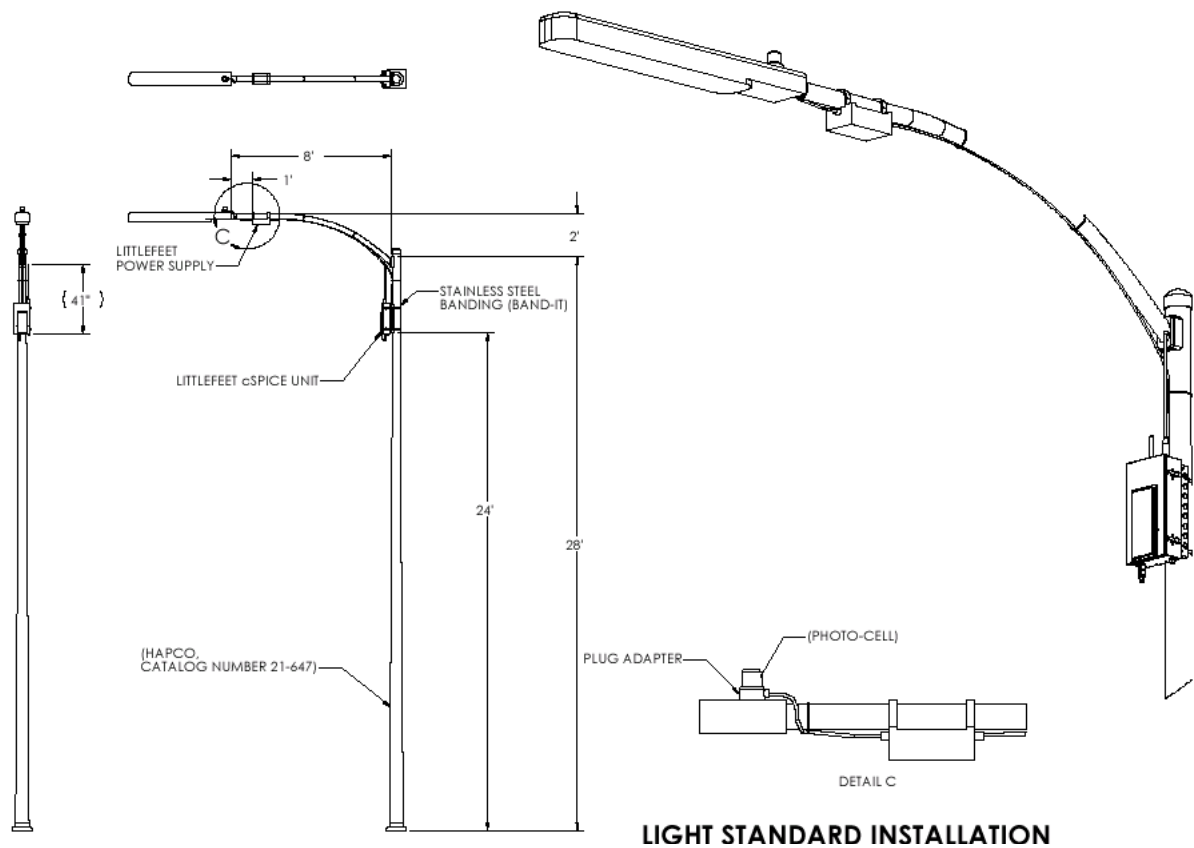


figure 27. light pole mount

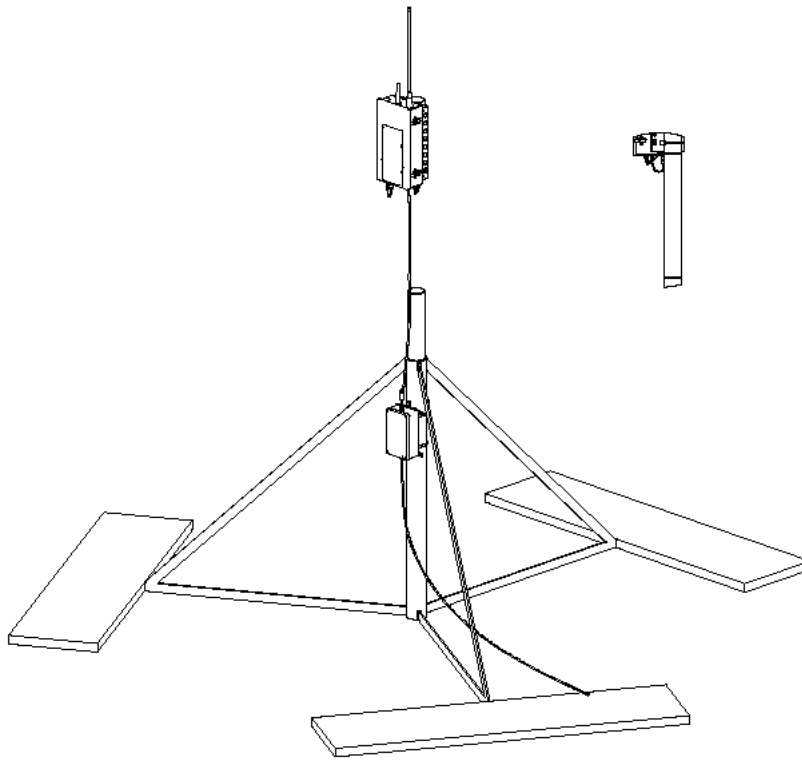


figure 28. tripod installation

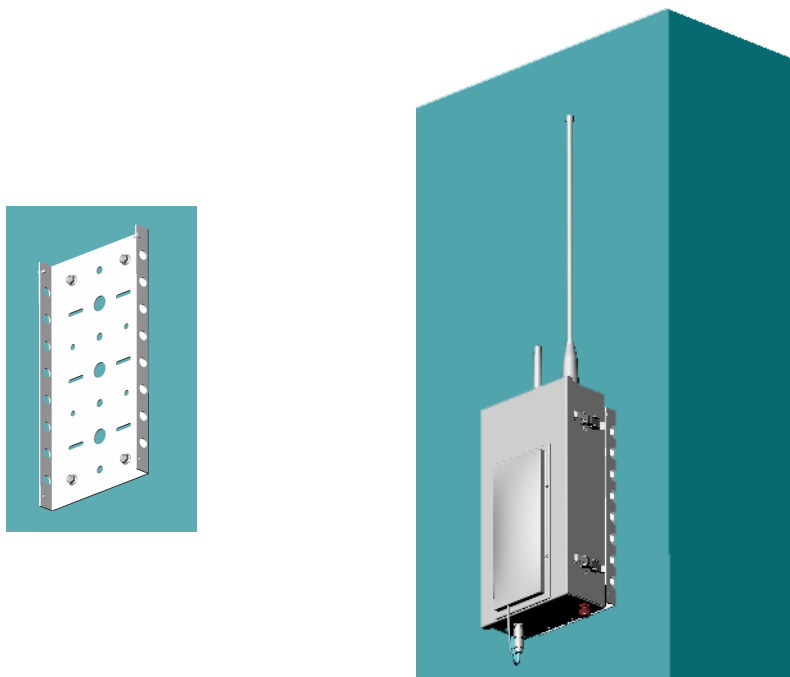


figure 29. wall bracket and mount

## check alignment

Link antenna alignment adjustment will usually be needed to maximize the link signal strength from the bSPICE (greenfield deployment) or BTS (existing network), or to minimize an interfering signal. There are several ways to do this; which method you use will depend on the availability of equipment.

## spectrum analyzer

Detach the link antenna connector from the bottom of the unit and connect it to a spectrum analyzer. You will need an N-type connector (male). Set the spectrum analyzer to the frequency broadcast by the BTS/bSPICE and rotate the unit until the highest signal is received. If using the flex bracket for the link antenna, loosen the lock screws to move the link antenna. Tighten the lockscrews once the highest level is achieved.

## test handset

Detach the link antenna connector from the bottom of the unit and connect it to a test handset. You will need an N-type connector (male). Set the test handset to the frequency broadcast by the BTS/bSPICE and rotate the unit until the highest signal is received. If using the flex bracket for the link antenna, loosen the lock screws to move the link antenna. Tighten the lockscrews once the highest level is achieved.

---

|      |                                                                                                                                                                                                                             |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| note | If no signal from the BTS/bSPICE is detected, check that the BTS/bSPICE system is operational. If the BTS/bSPICE system is operational and the cSPICE is still not receiving a signal, you may have to relocate the cSPICE. |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

---

Reattach the antenna output to the unit. Do not overtorque the connector, but make sure that it is fully tightened.

---

|      |                                                                                                                         |
|------|-------------------------------------------------------------------------------------------------------------------------|
| note | If the bracket is not tightly attached to the mounting surface, tighten it once the link antenna alignment is verified. |
|------|-------------------------------------------------------------------------------------------------------------------------|

---

## ground unit

Connect the ground lug on the unit (Figure 30) to earth ground.

---

**n o t e**      The wire used to connect the ground lug to earth ground must be 16-gauge wire, at a minimum.

---

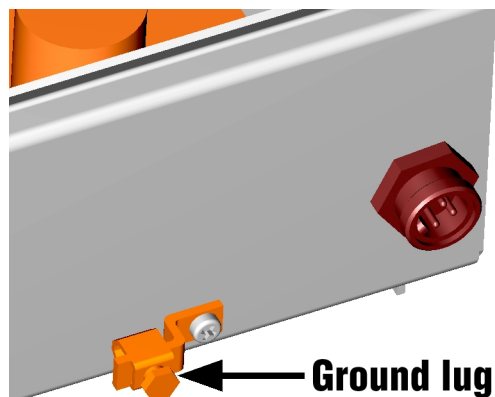


figure 30. ground lug

## connect power

Connect the unit to the power supply as described in the bSPICE installation.

---

### WARNING



---

**The power supply must be connected to the power source in accordance with local codes.**

---

Connect the power cord to the mains power and check that the fault LED illuminates (Figure 31).

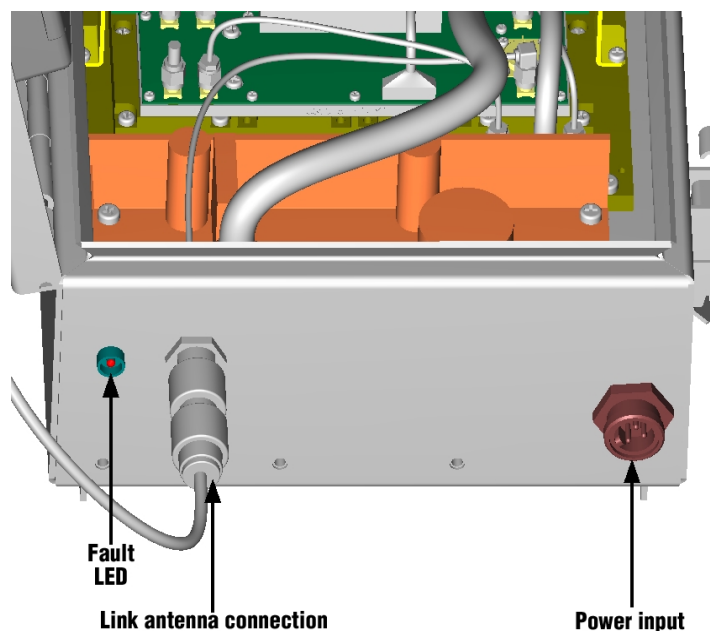


figure 31. fault LED and power input for cSPICE

---

|         |                                                                                                                                                |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------|
| n o t e | If there is extra cabling between the cSPICE and the power supply, coil the extra wire near the power supply rather than near the cSPICE unit. |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------|

---

## notify O M C

Call the OMC operator and ask the operator to dial into the unit. After a successful call, the cSPICE is on-line. If the OMC operator is not available, call the unit using a laptop computer equipped with a wireless modem as described in the *SPICE Software Guide*.

Make sure that the installation form is completed.

Secure the door latch with cotter pins or with wire, if desired.





# FOUR

## commissioning and maintenance

This chapter describes how to commission and maintain SPICE units. You will need to have a copy of the *SPICE Software* guide in order to perform many of the operations described in this chapter.

| operation                        | page |
|----------------------------------|------|
| commission bSPICE .....          | 34   |
| connect laptop to the unit ..... | 36   |
| replace SIM card .....           | 38   |
| replace batteries .....          | 39   |

Figure 32 and Figure 33 show the inside of the bSPICE and cSPICE units.

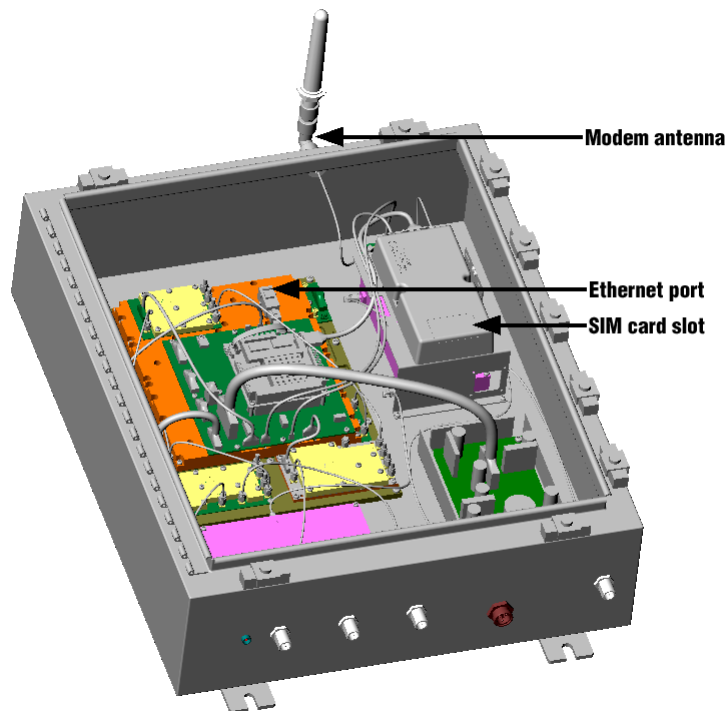


figure 32. bSPICE unit

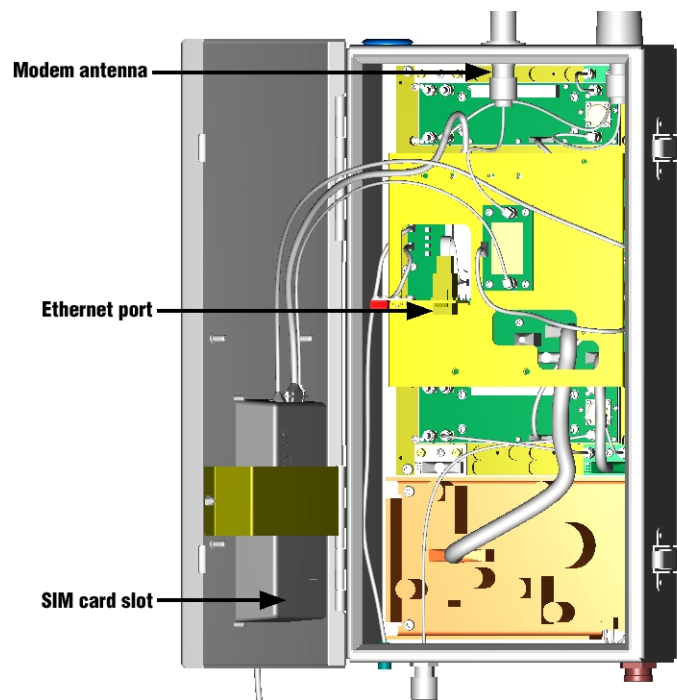


figure 33. cSPICE unit

## operation overview

Table 3 gives a brief description of the steps needed to perform the operations detailed in this documentation. For additional information, see the reference listed in the **Details** column.

table 3. operations

| Operation                          | Steps                                                                                                                                                                                                                                                                                                                                                                     | Details |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| commission bSPICE                  | <ol style="list-style-type: none"> <li>1. connect antenna</li> <li>2. connect to BTS</li> <li>3. weatherproof connections</li> </ol>                                                                                                                                                                                                                                      | page 34 |
| connect laptop to the unit         | <ol style="list-style-type: none"> <li>1. open the unit's door</li> <li>2. connect Ethernet cable to laptop and unit's Ethernet port</li> <li>3. follow SST instructions detailed in <i>SPICE Software Guide</i></li> <li>4. disconnect Ethernet cable from unit and laptop</li> <li>5. close the unit's door</li> </ol>                                                  | page 36 |
| replace SIM card                   | <ol style="list-style-type: none"> <li>1. open the unit's door</li> <li>2. remove the old SIM (if any)</li> <li>3. insert the new SIM</li> <li>4. close the unit's door</li> </ol>                                                                                                                                                                                        | page 38 |
| determine link antenna orientation | <ol style="list-style-type: none"> <li>1. close the unit's door</li> <li>2. unplug link antenna cable from bottom of unit</li> <li>3. plug link antenna into test handset or spectrum analyzer</li> <li>4. rotate unit until highest received level is achieved</li> <li>5. disconnect test handset or spectrum analyzer</li> <li>6. reconnect antenna to unit</li> </ol> | page 22 |
| replace batteries                  | <ol style="list-style-type: none"> <li>1. open the unit's door</li> <li>2. disconnect the power from the unit</li> <li>3. remove old batteries</li> <li>4. install new batteries</li> <li>5. reconnect unit to power</li> <li>6. check that alarm is cleared</li> <li>7. close unit door</li> <li>8. properly dispose of old batteries</li> </ol>                         | page 39 |

## commission bSPICE

To commission the bSPICE once it is installed and online, connect the unit to the BTS and antenna.

### connect link antenna

Mount the link antenna at the predetermined antenna site. If you are using an existing antenna (examples shown in Figure 34), ensure that the gain is 17.5 dB, that the input power is 25 dBm, and that the antenna is aligned correctly to serve the cSPICE units in the coverage area.

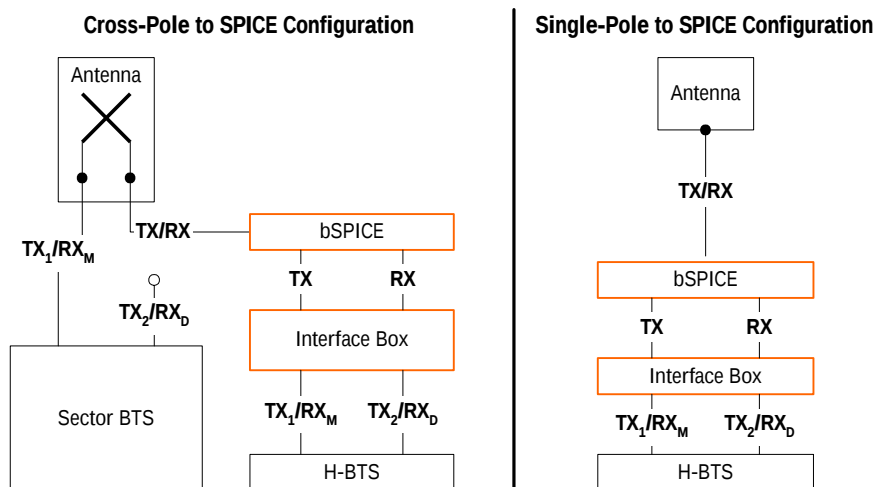


figure 34. bSPICE to existing antenna configuration - examples

Run coaxial cabling from the antenna to the unit.

#### note

The type of connections used between the bSPICE and the BTS will vary according to the type of BTS used. The RF connectors on the bSPICE are N-type female connectors.

Connect the antenna to the bSPICE unit (Figure 35).

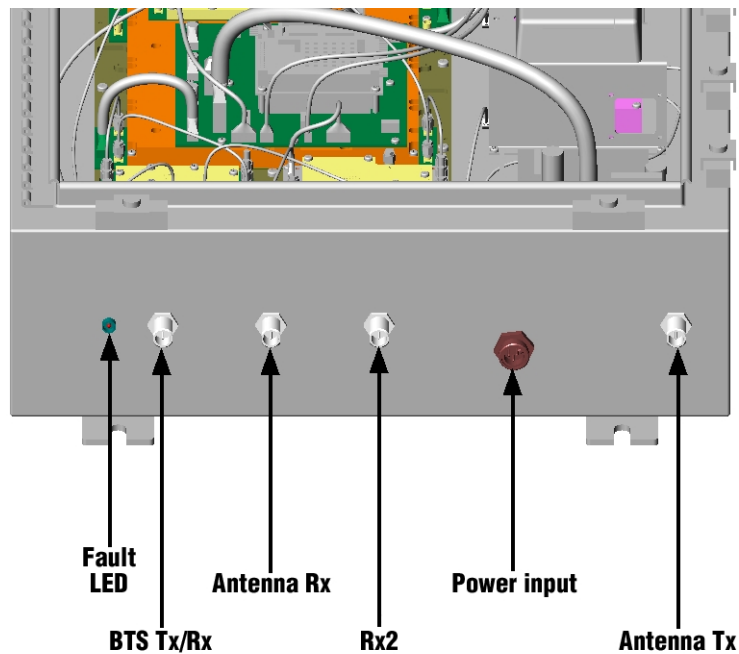


figure 35. bSPICE connectors

## connect BTS to RF input

The bSPICE unit connects directly to the RF output of the BTS. The unit accepts both duplexed and separate TX and RX connections. If the output is duplexed, use the Tx/Rx port (Figure 35).

The RF input of the bSPICE can accept the maximum output power from the BTS, but we strongly recommend against this. The power requirements for the bSPICE are flexible in case the BTS is accidentally set to full output power.

---

**note** The BTS sector should not be broadcasting to air when the SPICE system is in place.

---

The maximum allowed input power from the BTS is +44 dBm per carrier. The BTS should be set to its lowest possible output power.

## waterproof connections

If the unit is mounted outdoors, you will need to seal all the connectors. Waterproof all connectors (power, antenna cables, etc.).

## connect laptop to the unit

The SST is software that is resident on SPICE units. Basically, when you call a SPICE unit, the SST is what answers. Laptops are usually used to access the SST.

### Ethernet connection

To connect to the SST using the Ethernet connection, you have to have access to the inside of the unit. You will also need a “crossover” Ethernet cable (Figure 36), and an Ethernet card installed on your laptop.

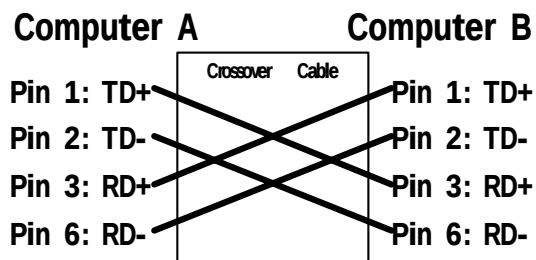


figure 36. pin configuration of a crossover Ethernet cable

Plug one end of the crossover Ethernet cable into your laptop, and the other into the Ethernet port inside the unit (Figure 37, Figure 38).

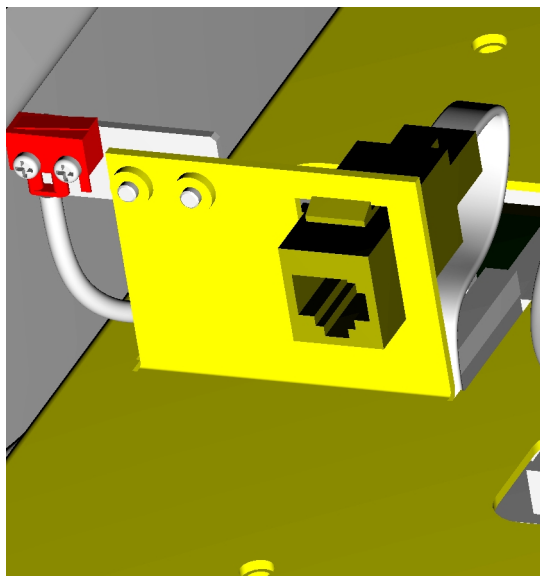


figure 37. cSPICE Ethernet port

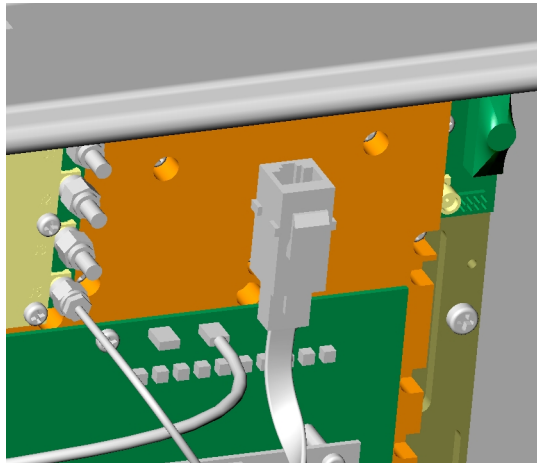


figure 38. bSPICE Ethernet port

Once your laptop is connected to the unit, follow the instructions for using the SST in the *SPICE Software* guide.

## modem dial-in

Accessing the SST using the wireless modem is described in the *SPICE Software Guide*.

## replace SIM card

The wireless modem that is integrated into SPICE units requires a data-enabled SIM card, which is not provided by Littlefeet. If the SIM needs to be replaced, follow the steps below.

1. Open the door of the unit.
2. Remove the SIM in the modem (if any) (Figure 39, Figure 40).
3. Replace the old SIM with a new data-enabled SIM.
4. Close and secure the unit's door.

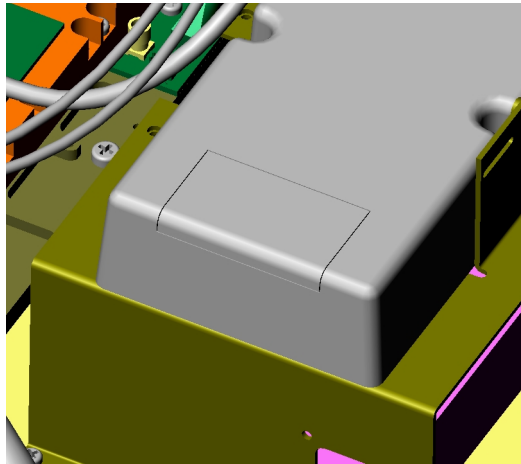


figure 39. bSPICE SIM card slot

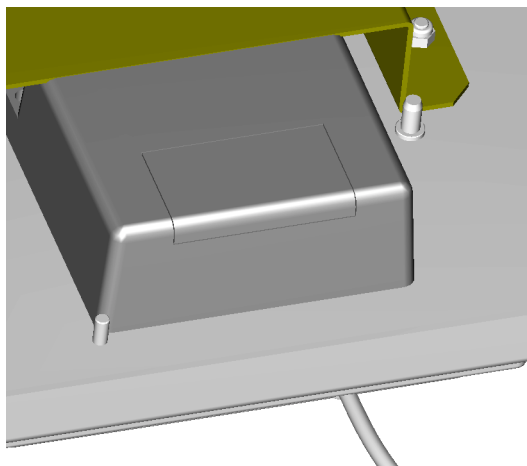


figure 40. cSPICE SIM card slot

## replace batteries

To replace the battery pack on a cSPICE unit, first disconnect the power to the unit. Remove the old batteries and install the new batteries.

Reconnect the power to the unit. Access the SST using your laptop and check that the battery alarm is no longer present. If the alarm persists, replace the unit.

---

### WARNING



**Be sure to properly dispose of the old batteries. Follow the instructions on the battery for disposal.**

---

The batteries used in SPICE units have a ten-year life at 25° C.





# FIVE

## s a f e t y   a n d   s t a n d a r d s

This chapter details requirements for the safe installation and use of SPICE units. The safety of the unit, of the technicians working on the unit, and of the general public are addressed. Additionally, the safety standards to which SPICE units comply are listed.

### W A R N I N G



**Make sure you read, understand, and observe the cautions and warnings described in this chapter as well as those found elsewhere in this documentation and on the unit itself.**

SPICE units transmit and receive signals via RF (radio frequency) energy. The emissions from SPICE units are comparable to those from a typical cellular phone. Handle SPICE units using the same consideration due cellular phones.

## c o n c e p t s   a n d   t e r m i n o l o g y

|                                |                                                                                                                                                                                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EiRP</b>                    | Effective Isotropic Radiated Power. The total of the RF output power of a device plus the gain of the antenna used.                                                            |
| <b>electrostatic discharge</b> | A discharge of static electricity. Static electricity is a buildup of excess electrical charge, as when you shuffle across carpeting in wool socks and touch a metal doorknob. |
| <b>RF</b>                      | Radio Frequency. A portion of the electromagnetic spectrum, used to transmit and receive radio signals.                                                                        |

## RF exposure

Many studies have been performed regarding exposure to RF energy. Although all studies to date have been inconclusive as to the effects of RF exposure and human health, there is still some public concern. Since SPICE units operate at low power, there is less exposure to radiation and thus less potential health risk.

A number of documents are available detailing potential health risks due to RF exposure, many of which are available on the Internet. One such website is the Federal (U.S.) Communications Commission (FCC) RF safety website: [www.fcc.gov/oet/rfsafety](http://www.fcc.gov/oet/rfsafety).

## levels

The amount of RF exposure from SPICE units is comparable to that from a typical cellular phone, and is detailed in Table 4. Safe distances from bSPICE units depend upon the antenna used, and therefore vary by site.

table 4. RF exposure from cSPICE units

| Maximum Output Power (EIRP) | Minimum Safe Distance                             |
|-----------------------------|---------------------------------------------------|
| +28 dBm                     | Technician: 7 inches<br>General Public: 17 inches |

Keep these distances in mind when installing a SPICE unit, and make sure to maintain a safe distance. These are distances directly in front of the antenna. Prolonged exposure within the minimum safe distance should be avoided. Since this standard is for prolonged exposures, brief exposures to higher fields may not cause harm. If there is public access to the unit within the minimum safe distance, access must be limited to the minimum safe distance or the area must be posted.

## interference

Most, but not all, electronic devices are shielded from RF radiation. People with pacemakers, hearing aids, medical and other electronic devices should be aware of the possibility of a SPICE unit interfering with the function of those devices. Note that these cautions are the same as those applicable to handsets.

### WARNING



**Exercise special caution if you have a pacemaker and are installing SPICE units. Ask your physician about the type of pacemaker and its degree of shielding from RF radiation. Do not install SPICE units without your physician's approval (as for a handset).**

## unit safety

In order to properly maintain a SPICE unit, follow the guidelines described below. Any failure to do so may void any warranties.

### water

Do not expose the interior of the unit to water. Make sure that the door is completely closed after installing or servicing the unit.

If the unit is accidentally exposed to water, disconnect the unit from power immediately. Return the unit to Littlefeet, as there are no user-serviceable parts within the unit, and there is a possibility that the water has damaged the unit's components.

#### WARNING



**If the interior of the unit has been exposed to water, do not attempt to fix it. Disconnect the unit from power immediately and return it to Littlefeet. Do not reconnect the unit to power, even when it has dried.**

### electrostatic discharge

The interior of the unit is sensitive to electrostatic shock. Do not touch the interior of the unit, as handling the interior of the unit may result in damage to the unit from electrostatic discharge (ESD) if proper precautions are not taken.

#### WARNING



**Do not touch the interior of the unit.**



figure 41. ESD warning symbol

### lightning

If a SPICE unit is struck by lightning, disconnect the unit from power as soon as it is safe to do so, uninstall it and return it to Littlefeet.

Lightning strikes can also travel through power cables from remote areas and damage the unit internally. If you suspect that this has happened and the unit is malfunctioning, do not attempt to fix it yourself; disconnect the unit from power and return it to Littlefeet.

## grounding

Always make sure that the unit is properly grounded. Never plug the unit into a two-pronged (non-grounded) outlet or use a two-conductor extension cable. Failure to do so may result in a buildup of excess charge which may damage the unit or cause a potentially hazardous situation.

The chassis of the unit must also be grounded.

## heights

Do not drop the unit or any equipment being used to install the unit (installation hardware, mounting bracket, etc.). Dropping the unit will damage the unit and may harm anyone standing under the unit. Establish a safety zone around an installation site to eliminate the possibility of someone standing or passing underneath a unit that is being installed.

If the unit has fallen and/or rattles when moved, do not open or attempt to fix the unit. Dropped units must be thoroughly checked for damage to the antennas and connectors. Seal the unit and return it to Littlefeet, with a note describing how the damage was caused.

---

### WARNING



**Certain components, such as RF power transistors, are potentially hazardous when their seals have been broken. Do not open a damaged unit. Observe and follow any warning labels on the unit, such as warnings about BeO (a substance used in the manufacture of RF hardware).**

---

## servicing the unit

The only user-serviceable parts inside a SPICE unit are the wireless modem and the battery pack.

### WARNING



**Do not attempt to fix any unit components other than the modem (replacing the SIM) and battery pack (replacing the batteries). Refer to the installation documentation for details. Return the unit to Littlefeet for replacement if it is not functioning correctly.**

## wireless modem

The only operation that you will need to perform on the wireless modem is the installation of the SIM card, described in the installation documentation.

Do not attempt to fix or replace the modem if it is malfunctioning; return the entire unit to Littlefeet.

## battery pack

SPICE units are equipped with battery packs that can be replaced. Instructions on replacing the battery pack can be found in the installation documentation.

Before changing the batteries, read all the instructions and cautionary markings. Disconnect the unit from power for a minimum of five minutes before changing the batteries.

### WARNING



**If the battery charger is not operational, do not attempt to fix or replace it; return the entire unit to Littlefeet.**

Since the batteries used in SPICE units are rechargeable, they must be disposed of properly. **Do not incinerate the batteries.** Instructions on proper battery disposal can be found on the battery pack.

## power

Details on safe practices while installing power supplies are found in the installation documentation. While servicing a SPICE unit, be aware that electricity is flowing to the unit if the unit is connected to power.

### WARNING



**Dangerous voltages are found inside the external power supply. Do not open the cover of the external power supply; contact Littlefeet if it is not functioning properly. Check that the mains power has correct fusing and that the circuit breaker is not broken.**

## installation safety notes

The following safety concerns must be taken into account when installing SPICE units.

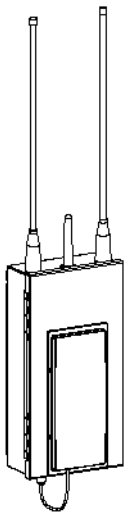
### WARNING



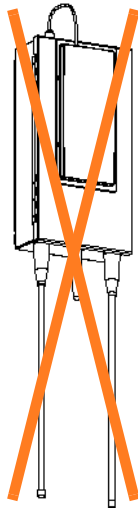
**SPICE units must be installed by carefully following the installation documentation and by noting the safety concerns described here. Failure to do so may result in harm to the unit, installer, or general public. Littlefeet is not responsible for any damages caused by improper installation.**

## orientation

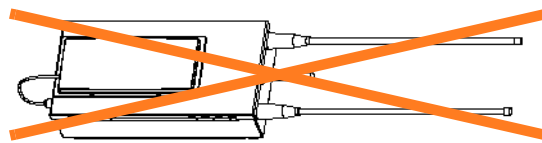
The unit must be installed right-side up, never upside-down, on its side, or on its back or front (Figure 42). Note that the cSPICE antennas are on the top of the unit when it is correctly installed.



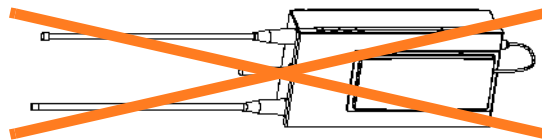
correct



incorrect



incorrect



incorrect

figure 42. correctly and incorrectly installed units

## siting

Do not install SPICE units in areas where **any** of the following conditions apply:

- In or near a potentially explosive atmosphere, such as a fuel or chemical transfer or storage facility, or an area containing chemicals or particles (grain, dust or metal powders).
- At any location where it is not possible to properly install the unit (for example, if there is not enough room to install the unit right-side up).
- At any location where the unit may be covered with water (for example, on a low pole in an area where flooding may occur).
- In an area where the ambient temperature is excessively high (for example, near smelting equipment).
- Near an area where blasting caps are used.

- In or near an area where the SPICE unit could cause interference with equipment sensitive to RF radiation, such as hospitals or other areas where people may have pacemakers.
- At a location where lightning strikes are frequent.
- At any location where the unit may be exposed to fire.
- At a location where the public may have access to the unit within the minimum safe distance.
- Anywhere you would not be permitted to use a cellular phone.

## markings and standards compliance

The following markings can be found on SPICE units and other products supplied by Littlefeet.

\*

SPICE units meet the following international standards:

- CE
  - Meets LVDirective
  - Meets EMC Directive
  - Meets RTTE Directive
- FCC
  - Part 15
  - Part 24
- NRTL to UL 1950

The power supply used by SPICE units is

- UL recognized
- FCC Part 15
- CE
  - Meets LVDirective
  - Meets EMC Directive

## general precautions

---

### WARNING



**Do not incinerate or crush units, as the batteries may explode and/or hazardous substances may be released. Contact Littlefeet for proper disposal instructions.**

---

**Do not attempt to service the inside of the unit, other than replacing batteries or the SIM card of the modem.**

---

**Do not operate the unit if the antenna has been damaged. Do not attempt to fix, touch, or replace the antenna; return the entire unit to Littlefeet.**

---

**Note and follow any warnings, cautions, or instructions written on or in the unit, or in any other documentation.**

---





# SIX

## glossary

|                           |                                                                                                                                                                                                                         |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AC</b>                 | Alternating Current                                                                                                                                                                                                     |
| <b>AGC</b>                | Automatic Gain Control. This cSPICE-only feature adjusts the uplink gain to maintain the power-versus-time profile over the AGC range. AGC can be disabled with the SST or the OMC. The AGC overrides the ALC function. |
| <b>Alarm</b>              | Notification that a fault has occurred. In order of severity, alarms can be Critical, Major, or Minor.                                                                                                                  |
| <b>ALC</b>                | Automatic Level Control                                                                                                                                                                                                 |
| <b>BCCH</b>               | Broadcast Control CHannel                                                                                                                                                                                               |
| <b>BSC</b>                | Base Station Controller                                                                                                                                                                                                 |
| <b>BSIC</b>               | Base Station Identity Code                                                                                                                                                                                              |
| <b>bSPICE</b>             | SPICE variant for direct coupling to the BTS. Broadcasts the signal from the BTS on a set of link frequencies.                                                                                                          |
| <b>BSS</b>                | Base Station System                                                                                                                                                                                                     |
| <b>BTS</b>                | Base Transceiver Station                                                                                                                                                                                                |
| <b>Cell Area</b>          | An area that contains a single bSPICE and its corresponding cSPICES, defined by common link frequencies.                                                                                                                |
| <b>Channel</b>            | The RF carrier assigned to a specific frequency (not a traffic channel timeslot); one of the four RF paths within a SPICE unit.                                                                                         |
| <b>Coverage</b>           | The subscriber's coverage area provided by cSPICE.                                                                                                                                                                      |
| <b>Coverage Frequency</b> | The frequency used by the BTS to communicate with the mobile subscribers.                                                                                                                                               |
| <b>cSPICE</b>             | SPICE variant for broadcasting to the coverage area. Receives signals from a bSPICE on a set of link frequencies and broadcasts on a set of coverage frequencies.                                                       |
| <b>dBi</b>                | Gain (of an antenna) relative to an isotropic radiator.                                                                                                                                                                 |

|                       |                                                                                                                                                                                |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DC</b>             | Direct Current                                                                                                                                                                 |
| <b>DFR</b>            | Data Full Rate, also known as TCH/F9.6 (Traffic CHannel/Full 9.6 Kbs rate).                                                                                                    |
| <b>DL</b>             | Downlink; radio path from BTS to subscriber.                                                                                                                                   |
| <b>ETSI</b>           | European Telecommunications Standards Institute                                                                                                                                |
| <b>FTP</b>            | File Transfer Protocol                                                                                                                                                         |
| <b>GPRS</b>           | General Packet Radio Service                                                                                                                                                   |
| <b>GPS</b>            | Global Positioning System                                                                                                                                                      |
| <b>GSM</b>            | Global System for Mobile Communications                                                                                                                                        |
| <b>HBTS</b>           | Hub BTS; the BTS used as the RF input for a bSPICE.                                                                                                                            |
| <b>HTTP</b>           | HyperText Transfer Protocol                                                                                                                                                    |
| <b>IF</b>             | Intermediate Frequency                                                                                                                                                         |
| <b>IMD</b>            | Intermodulation Distortion                                                                                                                                                     |
| <b>IP Address</b>     | Internet Protocol Address; a unique identifier for a specific computer on a network. An IP address must be of the form <b>x.x.x.x</b> , where x is a number between 0 and 255. |
| <b>Link</b>           | The radio path between the bSPICE and remote cSPICE.                                                                                                                           |
| <b>Link Frequency</b> | The frequency used for communication between bSPICE and cSPICE units.                                                                                                          |
| <b>LV</b>             | Low Voltage                                                                                                                                                                    |
| <b>MIB</b>            | Management Information Base                                                                                                                                                    |
| <b>MS</b>             | Mobile Station                                                                                                                                                                 |
| <b>MSC</b>            | Mobile Switching Center                                                                                                                                                        |
| <b>MTBF</b>           | Mean Time Between Failure                                                                                                                                                      |
| <b>NOC</b>            | Network Operations Center                                                                                                                                                      |
| <b>NSS</b>            | Network and Switching Sub-system                                                                                                                                               |
| <b>OMC</b>            | Operation and Maintenance Center                                                                                                                                               |
| <b>OMC-SPICE</b>      | SPICE Network Management System.                                                                                                                                               |
| <b>PDU</b>            | Protocol Data Unit                                                                                                                                                             |

|               |                                                                                                                                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>PLL</b>    | Phase Lock Loop                                                                                                                |
| <b>ppm</b>    | Parts per Million                                                                                                              |
| <b>PPP</b>    | Point-to-Point Protocol                                                                                                        |
| <b>RSSI</b>   | Received Signal Strength Indicator                                                                                             |
| <b>RF</b>     | Radio Frequency                                                                                                                |
| <b>RTFM</b>   | Read The Fine Manual                                                                                                           |
| <b>RX</b>     | Receiver (radio)                                                                                                               |
| <b>RxLev</b>  | Received Signal Level                                                                                                          |
| <b>RxQual</b> | Received Signal Quality                                                                                                        |
| <b>SIM</b>    | Subscriber Identity Module                                                                                                     |
| <b>SMS</b>    | Short Message Service                                                                                                          |
| <b>SNMP</b>   | Simple Network Management Protocol                                                                                             |
| <b>SPICE</b>  | Small Profile Intelligent Coverage Element. Also refers to a network of SPICE units maintained by a central operations system. |
| <b>SST</b>    | SPICE Support Tool. The tool used for field maintenance of SPICE units.                                                        |
| <b>TA</b>     | Timing Advance                                                                                                                 |
| <b>TCP/IP</b> | Transmission Control Protocol/Internet Protocol                                                                                |
| <b>TRX</b>    | Transceiver                                                                                                                    |
| <b>TX</b>     | Transmitter (radio)                                                                                                            |
| <b>UL</b>     | Uplink; radio path from subscriber to BTS.                                                                                     |
| <b>UPS</b>    | Uninterruptible Power Supply                                                                                                   |
| <b>µBTS</b>   | Micro-Base Transceiver Station                                                                                                 |





# appendix A

## installation checklist

This appendix summarizes the steps that must be taken in order to install a SPICE unit, from taking it out of the box to integrating it into the network. It is assumed that:

- ☐ Sites and settings (channel numbers, power levels) for units have already been chosen and entered in the Installation Form.
- ☐ The OMC is already set up (see the Quick Start Guide that accompanies the OMC).
- ☐ You have obtained and configured a laptop to be used as an SST (see the chapter on SST basics and setup in the *SPICE Software Guide*).

### unpacking unit

The first step is to unpack and check the unit. Follow the steps in the Quick Start Guide that accompanies the unit.

Tools and equipment needed:

- ☐ SPICE Quick Start Guide for unit
- ☐ Power source
- ☐ RF signal source (to check the unit's antenna)
- ☐ Laptop to access the SST
- ☐ Data-enabled SIM card for built-in modem

### installing unit

After transporting the unit to the location where it is to be installed, you will install the unit. Follow the steps in the installation chapter of the *SPICE Hardware Guide*.

Tools and equipment needed:

- ☐ Equipment listed in the *SPICE Hardware Guide* installation chapter (unit, mounting bracket, etc.)
- ☐ Suitable location for unit
- ☐ Appropriate power source

## programming unit

After installing the unit, you will need to program it so that it knows which frequencies to use, etc. You can also commission the unit prior to installation. Follow the steps in the chapter on using the SST in the *SPICE Software Guide*.

Tools and equipment needed:

- ☐ Laptop to access the SST
- ☐ Information from Installation Form

## commissioning network

Once the unit is installed and operational, integrate it into the network using the OMC. Follow the steps in the chapter on using the OMC in the *SPICE Software Guide*.

Tools and equipment needed:

- ☐ OMC
- ☐ Information from Installation Form
- ☐ *SPICE Software Guide*

## optimizing the network

Once the network is installed, drive test the SPICE network as you would a conventional network, but you can fine-tune each individual unit to optimize the network.

- ☐ Tools and equipment needed:
- ☐ Drive-test equipment
- ☐ Data logging and analysis equipment

## maintaining the network

Maintain the network by monitoring alarms and optimizing as necessary.

Tools and equipment needed:

- ☐ OMC
- ☐ Laptop to access the SST
- ☐ Documentation

## cSPICE flowchart checklist

Use this checklist to indicate that the cSPICE has been installed according to the instructions contained in this documentation. Check off the boxes in the flowchart as you complete the steps.

Site Reference:

Part #:

Serial #:

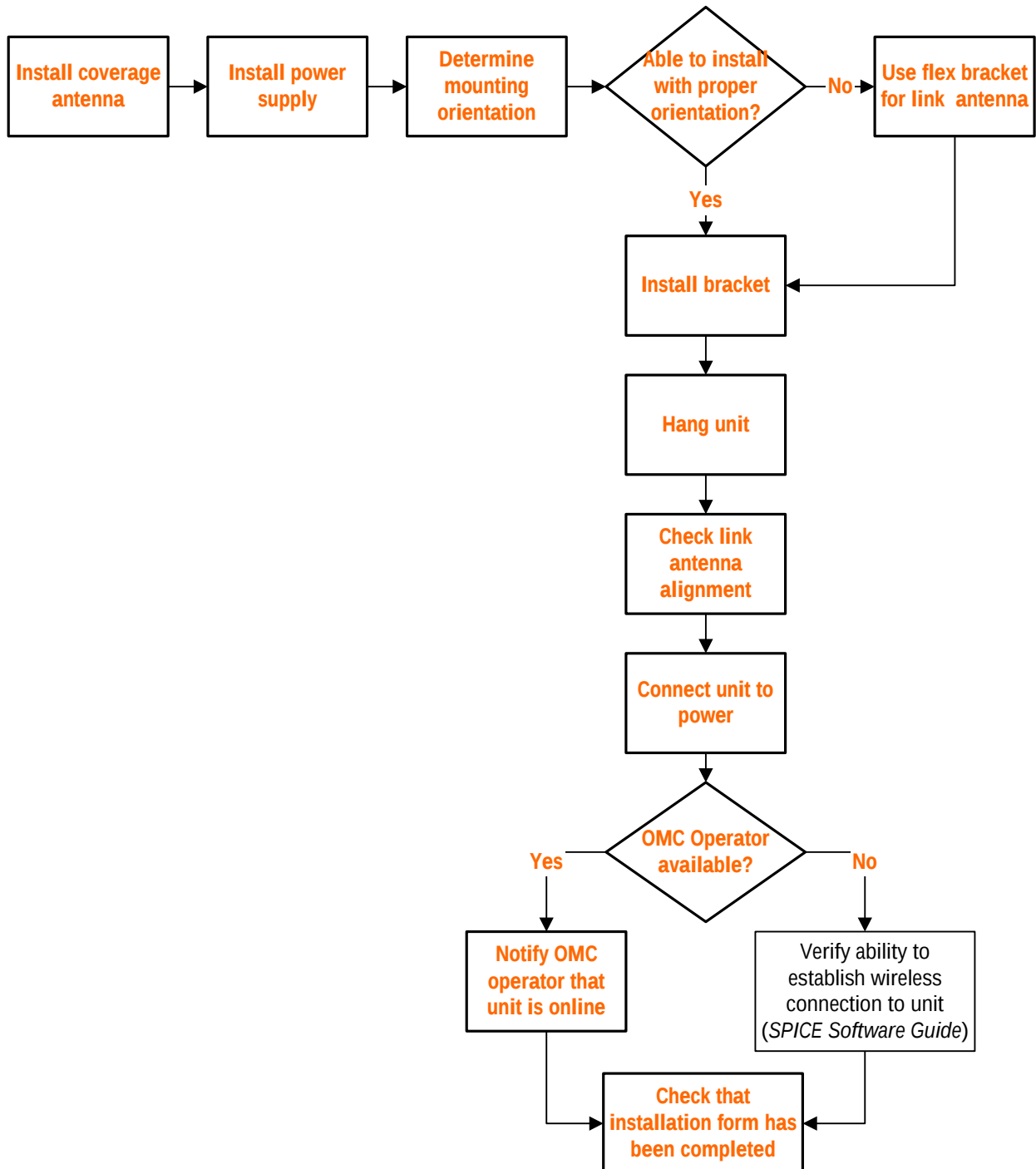


figure 43. cSPICE flowchart checklist

## bSPICE flowchart checklist

Use this checklist to indicate that the bSPICE has been installed according to the instructions contained in this documentation. Check off the boxes in the flowchart as you complete the steps.

Site Reference:

Part #:

Serial #:

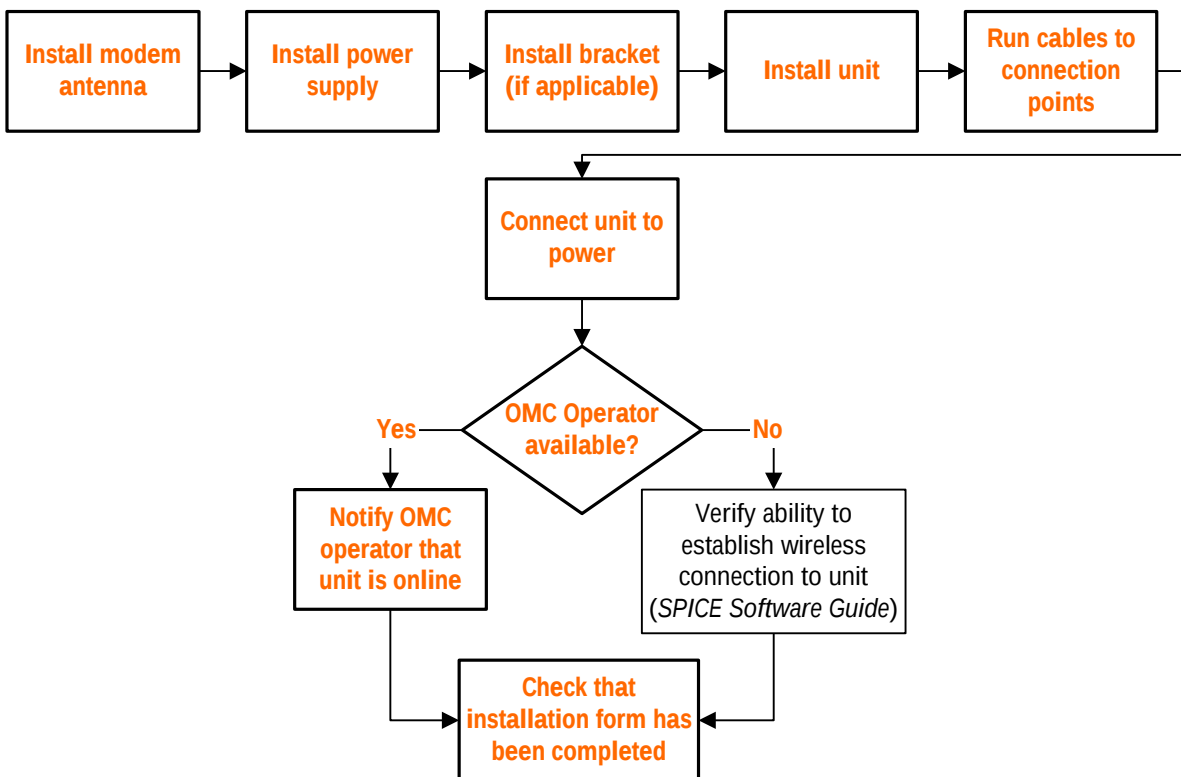


figure 44. bSPICE flowchart checklist



# appendix B

## unit specifications

This appendix contains hardware specifications for bSPICE and cSPICE units.

| s p e c i f i c a t i o n | p a g e |
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## bSPICE specs

This section details the physical specifications of bSPICE units.

table 5. bSPICE specifications

| Parameter                  | Value                                                                              |
|----------------------------|------------------------------------------------------------------------------------|
| Standard                   | GSM 1800 or PCS 1900 (US)                                                          |
| Compliance                 | Meets ETS 300-609-4 (for GSM) or FCC equivalent (for PCS)                          |
| Power supply               | 28-48V AC/DC                                                                       |
| Power consumption          | Less than 125 W                                                                    |
| Control                    | GSM Wireless Modem or Ethernet port                                                |
| Downlink frequency         | 1805-1880 MHz for GSM; 1930 to 1990 MHz for PCS                                    |
| Uplink frequency           | 1710-1785 MHz for GSM; 1850 to 1910 MHz for PCS                                    |
| BTS interface              | N-type connectors (duplexed or non-duplexed)                                       |
| Number of channels         | 1-4                                                                                |
| Max. RF output per channel | +25 dBm (316 mW)                                                                   |
| Max. RF input from BTS     | +44 dBm                                                                            |
| Max. UL noise figure       | 4 dB                                                                               |
| Max. UL input              | -10 dBm                                                                            |
| Total delay                | less than 3 $\mu$ S                                                                |
| Link antenna               | External                                                                           |
| Dimensions                 | Standard 19-inch (48 cm) rack-mountable                                            |
| Weight                     | 27 lbs (12.25 kg)                                                                  |
| Sealing class              | IP65                                                                               |
| Mounting                   | Rack or other suitable horizontal surface                                          |
| Temperature Range          | Operational: -22 to 130° F (-30 to 55° C)<br>Storage: -40 to 158° F (-40 to 70° C) |

## cSPICE specs

This section details the physical specifications of cSPICE units.

table 6. cSPICE specifications

| Parameter                  | Value                                                                                                                                                                             |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standard                   | GSM 1800 or PCS 1900 (US)                                                                                                                                                         |
| Compliance                 | Meets ETS 300-609-4 (for GSM) or FCC equivalent (for PCS)                                                                                                                         |
| Power supply               | 28-48V AC/DC                                                                                                                                                                      |
| Power consumption          | Less than 80 W                                                                                                                                                                    |
| Control                    | GSM Wireless Modem or Ethernet port                                                                                                                                               |
| Downlink frequency         | 1805-1880 MHz for GSM; 1930 to 1990 MHz for PCS                                                                                                                                   |
| Uplink frequency           | 1710-1785 MHz for GSM; 1850 to 1910 MHz for PCS                                                                                                                                   |
| Number of channels         | 1-4                                                                                                                                                                               |
| Max. RF output per channel | +23 dBm (200 mW)                                                                                                                                                                  |
| Max. UL noise figure       | 7 dB                                                                                                                                                                              |
| Max. UL input              | -10 dBm                                                                                                                                                                           |
| Total delay                | less than 6 $\mu$ S                                                                                                                                                               |
| Link antenna gain          | 8 dBi                                                                                                                                                                             |
| Coverage antenna gain      | 8 dBi                                                                                                                                                                             |
| Dimensions                 | excluding antenna: 18.4 in. (H) x 9.9 in. (W) x 6.6 in. (D) (466 mm x 252 mm x 167 mm)<br>including antenna: 40.9 in. (H) x 9.9 in. (W) x 6.6 in. (D) (1040 mm x 252 mm x 167 mm) |
| Weight                     | 20 lbs (9.07 kg)                                                                                                                                                                  |
| Sealing class              | IP65                                                                                                                                                                              |
| Mounting                   | Pole or wall                                                                                                                                                                      |
| Temperature Range          | Operational: -22 to 130° F (-30 to 55° C)<br>Storage: -40 to 158° F (-40 to 70° C)                                                                                                |

