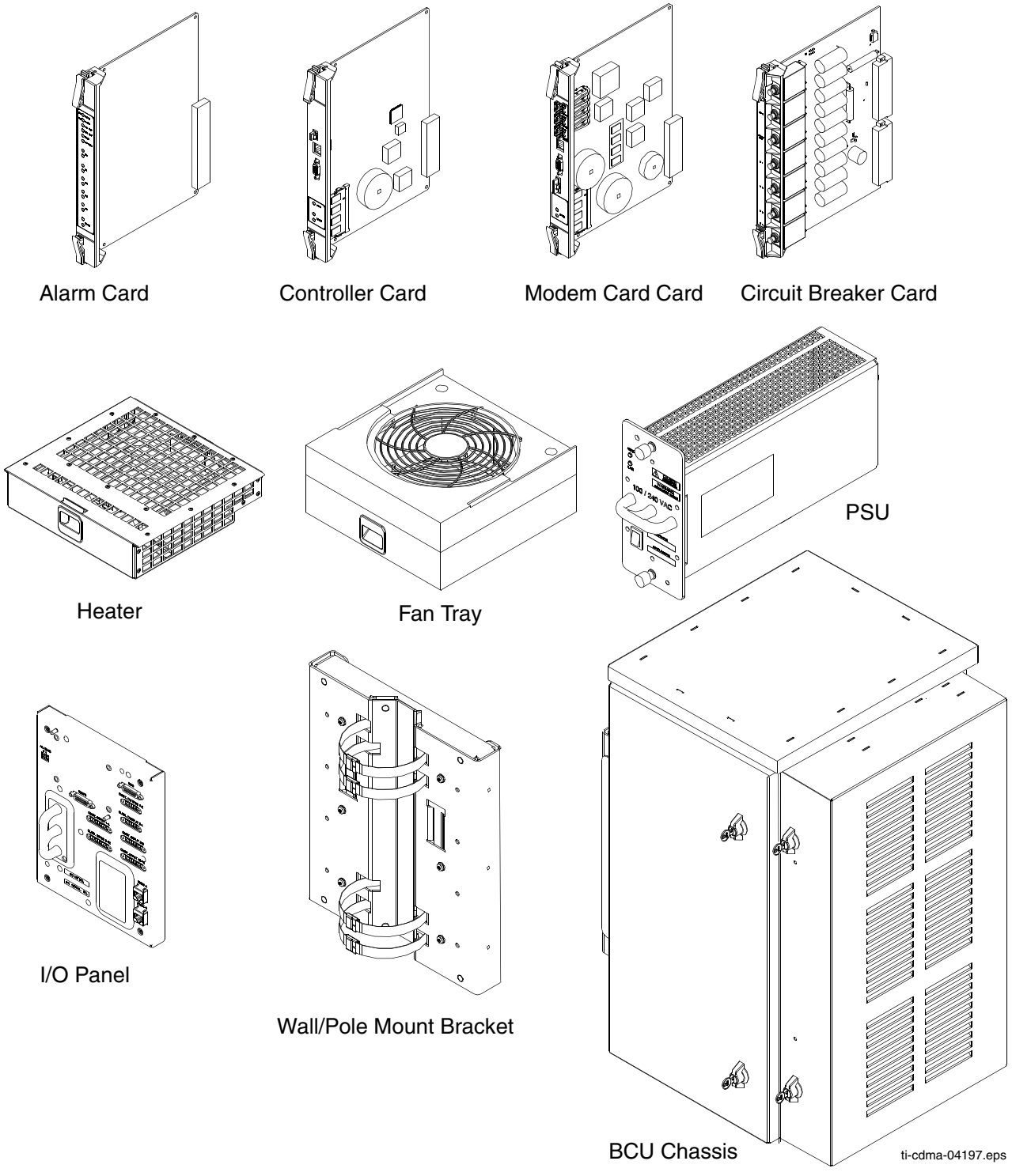
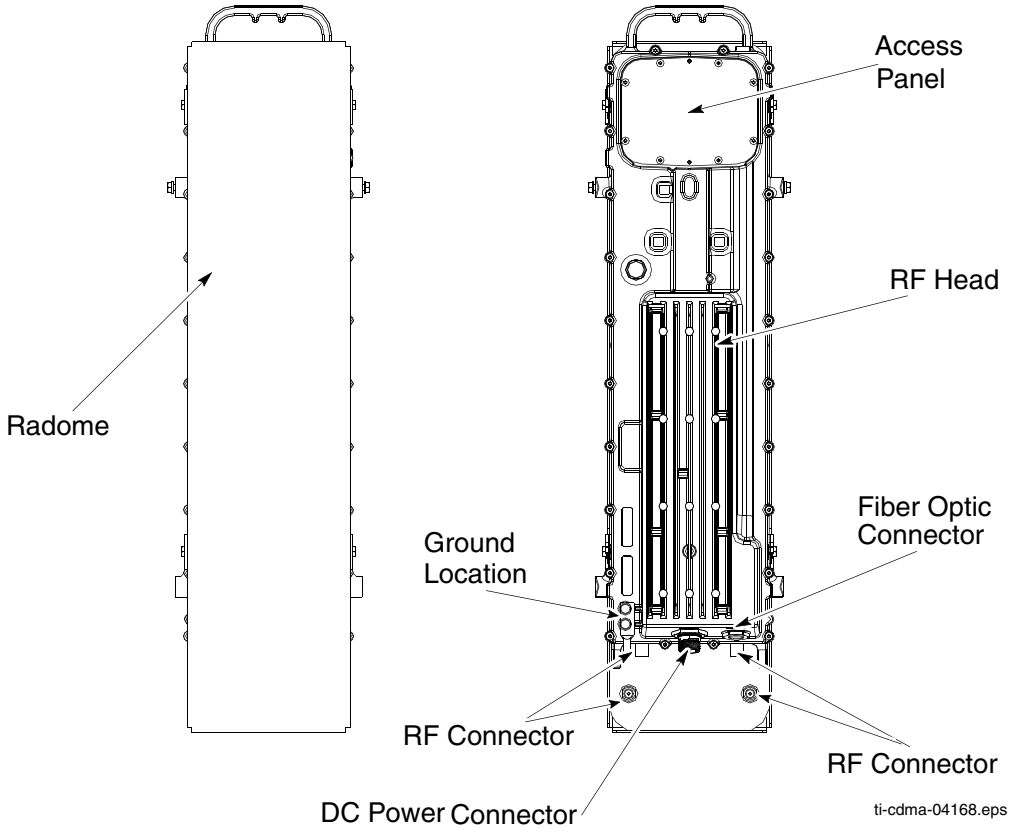
Figure 1-3 BCU Hardware



RF Head Hardware Identification

The Diversity Access Point (DAP) RF Head Assembly consists of a two antenna element using a single radome and a (one Transmit/Receive RF Module (RF Head)).

Figure 1-4 DAP RF Head Hardware



Chapter

2

Site Preparation

Site Preparation Overview

Overview

This chapter provides the procedures and information to verify that the site is ready for equipment installation. It also provides procedures to ensure the safety of the installation personnel, protect the equipment from damage, and verify the site layout parameters.

WARNING

Every effort should be made to provide a safe working environment for all installation and service personnel.

Installation

This Base Control Unit (BCU) may be installed indoors or outdoors. The RF Head is installed outdoors. The site preparation depends on the type of installation and the site characteristics.

Site Manager

The site manager is the person in charge of and responsible for the full site.

Verification and Procedures

Verifications typically have the installer check with the site manager that a condition has been previously checked or procedure previously performed and meets a stated specification.

Inspections typically have the installer personally checking that a condition or item meets stated specifications.

The verifications and procedures provided in this chapter are:

- Internal site inspections
- Preparing site for the arrival of equipment
- Site layout verification

Prepare Site for Equipment Arrival

Description

This information covers various topics not all of which are needed at every site. Based on the site characteristics execute the steps that apply to your site. Before installing the equipment, do the following to ensure the safety of installation personnel and to protect the equipment.

Equipment Arrival

Before the equipment arrives, indicate to the transport company an area at the site where the equipment can be unloaded and, if necessary, unpacked. The equipment should be carefully delivered to the site, along with all equipment dollies and padding required to safely move the equipment from the unloading area to the cell site. The following should also be provided, outdoor weather protection, temporary lighting and power for lighting and power tools.

Procedure to Prepare the Site for the Equipment

Procedure 2-1 Procedure to Prepare the Site for the BTS

1	Consult with site manager.
2	Locate the demarcation blocks for external utilities. Verify that they are shown on the Site Engineering documents, and determine the required cable routing back to the equipment frames.
3	Verify the following: • AC power is available and meets the site documentation specifications • Pole and/or wall mounting structures are adequate • Outdoor cable runs are installed and meet local building codes • Customer input termination tie points are available • There is clear access to move the equipment to the desired mounting area • There is sufficient space for installation and service access to the equipment • Customer supplied shelters are installed

Shipping and Handling

Overview

The purpose of this chapter is to describe how the Base Control Unit (BCU) and RF Head are packaged for shipping and how to correctly unpack the units in preparation for installation.

How Equipment is Shipped

The BCU and RF Head will be shipped in separate containers or separate pallets. The containers, if used will either be wood or card board, with packing material to protect the units.

If pallets are used, the units will be wrapped in packing material and strapped to the pallet. Plastic wrapping will be used to encase the units and provide protection as well as securing the units to the pallets.

The BCU is shipped with all cards/modules and internal cabling installed.

The RF Head is shipped fully assembled.

How Equipment Arrives

Before the equipment arrives, indicate to the transport company an area at the site where the equipment can be unloaded and, if necessary, unpacked. The equipment should be carefully delivered to the site, along with all equipment dollies and padding required to safely move the equipment from the unloading area to the cell site. The site should also have the following items available: outdoor weather protection and power for temporary lighting and power tools.

Unpacking

The unpacking process requires that the following procedures be completed in the order shown:

1. Unpack the shipping container
2. Inventory the shipping container
3. Inspect equipment for damage

Recommended Tools

The tools in Table 2-1 are recommended to assist in opening the containers housing the equipment. Tin snips Knife, box cutter, or scissors

Table 2-1 Recommended Unpacking Tools

Qty	Description
1	Tin snips
1	Knife, box cutter, scissors

Unpacking Diagrams

The following diagrams show how to unpack the equipment.

Figure 2-1 Shrink Wrapped Shipment

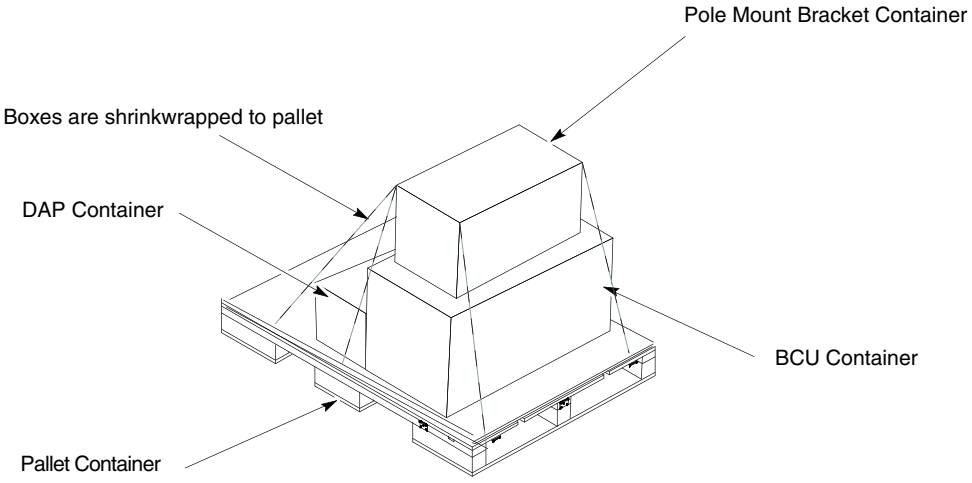


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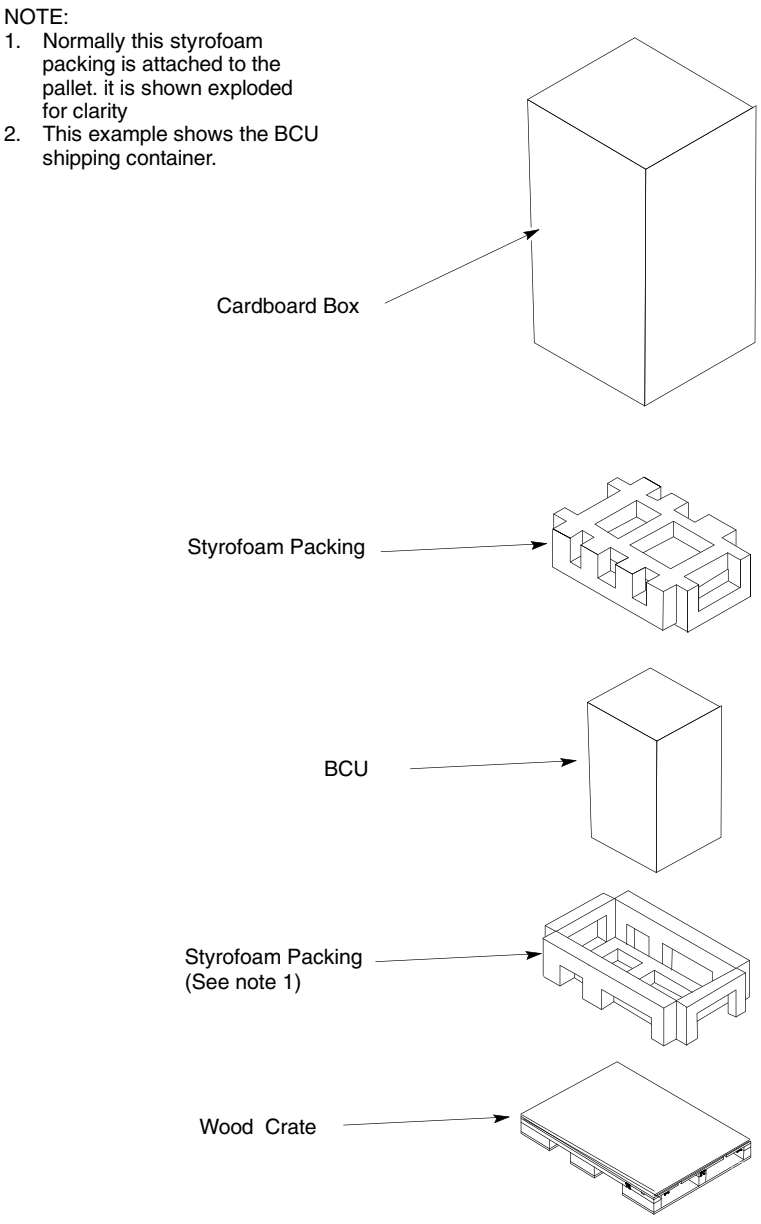
Figure 2-2 Cardboard Shipping Container



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Unpacking a Cardboard Container or Shrink Wrapped Shipment

Follow the procedure in Procedure 2-2 to unpack equipment from a container or shrink wrap.

Continued

Procedure 2-2 Unpacking Equipment from a Cardboard Container or Shrink Wrap

1	Inspect for damage.  **NOTE** Components may or may not be delivered on one pallet. Procedure assumes components are delivered in separate containers on one pallet.
2	If container is made of cardboard, proceed to step 3.
3	Open container using tin snips to cut each outer steel band.
4	Cut bands securing pole/wall mounting bracket container to top of BCU container. Remove pole/wall mounting bracket container, and place to one side.
5	Cut bands securing RF Head container and RF Head mounting bracket container to pallet.
6	Cut bands securing RGPS container to pallet.
7	Proceed to Procedure 2-3.
8	Using a knife or equivalent, carefully cut shrink wrap.
9	Carefully separate individual shipping containers. Check for damage to containers.
10	Proceed to Procedure 2-3.

Procedure 2-3 Procedure to Remove Outdoor Equipment from Container

1	Lift cardboard container off of the BCU. Find and remove equipment door key. Open the shipping container holding the BCU mounting bracket. Open the shipping container holding the RF Head. Open shipping container holding RF Head mounting bracket assembly. Open shipping container holding the GPS equipment.
2	Remove packing material from all containers.
3	Upon opening containers, if components are enclosed in plastic, use a knife or equivalent to carefully cut plastic away.
4	 **NOTE** The BCU weighs a maximum of 68 kg (150 lbs). Recommend that a minimum of two people be present to move the BCU.

Continued

Procedure 2-3 Procedure to Remove Outdoor Equipment from Container (Continued)

	Locate BCU door key. Remove BCU.
5	Use the key to open the door. Verify that cards and modules are installed.
6	If BCU is to be pole mounted, check that BCU has part of the mounting bracket already attached. Remove BCU pole/wall mounting bracket assembly from its container.
7	 **NOTE** The RF Head for the Diversity Access Point (DAP) weighs 15.9 kg (35.0 lbs). Remove the DAP RF Head from its container.
8	Remove DAP RF Head mounting bracket assembly from its container.
9	Remove GPS equipment from its container.
10	Take inventory of equipment received. Report the extent of any equipment damage to the transport company and to appropriate management personnel.

Chapter

3

Cable Descriptions

Cable Descriptions

Overview

This chapter provides the descriptions of the site cabling.

Procedures for routing cables (through metallic or conductive conduit) to the outdoor equipment are found in Chapter 4 Access Point Hardware Installation .

NOTE

Cabling is one of the most noticeable aspects of workmanship. Straight runs and proper turns are critical for a positive evaluation of the work.

Configurations Supported

This chapter supports cable installation for 3 and 4 sector configurations.

Cable Installation Order

1. Ground Cabling
2. Power Cabling
3. Antenna Cabling
4. RGPS or Local GPS Cabling
5. Ethernet Cabling
6. Fiber Optic Cabling
7. Customer Defined Input/Output Cabling

Cable Labels

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Cable Descriptions and Part Numbers

Table 3-1 gives the cable descriptions and part numbers of the various cables that will connect to the Base Control Unit (BCU) and RF head.

Table 3-1 Cable Description and Part Numbers

Cable	Qty	Part Number	Description
A	2	Customer Supplied	Ground cable, 6 AWG or larger, insulated copper wire.
B	2–8	3089492T02	Antenna Cable, 300 mm (1 ft.)
C	1	T472AA	RGPS cable, 15 m (50 ft.)
		T472AB	RGPS cable, 38 m (125 ft.)
		T472AC	RGPS cable, 76 m (250 ft.)
		T472AD	RGPS cable, 152 m (500 ft.)
		T472AE	RGPS cable, 304 m (1000 ft.)
		T472AF	RGPS cable, 608 m (2000 ft.)
C1	1		Part of Motorola Kit.
D	1	SGRG4030A CGDSGPSKITF4NM50	Assembly, Receiver, GPS, RF Module Antenna, GPS, with mounting and 50 ft. cable.
E	2	Customer Supplied	AC Power Cable, 10 AWG, copper DC Power Cable,
F	1	SGLN6414A	Assembly, Installation, Installation HDW Pkg BCU
G	1–4	3089298C01	RF Head DC Power Cable, 20 m (65.6 ft)
		3089298C02	RF Head DC Power Cable, 40 m (131.2 ft)
		3089298C03	RF Head DC Power Cable, 60 m (196.8 ft)
		3089298C04	RF Head DC Power Cable, 80 m (262.4 ft)
		3089298C05	RF Head DC Power Cable, 100 m (328.0 ft)
H	1–4	3089843T01	Fiber Optic Cable, 20 m (65.6 ft)
		3089843T02	Fiber Optic Cable, 40 m (131.2 ft)
		3089843T03	Fiber Optic Cable, 60 m (196.8 ft)
		3089843T04	Fiber Optic Cable, 80 m (262.4 ft)
		3089843T05	Fiber Optic Cable, 100 m (328.0 ft)

Continued

Table 3-1 Cable Description and Part Numbers (Continued)

Cable	Qty	Part Number	Description
J	6	Customer Supplied	Ethernet cables, RJ-45 connectors, straight
K	1	GCNTM20A3A CGDSVXL550 FSJ4–50B)	Assembly, Receiver, GPS, RF Module Antenna, GPS, with mounting and 50 ft. cable. Antenna cable from Surge Arrestor (Customer supplied) to BCU
L	1	SGKN4386	Punch block to BCU I/O board, 15–pin D-connector on one end and loose wires on the other end. Cable is Motorola P/N 3086433H12
M	1	Customer Supplied	DC power cable, 8–10 AWG, 10 m

Cable Lengths

Table 3-2 Cable Length Requirements

From	To	Cable Designation	Cable length
BCU DC Source	RF Head DC Connector	G	5 lengths, 20 to 100 m in 20 m increments (65.6 to 328 ft)
BCU RF Connector	RF Head RF Connector	B	300 mm (1 ft)
AC Source	BCU Customer Interface Compartment	E	Length as required.
Customer Output Source	BCU Customer Interface Compartment	F	Length as required.

Earth Ground and Power Cables

The objective of this procedure is to install the power and earth ground cabling for the Base Control Unit (BCU) and RF Head.

The site should have had an external ground ring or bus bar being used. The ground ring and bus bar should be an integral part of the structures that will hold the equipment. Reference *Hard copy (Motorola Part Number 6881089E50)*.

Grounding Considerations

Above Ground For ground rings and the interconnection of internal and external ground rings, #2 to #6 AWG may be used. For grounding of equipment and miscellaneous metallic objects, #6 AWG minimum is required.

Exceptions Connection from an isolated ground bar (IGB) to master ground bar (MGB) is accomplished using #2 to #6 AWG. The external ground bar (EGB) is grounded through a 2-inch (50.8 mm) wide, 16-gauge copper strap, if available; otherwise, 2-#6 AWG wires can be used. If the #6 AWG wires are used, then they must be connected at opposite ends of the EGB and have a minimum separation of 12-inches between them.

Below Ground All wire must be #2 AWG as a minimum. Ground rods are to be a minimum of 8 feet long and 5/8-inch in diameter. In the case of a deep basement next to the rod, the rod must be long enough to extend 3 feet below the basement floor.

BCU Grounding

The BCU should be tied to a single point grounded to the system master ground (ground bus bar). All interconnect cables should be in metallic sealtight type conduit or solid shield RF cables. It is recommended that these cables be run in raceways to reduce the loop dimensions of the cable runs. This minimizes the effect of inducted currents caused by the intense electromagnetic field of lightning current. A ground stud is provided on the external surface of the BCU enclosure to attach the ground wire. Refer to requirements for cable A in Table 3-1.

RF Head Grounding

All RF cables should be in metallic sealtight type conduit or solid shield RF cables. It is recommended that these cables be run in raceways to reduce the loop dimensions of the cable runs. This minimizes the effect of inducted currents caused by the intense electromagnetic field of lightning current. A ground lug with captive screws is provided on the RF Head to attach the ground wire.

DC Power Grounding

The DC power cables from the BCU to the RF Head are routed through conduit. The conduit is grounded to the master ground. The ground for the DC cable is attached DC power surge protect module. See Figure 4-11

AC Power Grounding

The AC power cables from the BCU to the RF Head are routed through conduit and into the BCU. The conduit is grounded to the master ground. The ground for the AC cable is attached AC power surge protect module. See Figure 4-10.

Antenna Grounding

The antenna is grounded through the RF Head.

Figure 3-1 Typical Outdoor Grounding Diagram

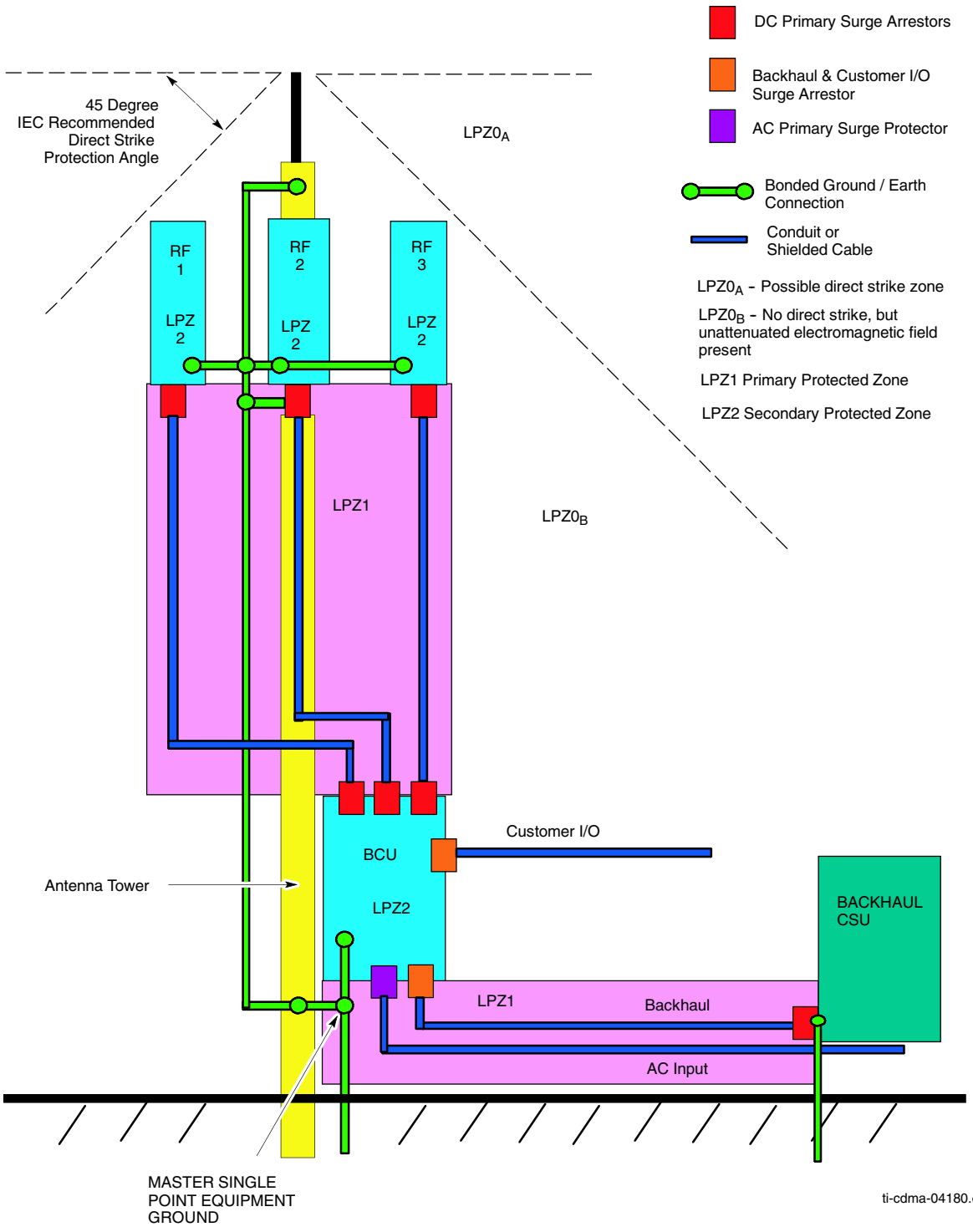
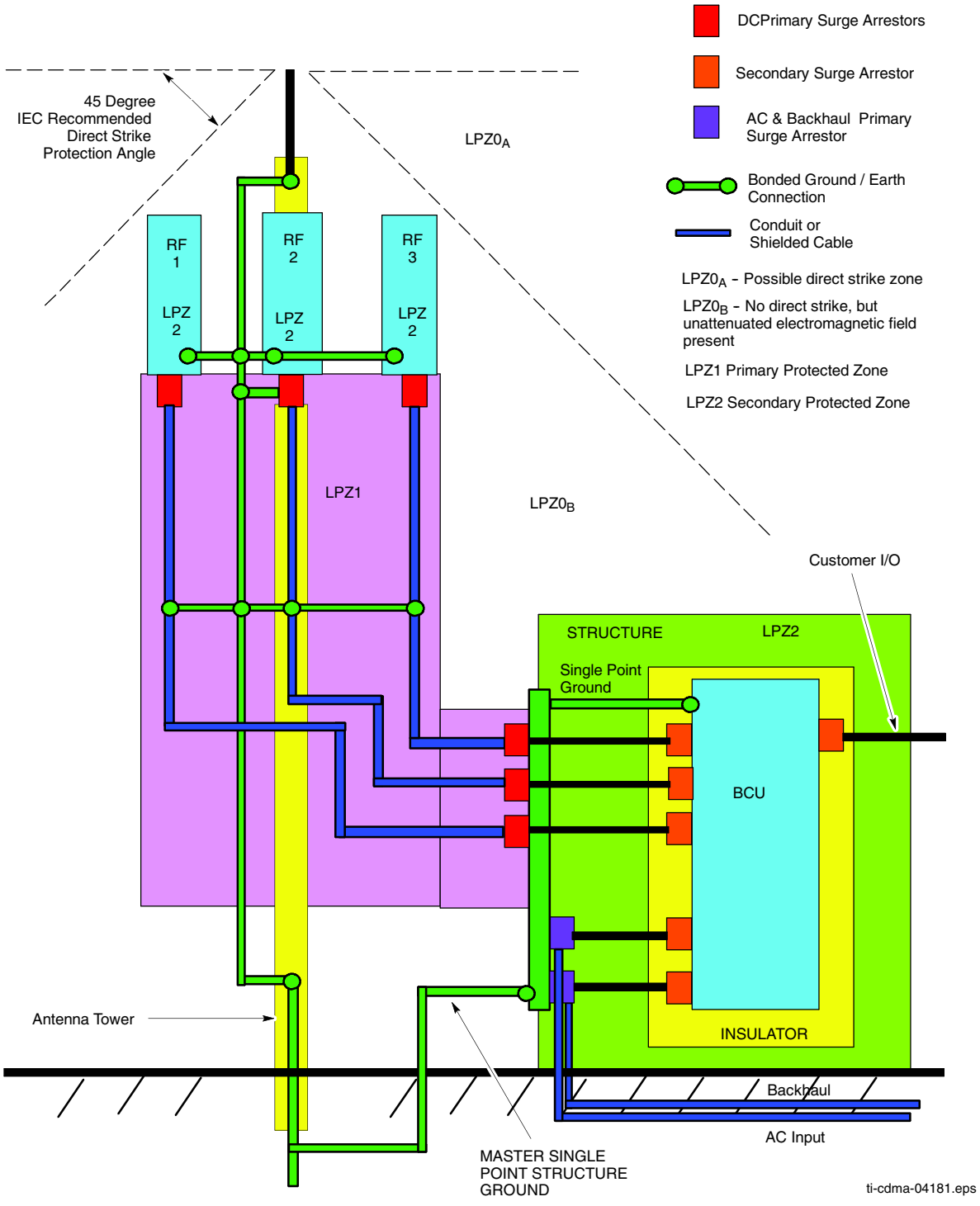


Figure 3-2 Typical Indoor Grounding Diagram



Power Considerations

The Base Control Unit (BCU) is designed for 100/240 VAC @ 50/60 Hz, 16A max., +20 to +30 VDC, 78A max. or –60 to –39 VDC, 38A max.

The system configuration determines which power cables are installed. The ground cable is always installed first. Based on the system configuration perform the appropriate procedures described in Chapter 4 Access Point Hardware Installation .

DC Power (RF Head)

The DC power cable is orderable in a variety of lengths as indicated in Table 3-3 below. Depending on site configuration all of one length or a combination of lengths (up to 4) may be used.

Table 3-3 RF Head DC Power Cable Description and Part Numbers

Cable	Qty	Part Number	Description
G	1–4	3089298C01	Power Cable, 20 m (65.6 ft)
	1–4	3089298C02	Power Cable, 40 m (131.2 ft)
	1–4	3089298C03	Power Cable, 60 m (196.8 ft)
	1–4	3089298C04	Power Cable, 80 m (262.4 ft)
	1–4	3089298C05	Power Cable, 100 m (328.0 ft)

Antenna Cable

Objective

This section contains general information on the antenna cabling.

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Table 3-4 Cable Description and Part Numbers

Cable	Qty	Part Number	Description
B	2 – 4	3089492T02	Antenna Cable, 300 mm (1 ft.)

Antenna Cable Pin and Signal Information

The antenna cabling uses a 50-Ohm coaxial cable. The inner conductor provides signaling and the outer conductor provides shielding and ground.

Table 3-5 Pin and Signal Information for Antenna Cable

Antenna	Inner Conductor	Outer Conductor
B	TX/RX	Ground

Remote GPS Cable

Objective

This section contains general information on the Remote Global Positioning System (RGPS) cabling. Installation information is found in Appendix B Alternate RGPS Installation, beginning with Procedure B-1 .

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter. Cable C is available in different kits covering several lengths.

RGPS Cables

Table 3-6 provides the quantities and descriptions of the cables.

Table 3-6 Cables Needed for RGPS Connections

Cable	Qty	Part Number	Description
C	1	T472AA	RGPS cable, 15 m (50 ft.)
		T472AB	RGPS cable, 38 m (125 ft.)
		T472AC	RGPS cable, 76 m (250 ft.)
		T472AD	RGPS cable, 152 m (500 ft.)
		T472AE	RGPS cable, 304 m (1000 ft.)
		T472AF	RGPS cable, 608 m (2000 ft.)
L	1	SGKN4386	15 pin D-connector on one end and loose wires on the other end. Cable is Motorola P/N 3086433H12.

Mounting Considerations

The RGPS Head requires specific mounting considerations in order to properly observe the GPS satellites.

- The mounting pipe for the RGPS head should be mounted vertically with less than five degrees of tilt.
- It is recommended that the RGPS head be installed using the supplied mounting mast and mounting hardware. Care should be taken to ensure that the RGPS chassis does not come into contact with any metal surfaces. Failure to properly isolate the RGPS chassis from other conductive surfaces can lead to RGPS head failure. The supplied mounting hardware has been designed to provide the required RGPS chassis isolation.
- Position the RGPS head to have an unobstructed view of the sky and to minimize the chance of debris (leaves, dirt, snow, ice, etc.) accumulating on the radome of the RGPS head.
- The RGPS head must have a clear view of the sky, preferably to within 10 degrees of the horizon in all directions. The total blockage of the sky (due to buildings, mountains, etc.) should be less than 50%.
- Place the RGPS head as far away from the transmit antenna as possible to avoid RF interference issues.
- Place the RGPS head at least 15 m away from lightning rods, towers, or structures that attract lightning. RGPS head damage is usually not the result of a direct lightning strike, but of a lightning strike on a nearby structure. Also, since a lightning rod is connected to an earth ground, it can act as a shield and create a shadow that may block or reduce the signal from a satellite.
- After the Base Control Unit (BCU) is powered up (approximately 15 minutes), check the RGPS signal strengths with the *gstatus* command on the BCU MMI port.
  - An optimal installation will have at least one satellite (SV) with an RSSI value $\geq$ 50, and three (3) satellites with RSSI values $\geq$ 45.
  - A minimal installation should have at least four (4) satellites with RSSI values $\geq$ 40.
- The RGPS head is rated for ambient air temperatures from –40°C (–40°F) to 75°C (167°F), and has ratings for humidity, shock, waterproof, UV light resistance, vibrations, salt fog, ESD, EMI, and altitude.
- The RGPS system used for the Access Point will support up to 1 km (3280 ft.) of overall cable length from the RGPS head. If a long cable run needs to be broken into pieces, minimize the number of breaks in the cable.

Local GPS (RF GPS) Cable

Objective

This section contains general information on the Radio Frequency Global Positioning System receiver (RF GPS) antenna cabling. More commonly referred to as Local GPS. Refer to Procedure 4-10 for installation information.

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Table 3-7 Local GPS Cable Description and Part Numbers

Cable	Qty	Part Number	Description
D	1	Receiver SGRG4030	Assembly, GPS, RF Module
	1	CGDSGPSKITF4NM50	Assembly, Receiver, RF GPS with 50 ft. cable

Surge Protection

Local GPS antenna requires lightning protection.

Mounting Considerations

Refer to Table 3-8 for Local GPS mounting considerations.

Table 3-8 Local GPS Antenna Mounting Considerations

	Description
1	The mounting pipe for the Local GPS Head should be mounted vertically with less than five (5) degrees of tilt.
2	The Local GPS Head requires a clear view of the sky, preferably to within ten (10) degrees of the horizon in all directions. The more sky that is observed increases the number of potential satellites that can be tracked, resulting in better Local GPS performance.
3	During normal operation, the Local GPS Head continuously tracks a minimum of four (4) GPS satellites. However, it is theoretically possible to operate the BTS by

Continued

Table 3-8 Local GPS Antenna Mounting Considerations (Continued)

	Description
	tracking only one (1) GPS satellite. Motorola does not recommend tracking only one (1) GPS satellite unless there has been an accurate site survey.
4	Place the Local GPS Head where RF obstructions of the sky are minimal. The *sky* includes everything to within ten (10) degrees of the horizon in all directions. RF obstructions include buildings, towers, natural rock formations, snow, foliage, and debris.
	NOTE The mounting of the Local GPS head on antenna towers is not recommended due to increased risk of damage due to lightning strikes. If tower mounting is necessary the Local GPS head should mounted at the lowest point possible and still maintain an unobstructed view of the sky.
5	Separate the Local GPS Head from other radiating sources. Excessive RF energy can degrade the Local GPS Head's ability to observe the GPS satellites. The Local GPS Head receives on the GPS L1 frequency of 1575.42 MHz and incorporates filters to minimize the effects of potential RF interference, however, strong radiants can overwhelm the filters, thus degrading the units reception capability.
6	The Local GPS Head is rated for ambient air temperatures in the range -40 to +50 degrees C, and has ratings for humidity, shock, waterproofing, UV light resistance, vibrations, salt, fog, ESD, EMI, and altitude.
7	An RF gain of between +10 dB and +26 dB should be provided to the Local GPS receiver antenna input. The GPS antenna supplied in the CGDSGPSKITF4NM50 kit provides a nominal gain of +25 dB. The total signal loss from the CGDSGPSKITF4NM50 antenna output and Local GPS antenna input must be less than 15 dB at 1.575 GHz.

Ethernet Cable

Objective

This section contains general information on the Ethernet Cabling. Refer to Chapter 4 Access Point Hardware Installation for ethernet cable installation information.

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Tools and Materials

There are no tools and materials required to install the Ethernet Cables.

Fiber Optic Cable

Objective

This section contains general information on the fiber optic cable

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Cable Description and Part Number

The fiber optic cable is orderable in a variety of lengths as indicated in Table 3-9 below. Depending on site configuration all of one length or a combination of lengths (up to 4) may be used.

Table 3-9 Fiber Optic Cable Description and Part Number

Cable	Qty	Part Number	Description
H	1–4	3089843T01	Fiber Optic, 20 m (65.6 ft)
	1–4	3089843T02	Fiber Optic, 40 m (131.2 ft)
	1–4	3089843T03	Fiber Optic, 60 m (196.8 ft)
	1–4	3089843T04	Fiber Optic, 80 m (262.4 ft)
	1–4	3089843T05	Fiber Optic, 100 m (328.0 ft)

Customer Defined Input/Output Cables

Objective

This section contains general information on the Customer Defined Input (CDI) and Output (CDO) cables. Refer to Chapter 4 Access Point Hardware Installation for installation information.

Cable Label

Refer to Table 3-1 for the labels used to identify the cables that will be shown in illustrations throughout this chapter.

Cable Descriptions and Part Numbers

Table 3-10 gives the cable descriptions and part numbers used to install the Customer I/O connectors.

Table 3-10 Customer Defined I/O Cable Description and Part Numbers

Cable	Qty	Part Number	Description
F	1	SGLN6414A	Assembly, Installation, Installation Hdw Pkg BCU

Customer Defined Input and Output Connector Pinouts

Input Pins Table 3-11 lists the pinouts for the Customer Defined Input 1-4 and 5–8 connectors. Refer to Figure 4-16.

Table 3-11 Customer Defined Input Connector Pins 1–4 and 5–8

Pin Number	Description	Pin Number	Description
Connector 1–4		Connector 5–8	
1	Customer Defined Input 1	1	Customer Defined Input 5
2	Customer Defined Input 1 Return	2	Customer Defined Input 5 Return
3	Customer Defined Input 2	3	Customer Defined Input 6
4	Customer Defined Input 2 Return	4	Customer Defined Input 6 Return
5	Customer Defined Input 3	5	Customer Defined Input 7
6	Customer Defined Input 3 Return	6	Customer Defined Input 7 Return
7	Customer Defined Input 4	7	Customer Defined Input 8
8	Customer Defined Input 4 Return	8	CustomerDefined Input 8 Return

Table 3-12 lists the pinouts for the Customer Defined Input 9-12 and 13–16 connectors. Refer to Figure 4-16

Table 3-12 Customer Defined Input Connector Pins 9–12 and 13–16

Pin Number	Description	Pin Number	Description
Connector 9–12		Connector 13–16	
1	Customer Defined Input 9	1	Customer Defined Input 13
2	Customer Defined Input 9 Return	2	Customer Defined Input 13 Return
3	Customer Defined Input 10	3	Customer Defined Input 14
4	Customer Defined Input 10 Return	4	Customer Defined Input 14 Return
5	Customer Defined Input 11	5	Customer Defined Input 15
6	Customer Defined Input 11 Return	6	Customer Defined Input 15 Return
7	Customer Defined Input 12	7	Customer Defined Input 16
8	Customer Defined Input 12 Return	8	Customer Defined Input 16 Return