



MOTOROLA

Cellular Networks

APPLICANT: MOTOROLA

FCC ID: IHET7HM1

Users Manual Exhibit

2.5GHz MOTOwi4™ 25600 Diversity Access Point

Ground Based Access Point (GAP) Hardware Installation

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Ground Based Access Point (GAP) Hardware Installation

What is covered in this manual?

This manual describes general information and procedures for unpacking, site preparation, installation, and site clean up of the Ground Based Access Point (GAP) hardware.

Revision history

Version information

The following shows the status of this document since it was first released.

Issue	Date of issue	Remarks
1	JUL 2007	Preliminary release

Resolution of Service Requests

The following Service Requests (SR) are resolved in this document:

Service Request	CMBP Number	Remarks
N/A	N/A	N/A

Incorporation of Change Notices

The following Change Notices (CN) are incorporated in this document:

CN Date	CN Number	Title
N/A	N/A	N/A

General information

Purpose

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References made to external publications are shown in italics. Other cross references, emphasized in blue text in electronic versions, are active links to the references.

This document is divided into numbered chapters that are divided into sections. Sections are not numbered, but are individually named at the top of each page, and are listed in the table of contents.

Text conventions

The following conventions are used in the Motorola cellular infrastructure documents to represent keyboard input text, screen output text, and special key sequences.

Input

Characters typed in at the keyboard are shown like this.
Items of interest within a command appear like this.

Output

Messages, prompts, file listings, directories, utilities, and environmental variables that appear on the screen are shown like this.
Items of interest within a screen display appear like this.

Special key sequences

Special key sequences are represented as follows:

CTRL-c or CTRL+C	Press the Ctrl and C keys at the same time.
CTRL-SHIFT-c or CTRL+SHIFT+C	Press the Ctrl , Shift , and C keys at the same time.
ALT-f or ALT+F	Press the Alt and F keys at the same time.
ALT+SHIFT+F11	Press the Alt , Shift and F11 keys at the same time.
 	Press the pipe symbol key.
RETURN or ENTER	Press the Return or Enter key.

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Motorola appreciates feedback from the users of our documents.

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- The document type
- The document title, part number, and revision character
- The page number with the error
- A detailed description of the error and if possible the proposed solution

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In certain instances, Motorola makes specific recommendations regarding security practices. The implementation of these recommendations and final responsibility for the security of the system lies with the operator of the system.

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The following describes how warnings and cautions are used in this document and in all documents of this Motorola document set.

Warnings

Warnings precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:



Warning text and consequence for not following the instructions in the warning.

Cautions

Cautions precede instructions and are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. A caution has the following format:



Caution text and consequence for not following the instructions in the caution.

Notes

A note means that there is a possibility of an undesirable situation or provides additional information to help the reader understand a topic or concept. A note has the following format:



Note text.

Safety

General safety

The following general safety guidelines apply to Motorola equipment:

- The power jack and mating plug of the power cable must meet International Electrotechnical Commission (IEC) safety standards.



NOTE

Refer to *Grounding Guideline for Cellular Radio Installations – 68P81150E62*.

- Power down or unplug the equipment before servicing.
- Using non-Motorola parts for repair could damage the equipment or void warranty. Contact Motorola Warranty and Repair for service and repair instructions.
- Portions of Motorola equipment may be damaged from exposure to electrostatic discharge. Use precautions to prevent damage.

Electromagnetic energy

Relevant standards (USA and EC) applicable when working with RF equipment are:

- *ANSI IEEE C95.1-1991, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.*
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations.
- *Directive 2004/40/EC of the European Parliament and of the Council of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (18th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC).*

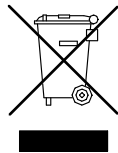
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Disposal of Motorola equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of Motorola equipment in landfill sites. In the EU, Motorola in conjunction with a recycling partner ensures that equipment is collected and recycled according to the requirements of EU environmental law.

Disposal of surplus packaging

European Parliament and Council Directive 94/62/EC Packaging and Packaging Waste

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In non-EU countries

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The label is placed in a customer visible position on the product.

- Logo 1 means the product contains no substances in excess of the maximum concentration value for materials identified in the China Management Methods regulation.
- Logo 2 means that the product may contain substances in excess of the maximum concentration value for materials identified in the China Management Methods regulation, and has an Environmental Friendly Use Period (EFUP) in years, fifty years in the example shown.



The Environmental Friendly Use Period (EFUP) is the period (in years) during which the Toxic and Hazardous Substances (T&HS) contained in the Electronic Information Product (EIP) will not leak or mutate causing environmental pollution, or bodily injury from the use of the EIP. The EFUP indicated by the Logo 2 label applies to a product and all its parts. Certain field-replaceable parts, such as battery modules, can have a different EFUP and are marked separately.

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Disclosure table

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁶⁺)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
金属部件	×	○	×	×	○	○
电路模块	×	○	×	×	○	○
电缆及电缆组件	×	○	×	×	○	○
塑料和聚合物部件	○	○	○	○	○	×

○： 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
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Without internet access available, order hard copy documents or CD-ROMs with your Motorola Local Office or Representative.

If Motorola changes the content of a document after the original printing date, Motorola publishes a new version with the same part number but a different revision character.

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A banner (oversized text on the bottom of the page, for example, **PRELIMINARY — UNDER DEVELOPMENT**) indicates that some information contained in the document is not yet approved for general customer use.

Data encryption

In order to avoid electronic eavesdropping, data passing between certain elements in the network is encrypted. In order to comply with the export and import requirements of particular countries, this encryption occurs at different levels as individually standardized, or may not be present at all in some parts of the network in which it is normally implemented. The document set, of which this document is a part, covers encryption as if fully implemented. Because the rules differ in individual countries, limitations on the encryption included in the particular software being delivered, are covered in the Release Notes that accompany the individual software release.

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FCC requirements

Content

This section presents Federal Communications Commission (FCC) Rules Parts 15 and 68 requirements and compliance information for the (WAP25400) MOTOwi4™ Diversity Access Point .

Radio frequency exposure



WARNING

This equipment is designed to generate and radiate radio frequency (RF) energy. It should be installed and maintained only by trained technicians. Licensees of the Federal Communications Commission (FCC) using this equipment are responsible for insuring that its installation and operation comply with FCC regulations (47 C.F.R. & 1.1310) designed to limit human exposure to RF energy.

FCC Part 15 requirements

Part 15.19a(3) - Information to user



NOTE

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

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

Part 15.21 - Information to user



NOTE

Changes or modifications that change the FCC type approved configuration of the equipment could void the user's authority to operate the equipment.

15.105(b) - Information to user



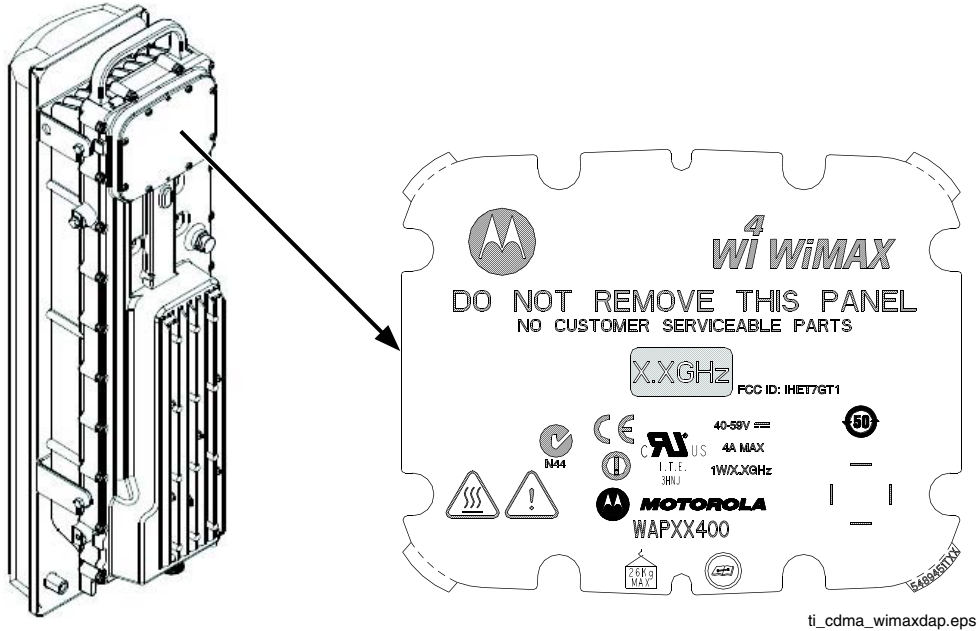
NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

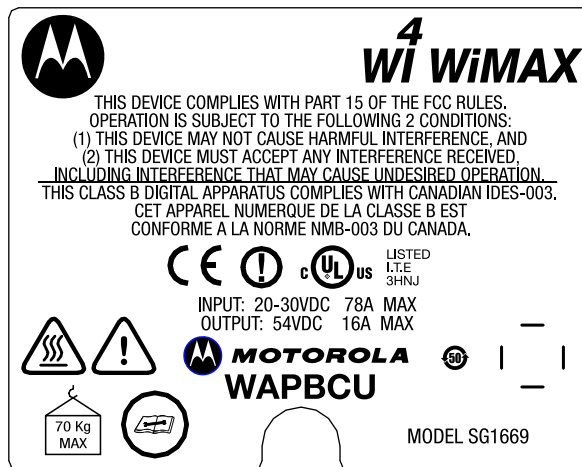
DAP label and location

A label similar to the one illustrated is located as shown. All symbols may not display on the label depending on the market.



BCU label

A label similar to the one illustrated is located on the equipment. All symbols may not display on the label depending on the market.



Overview

Introduction

This document provides information pertaining to the hardware and cabling installation for the outdoor and indoor (19 – inch rack) version of the *Motorola* Ground Based Access Point (GAP) Hardware.

This hardware installation manual ***does not include*** card and module placement, applying power, tuning, network configuration, software site commissioning, troubleshooting, etcetera. Refer to other associated manuals (product specific documentation, and product enabled, such as on-line help on the LMT or EMS).

Product Description

The *Motorola* Ground – based Access Point (GAP) hardware is made up of three main component assemblies; the Base Transceiver (sub) System (BTS) and the Battery Backup Unit (BBU). Two configurations are available; an indoor GAP, and an outdoor GAP. The indoor configuration is mounted in a standard 19–inch rack. The outdoor configuration is housed in two (typical) weather resistant cabinets. The outdoor cabinets may be mounted side-by-side, or stacked on top of each other.

The GAP BTS includes the Base Control Unit (BCU) cage and Transceiver modules (TRX) cage. The BCU contains signal processing and interface hardware. The TRX module contains an interface for the BCU, the TX (transmit) and RX (receive) components, and RF interface for the RF antenna(s). The RF interface is an external connection between the TRX module(s) and the RF antenna(s).

The GAP BBU (battery cabinet) is typically used in an outdoor configuration. The BBU contains batteries and/or additional TRX module cages for multi sector configurations. For indoor configurations, the battery supply would come from the battery room at the customer site.

Manual Order

This section outlines the content of this manual.. The appendices provide additional information about installation not otherwise covered in the chapters.

Chapter 1 – Overview This is a brief outline of the manual. It also provides a list of additional documents and tools necessary to complete the procedures.

Chapter 2 – Site Preparation This chapter contains the information for site verification and shipping and handling of the hardware.

Chapter 3 – Cable Descriptions This chapter contains general information on the cabling available for the BCU and RF Head.

Chapter 4 – Indoor Ground-based Access Point (GAP) Hardware Installation This chapter contains general information and procedures for installing the indoor (19 - inch rack) version of the Ground-based Access Point (GAP) hardware

Chapter 5 – Outdoor Ground-based Access Point (GAP) Hardware Installation This chapter contains general information and procedures for installing the outdoor (weather - resistant cabinet) version of the Ground-based Access Point (GAP) hardware

Chapter 6- Optional Equipment

Chapter 7- What's Next This chapter contains general information and procedures for installing optional equipment.

Chapter 8- XXXXXXXXXX This chapter contains general information and procedures for site clean up and installation checklist.

Appendix A – Alternate RF Head Installation Procedure This appendix contains general information and alternate procedures for RF Head installation.

Appendix B – Alternate RGPS Installation This appendix contains general information and alternate procedures for RGPS installation.

Appendix C – MMI Cable Fabrication This appendix contains general information and a procedure for manufacturing an MMI cable if the SLN2006A Kit is not available.

Recommended Documents

The following documents may be required to assist in the installation of the GAP Hardware.

- Standards and Guidelines for Communication Sites
 - Hard copy (*Motorola* Part Number 6881089E50)
 - CD-ROM (*Motorola* Part Number 9882904Y01)
- Site Document (generated by *Motorola* Systems Engineering), which includes:
 - site specific documentation
 - channel allocation
 - contact list (customer)
 - ancillary/expendable equipment list
 - site wiring lists
 - contact list (*Motorola* support)
 - job box inventory
- Demarcation Document (Scope of Work agreement)
- Installation manuals for non-*Motorola* equipment (for reference purposes).

Abbreviations and Acronyms

Table 1-1 lists the uncommon abbreviations and acronyms that appear within this manual.

Table 1-1 Abbreviations and Acronyms

Term	Definition
AP	Access Point
BBU	Battery Backup Unit
BCU	Base Control Unit
BCU I/O	Base Control Unit Input/Output
BTS	Base Transceiver (sub) System
CBC	Circuit Breaker Card
DAC	Direct Air Cooling
DAP	Diversity Access Point
GAP	Ground - based Access Point
GPS	Global Positioning System
PSU	Power Supply Unit
PSM	Power Supply Module
RFCU	RF Carrier Unit
RF GPS	RF Global Positioning System (typically regarding antennas)
RGPS	Remote Global Positioning System (typically regarding antennas with powered module / amplifier)
TRX	Transmit/Receive RF Module

Tools and Materials

Introduction

Many of the tools and materials depend on the GAP installation, being indoor or outdoor. The indoor GAP is mounted in a standard 19 - inch rack. The outdoor GAP is installed on a concrete slab. Tools and materials also depend on the style of the wall or pole on which the RF Head mounting bracket is being installed. Due to different mounting styles, additional tools and materials may be required to meet site specific needs.

Tools and Materials

The tools and materials listed in [Table 1-2](#) are generally recommended to properly and safely perform the various installation procedures. Not all tools will be used in all procedures.

Table 1-2 Tools and Materials

Hand Tool	Materials	Purpose
Adjustable Torque ratchet and metric/standard socket set	Customer Supplied	For general torquing of bolts and nuts.
Cordless Power Drill, 3/8-in or 1/2-in drive	Appropriate wood and masonry drill bits (Standard set may be adequate) Customer Supplied	Drill holes in wood and light concrete
Bucklestrap Cutting Tool	(Motorola P/N 6604809N01)	For the pole mounting brackets
Tape Measure	Customer Supplied	General purpose measurement
Tin Snips	Customer Supplied	General purpose metal cutting
Safety Glasses	Customer Supplied	Eye Safety
Knife or Box Cutter	Customer Supplied	General purpose cutting
13/16 Breakaway Torque Wrench 38-in. lb	Customer Supplied	N Connectors
Crane or industrial fork lift (must be rated for at least two ton capacity)	Customer Supplied	Used to transport and support for GAP cabinet(s)
Block and Tackle	Customer Supplied	High - capacity, 4 - point cable with hooks or carabiners used for transport and support for GAP cabinet(s)
No. 2 Blade Screw Driver	Customer Supplied	General purpose

Continued

Table 1-2 Tools and Materials (Continued)

Hand Tool	Materials	Purpose
Electrical Tape	Customer Supplied	General purpose
Adjustable Crescent Wrench	Customer Supplied	General purpose
Torx Screw Driver Set (T30 and lower)	Customer Supplied	General purpose
Tie-Wraps	Customer Supplied	General purpose, varying lengths.
Heat Shrink Tubing	Customer Supplied	General purpose, varying lengths and diameters
Heat Shrink Gun	Customer Supplied	General purpose
Crimp Tool	Customer Supplied	Ground wires

Site Preparation

This chapter provides general information for verification of the site prior to installation of the GAP hardware.

General

All customer sites have unique situations for installation of equipment. Specific site situations that affect installation need to be identified, and resolved if necessary, prior to the actual installation of any equipment.

Overview

The following sections provide 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.

Indoor and outdoor sites

Both indoor and outdoor configurations need to include compliance with local, state and country electrical and mechanical codes (building code). While low voltage for main power is typically used, proper cabling of the correct specification for power is required. Equipment weight and weight distribution needs to be considered for stable structural mounting. Adequate space around the GAP unit is required for proper air flow and maintenance. For indoor installations, proper room temperature and clean air flow also needs to be considered. For outdoor installations, proper clearance for the cabinet and cabinet doors needs to be considered for the installation and any subsequent maintenance procedures.

Site Preparation Overview

This section 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.

Installation

The site preparation depends on the type of installation and the site characteristics. The Base Control Unit (BCU) cage and associated TRX cage(s) may be installed indoors or outdoors. Indoor installations require the use of 19-inch rack (open style). Outdoor installations require a weatherproof enclosure (GAP cabinets). The RF and GPS antennas are cabled from the GAP equipment and are mounted outdoors.

Site Manager

The site manager is the person in charge of and is 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:

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

Initial site inspection

This section describes general items to consider for an initial site inspection.

Indoor initial site inspection

Indoor site inspections should include considerations for:

- General safety inspection to ensure a safe working environment for personnel and protection of equipment.
- Lighting and power for installation and maintenance personnel.
- Appropriate general space to install the GAP frame equipment.
- Availability of appropriate electrical ground connections for the GAP equipment.
- Access to, and routing of; input power, RF output, and general interconnection cabling space for the rack mounted equipment.
- Availability of appropriate rated input power; battery or main line voltage and current.
- Minimum distance to access the front and rear of the GAP equipment.
- Minimum distance for air flow circulation around the GAP equipment.
- Level surface and enough floor support to handle the weight of the GAP equipment, frame, and cabling.
- Staging area for equipment arrival, unpacking, and transportation equipment for moving the GAP equipment.
- Compliance with any site engineering documentation and specifications.

Outdoor initial site inspection

Outdoor site inspections should include considerations for:

- General safety inspection to ensure a safe working environment for personnel and protection of equipment.
- Lighting and power for installation and maintenance personnel.
- Configuration of the GAP cabinets, either side - by - side or stacked.
- Appropriate general space to install the GAP cabinets.
- Availability of appropriate electrical ground connections for the GAP equipment.
- Access to, and routing of; input power, RF output, and general interconnection cabling space for the GAP cabinets.
- Availability of appropriate rated input power; battery or main line voltage and current.
- Configuration and position of the concrete pad(s) to mount GAP cabinets.
- Level surface and the appropriate weight bearing characteristics of the concrete pad(s).
- Mounting structure for cable routing or environmental conditions; direct concrete mounting or with bottom I-beam support.
- Minimum distance to access the front and rear of the GAP equipment.
- Minimum clearance to open doors and panels on the front and rear of the GAP cabinets.
- Minimum distance for air flow circulation around the GAP equipment.
- Staging area for equipment arrival, unpacking, and transportation equipment for moving the GAP cabinets..
- Compliance with any site engineering documentation and specifications.

Prepare Site for Equipment Arrival

This section 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.

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 (staging 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 installation 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 GAP equipment

1	Consult with the site manager.
2	Locate the outdoor demarcation blocks for external (or internal, for rack installations) utilities. Verify that they are shown on any site engineering documents, and determine the required cable routing back to the equipment frames.
3	Verify the following: <ul style="list-style-type: none"> • AC or battery power is available and meets the site documentation specifications • Concrete pad, floor, outdoor pole and/or wall mounting structures are installed (if needed) and meet specifications in the site engineering documents • Outdoor cable runs are installed and meet local building codes • Customer input termination tie points are available

Continued

Procedure 2-1 Procedure to prepare the site for the GAP equipment (Continued)

	<ul style="list-style-type: none">• 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 (if needed) are installed
4	Note any concerns or conditions that may create a safety hazard to personnel, or impair the installation of the GAP equipment.
5	

Site layout inspection

Most of the site layout should have been inspected in the previous sections, and any special conditions noted. Consult with the site manager to resolve any outstanding condition that would impair the installation or safety of personnel. Correct all conditions and note any special instructions needed to install the GAP equipment. Verify with the site manager that any special instructions are related to the appropriate installation personnel.

Shipping and Handling

Overview

The purpose of this section is to describe how the GAP Base Transceiver (sub) System (BTS) (includes the BCU and TRX), Battery Backup Unit (BBU) and RF Head are packaged for shipping and how to correctly unpack the units in preparation for installation.

How Equipment is Shipped



CAUTION

The pallets containing the GAP equipment are heavy and require the use of an industrial fork-lift truck. For the outdoor GAP cabinet, the fork lift truck should be rated to handle at least two tons.

The GAP can be shipped in several configurations. The outdoor GAP is shipped as two units (typically as a BTS and a BBU). Both the GAP BTS and the GAP BBU are shipped on separate pallets with cardboard box coverings. The indoor GAP is packaged as separate containers in cardboard boxes strapped to a pallet. Plastic wrapping is used to encase the units and provide protection as well as securing the units to the pallets.

For indoor configurations, the BCU, and TRX cages, and other required and optional equipment, will be shipped in separate containers or on separate pallets. The containers, if used, will either be wood or cardboard, with packing material to protect the units.

For the indoor GAP:

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

For the outdoor GAP:

- The BTS cabinet is shipped with the BCU cage with all cards/modules and internal cabling installed.
- The BBU cabinet is shipped with all batteries and internal cabling installed.
- Depending on the ordered configuration, the TRX cage can be in either the BTS cabinet and / or the BBU cabinet.
- The TRX cage, with the installed TRX modules, will have all internal cabling installed.

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 fork lift, dollies and padding required to safely move the equipment from the unloading area to the cell site. The site should also have outdoor weather protection and power for temporary lighting and power tools.

Recommended Unpacking Tools

The following tools are recommended to assist in opening the containers housing the equipment:

- Tin snips.
- Knife, box cutter, or scissors.

Unpacking

This section describes unpacking the various units for the GAP.

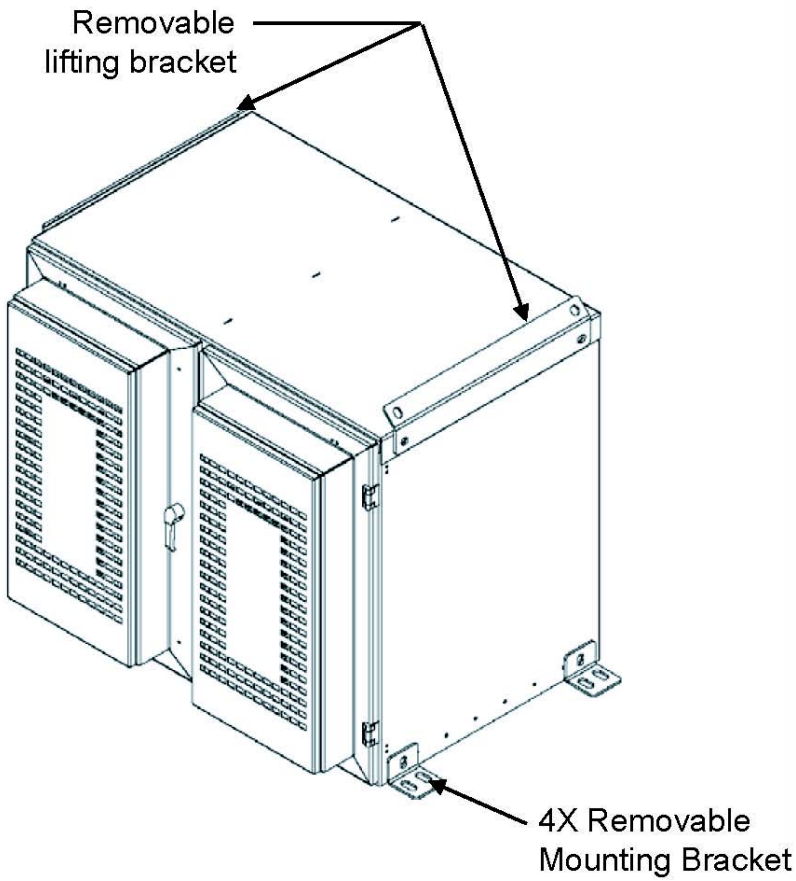
GAP equipment

The GAP equipment is shipped either as an indoor unit and as an outdoor unit. The indoor unit includes the BCU and TRX cages and is designed to fit in a standard 19-inch rack. The outdoor unit is comprised of two outdoor cabinets, the BTS and BBU. Both the BTS and BBU cabinets are pre-configured per order, and shipped with the internal cabling included.

Outdoor GAP

Installation of the two outdoor cabinets (BTS and BBU) mainly consists of mounting the unit, grounding cabling, main power cabling, cabling between cabinets and cabling between the TRX modules and the RF antennas.

Figure 2-1 GAP cabinet - lifting and mounting bracket locations



PRELIMINARY ILLUSTRATION

Unpacking procedure

Procedure 2-2

1	
2	
3	
4	
5	

Indoor GAP

The indoor BCU and TRX cages are internally cabled and installation mainly consists of mounting the cages in the indoor rack, grounding cabling, main power cabling, cabling between the cages, and cabling between the TRX modules and the RF antenna(s).

Unpacking procedure

Procedure 2-3

1	
2	
3	
4	
5	

Cable Descriptions

Individual installations at customer sites vary. This chapter describes the typical cabling for the GAP.

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 Indoor GAP 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 Descriptions and Part Numbers

Table 3-1 gives the cable descriptions and part numbers of the various cables that connect the GAP Base Control Unit (BCU), the GAP Battery Backup Unit (BBU), the GPS antenna, and the RF head.

Table 3-1 Cable Length Requirements

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)

Continued

Table 3-1 Cable Length Requirements (Continued)

Cable	Qty	Part Number	Description
		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)
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 gives the typical lengths of the various cabling.

Table 3-2 Cable Lengths

From	To	Cable	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)
BBU DC Source	BCU / TRX		
AC Source	BBU Customer Interface Compartment	E	Length as required.
DC Source	BBU Customer Interface Compartment	E	Length as required.
Customer Output Source	BCU Customer Interface Compartment	F	Length as required.

Indoor GAP Hardware Installation

This chapter describes guidelines for installing the GAP hardware in an indoor rack.

Indoor (rack - mount) GAP installation

This section provides information to install the Ground - based Access Point (GAP) in an indoor environment. This requires the use of a standard 19 - inch rack.

GAP rack - mount cages

Cards, modules, and batteries are installed separately in the GAP cages after the cages are mounted in a standard 19 - inch rack. Installation of the cards, modules, and batteries are customer site dependent, and are not specifically covered in this manual.

Indoor GAP product identification

This section shows the various configuration for indoor GAP cabinets.

BCU Cage and components

TRX cage and components

Rack mounting configuration

This section shows the typical mounting configuration of the GAP cages in a standard 19 - inch rack.

GAP rack mounting (typical)

Mounting and bolt configurations

This section describes different mounting bolt configurations and isolation considerations for both indoor and outdoor GAP installations.



WARNING

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



CAUTION

The pallets containing the GAP equipment are heavy and require the use of an industrial fork-lift truck. For the outdoor GAP, the fork lift truck should be rated to handle at least two tons (2000 lbs or 1000 kg).

Mounting hardware

Hilti Bolt

The Hilti bolt is a concrete anchor and bolt. This is shown below in [Figure 4-1](#)

Isolation washer

The GAP cabinet(s) or rack floor mounting is typically isolated using nylon isolation washers, and isolation pads bonded to the GAP floor mounting brackets. The isolation washer is shown as optional parts in [Figure 4-1](#) and [Figure 4-2](#). The isolation washer depicted in the figures is combination washer and bushing. *Motorola* recommends that the isolation washer be used, particularly for ease of installation, vibration suppression, and particularly for maintaining electrical ground isolation.

It may be necessary to ensure grounding isolation on an indoor GAP configuration using a rack. The rack floor mounting hardware may need to be modified slightly (hole mounting diameter) for the inclusion of the isolation washer. Additional isolation pads for the rack floor mounting tabs may also be necessary.

Installation on concrete

Concrete mounting is used in an outdoor GAP configuration. The same mounting can be used for an indoor rack mounting on a concrete floor.

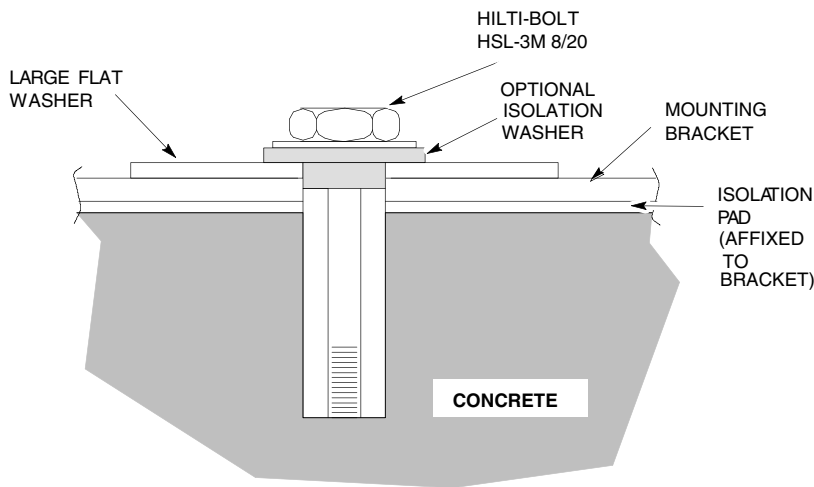


CAUTION

Due to the weight of the GAP cabinet, the supporting structure (concrete slab) must be able to withstand at least 1000 lbs (500 kg).

Refer to [Figure 4-1](#) for a typical cross - section of the concrete bolt mounting to the GAP cabinet or rack mounting brackets.

Figure 4-1 Concrete mounting



PRELIMINARY ILLUSTRATION

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Installation on wooden floor

Wooden floor mounting is typically used in an indoor GAP, rack mounting configuration.

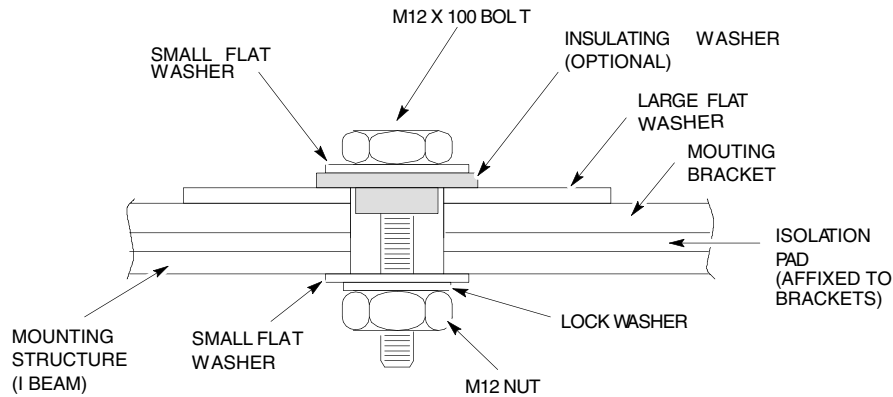


CAUTION

Due to the weight of the GAP components and rack, the supporting structure (floor deck) must be able to withstand at least 1000 lbs (500 kg). A structural floor support, such as an iron I-beam, underneath the wooden floor is recommended.

Refer to [Figure 4-2](#) for a typical cross - section of the wooden floor bolt mounting to the GAP cabinet or rack mounting brackets.

Figure 4-2 Wooden floor mounting



PRELIMINARY ILLUSTRATION

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Installation of GAP cages in the indoor rack

BCU cage

TRX cage

Rack cabling with cages installed

Cage to cage

External cabling to rack

Outdoor GAP Hardware Installation

This chapter describes guidelines for installing the GAP hardware cabinets in an outdoor environment.

Outdoor (cabinet - mount) GAP installation

This section provides general information to install the Ground - based Access Point (GAP) in an outdoor environment. Each customer installation will vary. All outdoor GAP installations require the use of a 5 - ft by 7 - ft concrete slab capable of supporting one ton (2000 lbs or 900 kg). Side - by - side cabinets will require the use of two 5 - ft by 7 - ft concrete slabs.

GAP cabinets

The GAP cabinet comes pre-loaded with hardware cages. Cards, modules, and batteries are installed separately in the GAP cages after the main mounting to a concrete or other support (re - enforced floor) surface. Installation of the cards, modules, and batteries are customer site dependent, and are not specifically covered in this manual.



WARNING

The GAP cabinets are heavy. The use of a crane and / or hoisting system that is rated to handle at least two tons (4000 lbs or 1800 kg) is recommended. A four-point hoisting cable with appropriate hooks or carabiners should be used to unload the GAP cabinet from the shipping pallet to the area of final installation.

Outdoor GAP product identification and configurations

The following sections outline general mounting configurations for the GAP product. This section also discusses common considerations when installing an outdoor GAP.

Common outdoor mounting information

This section outlines consideration common to any GAP outdoor installation. Concrete mounting and general clearance information is provided.

Stacked GAP cabinet configuration

This section shows how a typical GAP is configured as a pair of stacked cabinets.

Side - by - side GAP cabinet configuration

This section shows how a typical GAP is configured as a pair of side - by - side cabinets.

GAP concrete slab mounting

This section shows the typical mounting used on a concrete slab for the outdoor GAP cabinet(s). This section also applies to mounting the cabinets on a concrete floor as well.

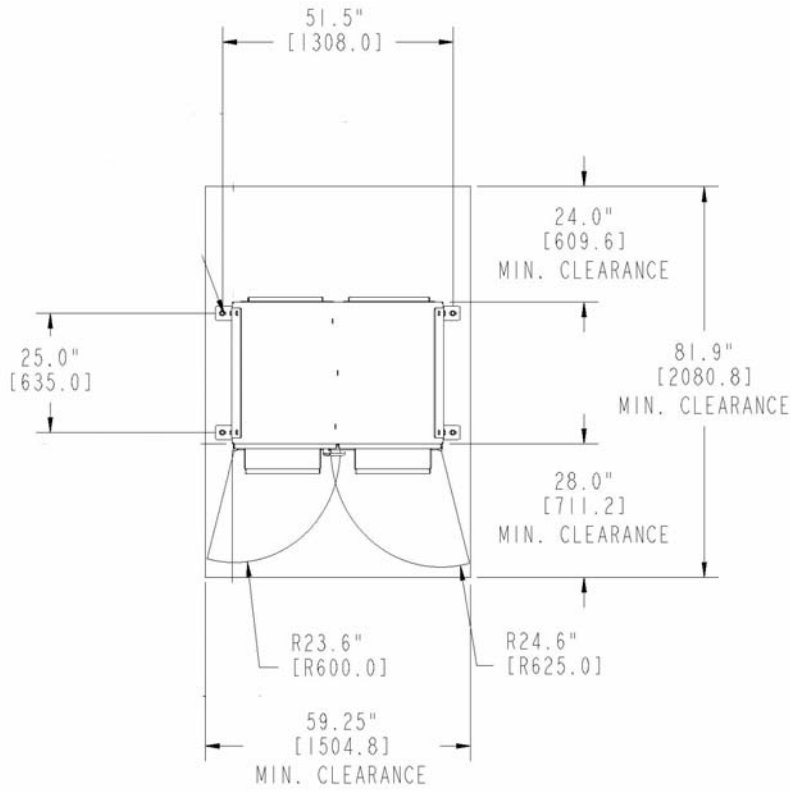
Installation Planning

Since customer site configurations vary, the mounting of the GAP cabinet on a concrete slab will vary. The installation needs careful planning before installing the GAP cabinet(s). Customer site physical dimensions, cabinet ventilation, adequate air space around the equipment, minimum cabinet door clearance and power routing all contribute to how to plan out the installation. For utility mains power (AC power), local and country electrical code rules must also be taken into consideration when planning the installation.

Concrete slab configurations

For a single cabinet, a 5 ft by 7 ft concrete slab is required. This also is the basic footprint of the door clearance needed around the GAP cabinet, when the cabinet is mounted in the center of the concrete pad as viewed from the top of the GAP cabinet.

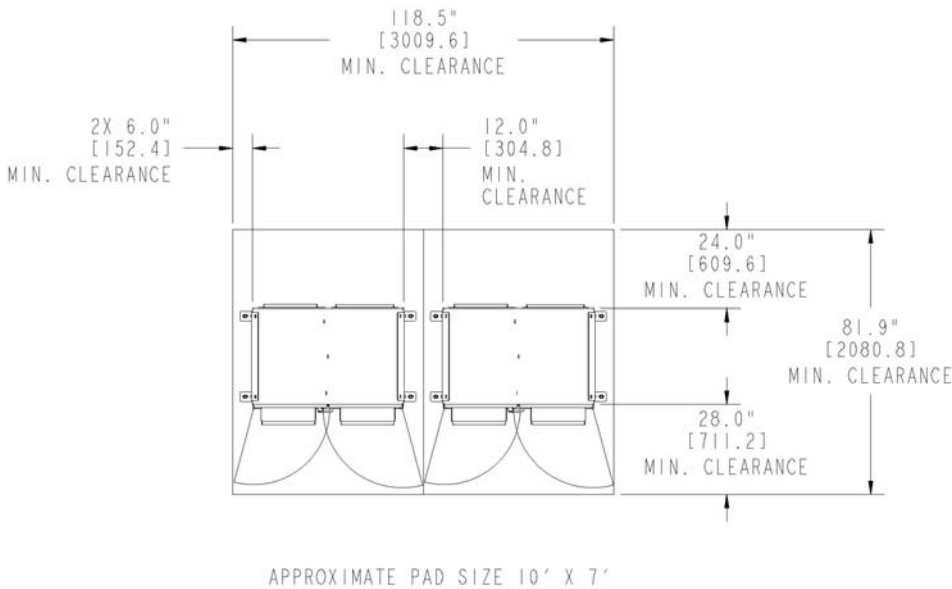
Figure 5-1 Single cabinet mounting



APPROXIMATE PAD SIZE 5' X 7'

PRELIMINARY ILLUSTRATION

Figure 5-2 Dual cabinet mounting

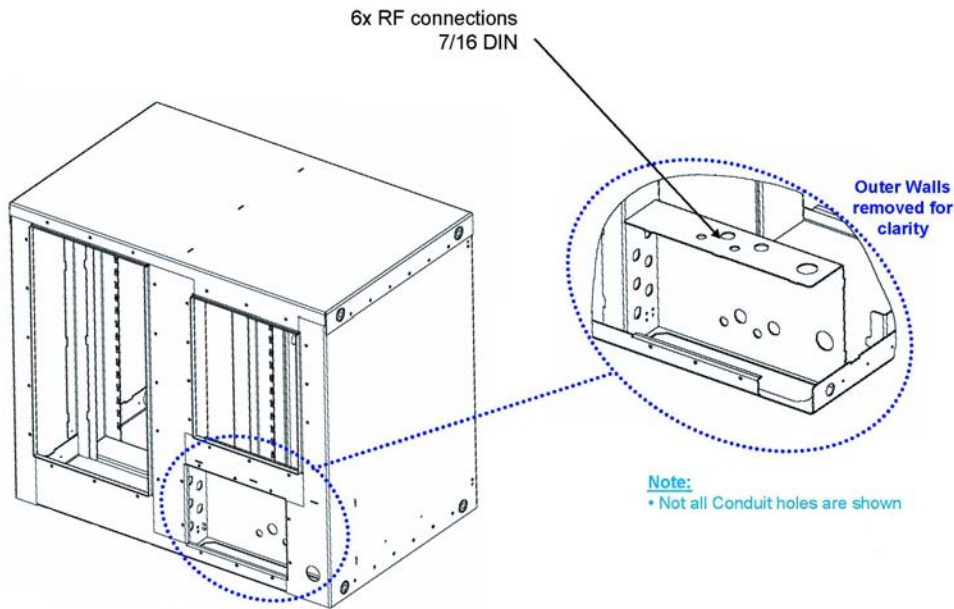


PRELIMINARY ILLUSTRATION

Cabinet mounting

Depending on how the external power and interconnections are run to the cabinets, this will determine if the GAP cabinets are mounted on a support between the concrete slab and the cabinet(s). Routing of the external power and interconnections between the cabinets is through the cabinet rear or underside of the cabinet. All external connection from a GAP cabinet is through the BTS cabinet, namely the "mud room". [Figure 5-3](#) shows the location of the mud room area on the BTS cabinet.

Figure 5-3 GAP BTS cabinet “mud room”

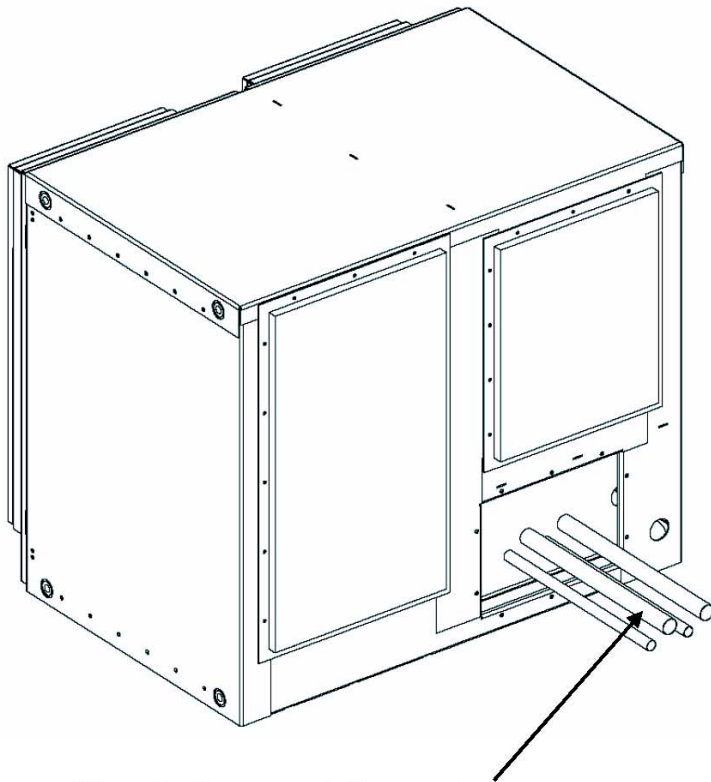


PRELIMINARY ILLUSTRATION

Conduit routed through back of BTS cabinet

Figure 5-4 shows the conduit routed through the back of the BTS cabinet. This will not require a support between the cabinet and the concrete slab. The cabinet may be mounted directly to the concrete slab.

Figure 5-4 "Mud room" conduit routed through back of BTS cabinet



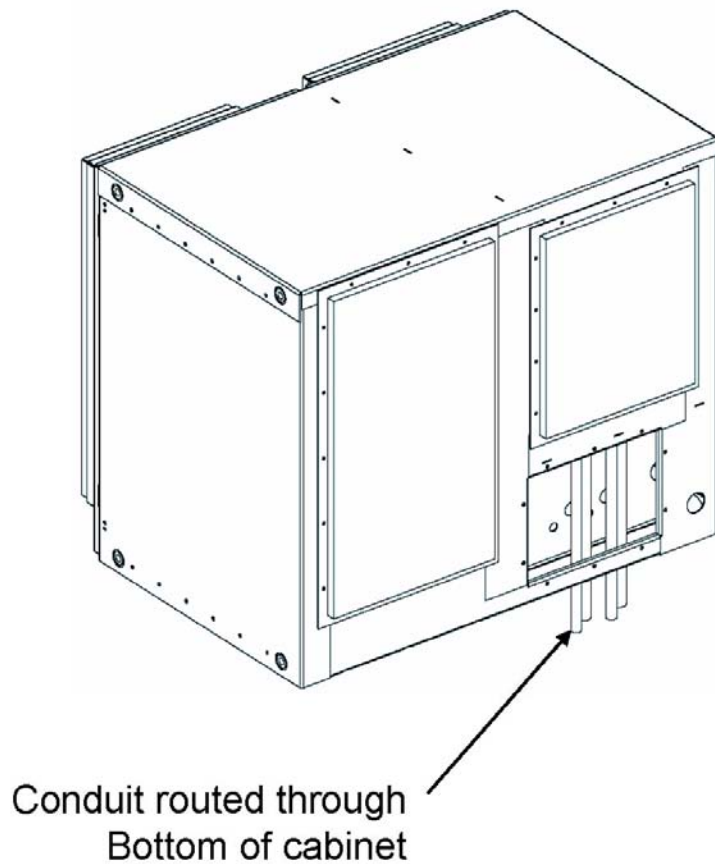
Conduit routed through
Back of cabinet

PRELIMINARY ILLUSTRATION

Conduit routed through bottom of BTS cabinet

Figure 5-5 shows the conduit routed through the bottom of the BTS cabinet. This will require a support between the cabinet and the concrete slab.

Figure 5-5 "Mud room" conduit routed through bottom of BTS cabinet



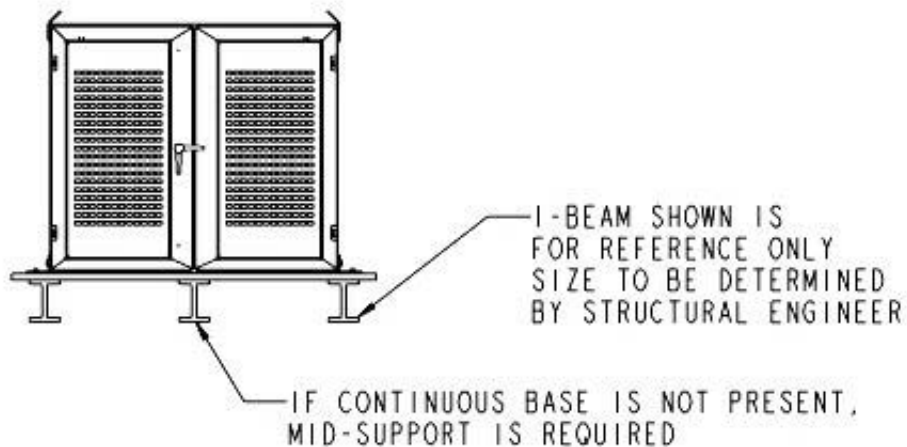
PRELIMINARY ILLUSTRATION

I-beam support

To elevate the GAP cabinet from the concrete mounting, an I-beam support can be used. Three I-beams are required for even support of the GAP cabinet. This description uses a 12 - inch I-beam to allow clearance for a 90 - degree flexible conduit bend. For utility mains power (AC power), local and country electrical code rules must also be taken into consideration for a minimum clearance bend.

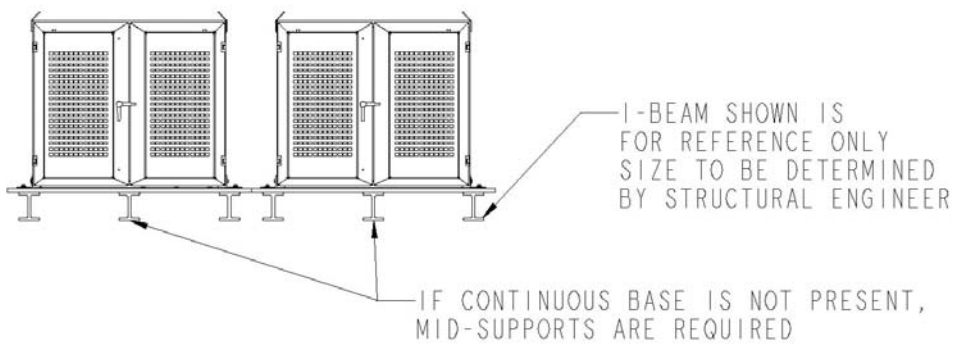
X and Y show typical supports for the GAP cabinets. Note that all installations require mid - support of the cabinet.

Figure 5-6 I-beam support for a single GAP cabinet



PRELIMINARY ILLUSTRATION

Figure 5-7 I-beam support for two GAP cabinets



PRELIMINARY ILLUSTRATION

Outdoor mounting and bolt configurations

The mounting of a GAP cabinet to an outdoor concrete slab is similar to mounting an indoor GAP frame to a concrete floor. The same techniques are used. The use of plated or painted bolts is recommended in the outdoor setting to resist rust.

Please refer to [Mounting and bolt configurations on page 4-5](#) for information pertaining to this topic.

Concrete pad installation and ground system

Materials needed



NOTE

Also see the tools list in the beginning of this manual.

Table 5-1 General materials needed

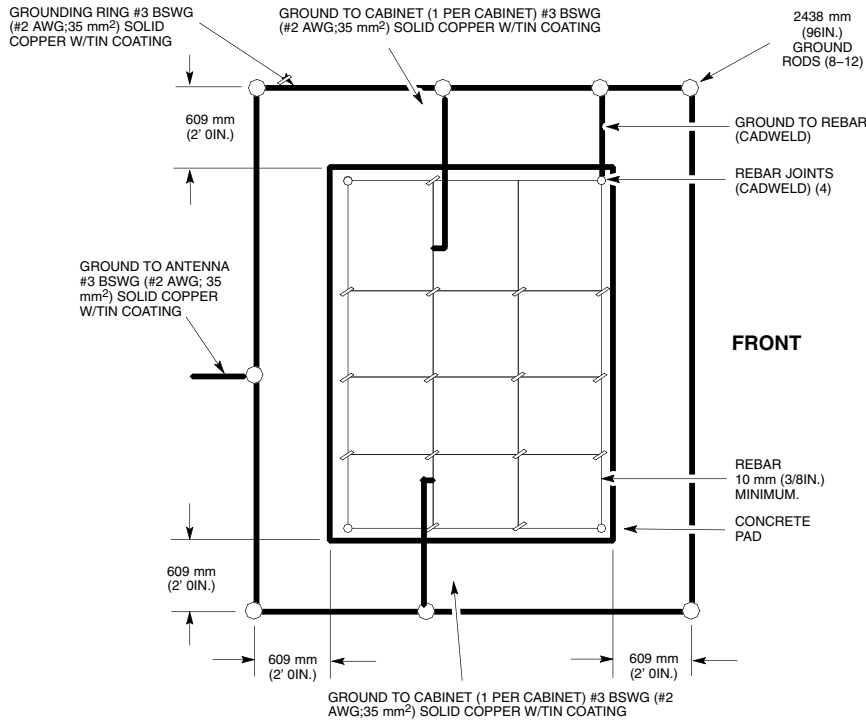
Quantity	Description

Procedure 5-1 Concrete pad and ground system Installation procedure

1	
2	
3	
4	
5	

Ground system

Figure 5-8 Ground ring layout

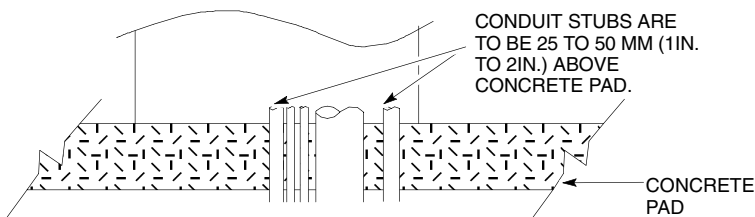


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Conduit routing through concrete slab

Conduit routing is customer site dependant. This section is included here for installations that use conduit routing integral to the concrete slab.

Figure 5-9 Conduit stub in concrete slab



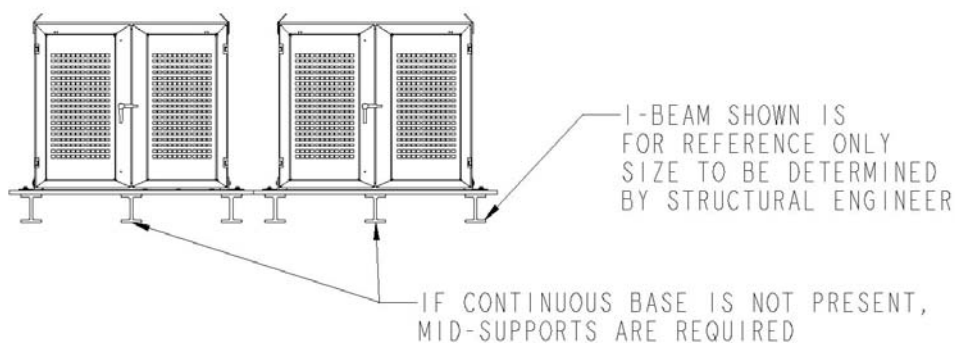
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GAP side - by - side configuration

This section shows a typical installation of the GAP side - by - side cabinet configuration.

Side - by - side cabinets

Figure 5-10 GAP cabinets

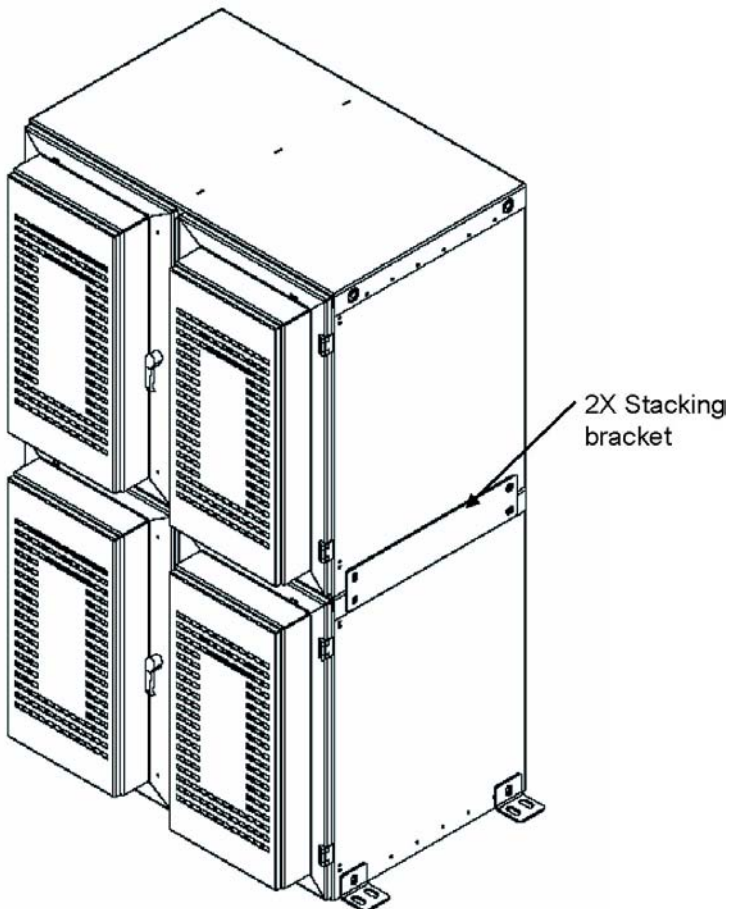


PRELIMINARY ILLUSTRATION

GAP stacked configuration

Stacked cabinets

Figure 5-11 GAP cabinets



PRELIMINARY ILLUSTRATION

GAP Cabinet cabling

Grounding

Cabling between cabinets

External cabling to cabinets

Other cabling

Optional Equipment

What's Next and Cleanup

Introduction

This section describes general information regarding the final steps of the installation.

These are:

- Clean up the site
- Fill out the installation completion checklist
- Optimize the system

Clean up the site

Clean up the site by following the information given in the *Site Cleanup* section in this chapter.

Installation checklist

After the site is cleaned up, fill out the installation completion checklist. This checklist is located in the *Installation Completion Checklist* section of this chapter.

Optimize the system

Optimize the system by following the procedures given in the appropriate optimization and other associated manuals (product specific, and product enabled, such as on-line help on the LMT or EMS).

This hardware installation manual does not include card and module placement, applying power, tuning, network configuration, software site commissioning, troubleshooting, etcetera.

Site Cleanup

Tools and storage

Place all hand and power tools in the installation tool kit or other appropriate place. Note any tools that need replacement, cleaning, or adjustment. Keep any tools unique to the *Motorola* equipment either at the site, or in an appropriate safe place for later use if needed, as specified by the site manager.

Tools unique to the *Motorola* site equipment can include, but are not limited to:

- Keys
- Special *Motorola* – supplied tools, such as a single-purpose security socket wrench
- Other third-party installation tools unique to the installation of the site equipment

Materials storage

Place any leftover (usable) materials in a location specified by the site manager.

Debris cleanup

Remove any packing material. Ensure that all scrap materials have been removed. Clean/sweep the floor. Ensure that all chalk line marks have been removed. Appropriately dispose of any hazardous waste as specified by the site manager.

Environment

Organize any items (manuals, materials, etc.) left on site and place them in a location specified by the site manager.

Other items unique to the *Motorola* site equipment can include, but are not limited to:

- Check for any safety hazards and correct if necessary as specified by the site manager.
- Site specific documentation
- Product manuals
- Other third-party installation documentation
- A copy of the installation checklist provided in this manual

Installation checklist

This section provides a *general* list of items to be checked upon the completion of the site installation.

Installation completion checklist

Fill in and check the items listed in the [Installation completion checklist on page 7-5](#), (below) comprised of [Table 7-1](#) and [Table 7-2](#)

Directions

If this manual is provided in electronic form, print out the following installation checklist. If a paper copy is provided, you may want to make a copy before filling out the checklist so that it is separate from this manual. Refer to the site manager. Fill out the installation completion checklist and make any necessary copies. Make copies of this checklist as needed. The item numbers listed in [Table 7-2](#) do not represent a specific order, they are supplied for convenience.

Installation completion checklist

Some of the following site information may not be available, such as a model number. Include a short description of the site information as specified by the site manager.

Table 7-1 Site information

Site information	Item entry
Hardware installation completion date:	
Site: (name and description)	
Serial number(s):	
Model number(s):	
Checklist completed by:	
Checklist reviewed by:	

Table 7-2 Checklist

Item no.	Item	Notes
1	Equipment is not damaged.	
2	Air flow clearance requirements are met.	
	Door opening clearance requirements are met.	
3	If indoor installation; GAP rack is securely mounted to floor.	
	If outdoor installation; GAP cabinet(s) is securely mounted to floor or concrete slab.	
	If outdoor installation; GAP cabinet(s) that are stacked are securely mounted together.	
	If outdoor installation; GAP cabling and conduit between cabinets meet local code requirements (for utility power), and are installed correctly. Flexible and rigid conduit is not stressed.	
4	BCU and RF Carrier Unit (RFCU) are RF cabled correctly.	
5	BCU and RFCU are DC power cabled correctly.	
6	BCU is ethernet cabled (if installed).	
	Fiber optic, power and RF (if required) cable between RF head and GAP is installed correctly.	
7	RF head is securely mounted to pole.	
	RF head is correctly cabled.	
8	Band pass filters are cabled to RFCU correctly (if used).	
9	Conduit is sufficiently grounded.	
10	Antennas are grounded to tower.	
11	The antenna cables are protected by lightning arrestors (if applicable).	
12	GAP is grounded.	

Continued

Table 7-2 Checklist (Continued)

Item no.	Item	Notes
13	RF Head is grounded.	
14	RGPS is cabled to BCU.	
15	RGPS head and mast are secure.	
16	RGPS connection is protected by lightning arrestors (if applicable).	
17	RGPS head has a clear view of the sky and is not in a location which accumulates debris. Make sure the RGPS is located away from the transmit antennas.	
18	Local GPS (RF GPS) antenna is secure (if used).	
19	Local GPS cabling is installed (if used).	
20	Installation hardware is removed.	
21	The site is cleaned, swept and trash removed.	
22	The site specific documentation is present at the site.	
23	This installation checklist is present at the site.	

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Alternate RF Head Installation Procedure

Alternate RGPS Installation

MMI Cable Fabrication