*IP*Series

B64700G25
700 MHz Base Station

Product Owner's Manual

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Operation is subject to the following two (2) conditions: (1) this devise may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

The following U.S. Patents apply to this product:

U.S. Patent numbers 5,640,695,6,018,647,6,243,393

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Product Description

✎ The content of this manual applies to all frequency ranges of the *IP*Series Base Stations, unless otherwise specified. This manual will note key differences between frequency ranges when appropriate.

The *IP*Series Base Stations are intelligent devices designed for stringent requirements of mobile data communication systems. Intended for mounting in rack units, the base station requires very little room at tower sites and may be connected via Serial Line Internet Protocol (SLIP) or Ethernet ports. The base station circuit boards are built using surface mount technology (SMT) and through-hole components. At the minimum, the unit requires a 13.8 VDC power supply, an antenna system, and a high-speed data connection to an Internet Protocol Network Controller (IPNC) system to operate. The base station is typically teamed up with a Power Amplifier (PA) and third-party system components such as antennas, preamplifiers, preselectors, filters, and combiners.

Figure 1: *IP*Series Base Station External Illustration (Front View)

Product Functionality

The base station utilizes an internal high-performance 4-level Frequency-Shift Keying (FSK) wireless data modem (19200 bps or 32000 bps) for 25 kHz channel spacing, a multi-layered approach to signaling reliability, including patented multi-receiver Intelligent Diversity Reception™, dynamic scrambling, data interleaving for burst error protection, Forward Error Correction (FEC), and Viterbi soft-decision algorithms.

The *IP*Series Base Station technology includes *IP*MobileNet's Diversity Reception (DR) capability. Diversity Reception reduces the number of fades and the effects of multi-path reception. With the use of three (3) antennas, mounted as far apart as possible on the base station tower, the Diversity Reception System (DRS) minimizes the effects of fading. One of the antennas is likely to receive a viable signal while the others may not. DRS minimizes fading effects by comparing the signal levels from the three (3) antennas, and selecting the strongest signal.

✎ Diversity is most effective when the vehicle using an *IP*Series Mobile Radio is in motion.

External Features

The base station technology is enclosed in a sturdy aluminum case. The external features consist of a series of connectors in the rear of the base station and light emitting diodes in the front of the base station, as described in this section.

The product warranty becomes void if an uncertified or unauthorized individual removes the base station cover.

Figure 2: External Connectors of an *IP*Series Base Station (Rear View)

The base station's rear external features consist of the following connectors and ports:

TABLE 1: EXTERNAL FEATURES (Rear)

FEATURE	DESCRIPTION
TX	Transmitter antenna connection
RX1/RX2/RX3	Receivers 1, 2, and 3 antenna connections
Power Connector	13.8 VDC base station power connector
Serial Port 1 (DB9M)	RS232 Serial Line Internet Protocol (SLIP) interface port
Serial Port 2 (DB9F)	ANSI/TTY Terminal Connection (used for programming) (9600 bps, no parity, 8-databits, 1-stop bit)
Ethernet Port	RJ45 Ethernet 10 Base T interface port
GPS	SMA GPS antenna connector

The base station's front external features consist of six (6) LED (light emitting diodes) indicators defined as follows:

TABLE 2: EXTERNAL FEATURES (Front)

LED Name	When lit….
TX	Indicates that transmission is in progress
CD	Carrier detect indicates an RF message is detected
RX1	Indicates that receiving is in progress on Receiver 1
RX2	Indicates that receiving is in progress on Receiver 2
RX3	Indicates that receiving is in progress on Receiver 3
POWER	Indicates the base station is powered on

Base Station Setup

Intended for rack unit configuration, the base station can be installed in an existing rack or assembled into a rack of its own.

Rack Unit Mounting

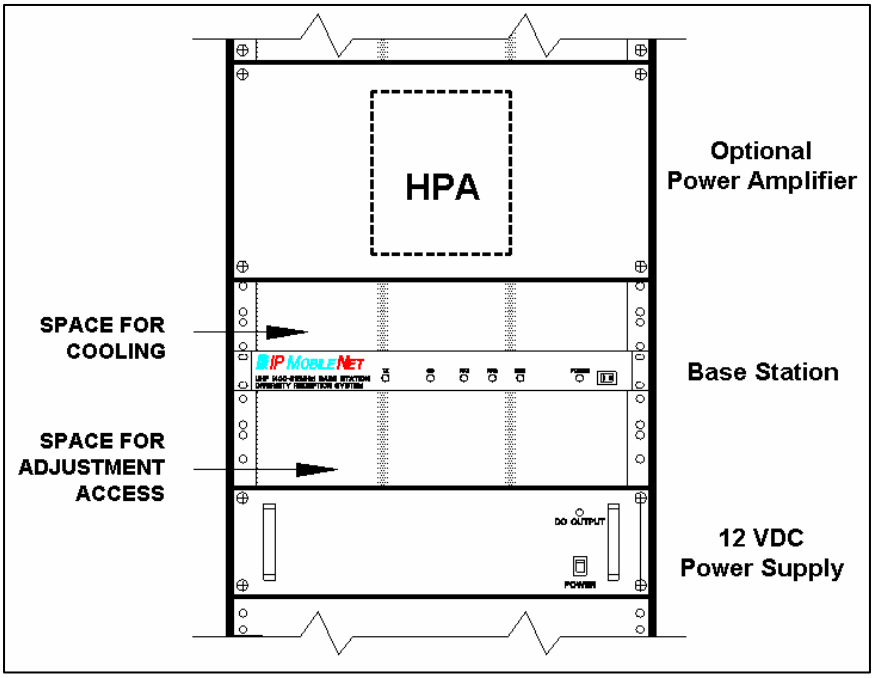

Figure 3: Base Station Mounting in the Rack Unit (Front View)

Table 3 lists the required components for a base station setup.

TABLE 3: BASE STATION COMPONENTS REQUIRED FOR INSTALLATION	
QTY	**DESCRIPTION**
1	Frequency appropriate *IP*Series Base Station
1	Ethernet cable
1	5’ DC power input cable with connector
4	RF coaxial cables (may require an additional cable if connecting the base station to a power amplifier)

Installation Overview

This chapter provides the basic setup involved in the installation process of an *IP*Series Base Station. For backhaul requirements, refer to Appendix A of this document.

Standard considerations such as air flow clearance above the base station for heat dissipation and ensuring adequate space exists behind the base station for the routing of cables are of primary importance.

A minimum clearance of 1 rack space is recommended for natural convection cooling. Adjustment points are available through holes in the base station's bottom cover. Sufficient space below the base station should exist to facilitate adjustments.

Coax, power, and interface cabling service lengths with neat routing will make the removal and replacement of the base station easier for functional testing and maintenance purposes.

To prevent injury and damage to the base station, exercise extreme caution throughout the installation process and follow the reminders listed below.

- Follow safety precautions for handling rack unit installations.
- **Do not** alter the components listed in the Installation Requirements section, unless substituions are noted within this chapter.

Installation Instructions

If setting up a new rack unit, make sure to complete the rack unit setup according to the Manufacturers' instructions.

Base Station Installation into the Rack Unit

Receiver and Transmitter Connections

To connect the base station, perform the following steps:

Step 1 Connect the RF coaxial cable to Receiver 1 (RX1) on the back of the base station.

Step 2 Route the cable neatly toward the top of the rack. Allow a little slack in the cable to avoid accidental disconnection.

Step 3 Connect the RF coaxial cable to Receiver 2 (RX2) on the back of the base station.

Step 4 Route the cable neatly toward the top of the rack. Allow a little slack in the cable to avoid accidental disconnection.

Step 5 Connect the RF coaxial cable to Receiver 3 (RX3) on the back of the base station.

Step 6 Route the cable neatly toward the top of the rack. Allow a little slack in the cable to avoid accidental disconnection.

For clear identification for troubleshooting and/or maintenance activities, avoid crossing the coaxial cables.

Step 7 Connect the RF coaxial cable to the Transmitter (TX) connection on the back of the base station.

Step 8 If connecting to a power amplifier (as shown in the figure below), connect the cable from the base station to the power amplifier via the Transmitter (TX) connection.

If not connecting to a power amplifier, skip to Step 11.

Step 10 If a power amplifier is used, connect an RF coaxial cable to the output port of the power amplifier.

Step 11 Route the cable neatly toward the top of the rack. Allow a little slack in the cable to avoid accidental disconnection.

Step 12 To perform the RX1, RX2, RX3, and TX antenna connections, refer to the *Typical Antenna Configuration* section in this chapter.

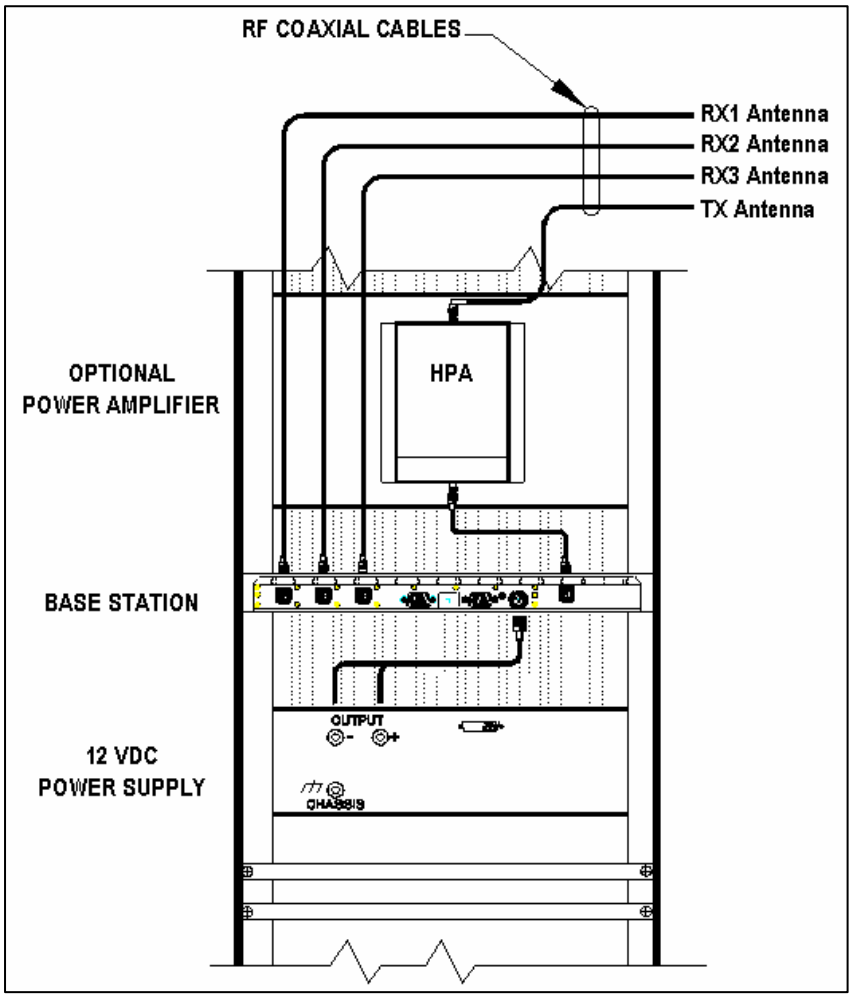

Figure 4: Base Station Mounting and Connection in the Rack Unit (Rear View)

Single Base Station Configuration

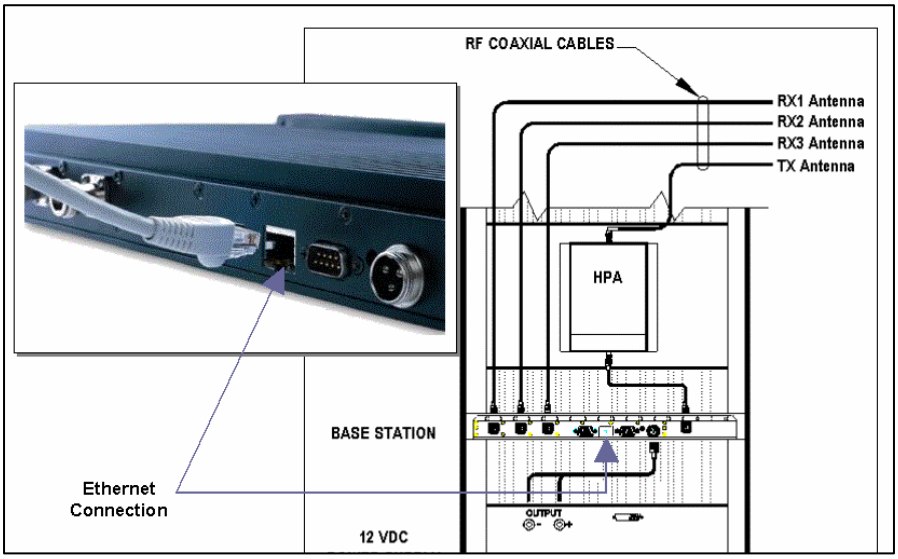

Figure 5: Base Station Ethernet Connection

NOTE: The base station shown in the figure only displays Ethernet connectivity and is not display the actual 700 MHz base station.

To connect a single base station, perform the following steps:

Step 1 Plug in the Ethernet crossover cable into the Ethernet port on the base station (as shown in the figure above).

Step 2 Route and plug in the other end of the Ethernet crossover cable to an *IP*MobileNet's Internet Protocol Network Controller (IPNC) via the hardware as defined by the organization's configuration.

If connecting to a Serial backhaul, an *IP*MobileNet *IP*Turbo Converter is required. For connection instructions, refer to the *IP*Turbo Converter Quick Reference Guide (IPMN p/n: 516.80496.QR) available on the Product Documentation CD provided with this product.

Multiple Base Station Configurations

To connect multiple base stations, perform the following steps:

Step 1 Plug in the Ethernet cables to the back of each base station (as shown in the figure above) and route according to selected setup. Refer to the *IP*Turbo Converter Quick Reference Guide (IPMN p/n: 516.80496.QR) for setup instructions and scenarios.

Step 2 Route and plug in the Ethernet cables to an *IP*MobileNet's Internet Protocol Network Controller (IPNC) via the hardware as defined by the organization's configuration.

If connecting to a serial backhaul, an *IP*MobileNet *IP*Turbo Converter is required. For connection instructions, refer to the *IP*Turbo Converter Quick Reference Guide (IPMN p/n: 516.80496.QR).