



**SPECTRIAN**  
**MCPS2135 SERIES**  
**MCPA**  
**MultiCarrier Amplifier Systems**

**INSTALLATION & OPERATION**  
**MANUAL**

July 2001

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# 1 Introduction

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Chapter 1 introduces the MCPS2135 Series of Multi Carrier Power Amplifier (MCPA) Systems. It describes structure of this manual and introduces the different MCPS2135 Series amplifiers.

## 1.1 About this Manual

The following manual describes how to install, operate, and maintain the MCPS2135 series of amplifiers. It is arranged into the following sections.

Section 1, *Introduction*, introduces the systems in the MCPS2135 family and their main features and describes how the system documentation is organized.

Section 2, *Preparation and Planning*, contains information helpful for planning the installation and assuring proper preparation for the installation.

Section 3, *Installation Instructions*, describes how to properly install the MCPS2135 amplifier system.

Section 4, *System Start-up*, has procedures for power-up and initial check out of the MCPS2135 amplifier system.

Section 5, *System Monitoring*, presents information on basic and optional methods of MCPS2135 system monitoring.

Section 6, *Troubleshooting and Maintenance*, describes how to diagnose faults using the indicator LED's and status/alarm messages. Section 6 also has instructions for routine maintenance and for installation of new field-replaceable modules in the MCPS2135 amplifier


Appendix A1, *Spectrian, Inc. Company Offices*, contains company locations and other contact information.

Appendix A2, *Electrical Specifications*, details the electrical specifications met by the MCPS2135 amplifier systems, including the Connector Pin-outs and Interface Protocols used in the front panel diagnostic port and the optional base station alarm and control interfaces.

Appendix A3, *Mechanical Specifications*, includes mechanical and environmental specifications met by the MCPS2135 amplifier systems.




Appendix A4, *MCPS2135 System Check Out*, has the procedure for a quick operational check of the MCPS2135 amplifier system.

Throughout this manual, notes, cautions and warnings are used with this convention:

- *Note: Suboptimal or out-of-specification performance will result from not following the instructions presented in 'notes'.*
- \* *Caution: Follow 'caution' notes to avoid possible damage to equipment.*
-  *Warning: Injury to personnel, equipment fire, or other hazardous situations will result from not properly following 'warning' instructions.*

## 1.2 Safety Information

The MCPS2135 has been designed for maximum safety and reliability when it is installed, used, and maintained in accordance with the procedures and instructions in this manual by trained and qualified technicians. To ensure the safe and compliant operation of the system, always follow the safety and operational recommendations in this manual.

-  **WARNING: The MCPS2135 produces high levels of RF radiation. Severe radiation burns can occur if recommended safety precautions are not strictly observed.**
  - Do not operate exposed circuitry or radiating elements with personnel in close proximity to the radiating source. Always replace covers and shields during operation.
  - Persons with cardiac pacemakers should avoid exposure to RF radiating elements.
  - Exposing the human eye to high levels of radio-frequency radiation may result in the formation of cataracts.
-  **WARNING: Do not install or operate the MCPS2135 amplifier in the presence of flammable gases or fumes.**
-  **Each RF Module and the shelf subassembly weigh 22.7 kgs (50 lbs); when crated for shipping an MCPS2135 system can weigh in excess of 131.5 kgs (290 lbs) and be unbalanced. To avoid injuries or damage, use care and obtain assistance when lifting MCPS2135 components.**
- \* *Always use the recommended safety equipment.*
- \* *Please read and understand all instructions and warnings before handling an MCPS2135.*
- \* *MCPS2135 amplifiers may only be installed in restricted access areas (dedicated equipment rooms, equipment closets, or the like) in accordance with Article 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA No. 70.*

## 1.3 Introduction to the MCPS2135 Family

The MCPS2135 is a modular, ultra-linear cellular-frequency amplifier system providing up to 500 Watts (total) of output power. Designed for maximum flexibility and reliability, the MCPS2135 can increase the range and capacity of new or existing base stations.

## **Modulation Formats**

The MCPS2135 can amplify any number of signal carriers using AMPS, CDPD, IS-136 TDMA, [IS-136HS GSM](#), [IS-136HS EDGE](#), or IS-95 CDMA modulation up to the maximum rated system output power.

## **Modularity**

The MCPS2135 family is designed for operation with 1 to 4 amplifier modules, each providing up to 135 Watts of RF output power (exclusive of combining losses).

## **Mounting Configurations**

The MCPS2135 amplifier systems are available in a variety of configurations. Mounting kits are available for installation in 19-inch, 23-inch, 600mm, 24-inch, or 25-inch equipment racks. Multi-module shelves are 8 RU (14 in.) high. Single module shelves are 3 RU (5.25 in.) high.

## **Peripheral Products**

Spectrian offers optional products to assist in base station configuration and set-up. Among these products are multi-port RF combiners, bandpass filters, preamplifiers, and AC/DC power rectifiers. Please consult with the factory or sales for more information on these peripheral products.

## **RF Interfaces**

The Spectrian MCPS2135 has a single RF input for combined input signals, and a single RF output to the transmit filter. There is also a single module configuration with three input connectors combined within the amplifier and a single output connector.

## **Alarms and Control**

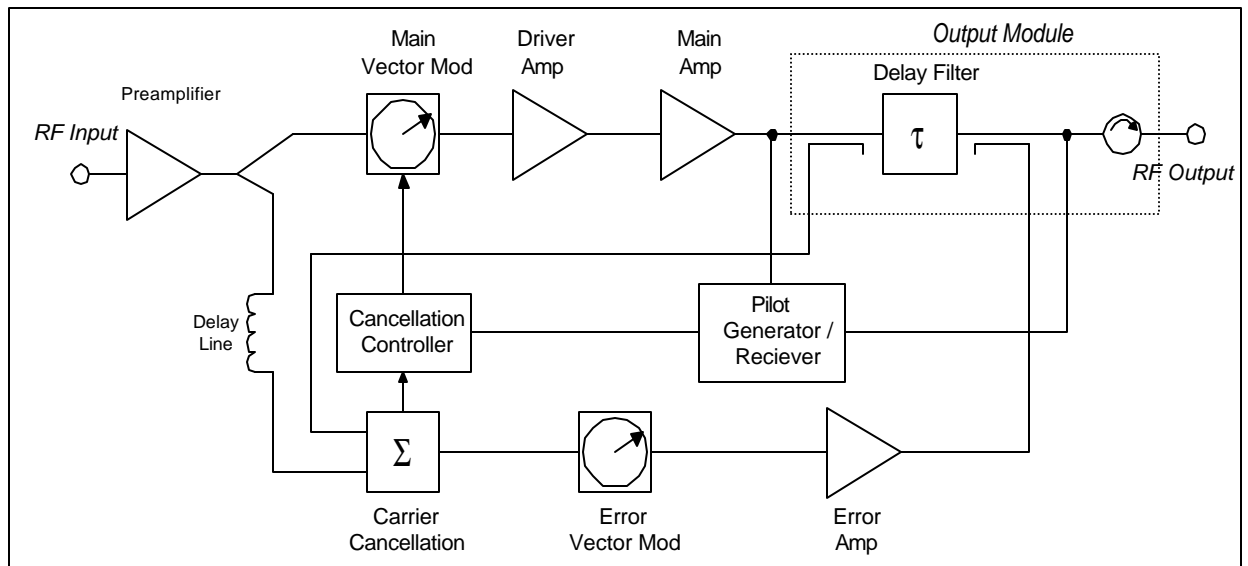
The MCPS2135 system provides visual status information through front-panel LED indicators. Status information is also transmitted via a front-panel RS-232 port using Spectrian's optional Graphical User Interface program.

The MCPS2135 can also be optionally equipped with additional alarm and control interfaces, including dry-contact or TTL alarm connections RS-232 or RS-422 interfaces to network operations and administration systems.

The MCPS2135 is designed to enable system maintenance without removing the amplifier from service. In multi-module (high power) systems, the RF modules can be hot-swapped during operation without affecting calls in process. The Amplifier Management Module (AMM) can be easily replaced in the field. The amplifier modules are designed so the cooling fans can be replaced in the field by qualified service technicians, greatly reducing service shipping costs and turn-around time.

### **1.1.11.3.1 MCPA Module Functional Description**

To achieve the high level of linearity required to support multiple cellular carriers at the minimum cost, the RF modules in the MCPS2135 use a single loop feed-forward correction architecture with two amplification paths – the *main path*, containing the main amplifier, and the *error path*, containing the error amplifier. The combination of these two paths in a feed forward loop configuration results in a signal in which the distortion products have been cancelled, enabling highly linear operation of the amplifier.



**Figure 1: RF Module Functional Block Diagram**

#### **1.1.11.3.1.1 Main Loop**

The output of the main amplifier contains both the desired signal and Inter-modulation Distortion (IMD) products. This signal is coupled off and combined with the undistorted input signal coupled off the preamplifier. The relative delay and phases of these signals are adjusted so they combine to cancel out the desired signal, creating an error signal composed of only the main amplifier IMD products. The cancellation process is controlled by a Digital Signal Processor, which insures optimum carrier cancellation over all environmental conditions.

#### **1.1.11.3.1.2 Error Loop**

The error signal is amplified in the error loop. The amplified error signal is then combined with the output of the main amplifier containing both the desired signal and distortion products such that the distortion products cancel. The error loop provides the adjustments and controls necessary to assure that the amplitude, phase and delay of both signals result in the desired cancellation.

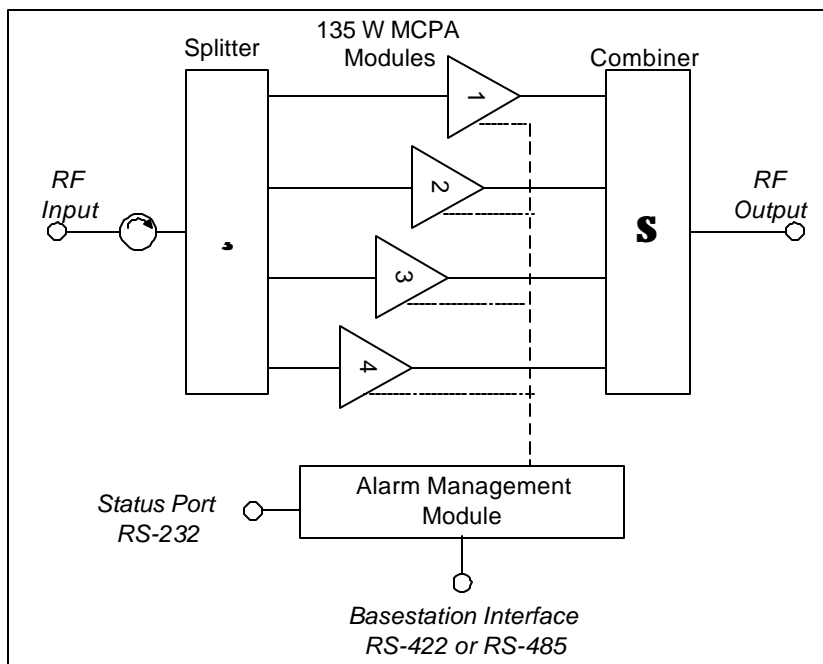


### 1.1.1.31.3.1.3 **Amplifier Management Unit**

The Amplifier Management Unit (AMU) monitors and controls performance of the various subassemblies within the RF module. The AMU provides operating status information via front panel LEDs. Within a multi-module system, the AMU provides status to the MCPS2135 AMM.

### 1.1.21.3.2 **MCPS2135 Amplifier System**

A fully-equipped MCPS2135 consists of a rack-mounted shelf containing up to four RF modules. Multi-module systems contain an Alarm Management Module, and an internal divider/ combiner. A block diagram of the system is shown in Figure 2.



**Figure 2 System Block Diagram**

The standard MCPS2135 configurations are summarized in Table 1. Please consult the factory or Spectrian sales for configurations not listed here.

<b>Power</b>	<b>Dimensions (W x D x H)</b>	<b>Comments</b>
135W	5.25" x 18" x 14"	Single module with communication interface
135W	19" x 18" x 3 RU	Single module configuration in 19 in. housing
135W	23" x 18" x 3 RU	Single module configuration in 23 in. housing
250W to 500 W	23" x 18" x 8 RU	2 to 4 modules combined
250W to 500 W	24" x 18" x 8 RU	2 to 4 modules combined 24 inch rack config

**Table 1: MCPS2135 System Configurations**

### **MCPA modules**

The RF modules are ultra-linear amplifiers optimized for high power amplification of cellular signals. Each RF module provides up to 135 Watts of RF output power. Multi-module systems have combiner losses which reduce the output power of each module to approximately 125 Watts. The RF module has been discussed in section 1.2.1

### **Amplifier Management Module**

The Amplifier Management Module (AMM) contains the system control and alarm management logic and the interface to external operation and control systems.

### **Divider/Combiner**

The divider/combiner used in multi-module systems allows the RF modules to function as a single system. The combiner has an active architecture, which automatically reconfigures to minimize combining losses if an RF module should fail.

## 2 Planning and Preparation

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### 2.1 Installation Planning

It is important to ensure proper planning and site preparation is complete prior to beginning the installation of the MCPS2135. The following sections describe installation considerations and the information required before beginning the installation procedure. Spectrian Applications Engineering is always available to assist with planning for the installation of the MCPS2135.

#### 1.22.2 Site Planning Guide

For each MCPS2135 cell site installation, there must be a Site Planning or Site Engineering guide giving the detailed information on the site considerations, rack installation, cable connections, and Radio Parameters.

- *Note: Local building and fire codes govern the manner in which some site preparation and installation tasks are performed. Spectrian recommends that you consult your local building inspector or a licensed engineer to ensure that the site installation conforms to local building codes.*

### 2.2.1 Site Considerations

#### ***Intended Installations***

The MCPS2135 system is intended for installation only in restricted access areas (dedicated equipment rooms, equipment closets, environmental shelters, or the like) in accordance with Articles 110-16, -17, and -18 of the National Electrical Code, ANSI/NFPA No. 70.

#### ***Weight***

The MCPS2135 shelf and each RF module weigh approximately 50 pounds (22.7 kg); the fully equipped system weighs 250 pounds (113.3 kg). The system must be installed, using the appropriate mounting kit, into a rack capable of supporting the unit, and located on a floor or surface capable of supporting the combined weight of the rack, the MCPS2135, and the installer or technician.

#### ***Floor Covering***

If you intend to use a floor covering under the MCPS2135, avoid combustible materials, industrial carpeting, and materials that will permit generation of electrostatic charges.

#### ***Illumination***

The MCPS2135 is designed to be installed and serviced under normal workroom lighting. During installation, room lighting must be bright enough to allow reading instructions and inspection of modules, but not so bright as to interfere

with viewing the status LED indicators on the front panel. The MCPS2135 should be oriented or shielded so that direct sunlight does not fall upon the front panel.

#### ***Fire Protection***

Spectrian recommends that the MCPS2135 installation site be equipped with smoke detectors and an automatic fire-extinguishing system. In addition, for personnel safety, the site should be equipped with a portable halon or CO<sub>2</sub> fire extinguisher.

#### ***Altitude***

When installing the MCPS2135 above 5000 ft (1542 m), derate the maximum operating temperature by 2° C per 1000 ft (304 m) above 5000 ft.

#### ***Ventilation***

The MCPS2135 requires unrestricted airflow around the MCPS2135. The site must be ventilated or air-conditioned so that ambient air does not exceed 50° Celsius (122° F).

#### ***Ambient air quality***

The MCPS2135 should be installed in a location that is free of airborne dust and toxic or corrosive fumes.

#### ***Vibration and Noise***

The MCPS2135 tolerates moderate levels of vibration and ambient noise. The MCPS2135 should not be installed in a location subject to mechanical shocks or vibrations conducted from nearby mechanical equipment. The MCPS2135 generates fan noise below 65 dBa during operation and no additional acoustic treatment of the site is needed.

#### ***Lightning Protection***

Spectrian recommends that all power, RF, and signal lines that connect to the MCPS2135 be protected by approved lightning arrestors. Your local fire or safety codes will determine the type of lightning protection required.

#### ***Grounding***

Spectrian recommends that the MCPS2135 and entire equipment rack be grounded with an engineered grounding system, including a ground halo and ground rods.

### **1.1.22.2.2 Rack Installation Considerations**

#### ***Rack Space***

Multi-module MCPS2135 systems require 8U of rack space in a 23" or a 24" rack. Optional mounting hardware for other rack sizes is also available. When used, the optional preamplifier requires an additional 2U above the shelf. Single module shelves require 3U of rack space.

#### ***Clearance***

During operation, the MCPS2135 requires front cabinet clearance for unrestricted cooling air input, plus a minimum of 4 inches (102mm) behind the MCPS2135 to exhaust hot air. Some additional rear clearance is desirable to accommodate routing the RF input and output cables and the DC power cables to their connections on the rear of the unit.

### 1.1.32.2.3 Cable Connections

#### **DC Power Supply**

The MCPS2135 requires customer-supplied connections to the site +27 VDC power supply. The MCPS2135 is normally connected to the power supply with a separate connection for each RF module; a single connection to each shelf is also possible using the optional shelf power bus. Table 2 shows the required current and recommended power service for MCPS2135 systems with the indicated number of active amplifier modules installed in a system shelf.

# RF Modules	RF Output Power	$I_{(Max)}$ , 27 VDC	Recommended Service
1	135W	55 Amps	2 wires (2/module), #6AWG, #10 lugs 1 ea. 60A Circuit Breaker
2	250W	110 Amps	4 wires (2/module), #6AWG, #10 lugs 2 ea. 60A Circuit Breaker
3	370W	165 Amps	6 wires (2/module), #6AWG, #10 lugs 3 ea. 60A Circuit Breaker
4	500W	220 Amps	8 wires (2/module), #6AWG, #10 lugs 4 ea. 60A Circuit Breaker

**Table 3: Individual Power Connections to each RF Module**

#### **Single Bussed Connection**

When using the bussed connection option, the service should be sized for a fully equipped shelf. This will provide adequate service with capacity for future expansion.

Recommended Service: 2 Wires, #2AWG, ¼” narrow tongue lug (T&B 55116 or equivalent); 1 ea. 240A Circuit Breaker.

#### **Chassis Ground Wire**

The MCPS2135 shelf requires a customer-supplied chassis ground connection using #8AWG with a ¼” ring lug .

#### **RF Input and Output Cables**

The MCPS2135 requires a single customer-supplied SMA male RF input cable and a single customer-supplied male type-N RF output cable. The RF output cable must be rated to properly handle the MCPS2135 output power. The female connectors are on the rear of the MCPS2135 shelf. Spectrian offers optional RF cables for use in connecting the MCPS2135 amplifier.

#### **Alarm Interface Cables**

The MCPS2135 requires customer-supplied interface cables to the system alarm interfaces. The standard system has screw terminal connections to form C-relay alarm contacts; optional RS 422 serial connections are also available. The alarm connection options for the MCPS2135 are listed in Appendix A3.

### **Radio Parameters**

To set up the MCPS2135, the installer must know the following radio parameters for the MCPS2135 installation.

- Total Planned Output Power
- Number of CDMA Frequency Assignments and power of each FA
- Number of AMPS/TDMA/CDPD Channels and power of each channel
- Planned System Gain

### **Installation Equipment**

Refer to the Tools and Materials listing in the following sections for the required MCPS2135 installation and test supplies.

## **1.32.3 Determine the required RF input power**

Before applying RF input power to the MCPS2135, determine the input drive level and output power needed for each channel being amplified by using the RF Drive Power Worksheet, shown below.

Once the required RF input power for each channel is determined, continue to the next step, setting the RF input drive power.

## RF Drive Power Worksheet

A) Total output power ( $P_{OUT}$ ) required =	W	dBm
B) Determine total output required for each fully loaded CDMA Frequency Assignment (FA):  # of FA's = total power per FA = total CDMA power ( $P_{CDMA}$ ) =		
Total available analog power ( $P_{AN}$ ) = ( $P_{AN} = P_{OUT} - P_{CDMA}$ )		W
D) Total # of analog channels, including setup (#ch) =		
E) Maximum per channel analog output power ( $P_{AN/ch}$ ) = ( $P_{AN/ch} = P_{AN}/\#$ of channels)	W	dBm
F) System Gain (Gain) *		dB
G) Maximum composite input power ( $P_{IN}$ ) = ( $P_{IN} = P_{OUT}$ in dBm – Gain in dB)		dBm
H) Maximum per channel analog input power ( $P_{IN/ch}$ ) = ( $P_{IN/ch}$ in dBm = $P_{AN/ch}$ in dBm – Gain in dB)		dBm

\* *NOTE: Depends on configuration which is factory settable from 30 dB to 60 dB. On single module systems, the gain may be adjusted by the end user with Spectrian's Graphical User Interface software. Consult with factory or Spectrian Sales for more information.*

### 1.1.12.3.1 Set RF input drive power for each channel

\* **Caution:** *If the RF Input Cable is connected to the MCPS2135, disconnect it from the MCPS2135. Connect the RF input cable to the Power Meter for the following step.*

\* **Caution:** *Make sure that the power to be measured with the meter does not exceed the manufacturers recommended maximum input level.*

Switch on the RF input drive power at the customer provided host system exciter following the instructions supplied with your RF source equipment.

Set and verify the RF input drive level for each individual channel

1. Key-on each RF input channel individually.
2. Monitor the RF input using a HP436A or equivalent power meter.
3. Verify that the maximum input power for the channel does not exceed the calculated levels on the RF Drive Power worksheet (line H).
4. Key off the channel and repeat for the remaining channels. Continue to verify the required channel input power is not exceeded.

After verifying the power of each individual channel individually, ensure that the total average input power remains less than or equal to the maximum rated composite power calculated in (G) of the worksheet.

1. Key-on all channels at one time, including any CDMA F.A.s, and measure input power.
2. If the average composite input power exceeds the calculated average composite input power (line H), readjust all channels as necessary to ensure average input power remains less than or equal to specifications.

Turn off all channels. The drive power is now set properly.

#### **1.42.4 Prepare for Installation**

Before beginning the installation, verify that all the necessary site and radio information, installation materials, tools, and MCPS2135 equipment are on hand. Correct any problems or omissions before continuing. Refer to the following Receiving and Unpacking Procedure to prepare the MCPS2135 equipment.

#### **1.1.12.4.1 Inventory Received Equipment**

1. Upon receipt of the MCPS2135, remove the packing lists, installation kit, and other documents attached to the shipping container.
2. Examine shipping documents to make certain that they agree with your copy of the order. If there is a discrepancy between the order and the items or quantity shipped, contact your Spectrian Customer Service representative listed in Appendix A1 of this manual.
3. Check the packing list and verify that all necessary equipment has been delivered, and that the parts are undamaged. If any evidence of shipping damage is noted, notify the delivery agency before continuing.

\* ***Caution: If the container or contents appear to be damaged, you must contact the carrier without delay and file a damage claim. If shipping damage occurred, the carrier may wish to have a claims agent present when the MCPS2135 is unpacked and inspected. To protect your warranty rights, you must also notify your Spectrian representative and advise that the MCPS2135 was damaged during shipment.***

### **2.4.2 Unpack Received Equipment**

Uncrating, inspecting, and preparing the MCPS2135 for site installation will require some tools and materials not included in the shipment. Use of the following materials is suggested to perform these tasks.

- ***Note: Assemble all tools, materials, and safety equipment before beginning work.***

#### **Safety Equipment**

- Safety glasses



- Work gloves
- Steel-toe shoes
- Back-support belt

#### ***Tools***

- Box knife
- Pair of large scissors
- Inspection flashlight or lamp
- Pen or pencil
- Strap cutter
- Straight-blade screwdriver

#### ***Other Materials***

- A copy of the Purchase Order
- A copy of the Packing List

#### ***Unpack equipment***

1. Open the shipping container(s) and inspect the contents. Using the required safety equipment and tools, carefully cut the metal and/or nylon straps that surround the shipping containers. When using a box knife or scissors, take care not to damage the contents of the box. Take care to avoid scratching the cabinet finish.
2. Do not remove the ESD protective wrapping that surrounds the cabinet, unless wearing an ESD protective wrist strap. If possible, remove this material by unwrapping the MCPS2135 by hand, rather than cutting this material with scissors or knives. Spectrian recommends not removing the protective wrapping until installation.
3. Remove spacers, packing inserts, protective coverings, plastic bags, and other shipping materials from the outside of the MCPS2135. Avoid using knives or scissors to perform this task.
4. Carefully collect and dispose of the packing materials. Many of the packing materials used by Spectrian are suitable for recycling and need not contribute to landfills.
5. While inspecting the unpacked MCPS2135, compare the quantity and labeling of each module with shipping documents and the purchase order. If there is an unresolved discrepancy between the order and the items received, contact your Spectrian representative.
6. Inspect the MCPS2135 exterior for evidence of shipping damage. Metal surfaces should not be dented or scratched. Panels, handles, screws, and indicators should appear undamaged and properly aligned. Connectors should be tightly affixed to the cabinet, with no visible dents or distortion.

*Note: If you discover damage during inspection, contact the shipper and Spectrian at once. The shipper will furnish instructions on how to document the discovered damage. Spectrian will arrange to promptly ship replacement parts.*

### **2.4.3 Repackaging for Return Shipment**

If it is necessary to repackage the MCPS2135 for return shipment, contact Spectrian Customer Service for detailed instructions. If possible, use the original cartons and inserts to package equipment for return. Otherwise, use suitable shipping cartons and foam inserts to prevent damage in transit.

## 3 MCPS2135 Installation

### 3.1 Introduction

The following section describes how to install the MCPS2135 series amplifier in a base station.

Each MCPS2135 system features rear-access RF input and output connectors, a DC voltage input receptacle, and a front-access RS-232 status interface connector. Additional optional features include a rear-access RS-422 serial interface connector and a remote alarms interface connector. Specific connector pinout information for your MCPS2135 configuration is provided in Appendix A3.

Please read and understand the instructions and warnings in this section and at the beginning of this manual before handling or unpacking the MCPS2135 modules.

The MCPS2135 is designed to be installed by trained and qualified technicians.



**Warning:** Each MCPS2135 amplifier module and the shelf subassembly weigh 50 lbs (22.7 kgs); when crated for shipping an MCPS2135 system can weigh in excess of 290 lbs (131.5 kgs) and be unbalanced. To avoid injuries or damage, use care and obtain assistance when lifting a crate containing MCPS2135 components.



**Caution:** Do not attempt to move an MCPS system with modules installed.



**Caution:** Provide bottom support when removing an MCPA module to avoid damage to the fan housing.



**Note:** Local building and fire codes govern the manner in which some site preparation and installation tasks are performed. Spectrian recommends that you consult your local building inspector or a licensed engineer to ensure that the site installation conforms to local building codes.

#### 1.23.2 Task safety equipment, tools and materials

The following safety equipment, tools, and materials are recommended to perform the installation tasks in this section.

##### Safety Equipment

- Safety glasses
- Work gloves
- Back-support belt

##### Tools

- Heat Gun (Master 10008 – MAS or equivalent)

- Cable Cutter (Klein 63050)
- Flat and Phillips screwdrivers
- Adjustable wrench
- ESD protective wrist strap
- Inspection lamp or flashlight
- Crimping tool (T & B TBMS or equivalent)
- Digital Volt Meter (DVM)
- Torque Driver (Mountz TLS1360 or equivalent)
- Current Meter
- Wire Strippers (Greenlee 45109 or equivalent)

### **Materials**

- Pressurized can of spray-on contact cleaner
- Rack-mounting hardware and fasteners
- DC Power, RF, and signal cables
- Crimp-on circular lugs
- 8 AWG insulated (green) copper ground wire
- Shrink Tubing

## **3.3 Rack Installation**

The MCPS2135 series amplifiers mount in the equipment rack using rack-mounted side support rails .

The MCPS2135 shelf subassemblies are labeled with the part and serial numbers, using standard EIA part identification, date code, and serializing methods. It is also labeled with the appropriate FCC approvals.

All MCPS2135 shelf subassemblies contain all internal wiring for DC power and RF signal distribution to the RF modules and the interfaces to the cell site. Brushless DC cooling fans are mounted on each RF module; cooling air is drawn through grille openings in the front of each module and discharged through the rear.



**Warning:** *The MCPS2135 shelf sub-assembly weighs approximately 50 lbs (22.7 kg). Use caution when lifting; obtain assistance if necessary.*

### **3.3.1 Install Shelf Subassembly**

1. Make certain that adequate vertical space within the rack enclosure is available. Verify that there will be at least 4 inches (10cm) of space behind the unit when installed for cooling air flow.
2. Put on an ESD protective wrist strap, and properly ground it.
3. Unpack the MCPS2135 side mounting rails and attachment hardware and install them in the rack as shown on the accompanying job sheet.

4. Unpack the MCPS2135 shelf and record its serial number. Ensure the shelf is in the proper upright vertical orientation and slide it onto the mounting rails.
5. Use the supplied mounting screws to attach the shelf to the rack. Tighten rack mounting screws securely.

### **3.3.2 Install Modules in Shelf**

1. Unpack each RF module. Align each module with the guides in an amplifier slot and slide the module as far as possible into the shelf, making sure the module is fully seated. Note that each module weighs approximately 50 lbs (22.7 kg); get a helper to assist if necessary. Tighten the fasteners at the bottom of each faceplate to lock the modules in place.
2. Unpack and install the Amplifier Management Module (AMM) module in the rightmost slot of the shelf. Tighten the fastener at the bottom of the faceplate to lock the module in place.
3. Inspect the alignment of the finished installation, and adjust if needed. If no problems are found, rack installation is complete.

## **3.4 Cable and Wire Connections**

### **3.4.1 Connect Chassis Ground Wire**

1. Locate the chassis ground stud on the rear of the MCPS2135 for ground wire attachment.
2. Measure the distance and routing between the MCPS2135 ground stud and an attachment point to earth ground. Cut a length of #8 AWG insulated (green) solid copper wire sufficient for the connection.
3. Crimp a ¼” circular lug to one end of the ground wire.
4. Remove the nut and lock washer on the MCPS2135 ground stud. Attach the DC ground wire lug to the grounding stud on the MCPS2135, and replace the lock washer and nut. Tighten the nut securely.
5. Connect the other end of the ground wire to the appropriate earth ground.
6. Use a DVM to verify that the resistance between the chassis ground and true earth ground is less than 100 Ohms.
7. Inspect the finished connection. If no problems are discovered, ground wire installation is complete.

### **3.4.2 Connect DC Input Power Cables**

The MCPS2135 power connection can be made using a pair of wires for each RF module, or via a single bussed connection. The DC input voltage cabling must be terminated by crimped lugs and sized to the correct wire gauge to accommodate the wire length and the DC current requirements of the MCPS2135 in accordance

with local building codes and industry practice. Refer to Table 2 for the recommended power supply circuit and wire sizing for each option.



**WARNING:** *Do not perform DC lead installation with energized leads. Ensure that the DC power supply is OFF for all installation activities!*

1. Locate the positive and negative terminals on the customer-provided DC power source, and verify polarity with a DVM.
2. Locate the power supply lugs at the top of the rear of the shelf subassembly. The four #10 lugs are for the per-RF-Module connection option, the single pair of ¼” lugs are for the bussed power option. Determine which set of lugs will be used for this installation.
3. Measure the distance and routing between the power source and the MCPS2135 DC lugs.
4. For each power connection being made, cut equal lengths of wire for power and return. Strip and connect each wire to the appropriate power connection, using the crimping tool and the supplied ground lug.



**Caution:** *Verify the polarity of each supply wire prior to connecting them to the shelf subassembly. A reversed-polarity connection will severely damage the MCPS2135 and will void the product warranty.*

5. Crimp the appropriate terminal lugs onto each power supply wire.
6. Attach one positive supply wire and one return wire to each of the four sets the power supply lugs at the top of the rear of the shelf subassembly. Tighten the attachment nuts firmly.
7. Inspect the finished connection. If no problems exist, the DC input power cable installation is complete.

### 3.4.3 Connect RF Output and Input Cables

The MCPS2135 has one female type-N amplified RF output for connection to a customer-supplied coaxial cable terminated with a male connector, and one female SMA RF input for connection to an customer-supplied input cable terminated with a male SMA connector.



**WARNING:** *Do not perform RF cable installation with DC power applied to the MCPS2135. Ensure that the input DC power supply is OFF before handling RF cables.*



**Caution:** *The Output cable must be connected before connecting the Input cable.*



**Note:** *The integrity of RF cabling is critical to the electrical performance of the MCPS2135. Ensure connectors are properly assembled, are free of debris, and are clean.*

1. Locate the male N-type RF output connector on the end of the coaxial cable attached to the output load. Inspect the connector and clean if necessary; fix any problems with the cable or connector before proceeding.

2. Locate the female N-type RF connector labeled “RF OUTPUT” on the MCPS2135.
3. Screw the male cable connector firmly onto the female RF output connector of the MCPS2135.
4. Locate the male input RF connector on the end of the coaxial cable from the RF signal source. Inspect the connector for damage or irregularity, and fix any problems with the cable or connector before proceeding.
5. Locate the female SMA connector labeled “RF INPUT” on the rear of the MCPS2135.
6. Screw the male cable connector firmly onto the MCPS2135 female connector.

### **3.4.4 Connect Alarm Interface Cables**

1. The MCPS2135 provides optional factory-configured connections for dry contact, TTL, or RS-422 communications and alarm output to the customer system. Refer to the connector pin-out and descriptions in Appendix A3 for the connections applicable to your MCPS2135.
2. Locate the interface connectors located on the rear of the shelf subassembly behind the Amplifier Management Module (AMM). Inspect the connector and clean if necessary; correct any problems with the cable or connector before proceeding.
3. Connect the male connector or input wires to the connector mounted on the MCPS2135. Tighten the two screws on the cable connector (if any) firmly.

## **3.5 Completing the Installation**

### **3.5.1 Set the MCPS2135 unit address**

Each MCPS2135 may be configured with a unique address (0 – 7) for commands and status reports sent through the RS-422 port.

If this option is included in the MCPS2135, locate the rotary switch on the rear of the MCPS2135 Amplifier Management Module. Set the switch to the desired address.

### **4.1.23.5.2 Verify Installation**

Recheck all physical and electrical connections to the MCPS2135 and remedy any problems discovered.

Once the installation is verified, the MCPS2135 is ready to be set up and placed in service, as described in the next section.

# 4 System Start-Up

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## 4.1 Introduction

This section contains instructions on powering up the MCPS2135 amplifier system. These procedures should be followed after installing the MCPS2135 amplifier system in the rack.

### 4.24.2 Safety Information and Tools

To avoid injury, installers, technicians, and maintenance personnel must follow Spectrian's recommended procedures and observe safety precautions.



**Warning:** *The MCPS2135 should only be operated by trained and qualified personnel. Always follow safety warnings.*



**Warning:** *Persons with cardiac pacemakers should avoid exposure to RF radiating elements. Exposing the human eye to high levels of radio-frequency radiation may result in the formation of cataracts. Do not operate exposed circuitry or radiating elements with personnel in close proximity to the radiating source. Always replace covers and shields during operation.*

.

**Note:** *Before shipment, the MCPS2135 was inspected and found free of mechanical and electrical defects. The electrical performance of the MCPS2135 should be verified using these procedures. If there is any deficiency, or if electrical performance is not within specifications, notify your Spectrian representative immediately.*

### Tools

The following tools are recommended to perform installation tasks.

- HP 436 Power meter
- Digital Volt Meter (DVM)

## 4.3 Verify system installation

Before operating the MCPS2135, verify proper installation as described in the previous section.

1. Verify that there are no obstructions to airflow in the front or rear of the MCPS2135.
2. Ensure that the DC power supply at the site is functioning normally. DO NOT turn on the DC supply to the MCPS2135 at this time.
3. Ensure that the MCPS2135 is physically connected to an input RF signal source and terminated in an output load. Ensure that the RF signal level has been set properly. DO NOT turn on the RF signal source at this time.



4. If used, verify that the MCPS2135 address is set correctly.



**WARNING:** *The RF output of the MCPS2135 should be connected to a 50-ohm load before DC power is turned on. The load must be capable of dissipating at least 500 watts average power and 6,300 watts of peak power.*

After mechanical and electrical installation tasks are complete, the MCPS2135 is ready for power-on check.

#### **1.44.4 Power Up the MCPS2135**

- \* **Caution:** *Read and understand all of the following steps before taking any action.*
- . **Note:** *The MCPS2135 should be powered on and enabled before the RF input power is applied.*
  1. Switch on the DC input power to the MCPS2135. Measure the input voltage at the bus bar connections at the rear of the unit and verify it is 27VDC. Adjust the power supply if necessary.

Following the power-up self-test, the MCPS2135 AMM **POWER** LED should be GREEN, indicating that the unit is functional and that in input voltage is between 24 and 28 VDC. If the **POWER** LED is amber, red, or does not light, turn off the DC input power and correct the power supply fault.

The ENABLE switch should be “ON”. The MCPS2135 RF modules will automatically be ENABLED. All four LEDs on each MCPA module should be GREEN.

To DISABLE an RF module, set the front panel ENABLE/DISABLE switch to DISABLE; the **ENABLE** LED will then be RED.
  2. Wait 5 minutes for the MCPS2135 to reach a stable operating temperature and to charge the real-time clock backup power. DO NOT apply commercial traffic signal power during this time.
  3. If the MCPS2135 is connected to a remote operations center via one of the rear panel interface connections, verify no alarms have been reported.
  4. Verify that all MCPS2135 status LED indicators remain GREEN.
  5. If any LED indicators are AMBER or RED, then RF modules are disabled or there is a problem which must be remedied before continuing. Refer to section 6, Troubleshooting.
- \* **Caution:** *Before applying RF input power to the MCPS2135, verify that the applied RF input power for a single channel and the sum of all channels is below the calculated maximum rated RF input.*

# 5 MCPS2135 System Monitoring

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## 5.1 Introduction

This section describes methods for monitoring the MCPS2135 amplifier system operation.

### 1.25.2 Monitoring the MCPS2135 System Operation

The MCPS2135 Amplifier Management Module (AMM) has a front panel RS-232 status port. This port provides the option to monitor the operation and status of the MCPS2135 using a laptop computer, if desired.

A LabView-based Graphical User Interface (GUI), which can run on Windows95<sup>®</sup>, 98, or NT4.0-based laptop computers is available from Spectrian.

### 1.35.3 Alarm Definitions

Fault management may be accomplished by various means with the MCPS2135. The MCPS2135 includes alarm LEDs, an RS-232 diagnostics port, and an optional base station status/alarm interface. These LEDs may be used for visual diagnostics by on-site technicians. Refer to Section 5 for details on the MCPS2135 alarm and protection circuits.

### 1.1.15.3.1 Alarm classification

The MCPS2135 fault management subsystem classifies faults into three categories. In order of escalation, these are *minor* faults, *major* faults, and *critical* faults.

#### 1.1.1.15.3.1.1 Minor Alarm

A minor problem exists, but the fault does not require a module to be taken out of service.

*Routine* service attention is recommended.

#### 1.1.1.25.3.1.2 Major Alarm

A major problem exists such that the MCPS2135 is not meeting all performance specifications, but the unit is not automatically disabled.

*Urgent* service attention is required or the unit may take itself out of service.

### 1.1.1.35.3.1.3      **Critical Alarm**

A major failure or a condition exists that could result in damage. The MCPS2135 is automatically taken out of service.

*Immediate* service attention is required.

### 1.1.25.3.2      **Alarm Responses**

The fault management system automatically responds when a fault is detected. Responses vary in impact from alarm notification with no subsequent action (for minor faults) to alarm notification and shut-down (for critical faults). The hierarchy of responses is designed to keep the MCPS2135 in operation unless continued operation would result in damage to the unit. Under some fault conditions, the MCPS2135 continues to operate in a degraded state. The operator may choose to continue to operate in a degraded state, shed channels, or shut down the MCPS2135 until repairs can be completed.

### 1.1.1.15.3.2.1      **Automatic Alarm resets**

#### ***Critical Alarm***

When a critical alarm occurs, the MCPS2135 will automatically be DISABLED (i.e., taken out of service) until the operator re-ENABLES the unit.

#### ***Major Alarm***

When a major fault is detected, the MCPS2135 attempts to clear the fault by performing a reset. In most cases, the MCPS2135 will attempt to reset five times. If the alarm condition fails to clear after five attempts, the MCPS2135 remains in operation with the fault alarm set.

In the case of an over-temperature major alarm, the fault manager will attempt to clear the alarm one time only by resetting. If the fault condition does not clear, the alarm classification will escalate to critical (out-of-service), and the MCPS2135 will shut down and remain off-line until returned to service by the operator.

#### ***Alarm Transient Supression***

To minimize false alarms from transient anomalies, the fault management system is designed with built-in hysteresis and filtering. If the fault condition persists past the filter interval, the appropriate fault alarm is set.

### 1.1.1.25.3.2.2      **Manual Alarm resets**

When a major Alarm is detected, the operator may choose from the following options:

- Take no action and allow the MCPS2135 to operate in a degraded state until service can be performed.
- Shed input channels to reduce the power to the MCPS2135.
- Disable the RF Module using the front panel switch, diagnostic port, or optional base station alarm and control interface

## **1.45.4 MCPS2135 Alarm Limits and Protection Circuits**

The MCPS2135 series of multicarrier power amplifiers has a wide range of alarm configurations available. These may be specified to meet the demands of specific applications. In addition, the MCPA modules have built-in protection circuits to prevent damage from unintentional misuse. Module alarms may be summarized and reported to a BTS using a customized interface. This hierarchical system insures that Spectrian's MCPS2135 series amplifier systems remain robust with a minimum of false alarms, but promptly report any real issues to the base station controller.

The default alarm limit settings and analog protection circuit operation for the MCPS2135 family of MCPA amplifier systems are summarized below. The information contained herein is provided *for reference only*. Guaranteed specification limits must be negotiated between prospective customers and Spectrian. There are three levels of the alarm/protection hierarchy:

- Analog Protection Circuits – Configured in hardware design to protect the MCPA.
- MCPA Module Alarms – Most are software configurable for specific applications.
- Amplifier System Alarms – Summarizes MCPA and Alarm Management Module status.

In general, analog protection circuit limits are set by design, and may not be changed. MCPA alarm limits are software configurable, and may be tailored to meet customer alarm specifications. Individual MCPA alarms are not displayed on the module front panel, but they are accessible through Spectrian's Graphical User Interface (GUI) software. System level alarms are summaries of the module alarm status (minor/major/critical), as well as the Amplifier Management Module (AMM) and the communication link between the modules and the AMM. The summary set-up is configurable using the amplifier GUI software.

### **1.1.15.4.1 MCPA Module Analog Protection Circuits**

The MCPS2135 MCPA module design incorporates circuits to prevent MCPA module damage by common misuse conditions. The circuits react automatically to the conditions shown in Table 3 with the limits set as noted. These limits are not adjustable by software configuration.

<b>Control</b>	<b>Condition</b>	<b>Speed</b>	<b>Latch</b>
Input Overdrive	> 10 dBm @ Input (configured for 57 dB module gain)	2 msec	No
Main Amp Overdrive	> 4 dBm @ Vectormod Input	35 µsec	No
Error Amp Overdrive	> -7 dBm @ Vectormod Input	35 µsec	No
Overvoltage Clamp	Internal DC line is limited to 28V by linear regulation up to 30V input	10 msec	No
Circuit Breaker	> 75 A current draw	25 msec	Yes

**Table 3: Analog Protection Circuit**

### 1.1.25.4.2 MCPA Module Alarms

The set points, delay, reset points, and latching conditions of all three types of alarms are software configurable. Some Minor alarm settings can be specified by the customer but must be agreed upon between the customer and Spectrian prior to installation or modification. Alarm limits for Major and Critical Alarms are fixed and can not be modified, insuring long term reliability of the MCPA module.

Type	Indicator	Condition	Action / Response
No Alarm	LED Green	Normal operation	None
Minor	LED Amber	System functional but with degraded performance	None
Major	LED Red	System malfunctioning but operating (degraded performance)	System Reset after Dwell
Critical	LED Red	Continuous operation may induce damage	System Shutdown after Dwell

**Table 4: Module Alarm Hierarchy**

Description	GUI Mne-monic	Minor Alarm Set Point	Major Alarm Set Point	Critical Alarm (Module Shutdown)	Critical Alarm Dwell Time	Critical Alarm Latch	Hysteresis Reset Point
Inlet Temperature	TMP	> 50 °C	> 70 °C	> 70 °C	10 min.	No	50 °C
Main Amp Base Temp	TMP	N/A	> 90 °C	> 90 °C, >120 °C, no dwell	10 min.	No	70 °C
Error Amp Base Temp	TMP	N/A	> 90 °C	> 90 °C, >120 °C, no dwell	10 min.	No	70 °C
PCM Base Temp	TMP	N/A	> 90 °C	> 90 °C, > 120 °C, no dwell	10 min.	No	70 °C
Over/Under Voltage	OVS/ UVS	22 to 24V	20 to 22V or 28 to 30V	<20V or >30V	5 sec	No	24V or 28V
IM Degradation	LOP	Loop 2 SNR < 0 dB	VMOD at rail	N/A	N/A	No	N/A
Load VSWR	VSR	>4:1	>10:1	N/A	N/A	No	N/A
RF Overdrive	OPR	>150W	>170W	>170W	2 sec	Yes	150W
Fan Failure	FAN	Low RPM (≤50% rated)	1 Fan Failed	2 Fans Failed	None	No	N/A
+8V DC-DC Converter	OVS/ UVS	N/A	<7V, >9V	<7V, >9V	2 sec	Yes	N/A
+16V DC-DC Converter	OVS/ UVS	N/A	<14V, >18V	<14V, >18V	2 sec.	Yes	N/A
-16V DC-DC Converter	OVS/ UVS	N/A	-18V, >-14V	-18V, >-14V	2 sec.	Yes	N/A
Input Current	CKT	N/A	>60A	>60A	No Delay	After 3 Failures	N/A
BPM Power Cell Failure	STK	1 Power Cell Failure	2 Power Cell Failure	> 2 Power Cell Failure	No Delay	Yes	N/A
Gain Drop	GAN	N/A	< -3 dB	N/A	2 sec.	No	< -1 dB

**Table 5: Default Alarm Descriptions and Settings**

### **1.1.35.4.3 MCPA System Alarms**

A multimodule MCPA system will have an Amplifier Management Module (AMM) that summarizes the status of all modules and reports this information to the base transceiver station (BTS). The format of this information is usually customized for specific customers. Options for physical layer customization include:

- Parallel TTL Interface – Summary bits for individual module status.
- Serial Interface (RS-232, RS-422) – Customized strings sent to BTS interface.
- Form-C Relay Contacts – Wired directly into BTS.

Messaging layer customization is usually specified by the customer. In addition Spectrian does maintain an internal standard for serial messaging. System status is generally a combination of the module status. This is also specified by the customer. An example of a system alarm hierarchy might be as noted in the table below.

<b>MCPA Alarm Condition</b>	<b>Amplifier System Status</b>	<b>Summary Logic</b>
Minor	At least one module reporting a minor alarm	OR
Major	At least one module reporting a major alarm	OR
Critical	At least 3 modules reporting a critical alarm	AND

**Table 6: Typical MCPS System Alarm Hierarchy**

# 6 Troubleshooting and Maintenance

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## 6.1 Introduction

The following chapter provides basic information about diagnosis of problems with the MCPS2135. Please read the following safety information prior to beginning diagnosis and repair actions.



**Warning:** *Troubleshooting and repairs should be performed only by trained and qualified personnel or at authorized Spectrian repair depots. Observe all safety warnings and use the required safety equipment when performing the tasks described in this chapter.*



**Note:** *Before shipment, the MCPS2135 was inspected and found free of mechanical and electrical defects. The electrical performance of the MCPS2135 should be verified using these procedures. If there is any deficiency, or if electrical performance is not within specifications, notify your Spectrian representative immediately.*

### Tools

The following tools are recommended to perform system service tasks.

- HP 436 Power Meter
- Digital Volt Meter (DVM)

### 6.1.1 Safety Information

To avoid injury, installers, technicians, and maintenance personnel must follow Spectrian's recommended procedures and observe all safety precautions.



**Warning:** *The MCPS2135 transmits high power at radio frequencies. Severe radiation burns can occur if recommended safety precautions are not strictly observed.*



**Warning:** *Persons with cardiac pacemakers should avoid exposure to RF radiating elements. Exposing the human eye to high levels of radio-frequency radiation may result in the formation of cataracts. Do not operate exposed circuitry or radiating elements with personnel in close proximity to the radiating source. Always replace covers and shields during operation.*



**Warning:** *Except where specifically indicated, always disconnect RF input power and DC input power to the MCPS2135 before performing procedures that do not require power. For those procedures that do require power, be extremely*

*cautious in handling test leads, tools, and equipment near live circuits. Never reach into an enclosure for the purpose of servicing or adjusting live equipment.*

## 6.2 Troubleshooting

Refer to section 5.3 for a definition of alarm types and the significance of those alarm types.

### 1.1.16.2.1 Using LED Indicators

Each MCPS2135 RF Module is equipped with four LED indicators mounted on the front panel. The system Alarm Management Module has two LED indicators mounted on the front panel. These indicators provide useful status and diagnostic information to operators and technicians.

Module LEDs	Green	Amber	Red
POWER	Voltage OK, 26 VDC	22-24 V or 28-29V; RF has degraded performance	<22 V or >29V; RF shuts down
ENABLED	Enabled	N/A	Disabled
STATUS	OK	Minor Alarm	Major or Critical Alarm
FAN	OK	N/A	Fan Failure
AMM LEDs	Green	Amber	Red
DC POWER	Voltage OK, 26 VDC	22-24 V or 28-29V; system has degraded performance	<22 V or >29V; system shuts down
STATUS	No Faults	N/A	System Fault Exists

### 1.1.26.2.2 Using the Diagnostic Port Output

Use of the Diagnostic Port is described in the release notes with the interface software distribution.

### 1.1.36.2.3 Using Remote Alarm Monitoring

The MCPS2135 can include an optional alarm or control interface to base station monitoring systems. These systems provide a serial interface to transmit status codes to a remote host computer and receive a limited set of commands from the host. For systems with such an interface, the interface is described in detail in the specifications Appendix, A3.

- *Note: The MCPS2135 fault management system and its associated alarms and fault indicators operate independently of the serial interface.*



## 6.3 Periodic Maintenance

### 6.3.1 Dust Removal

Keep the air inputs and outputs of the MCPS2135 free of dust or other material that could block cooling airflow.

#### 1.1.26.3.2 Visual Inspection

Periodically visually inspect the MCPS2135 to ensure that all indicators are functioning normally and that all system interfaces are properly connected.

#### 1.46.4 Module Replacement

The RF modules of the MCPS2135 are hot-swappable field replaceable units which can be removed and inserted while the system is online without affecting the operation of the other units in the system.

#### 1.1.16.4.1 Replacing an RF Module



**WARNING:** *The RF Module is very heavy, 50 lbs (22.7 kg). Get assistance if necessary.*



**Caution:** *Provide bottom support when removing an MCPA module to avoid damage to the fan housing.*

1. Disable the RF Module being replaced by switching the front panel switch to DISABLE. The **ENABLE** LED will be RED.
2. Undo the RF Module front panel fastener.
3. Slide the RF Module out of the shelf subassembly.
4. Place the RF module in a safe, static-free location.
5. Set the ENABLE switch on the replacement module to the DISABLE position.
6. Insert the replacement RF Module.
7. Fasten the RF Module front panel fastener.
8. Set the ENABLE switch on the replacement module to the ENABLE position.
9. The RF Module will automatically self-test and then ENABLE; the **ENABLE** LED will then be GREEN.

### 6.4.2 Replacing an AMM

1. Turn off the DC power to the MCPS2135.
2. Undo the AMM front panel fasteners.
3. Slide the AMM module out of the shelf subassembly.
4. Place the AMM in a safe, static-free location.

5. Slide the new AMM into the shelf sub-assembly.
6. Fasten the AMM front panel fastener.
7. Turn on the DC power to the MCPS2135. The system will perform a power-up self-test automatically.
8. The **POWER** LED will be GREEN.

### 6.4.3 Replacing shelf subassembly



**Warning:** Turn off the DC voltage and RF power prior to replacing an MCPS2135.



**Warning:** Remove all DC and RF connectors prior to removing the MCPS2135 from the rack.



**Caution:** Do not attempt to move an MCPS system with modules installed.

1. Remove the RF Modules' front panel retaining screws.
2. Remove the RF modules from the rack.



**WARNING:** The RF Module is very heavy (50 lbs / 22.7 kg). Get assistance if necessary.

3. Set each RF Module aside in a clean, safe place, free of electrostatic charges.
4. Remove the rack retaining screws. Grasp the front panel with both hands and pull the MCPS2135 straight out from the rack.
5. Set the disconnected MCPS2135 aside in a clean, safe place, free of electrostatic charges.
6. Remove the replacement MCPS2135 from its static-protective packaging.



**Note:** You may wish to record the serial number on your repair record before installing the module.

7. Follow the installation and operation instructions in Sections 3 and 4 to place the unit back in service.

## 6.5 Module Service

### 6.5.1 Replacing MCPS2135 Fan Modules



**WARNING:** The RF Module is very heavy (50 lbs / 22.7 kg). Get assistance if necessary.



**Caution:** Provide bottom support when removing an MCPA module to avoid damage to the fan housing.

1. Disable the RF module with the failed fan.
2. Remove the RF module with the failed fan from the rack.
3. Place the RF module on a clean, static-free work surface.

4. Remove the screws securing the fan module to the RF module.
5. Disconnect the wiring harness from the fan module.
6. Connect the harness to the new fan module.
7. Replace the fan module and replace the attachment screws.
8. Replace the RF module in the rack.
9. Enable the module. Following the automatic power-up reset sequence, the FAN indicator LED should be GREEN.

# Appendix A1 Spectrian, Inc. Offices

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## **Spectrian Headquarters**

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## **Centralized customer service:**

For customer service support please direct all requests, questions, comments, and inquires to [cs@spectrian.com](mailto:cs@spectrian.com) or mail to:

Spectrian Customer Service Department

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Fax: 408-541-0263

Technical Support Line

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# Appendix A2 Major Electrical Specifications

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## Major Equipment Specifications for the MCPS2135 Amplifier System

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Electrical Specifications	Specification @ 25° C
Frequency Range	869 - 894 MHz
Average Power <sup>1</sup> into 50 Ohms	135W (51.3 dBm) to 500W (57.0 dBm)
Intermodulation Distortion (IMD)	-65 dBc with AMPS and/or TDMA IS-136, or IS-97 CDMA dual mode input sources under nominal conditions
CDMA Adjacent Channel Power <sup>2</sup> @ 881 MHz, 100W Output	< -45 dBc, 750 KHz offset, 30 KHz res bandwidth < -60 dBc, 1.98 MHz offset, 30 KHz res bandwidth
Receive Band Noise	60 dBc
Carrier Spacing (AMPS/TDMA)	60 KHz min., 25 MHz max.
Power Output Stability for Single Frequency	± 0.5 dB under nominal conditions
Operating Bandwidth	up to 25 MHz
Gain	Factory set, 30 to 60 dB, 85 dB with optional preamp
Gain Flatness vs. Frequency	± 0.5 dB (over all temps)
Gain Variation over Temp @ Any Inband Frequency	± 1 dB
Forward Power Sample Port Coupling	-50 dB typ.
Input/Output Port Return Loss	-15 dB min.
Second/Third and Greater Harmonic Output	-50 dBc / -70 dBc
DC Input Voltage Range	26 to 28VDC
DC Input Current @ 27VDC	135W single RF module – 55A 250W two RF modules – 110A 370W three RF modules – 165A 500W four RF modules – 220A

<sup>1</sup>Power levels at the output of the system combiner will vary depending on the configuration.

<sup>2</sup>Measured at the RF module output connector and in accordance with IS-97.

# Appendix A3 Major Mechanical Specifications

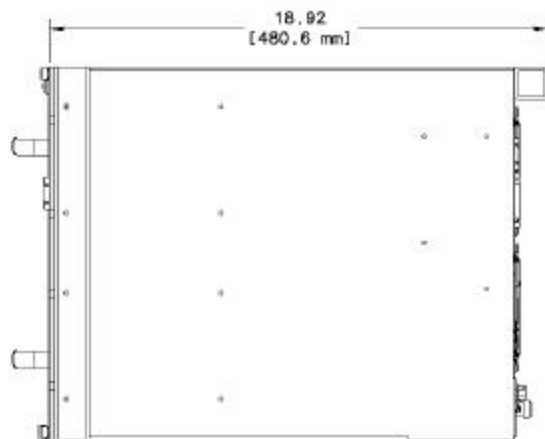
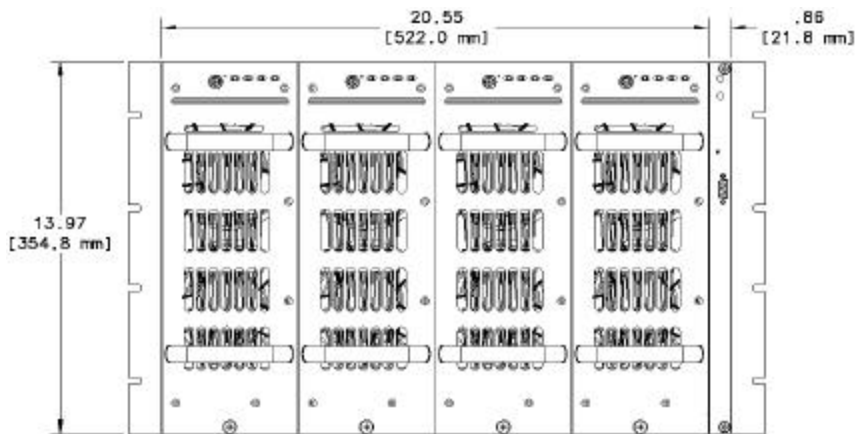
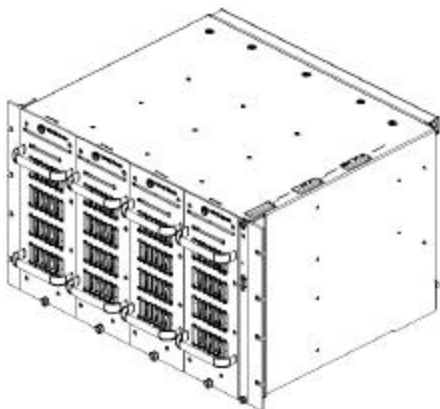
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## Mechanical Specifications

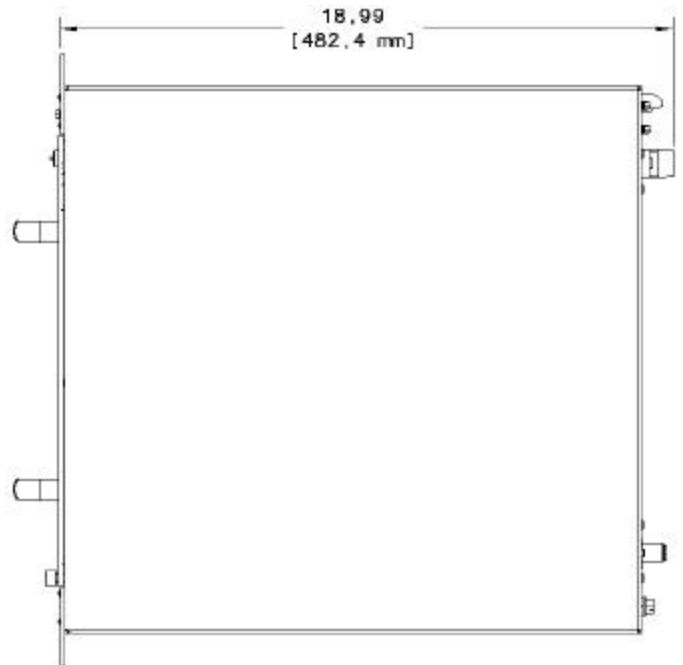
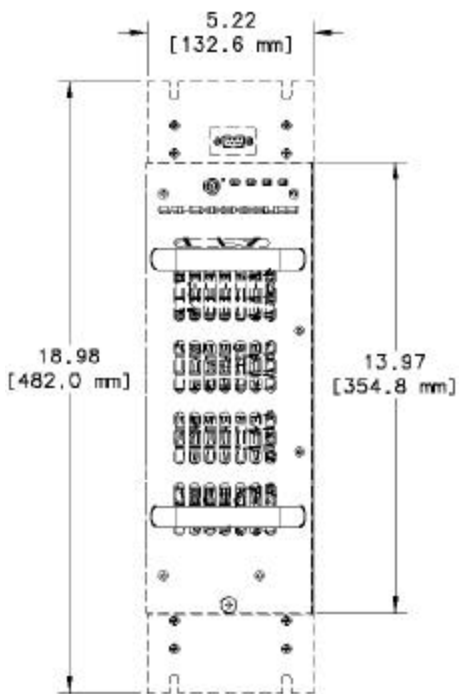
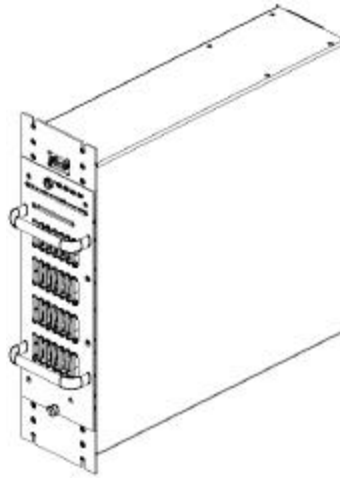
Operating/Storage Temperatures	0°C to 50°C/-40°C to 85°C
Size, 4 module shelf (Excludes mounting ears and handles).	(D x W x H) 17.72 x 21.56 x 13.97 in. max (450 x 547.62 x 354.84 mm max.)
Size, 1 module shelf (Excludes mounting ears and handles).	17.72 x 17.0 x 5.25 in. max (450 x 431.72 x 133.33 mm max.)
Weight, 4 module shelf (Empty)	Installed: approx. 45 lbs (20 kg) Shipping: approx. 60 lbs max. (27 kg)
Weight, 1 module shelf (Empty)	Installed: approx. 22 lbs (9 kg) Shipping: approx. 29 lbs max. (13 kg)
Weight, 1 module	Installed: approx. 50 lbs max. (22.7 kg) Shipping: approx. 65 lbs max. (29.5 kg)
Connectors	RF Input(s): SMA (F) RF Output(s): N (F) RF Output Sample Port: SMA (F) DC Inputs: 10-32 and ¼-20 threaded lugs DC Ground: ¼-20 threaded lugs Maintenance Port: RS232 Alarms Port: RS422 (standard)
RS232 (Front panel port) pinout:	Pin 1 GND Pin 2 TX Pin 3 RX Pin 4 N/C Pin 5 GND Pin 6 N/C Pin 7 RTS Pin 8 CTS Pin 9 N/C
Indicators	AMM: DC On, Alarm LEDs MCPA Modules: DC On, Enable, Alarm, Fan LEDs

# Mechanical Outlines

MCPS2135 500W

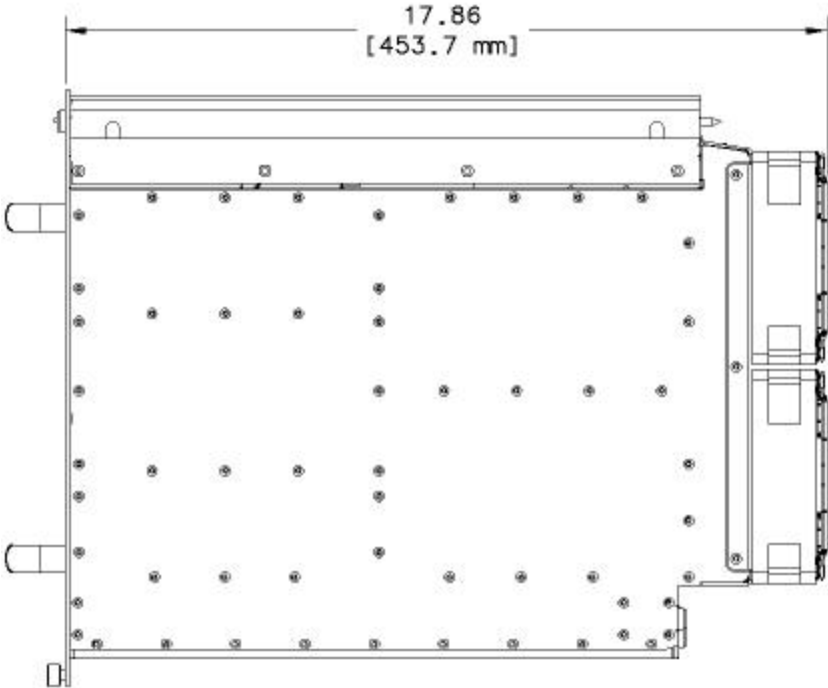
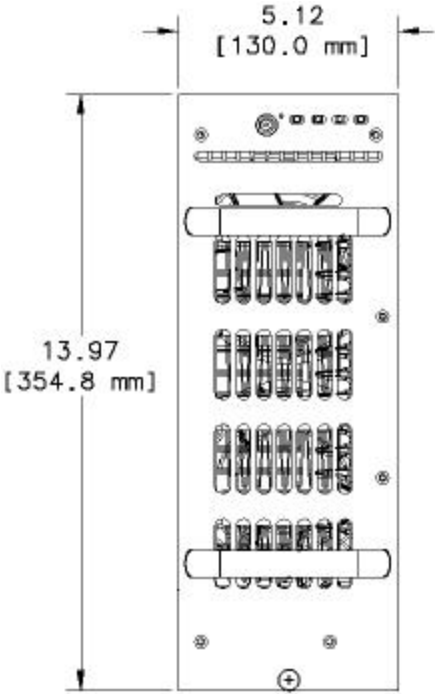
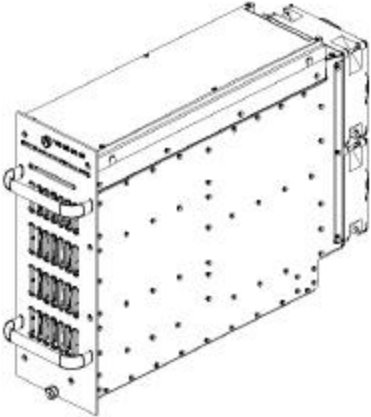


## MCPS2135 135W Configuration





### MCPA Module for MCPS2135 Family



# Appendix A4: MCPS2135 System Checkout

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## MCPS System Checkout

In some cases, it may be desirable to perform a system checkout prior to installation to insure proper operation. The following procedure is included here only for reference. Accurate specification verification is not guaranteed when using this procedure.

## Equipment Required

- HP4432 Signal Generator
- Sorenson DHP40-250 DC Power Supply
- HP8561A Spectrum Analyzer
- HP436 Power Meter
- HP8481A Power Head
- 750W, 30 dB Attenuator
- Digital Volt Meter (DVM)

## Setup Procedure

1. Connect Sorenson DHP-40-250 DC power supply to DC input as outlined in Section 3.4.
2. Connect HP4432 CDMA Signal Generator to RF input. Set RF level to –30 dBm. Set I/Q input to internal CDMA generator, IS-97 with EQ, 9 Walsh Codes.
3. Connect Attenuator to RF Output
4. Connect HP8481A Power Sensor to Attenuator output.
5. Connect HP8561A Spectrum Analyzer to Sample Port Output. Set ATTEN=10 dB, RBW=30kHz, VBW=10kHz, Vid. Avg.=100, SPAN=10MHz.

## Performance Checkout Procedure

1. Set current limit on Sorenson power supply to appropriate level as listed in Table 2.
2. Set DC voltage to  $27 \pm 1V$ .
3. With no RF applied, verify that idle current is approximately  $13A \times$  number of MCPA RF modules.
4. Apply RF signal, and slowly increase power to maximum rated power as listed in Appendix A2.
5. Verify that the total DC current is approximately that listed in Table 2.
6. Perform ACPR measurement. Verify that mask specification exceeds specification listed in Appendix A2.

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