



***Azimuth™ RPE- 401L User Guide***

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Electromagnetic Emissions Statements for Azimuth 800W and Azimuth 1000 RF test head Instruction/  
Installation Manuals:

**USA Requirements: Federal Communications Commission (FCC) Compliance Notice: Radio Frequency Notice**

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to take whatever measures may be necessary to correct the interference at their own expense.

**Canada Requirements: Canadian Department of Communications Radio Interference Regulations**

This digital apparatus does not exceed the Class A limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Règlement sur le brouillage radioélectrique du ministère des Communications Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

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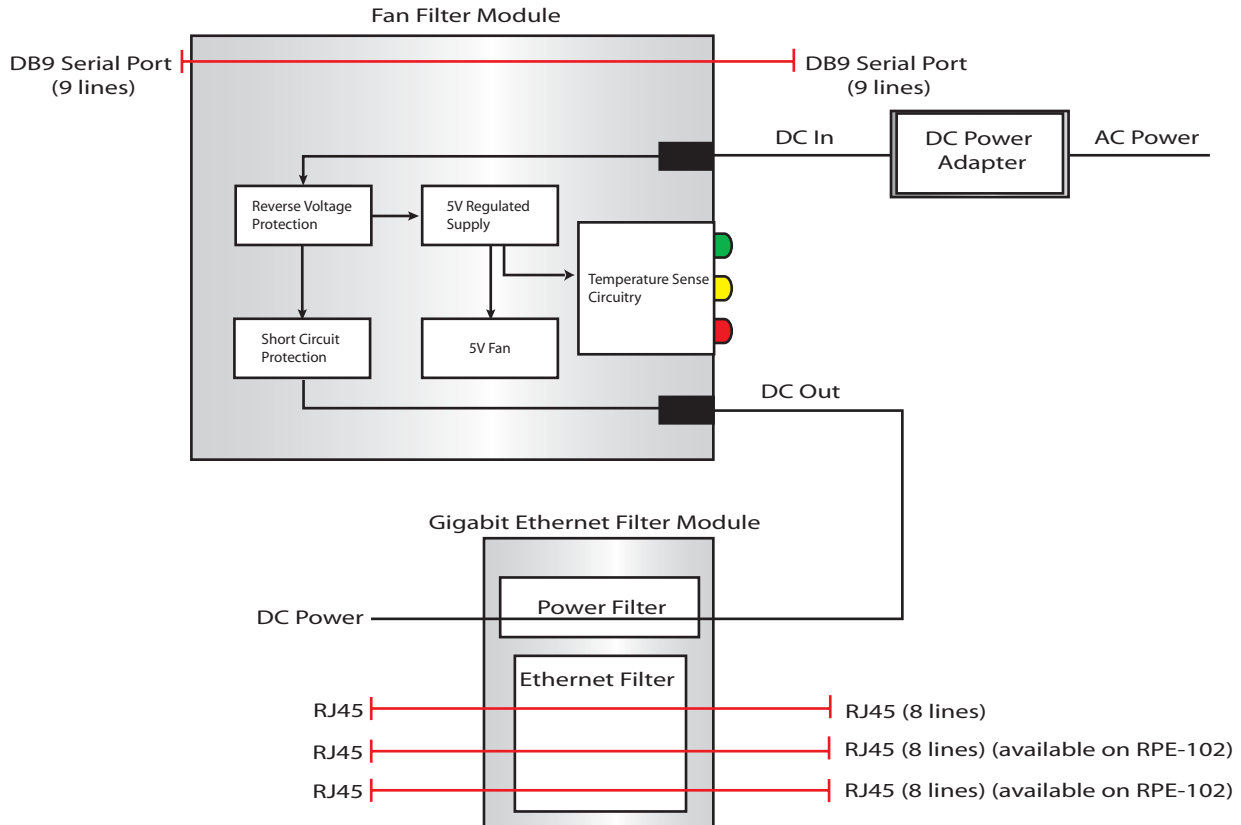
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# Introduction

The RPE - 401L provides an isolated environment for larger wireless devices to work in conjunction with the Azimuth Wireless LAN Analysis Platform. The RPE - 401L houses the device in an RF-isolated chamber that provides 90 dB of radiated RF isolation between the device under test and the outside world. RF isolation prevents unwanted radio frequency interference (RFI) from either entering or exiting the chamber.

Conducted path emissions are controlled by filter modules (see [Figure 1-1](#)) that attach to the back of the RPE - 401L chamber. The filter modules allow the desired signals to pass between the device and the Azimuth Wireless LAN Analysis Platform while filtering undesired RFI. The standard Ethernet Filter Module features Gigabit 10/100/1000 Mbps Ethernet ports and an extra communications port that can be configured by the user with adapters to handle other communication standards (such as USB and RS-232).



**Figure 1-1. RPE- 401L Fan Filter Module and Ethernet Filter Module Block Diagram**

The Fan Filter Module features a cooling fan that controls the chamber air temperature by drawing cool air into the chamber and exhausting the heated air. A DC power adapter connects to the Fan Filter Module to provide power to the fan, temperature sensor inside the fan filter module and device. A temperature sensor attached to the Fan Filter Module uses LEDs to indicate the temperature range inside the RPE - 401L chamber. The Fan Filter Module features an output power connector that feeds power for the device through the Ethernet Filter Module.

Physical access to the device under test is easily accomplished through the latched cover on top of the RPE - 401L. The cover can be completely removed to allow for ease of connection and access. If the cover is seated and closed correctly, RF integrity is ensured.

The following RPE - 401L models are currently available:

- **RPE-401L** - this multiple-input multiple-output (MIMO) RF test head features eight front panel SMA-type RF port connectors and four N-type RF port connectors on the back of the RPE for the RF signal path from a MIMO wireless device to the Azimuth DIRECTOR.

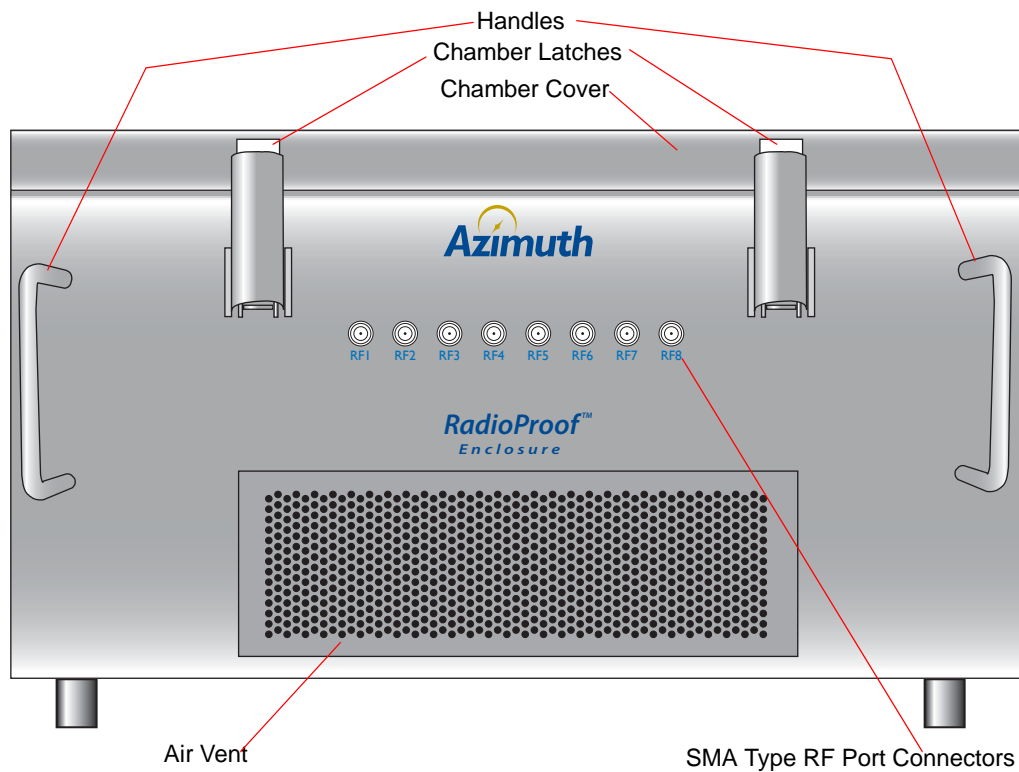
## *RPE - 401L Contents*

The RPE - 401L contains the following components:

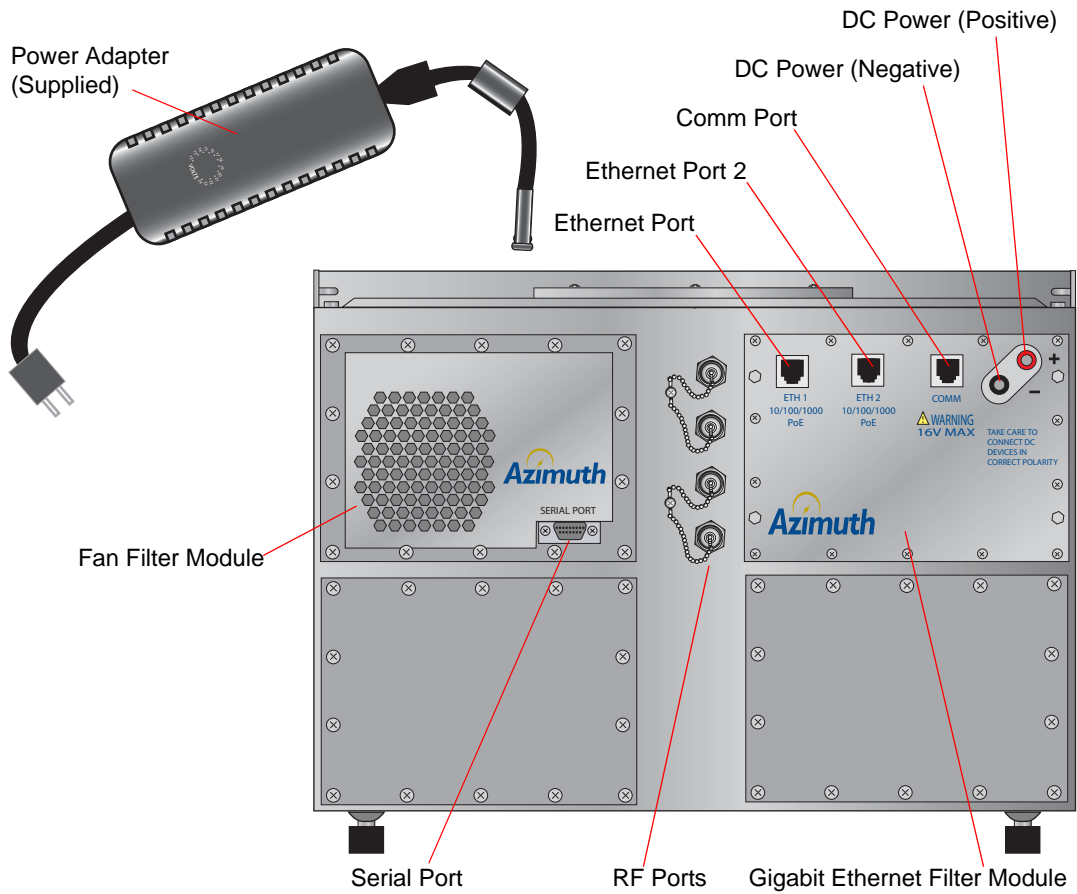
- RPE - 401L
- Fan filter module (Azimuth part number 14472) (attached)
- Gigabit Ethernet Filter Module (Azimuth part number 14693) (attached)
- RF cable for connecting RPE - 401L to the test network (Azimuth part number 14046)
- Power adapter (Azimuth part number 14812)
- One power cable to attach the device to the Ethernet Filter Module power connector in the RPE - 401L chamber (Azimuth part number 14809)
  - Various interchangeable tips are provided with the DC power cable
- One (1) power cable for connecting the fan filter module to the Ethernet Filter Module (part number 14505)

## RPE - 401L Components

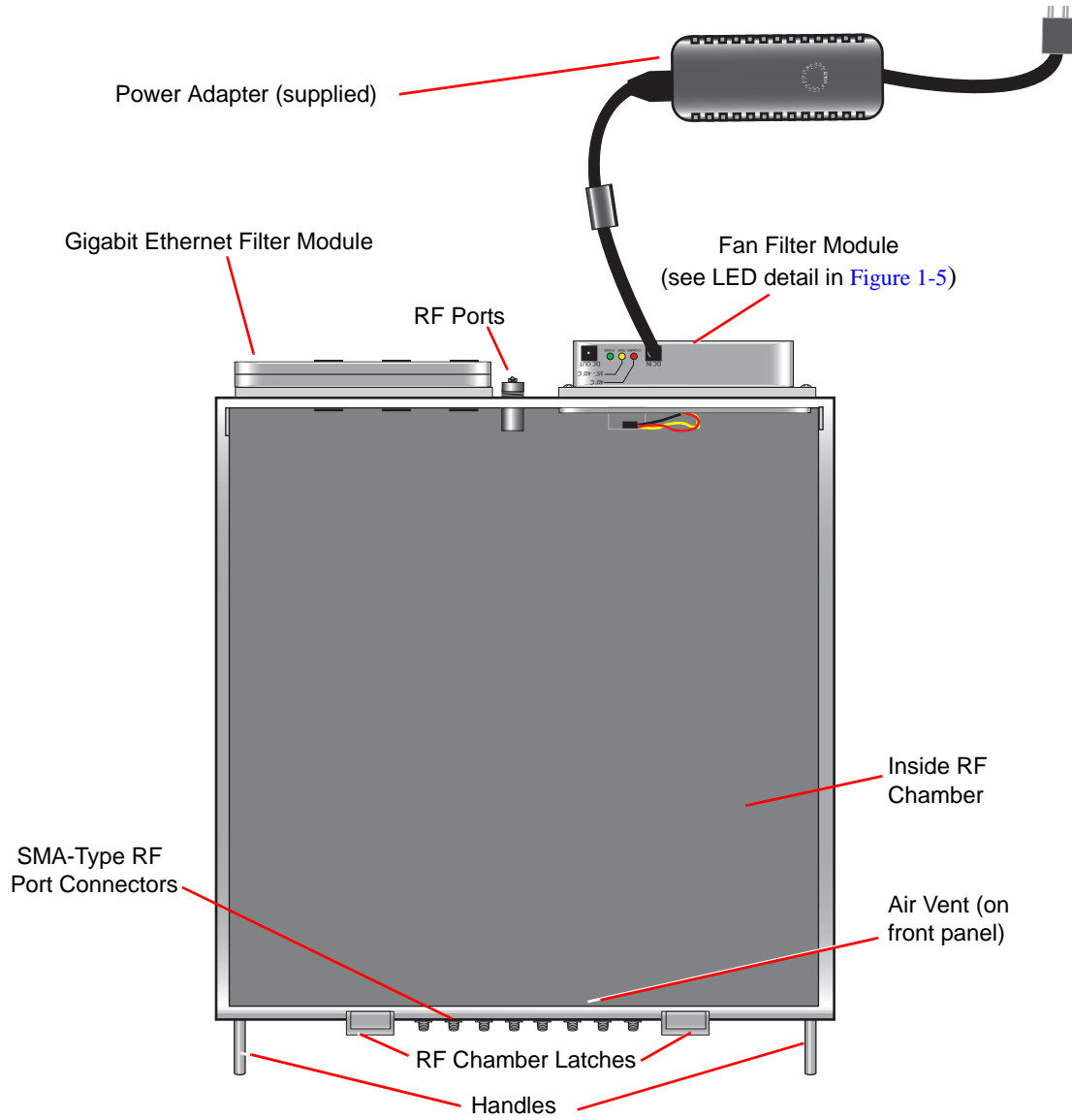
The front panel of the RPE - 401L is pictured in [Figure 1-2](#). The back panel of the RPE - 401L is pictured in [Figure 1-3](#). The top view showing the inside of the RPE - 401L chamber is pictured in [Figure 1-4](#). Each of the significant components in the RPE - 401L are called out in these illustrations and described below.



**Figure 1-2. MIMO RPE- 401L Front Panel**



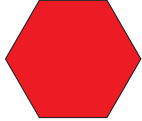
**Figure 1-3. RPE- 401L Back Panel (Showing Optional Gigabit Ethernet Filter Module)**



**Figure 1-4. Chamber with Optional Gigabit Ethernet Filter and Fan Filter Modules Installed (cover not shown)**

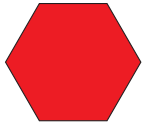
The RPE - 401L is comprised of the following components:

- **Rear Panel RF ports** - four N-type RF connectors and accessible within the RF chamber provide RF connection between the 802.11 wireless devices and the Azimuth W-Series WLAN Test Platform. These are straight-through connections with no filtering. These ports are available on the RPE - 401L.



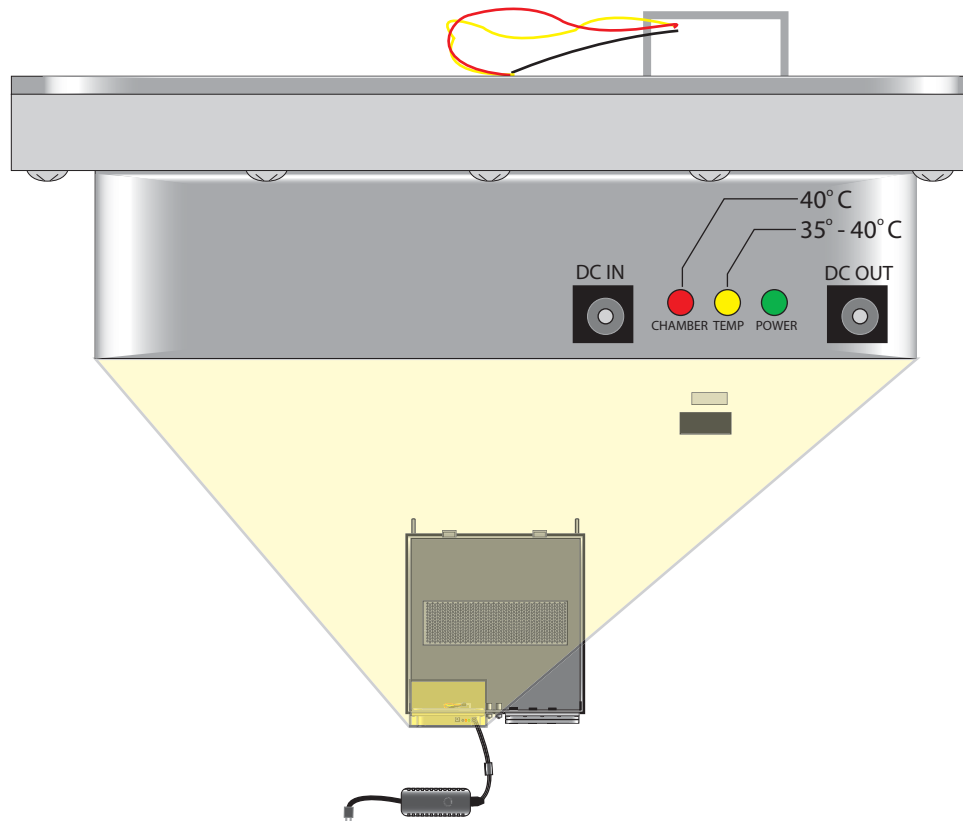
**Caution:** Dust caps attached to each external RPE - 401L RF port should be attached to the N-type RF ports when they are not in use to maintain RF isolation within the RPE chamber.

- **Front Panel RF ports** - eight SMA-type RF connectors are accessible from within the RF chamber provide RF connection between the 802.11 wireless devices and the Azimuth W-Series WLAN Test Platform. These are straight-through connections with no filtering. These ports are ideally suited for MIMO devices.



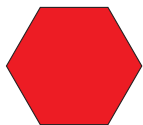
**Caution:** Rubber dust caps attached to should be attached to each external RPE - 401L SMA-type RF port when they are not in use to keep debris out of the connectors.

- **Fan Filter Module** - this module, which attaches to the back of the RPE - 401L, provides a fan to cool the interior RPE chamber. Air is drawn into the chamber through two air vents in the chamber, one on the cover and another on the floor. A variable power adapter provides power to the Fan Filter Module through the DC In connector. A connection between the DC Out connector on the Fan Filter Module and the Ethernet Filter Module provides power to the device inside the chamber. The Fan Filter Module has a filtered serial port that allows access to the serial port of the device under test. A temperature sensor in the Fan Filter Module activates LEDs on the module when the air temperature inside the chamber reaches various temperature ranges. The LED settings are presented in [“RPE Fan Filter Module LED Description” on page 1-10](#). An illustration of the Fan Filter Module is presented in [Figure 1-5](#).



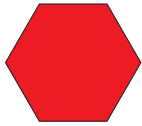
**Figure 1-5. Fan Filter Module**

- **Gigabit Ethernet Filter Module** - attaches to the back of the RPE - 401L to provide filtering of DC power, Ethernet and serial communications port connections. The standard Ethernet Filter Module supports a Gigabit Ethernet Filter Module that features Gigabit Ethernet ports and a communications port.) Standard Ethernet RJ45 connectors are provided on both the outside and inside of each filter module. The Ethernet ports support PoE. Positive (red) and negative (black) DC power connectors are filtered. Positive and negative DC connectors are provided on both the outside and inside of each Ethernet Filter Module for easy connections through the use of banana plugs.
- **RF chamber cover** - access to the RF chamber is accomplished by removing the RF chamber cover that latches to the top of the RPE - 401L. Two latches secure the RF chamber cover to the RPE. Air vents on the cover and in the bottom of each chamber provide ventilation for the chamber interior.



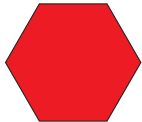
**Caution:** Do not block air vent holes in the RPE - 401L chamber! The air vent holes in the front panel of the RPE chamber are used to provide convection cooling for the device under test.

- **Slide rails** - the RPE - 401L can be mounted in a chassis rack using optional slide rails (see [Figure 1-6](#)) that mount to the holes that are located on either side of the unit. The rails enable the RPE to slide in and out of the rack for easy access to the chamber cover and interior. The slide rail mounting holes in the mounting hardware are sized to fit most standard size racks.
- **Absorbent foam liner** - lining the inside of the RPE - 401L chamber and the inside of the RPE chamber cover, this foam is used to absorb near-field radiation. The foam is designed for long life, but care must be taken not to damage this foam when installing and removing devices from the chamber.



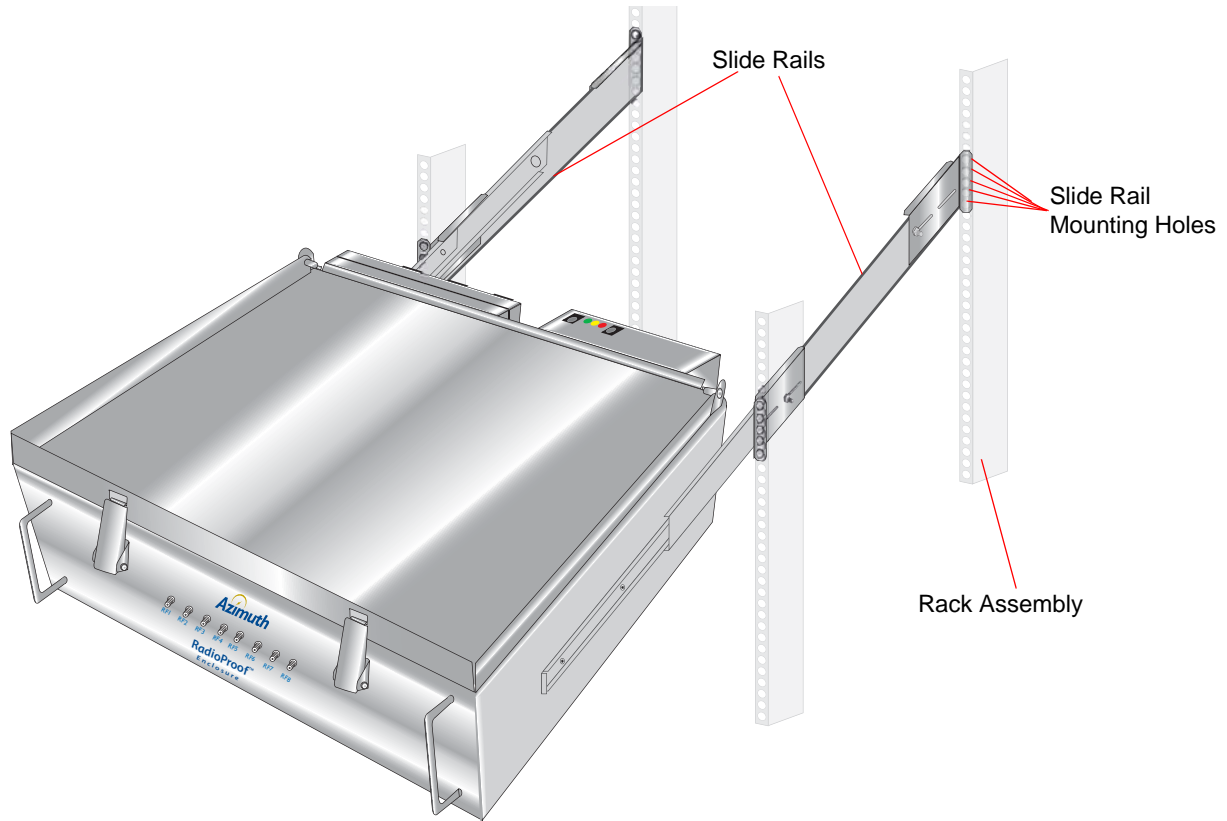
**Caution:** Do not damage the absorbent foam liner in the RPE chamber.

- 
- **Latches** - the latches are calibrated so that they close the chamber door the proper RF isolation.

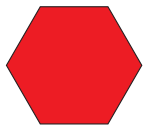


**Caution:** Do not adjust the screws on the latches. They are calibrated so that the proper amount of RF isolation is achieved.

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**Figure 1-6. MIMO RPE- 401L Shown with Optional Slide Rails Installed**



**Caution:** When the 401L is rack mounted, the slide rails **MUST** be attached to all 4 corner posts of the rack in order to ensure user safety. This device weighs approximately 45 lbs empty and cannot be supported by slide rails attached only to the front corner posts of the rack! Azimuth offers rail extenders specifically designed for this purpose.



**Danger:** Make sure that the rack is properly secured/anchored during loading so that the rack is unlikely to tip over and cause extreme personal injury (e.g., rack bolted to the floor).

## RPE Fan Filter Module LED Description

The RPE Fan Filter Module LEDs are illustrated in [Figure 1-4](#). The various states of the LED and their meanings are presented in [Table 0-1](#).

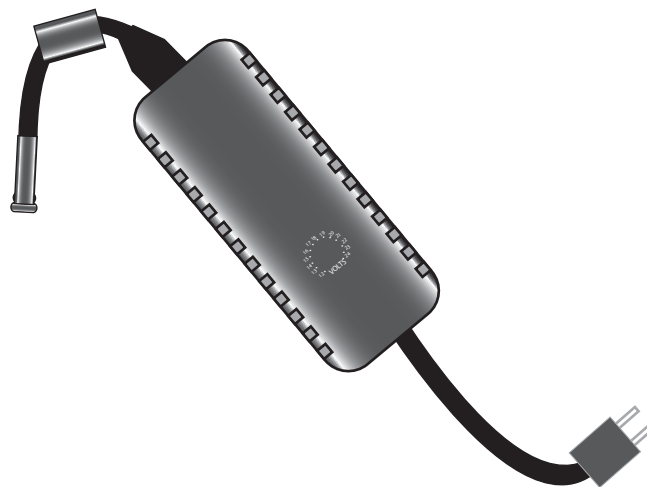
**Table 0-1. RPE Fan Filter Module LED States and Descriptions**

LED	State	Description
Green	On	Power is applied to the Fan Filter Module.
	Off	No power is applied to the Fan Filter Module.
Yellow	On	Interior chamber is 35 - 40° C.
	Off <sup>a</sup>	Interior chamber air temperature is outside the range of 35 - 40° C.
Red	On	Interior chamber air temperature has exceeded 40° C.
	Off <sup>a</sup>	Interior chamber air temperature is less than 40° C.

a. When neither the yellow nor the red LED is lit and the green LED is lit, the air temperature in the chamber is less than 35° C.

## Variable Power Adapter

A variable DC power adapter included with the RPE provides the user selectable DC power to power the device in the RPE (see [Figure 1-7](#)).



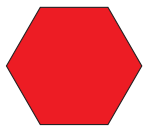
**Figure 1-7. Variable Power Adapter**

# Setting Up the RPE

This chapter provides information pertaining to connecting the device under test inside the RPE chamber and provides instructions on how to rack mount the RPE.

## Rack Mounting the RPE - 401L

The RPE - 401L should be rack mounted prior to making power connections and before installing a device in its chamber. The following procedure describes how to mount the RPE in a rack assembly.



**Caution:** When the 401L is rack mounted, the slide rails **MUST** be attached to all 4 corner posts of the rack in order to ensure user safety. This device weighs approximately 45 lbs empty and cannot be supported by slide rails attached only to the front corner posts of the rack! Azimuth offers rail extenders specifically designed for this purpose.

### PARTS NEEDED:

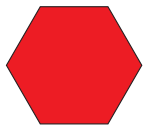
- Twelve #10-32 x 0.375L Phillips truss head screws (Azimuth part number 14106)
- EIA Telco Rack assembly, Zone 4 compliant
- Empty RPE- 401L

### TOOLS NEEDED:

- No. 2 Phillips screwdriver

### PREREQUISITES:

- The following procedure requires two technicians to lift the RPE and a third technician to install the RPE in a rack assembly. (See [“RPE Technical Specifications” on page A-1](#) for the weight specifications for the RPE.)



**Caution:** Do not restrict air flow around the RPE chamber vent.



**Warning:** Make sure that the environmental conditions conform to temperature and humidity requirements noted in [“RPE Technical Specifications” on page A-1](#).



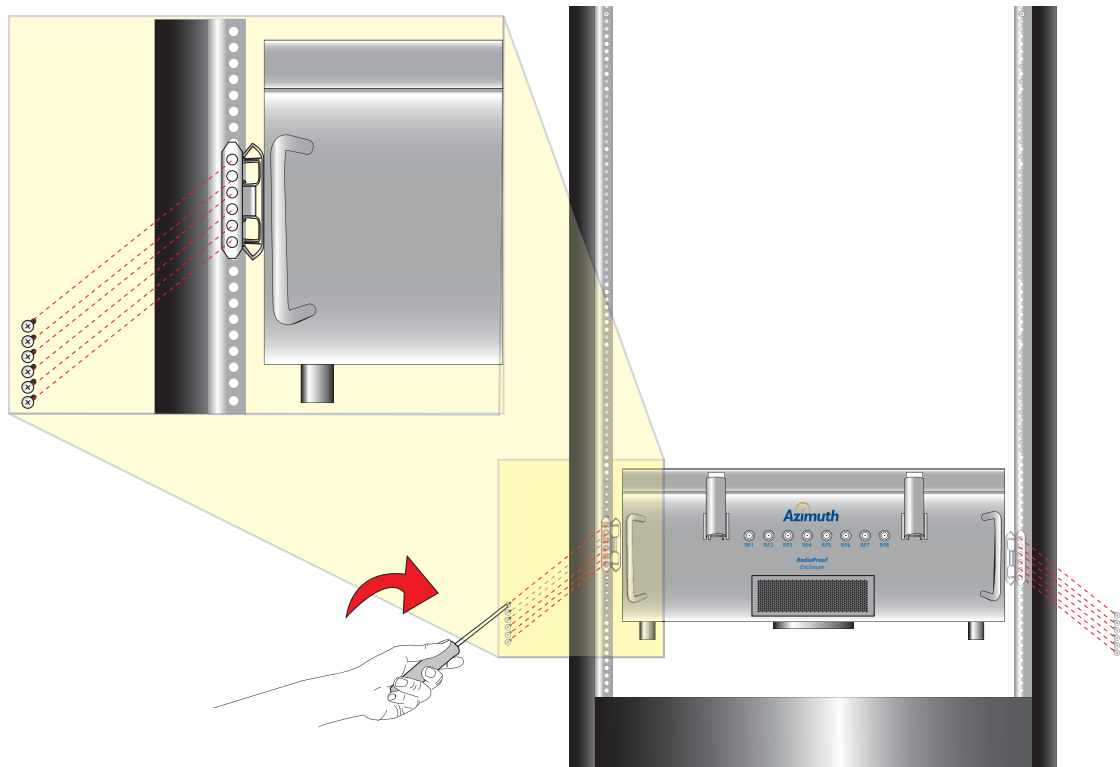
**Danger:** Make sure that the rack is properly secured/anchored during loading so that the rack is unlikely to tip over and cause extreme personal injury (e.g., rack bolted to the floor).



**Danger:** Make sure that the rack assembly that you use can accommodate the weight of the RPE. See “[RPE Technical Specifications](#)” on [page A-1](#) to determine the weight of the unit.

**Procedure:** To Install the RPE in a Rack Assembly

1. Two technicians should lift the empty RPE and position it in the rack assembly. The test head should be installed as low in the rack as possible so that you can easily see into the inside of the RF chamber through the top cover and easily make connections inside the chamber.
2. Line up the holes in the flange of the mounting bracket with the holes in the rack assembly ([Figure 2-8](#)).
3. Using a No. 2 Phillips screwdriver, fasten each of the twelve #10-32 x 0.375L Truss head screws to the rack assembly by turning the screws clockwise. You must install six screws in each of the chassis brackets.
4. You can install multiple RPEs in a rack as long as the rack is specified for holding the weight of the RPEs and devices under test. The minimum distance required between RPEs is defined by the feet located on the bottom of the test head.



**Figure 2-8. Mounting the RPE**

## Installing a Device in the RPE Chamber

This section describes in detail how to install a device in the RPE chamber.

The installation of a device in the RPE chamber requires the following connections:

- Connection to the RF port(s).
- Connection to the Ethernet port(s).
- Connection to the power source (not necessary when the device under test is powered by battery).

To make RF connections, first gain access to the antenna connection(s) on the device so that you can hard wire the antenna connection(s) to the RF port(s). The RF signal connects from the antenna connection(s) on the 802.11 wireless device to the RF port(s). The RF signal outside the chamber connects to the appropriate RF input of the Azimuth system.

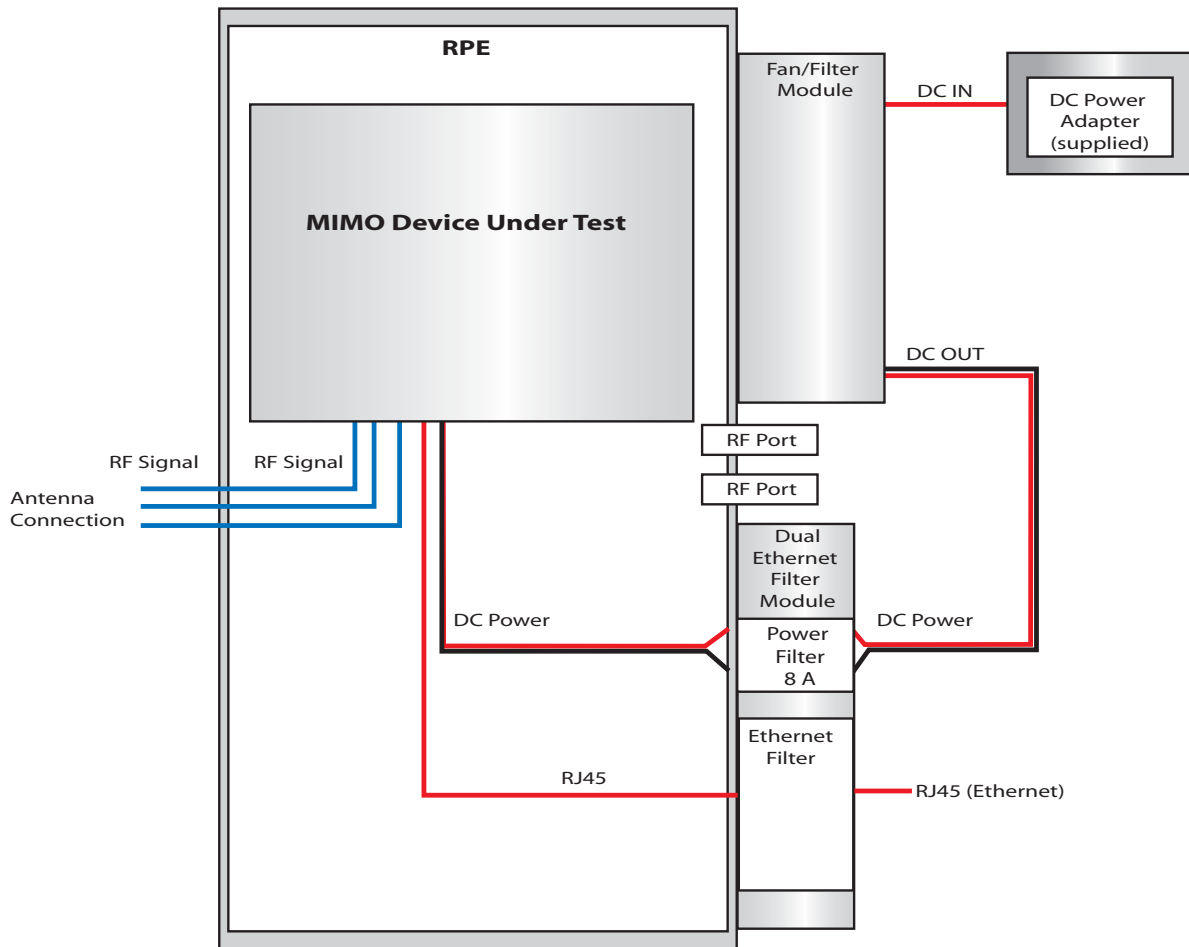
Note that there are many different ways of connecting the RF signals from the wireless station to the internal RF ports in the RPE. The precise manner in which the RF signal is attached depends on such variables as the number of antenna connections, the device being tested and the type of test being conducted. For example, in an RPE-101, some users may want to connect a two-antenna device to each of the RF ports rather than combine them. In other cases, such as a RPE-401, several antenna connections are made through the RF ports on the front panel of the chamber.



**Note:** For more information on making antenna connections, please see [“Physical Installation” on page 2-1](#) in the *Azimuth Carrier Card Hardware Installation and Product Description Guide* (Azimuth part number 14669).

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To provide power externally to the device under test, connect the power adapter (supplied) to the Fan Filter Module. Then connect the Fan Filter Module to the DC power connections on the Ethernet Filter Module. The device under test must then be connected to the internal DC power connectors. RPE-401L connections are shown in [Figure 2-9](#).



**Figure 2-9. RPE-401L Device Connection Configuration**



**Warning:** The RPE chamber is designed to accommodate devices with up to 100W of power dissipation.

Complete instructions on installing the device under test in the RPE is provided in the following procedure.

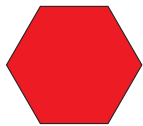
**PREREQUISITES:**

- The DUT should be configured so that:
  - The power save configuration remains on when the device is idle
  - The device does not hibernate or shut down when idle
- DUT with antenna(s) exposed on wireless device to be tested

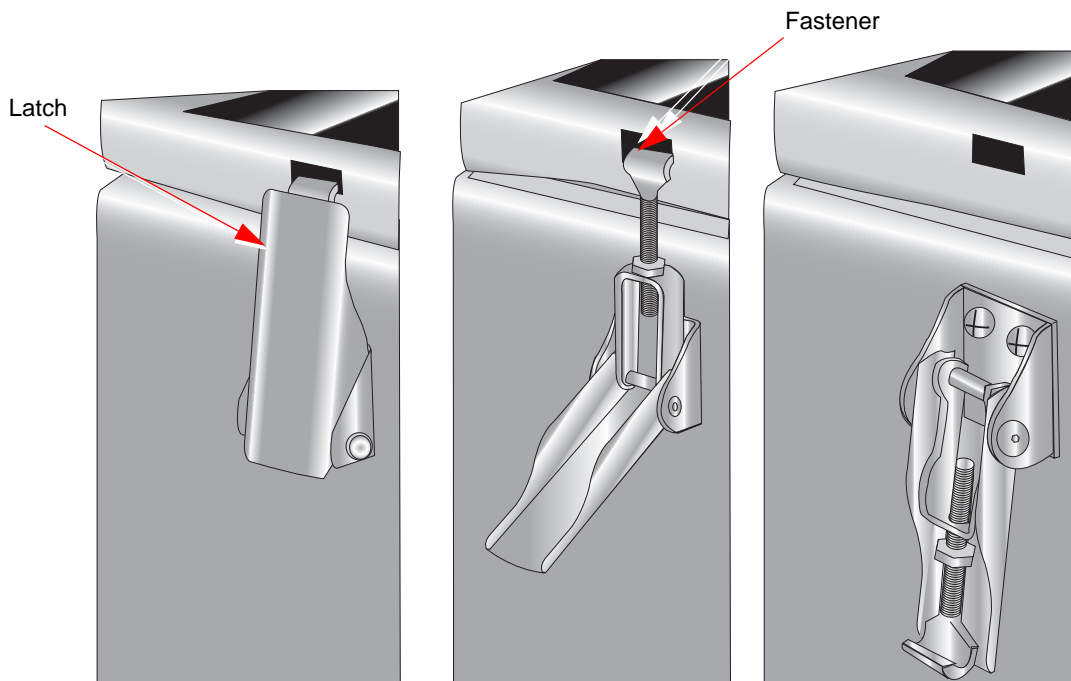
- DC power adapter (supplied) (Azimuth part number 14812) with small, flat-tipped screwdriver (included with power adapter)
- Two Ethernet cables (a small one for connection between the device and the interior chamber Ethernet port and a longer Ethernet cable between the exterior chamber Ethernet port and the Azimuth chassis)
- RF cables (one for each device under test). Ensure that only new or "known good" RF cables and connectors are used. Properly torque all RF connectors and adapters; otherwise, RF signal leakage might corrupt and invalidate testing.
- Power cord to attach DUT to Ethernet Filter Module (Azimuth part number 14809)

**Procedure:** To Install a DUT in the RPE Chamber

1. Provide access to the top of the RPE so that you can remove the chamber cover. If the unit is rack mounted, you may have to pull the RPE out by the handles to gain full access to the cover.
2. Open the mechanism that secures the cover to the RPE by pulling the latch, and then lifting and releasing the fastener (see [Figure 2-10](#)).

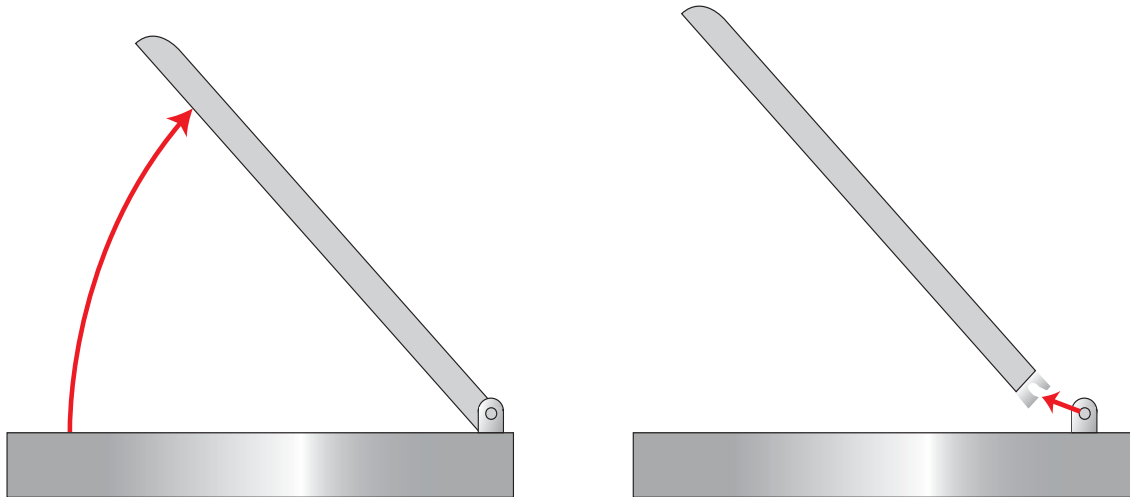


**Caution:** Do not adjust the screws on the latches. They are calibrated so that the proper amount of RF isolation is achieved.



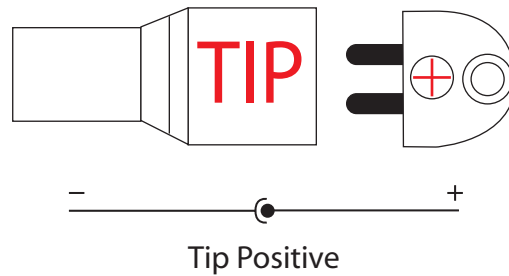
**Figure 2-10. Unlatching the Chamber Cover**

3. Remove the cover from the RPE chamber opening by raising the lid to about a 30-degree angle, moving the cover forward and lifting the cover up and off the assembly (see [Figure 2-11](#)).



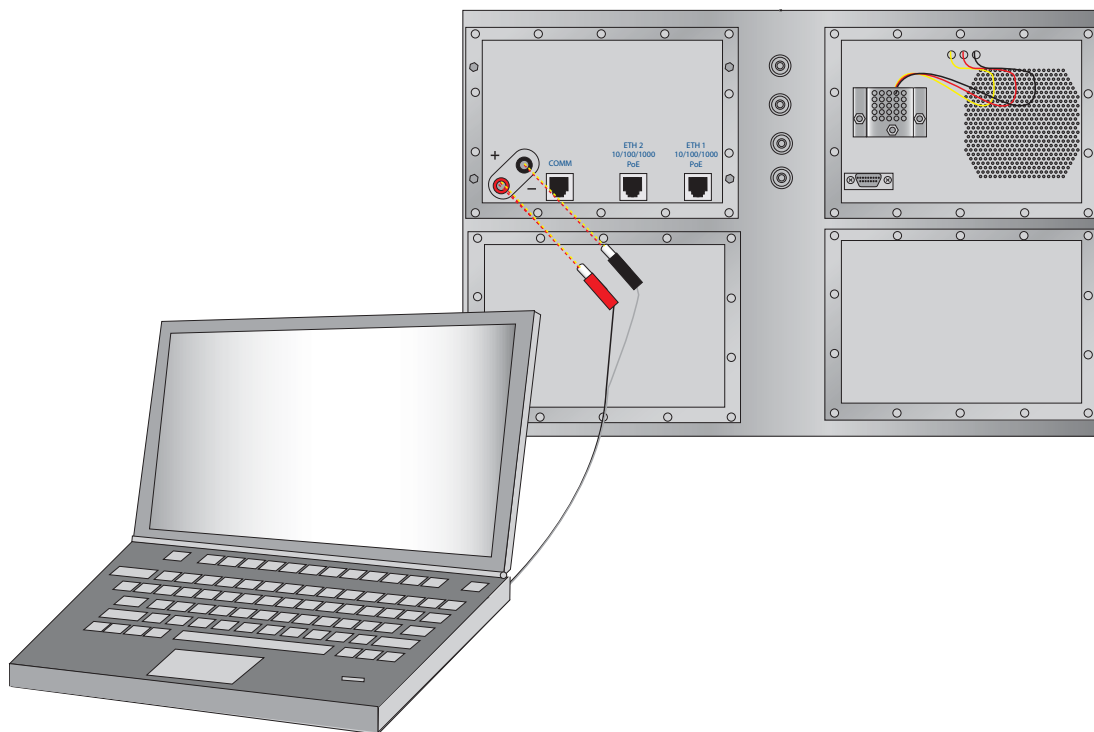
**Figure 2-11. Removing the Cover (Side View)**

4. Attach an RF cable(s) to the 802.11 station antenna(s) of the device. The antenna connection(s) are usually accessible on a printed circuit board inside the wireless station housing. For more information about connecting wireless station antennas to RF cables for use in testing, please see [“Physical Installation” on page 2-1](#) in the *Azimuth Carrier Card Hardware Installation and Product Description Guide* (Azimuth part number 14669).
5. Insert the device into the chamber.
6. Connect the RF antenna(s) to the appropriate RF port(s) inside the RPE chamber.
7. Using a short Ethernet cable, connect the Ethernet port from the device to an Ethernet port on the filter module in the chamber.
8. Connect an Ethernet cable from the appropriate Ethernet port on the filter module exterior to the Ethernet destination.
9. Connect the appropriate interchangeable tip to the DC power cord (Azimuth part number 14809) that attaches to the device. The selected tip should be oriented for the required polarity of the device. To set the correct polarity, orient the tip such that the positive (+) or negative (—) end of the interchangeable tip is aligned with the word “TIP” that appears at the end of the DC power cable. For example, in [Figure 2-12](#) the positive end of the interchangeable tip is aligned with the word “TIP” on the end of the DC power cable to set the connector to positive polarity.



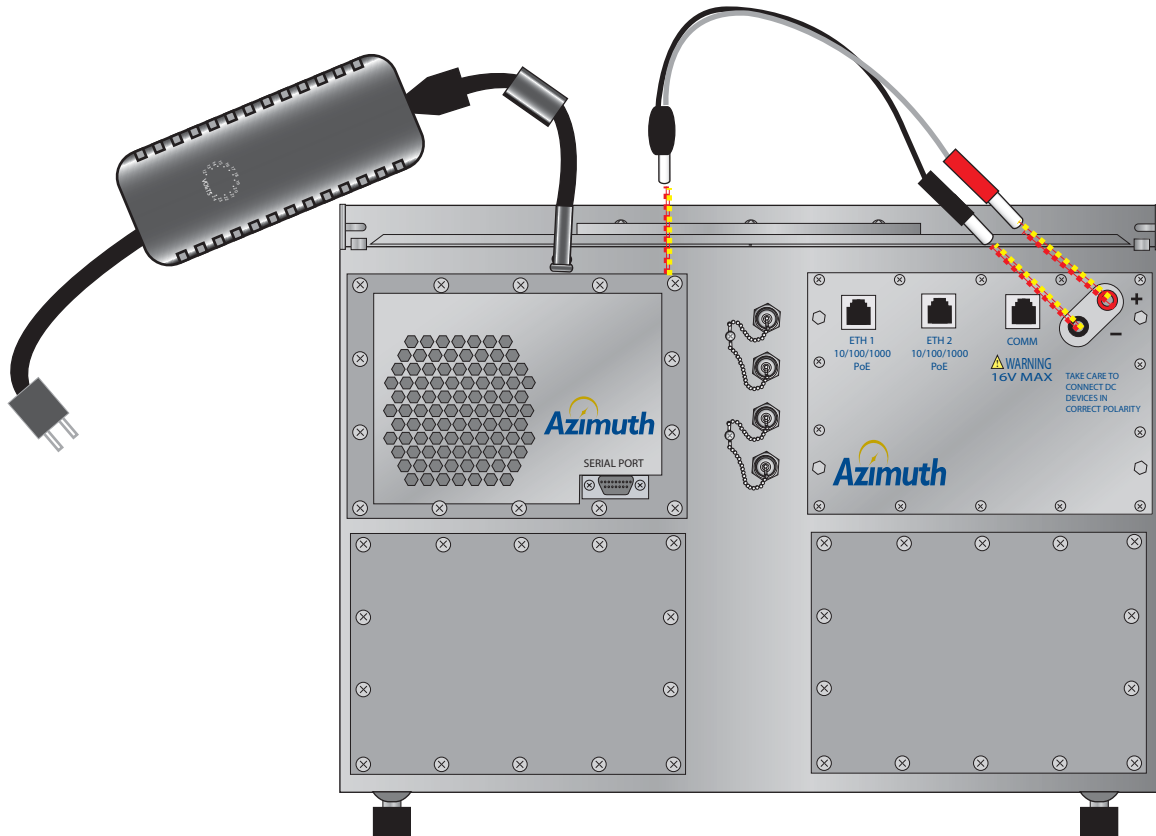
**Figure 2-12. Tip Positive Setting**

10. Connect the other end of the DC power cord to the Ethernet Filter Module's DC power connector.
11. Attach the other end of the device power cord to the DC power connectors on the Ethernet Filter Module using the red and black banana plugs (as shown in [Figure 2-13](#)). Make sure that the polarity of the plugs are properly configured.
12. Make sure that the polarity of the power cord matches the device manufacturer's recommended settings. To achieve normal polarity, plug the red jack (positive) into the red jack on the filter module and plug the black jack (negative) into the black jack on the module. To reverse polarity, plug the red jack into the black plug on the Ethernet Filter Module and plug the black jack into the red plug on the module.



**Figure 2-13. Wiring Power to the device Inside the Chamber**

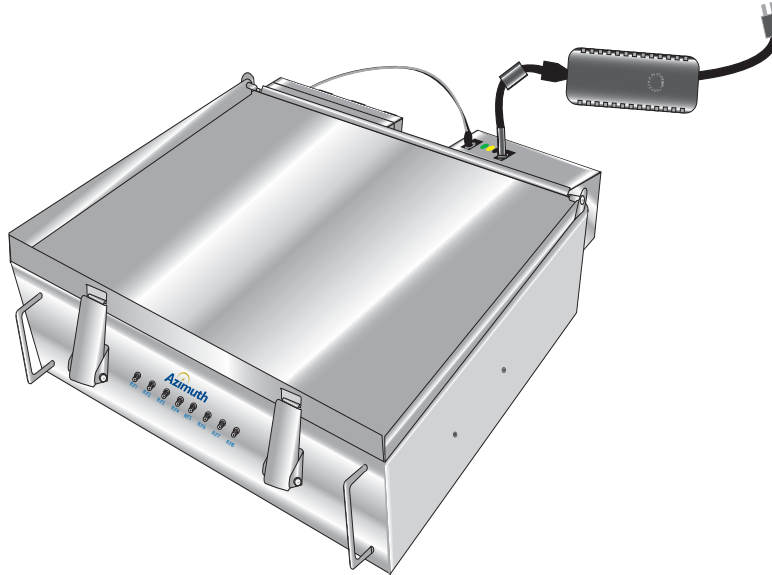
13. At the factory a 2.5mm interchangeable tip is attached to the end of the power adapter (Azimuth part number 14812) power cord that plugs into the fan filter module (see **A** in [Figure 2-14](#)). Ensure that the orientation of the interchangeable tip lines up the positive (+) symbol on the interchangeable tip with the power cord where the word “TIP” appears as shown in the example in [Figure 2-12](#).



**Figure 2-14. Wiring Power to the RPE**

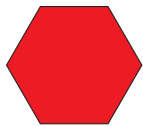
14. Attach the two-pronged connector of the external power cord to the external power connector on the filter module (see **B** in [Figure 2-14](#)). Attach the other end of the power cord (with a single prong) to the power connector closest to the RF ports on the Fan Filter Module (see **C** in [Figure 2-14](#)).
15. Attach the single pronged end of the supplied DC power adapter cord (see **C** in [Figure 2-14](#)) to the power connector on the Fan Filter Module furthest away from the RPE back panel RF ports. This power adapter will provide power to both the Fan Filter Module and the device under test in the RPE chamber.

16. Place the cover on the chamber opening. Make sure that the cover is seated firmly and that the pins are properly seated on either side of the hooks on both sides of the cover (Figure 2-15).

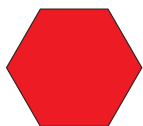


**Figure 2-15. Installed RPE Chamber Cover**

17. Secure the RPE chamber cover by positioning the fastener on the cover and then raising the latch to seal the chamber (see Figure 2-10 to identify the latch and fastener).
18. Determine the power adapter voltage requirements for the device by consulting the device's user documentation, the markings on the device manufacturing label and the original manufacturer's power supply or adapter for the device. If a voltage range is provided, always set the adapter to the highest setting in the range. Read the power adapter user guide for more information on determining the appropriate voltage for the device.
19. Set the DC power adapter to the appropriate voltage setting by using a small 1/8" flat-tipped screwdriver (provided) to turn the adjustment dial. You can turn the dial in either direction. Consult the power adapter user guide for more information.
20. Reposition the RPE in the chassis rack as appropriate.



**Caution:** When repositioning the RPE in the chassis rack, be careful of the external wires attached to the back of the RPE.



**Caution:** If the DC power adapter is not set to the appropriate voltage setting as recommended by the device manufacturer, you can severely damage the device!



**Note:** The Fan Filter Module operates on DC Voltage between 9 and 26 volts.

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21. Connect the DC power adapter(s) to a live AC electrical outlet.



# Appendix A: RPE Technical Specifications

This chapter provides the hardware specifications for the RPE product.

## RPE System Requirements

The specifications and requirements for the RPE are listed in [Table A-1](#). The specifications for external RF cables is presented in [Table A-2](#).

**Table A-1. RPE and Fan Filter Module Technical Specifications and Requirements**

Component	Specification
Dimensions, Interior (Chamber)	20.6" D x 15" W x 10" H
Dimensions, Exterior	28.5" D x 16.6" W x 12.7" H
Weight	<ul style="list-style-type: none"> <li>45.0 Lbs./20.45 Kgs (RPE-401L)</li> </ul>
Variable AC Power Adapter	<ul style="list-style-type: none"> <li>80W (maximum)</li> <li>Device Cable</li> <li>Input Voltage: 100 - 240VAC</li> <li>Output Voltage Settings: 12 - 24VDC</li> <li>Max Load Output, Amps: 4.0A</li> <li>Max Load Output, Watts: 80W</li> <li>Min Load Output, Amps: 0A</li> <li>Operation Temperature: 32 - 95° F (-0 - 35° C)</li> <li>Operating/Storage Humidity: 5 - 90% relative humidity, non-condensing</li> </ul>
Mounting	<ul style="list-style-type: none"> <li>19-inch rack mount or rest on stable bench</li> <li>Detachable rack mount kit includes slide rails</li> </ul>
Door	<ul style="list-style-type: none"> <li>One RF service hatch</li> <li>Two latches on service cover (17 in. W x 14 in. D) calibrated to ensure the proper RF isolation in the RPE chamber</li> <li>Provides 90 dB RF isolation</li> </ul>
RF Connectors (front of RPE-401L)	Eight SMA-type, RF coaxial connectors with external dust caps
RF Connectors (back of RPE-401L and RPE-401)	Four N type, RF coaxial connectors with externally attached dust caps
RF Isolation Performance, Test Head	90 dB, 1.0 - 6.0 GHz

**Table A-1. RPE and Fan Filter Module Technical Specifications and Requirements (Continued)**

Operating Temperature Range	0 - 45° C
Relative Humidity	Operation: 5 - 90%, non-condensing

Component	Specification
Fan Filter Module	<ul style="list-style-type: none"> <li>• One fan mounted on removable panel</li> <li>• Runs from 9 - 28V (with supplied DC power adapter)</li> <li>• Cools chamber interior</li> <li>• Temperature sensor with one (green) power and two temperature (red and yellow) LEDs</li> <li>• Dimensions: 7 in. x 5 in. x 2 in. (W x L x D)</li> <li>• 1.5 lbs.</li> </ul>
Serial Port	<ul style="list-style-type: none"> <li>• One nine-pin connectors, filtered, all conductors</li> </ul>
Power Cable (device to power connectors on Ethernet Filter Module)	<ul style="list-style-type: none"> <li>• Power cable with interchangeable tips connect to device</li> <li>• Banana plugs connect to power connector inside Ethernet Filter Module</li> </ul>

**Table A-2. RF Connection Cable Specification**

Component	Specification
External RF Connection Cable	<ul style="list-style-type: none"> <li>• Coaxial cable with at least 100 dB ingress and 50 ohm characteristic impedance</li> <li>• Total RF loss &lt; 1.0 db</li> </ul>

# Gigabit Ethernet Filter Specifications

- The specifications and requirements for the Gigabit Ethernet Filter Module for use with the RPE are provided in [Table A-3](#).
- Ethernet port pinouts are provided in [Table A-4](#).
- The Power Sourcing Equipment (PSE) pinout alternatives (from IEEE std. 802.3af-2003) to Ethernet pinouts are provided in [Table A-5](#).
- Comm Port pinouts are provided in [Table A-6](#).
- An illustration of the Gigabit Ethernet Filter Module is provided in [Figure A-1](#).

**Table A-3. Gigabit Ethernet Filter Technical Specifications**

Component	Specification
Dimensions	7 in. x 5 in. x 1 in. (W x L x D)
Weight	3 lbs.
Operating Temperature Range	0 - 50° C
Relative Humidity	Operation: 0 - 90%, non-condensing
Power Connections, External	<ul style="list-style-type: none"> <li>• Banana jacks, 16 amps operating, 20 amp surge, 72V max</li> <li>• Detachable screw-type binding posts for attaching wires to the banana jacks</li> </ul>
Power Connections, Internal	<ul style="list-style-type: none"> <li>• Banana jacks, 16 amps operating, 20 amp surge, 72V max</li> <li>• Detachable binding post-to-banana jack adapter for attaching wires to the banana jacks</li> </ul>
Ethernet 10/100/1000 Connection	<ul style="list-style-type: none"> <li>• Two filtered eight-pin RJ45 ports (Ethernet ports - 802.3af compliant). POE-compatible.</li> <li>• One filtered eight-pin RJ45 port (Comm port). Not POE-compatible. Can be used for other interfaces.</li> <li>• Pinouts for these ports are presented in <a href="#">Table A-4</a> and <a href="#">Table A-6</a></li> </ul>
Ethernet Port Filter Response	See <a href="#">Table A-4</a>
Comm Port Filter Response	See <a href="#">Table A-6</a>
Power Port Filter Response	<p>&lt; 0.01 GHz frequency: &lt; 3 dB</p> <p>0.01 - 6.0 GHz frequency: &gt; 60 dB loss</p>

**Table A-4. Gigabit Ethernet Filter Module Ethernet Port Pinouts**

Pin No.	Signal	Maximum Current	Filter Response
1	Ethernet Pair 1	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
2	Ethernet Pair 1	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
3	Ethernet Pair 2	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
4	Ethernet Pair 3	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
5	Ethernet Pair 3	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
6	Ethernet Pair 2	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
7	Ethernet Pair 4	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss
8	Ethernet Pair 4	300 mA	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss

a: Voltage polarity varies according to the user implementation. All physical Ethernet connections are 802.3af-compliant. See [Table A-5](#) for the PSE pinout alternatives.

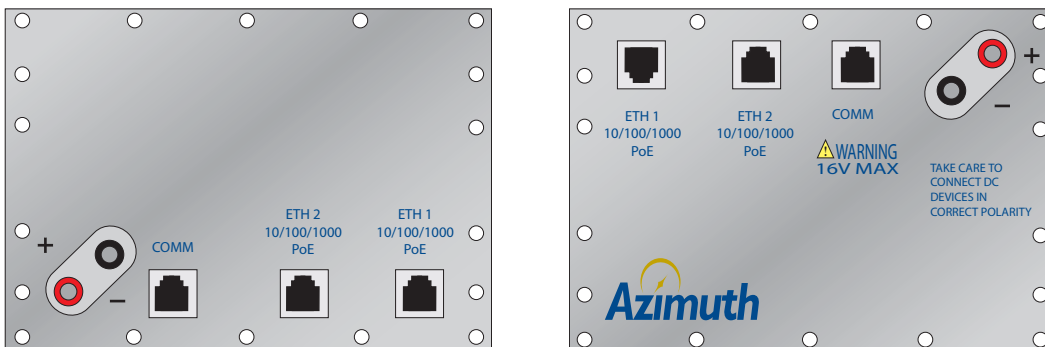
**Table A-5. PSE Pinout Alternatives\***

Pin No.	Alternative A (MDI-X)	Alternative A (MDI)	Alternative B (All)
1	Negative V <sub>Port</sub>	Positive V <sub>Port</sub>	
2	Negative V <sub>Port</sub>	Positive V <sub>Port</sub>	
3	Positive V <sub>Port</sub>	Negative V <sub>Port</sub>	
4			Positive V <sub>Port</sub>
5			Positive V <sub>Port</sub>
6	Positive V <sub>Port</sub>	Negative V <sub>Port</sub>	
7			Negative V <sub>Port</sub>
8			Negative V <sub>Port</sub>

\* The PSE (Power Sourcing Equipment) Pinout Alternatives ([Table A-5](#)) are from Table 33-1 of the IEEE Std 802.3af-2003. Please reference [Table A-4](#) for more information.

**Table A-6. Gigabit Ethernet Filter Module Comm Port Pinouts**

Pin No.	Signal	Filter Response
1 - 8	Single-ended signal line (not to exceed 100 mA, 16V)	0.0 - 0.38 GHz frequency: < 3 dB loss 2.0 - 6.0 GHz frequency: > 60 dB loss



**Figure A-1. Gigabit Ethernet Filter Module Interior (at left) and Exterior (at right)**



# Appendix B: RPE Troubleshooting

This chapter provides a procedure on installing the filter module onto the RPE.

## Troubleshooting RPE RF Isolation

The RPE isolates RFI (radio frequency interference) that could affect wireless devices either in another chamber of the chassis or in test equipment outside the RPE. In the unlikely event that RF isolation fails, it would result in faulty RF test results. Therefore, Azimuth Systems, Inc. recommends that you annually verify RF isolation of the RPE.

To verify RPE RF isolation, you must do the following (in order):

1. Verify each item in the troubleshooting checklist (see checklist below).
2. Perform the troubleshooting procedure described in [“Verifying RPE RF Isolation”](#) (page B-2).

### CHECKLIST:

- ✓ Are dust caps tightly secured to all unused RF ports? Proper torque is mandatory, as are clean, known good, connectors and cables. Worn cables are the primary cause of RF leakage.
- ✓ Are screws tightly secured on the RPE filter module?
- ✓ Is the coaxial cable for all RF connections at least 100 db ingress?
- ✓ Are all RF connections tightly secured, including the connection from the AP to the inner RF port, the outer RF ports, and from the external RF ports to the destination devices?

## Verifying RPE RF Isolation

The following procedure describes the process for verifying RF isolation in the RPE. The procedure enables you to verify RF isolation either between chambers or outside of the chassis.

### REQUIRED EQUIPMENT:

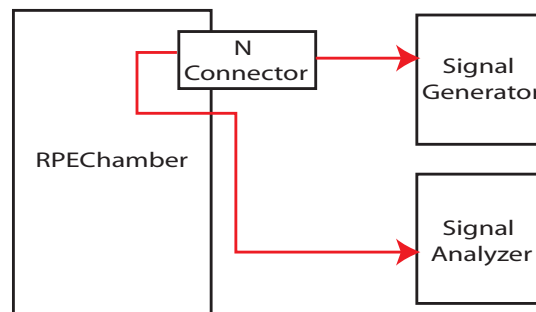
- RF signal generator covering frequencies of interest
- Spectrum analyzer covering frequencies of interest
- Two antennas or sets of antennas of known gain capable of covering frequencies of interest
- Coaxial cables

### PREREQUISITES:

- Read and verify each item in the troubleshooting checklist above before performing the following procedure. The checklist will rule out any potential problems with the hardware setup that could present the symptoms of RFI, but in actuality be caused by a faulty hardware setup.

### Procedure: To Verify RPE RF Isolation

1. Set up your equipment as illustrated in [Figure B-1](#).



**Figure B-1. Test Equipment Setup for Verifying RPE RF Isolation**

2. Remove the cover from the RPE chamber to be measured.
3. Connect the signal generator to that portion of the N connector that is external to the RPE.
4. Connect the signal analyzer to the interior portion of the RPE N connector.
5. Set the signal analyzer span and bandwidth for a noise floor of less than -100 dBm.
6. Set the signal generator and the signal analyzer to the same frequency of interest.
7. Set the signal generator level so that the signal analyzer measures 20 dBm.
8. Disconnect the signal analyzer cable from the RPE N connector and place an antenna on the end of the cable.
9. Place a second antenna on the inside of the RPE N connector.

10. Close the cover of the RPE chamber being measured.
11. Use the antenna connected to the signal analyzer to “sniff” around the RPE. It is especially important to check joints and seams such as those found around the chamber cover and filter module. It may be necessary to place the signal generator several yards away from the RPE to avoid picking up signals directly from the generator.



**Note:** Ensure that the RF signals seen on the analyzer are not emanating from the signal generator.

12. Measure the signal level.
13. Subtract 20 dB from the measured signal.
14. Subtract the gains of the two antennas. This number should be less than -90 dBm. If the number exceeds -90 dBm, then contact Customer Support for service.

## Fan and Temperature Troubleshooting

[Table B-1](#) presents common troubleshooting procedures for attempting to correct problems related to the RPE Fan Filter Module and the chamber temperature.

**Table B-1. RPE Fan Filter Module and Temperature Troubleshooting**

Problem Description	Corrective Action
Fan is not spinning	<ul style="list-style-type: none"> <li>• Ensure that the Power LED is green.</li> <li>• Ensure that the RPE is plugged in to an active AC outlet.</li> <li>• If the problem persists, please call Customer Support.</li> </ul>
Chamber temperature exceeds 40° C	<ul style="list-style-type: none"> <li>• Ensure that the RPE cooling fan is spinning.</li> <li>• Make sure that the cooling fan is not obstructed.</li> <li>• Ensure that the RPE is being operated at or below the maximum recommended operating temperature and relative humidity. For specifications, please see <a href="#">“RPE System Requirements” (page A-1)</a>.</li> <li>• If the problem persists, please call Customer Support.</li> </ul>

## Power System Troubleshooting

[Table B-2](#) presents common troubleshooting procedures for attempting to correct problems related to the RPE power system.

**Table B-2. Power System Troubleshooting**

Problem Description	Corrective Action
No device power	<ul style="list-style-type: none"> <li>• Ensure that the power adapter is connected to the device.</li> <li>• Ensure that the power adapter is set to the appropriate voltage.</li> <li>• Ensure that the green LED on the Fan Filter Module is lit.</li> <li>• <b>Note:</b> Even though the green LED is lit, it does not necessarily mean that there is enough current to run the device. Check the device’s power specifications to ensure that its current requirements does not exceed 3.5A. For power specifications, please see the device requirements and the power, polarity, and voltage requirements in <a href="#">“RPE System Requirements”</a> (page A-1).</li> </ul>
Green LED on the Fan Filter Module is not lit	<ul style="list-style-type: none"> <li>• Ensure that the RPE is plugged in to an active AC outlet, that the fan is spinning on the Fan Filter Module, and that the device is working.</li> <li>• If the problem persists, please call Customer Support.</li> </ul>

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