Multiband RPM Operating Guide

ASCEND COMMUNICATIONS, INC

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United Kingdom Usage Approval:

The Multiband RPM is approved under general approval, NS/G/12345/J100003, for connection to the data ports of the Multiband range of bandwidth aggregators.

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Revision E revises the description of Test 1 in Chapter 3.

The information in this guide is organized into the following chapters:

- Chapter 1, "Introduction to Multiband RPM," briefly describes how Multiband RPM operates and its key features.
- Chapter 2, "Installation Procedures and Tests," gives step-by-step instructions on the installation and configuration of Multiband RPM. An installation test procedure is described.
- Chapter 3, "RPM Diagnostics and Troubleshooting," describes what the RPM diagnostic tests do and what the RPM front-panel LEDs mean. This chapter also lists typical trouble conditions and their possible cause.
- The glossary describes key terms used in this guide. Terms given in the glossary appear in *boldfaced italic font* in the text of the guide.
- The index lists the topics covered in this guide in alphabetical order, along with their page-number reference.

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Glossary

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This guide describes Ascend's Multiband RPM, its applications, and its installation.

Multiband RPM is a limited-distance modem-like device that extends the distance and the control interfaces between Multiband products and host equipment. Because RPM uses standard unshielded twisted-pair wiring, you can easily bring global bandwidth on demand to wherever it is needed within your facility.

An **RPM link** consists of two RPMs terminating both ends of a twisted-pair communications cable. On the *access end* of the RPM link, a Multiband RPM is connected to a Multiband global bandwidth-on-demand product. On the *host end* of the RPM link, host equipment is connected to a Multiband RPM.

Multiband RPM is an external table-top module. In this guide the term *RPM*, when used by itself, refers to this module.

You can connect up to two independent single-port applications or one dual-port application at the host end of an RPM link. In this document, both the dual-port application and the application that uses both ports independently are called *two-port applications*. RPM treats all two-port applications identically and has no concept of a primary and secondary host port, as do other Multiband products.

The two RPM host ports support V.35 and RS-449/RS-422 electrical interfaces, including the RS-366, V.25 bis, and X.21 protocols. Up to 1.536 Mbit/s can be transmitted and received in full duplex mode on either one, but not both, of the RPM host ports. When both RPM host ports are operating, such as when an RPM link supports two independent applications, the maximum data rate of each host port is 768 kbit/s.

The RPM terminal controller port supports both the hand-held Palmtop and VT-100 terminals, bringing full management capability to the host end.

On the access end, Multiband RPM works with all Ascend Multiband products.

Common Multiband RPMs applications include

- multiple host locations tied to a Multiband bandwidth-on-demand hub
- rollabout applications
- any application where you must separate the host and network termination equipment

RPM links are not required when the host equipment and Multiband product are located in the same cabinet or shelf. Nor is an RPM link required when the distance between the host and Multiband product can be handled by the host interface cable alone.

1.1 Sample Configurations

This section describes two sample configurations. The first configuration illustrates a site with two separate videoconferencing applications working off a single Multiband Plus. The second sample configuration illustrates a LAN and a videoconferencing application working off a single Multiband Plus. 1.1.1 Multiple Videoconferencing Sample Configuration

The following illustration shows a sample RPM configuration where two dual-port video applications are supported by a four-port Multiband Plus:



In this illustration, the Multiband Plus is installed in the telecommunications closet, where the network lines enter the building. Attached to the Multiband Plus host ports are two RPMs. Each RPM connects to a primary and secondary host port, to reflect the dual-port configuration expected by the dual-port *video codec*.

Each application site is also equipped with an RPM. The RPM link connects to the host device as a virtual Multiband Plus. The host end RPM connects to the access end RPM via twisted-pair cabling. As the illustration indicates, the RPM link allows the applications to be physically separated from each other and from the Multiband Plus terminating the network interface in the telephone room. In addition, both the applications and the Multiband Plus can be managed locally, either through a VT-100 terminal, a PC with VT-100 terminal emulation, or through Ascend's Palmtop hand-held terminal. The control terminals all have access to the complete control interface of Multiband Plus.

1.1.2 LAN / Video Sample Configuration

The following illustration shows a sample RPM application in which a four-port Multiband Plus provides switched network access to a LAN router and a dual-port codec:



In this illustration, the Multiband Plus is installed in the telecommunications closet, where the network lines enter the building. Attached to the Multiband Plus host ports are two RPMs. One RPM connects to the primary and secondary host ports, to reflect the dual-port configuration expected by the dual-port codec. The other RPM connects to a single host port which serves as an access point for a router. One Multiband Plus host port remains for the future addition of new applications.

The router that connects to the RPM link at the host end requires only a single host port and is programmed to command Multiband Plus to dial other router sites as required by the wide area network. The other RPM link that connects a video codec to the public network dials through RS-366 commands.

1.2 Overview of the RPM Operator Interface

RPM is designed to provide a transparent interface between Multiband products and host equipment. Therefore, only during installation and troubleshooting do you actually operate RPM.

The three sections that follow briefly describe the external features of the RPM operator interface, namely, the LEDs, the configuration/test switches, and the connectors.

1.2.1 RPM LEDs

RPM has four LEDs on its front panel. The following drawing illustrates their location:



• DATA

During normal operation, the green **DATA** LED is lit. If this LED is on, it indicates the presence of the signal that carries data from the far-end RPM to this RPM.

• SYNC

When the green **SYNC** LED is fully lit, it indicates RPM is receiving an adequate signal from the RPM at the other end of the link. This LED indicates whether RPM can transmit and receive data over the link. When flickering or off, RPM is not receiving an adequate signal over the link and data transmission is not available.

• TEST

The yellow **TEST** LED lights when RPM is running one of its tests. During normal operations, this LED should be off. See section 3.1 for a description of RPM tests.

• POWER

The green **POWER** LED is lit when the power cord is connected and RPM is receiving power.

For more information on RPM LEDs, see section 3.2.

1.2.2 Configuration/Test Switches

You configure RPM by setting the 8-position DIP switch located on the left side of its back panel:



Switch positions #1 through #6 control RPM configuration. Switch positions #7 and #8 control RPM diagnostics. For normal operation, switch positions #7 and #8 should be down. A complete description of RPM configuration is found in Chapter 2. For more information on RPM diagnostic tests, see section 3.1.

1.2.3 Connectors and Interfaces

All connectors are located on RPM's back panel. Two female DB-44 connectors labeled HOST 1 and HOST 2 provide host interfaces electrically compatible with V.35, X.21, or RS-422. These interfaces also support RS-366 and V.25 bis dialing protocols. The twisted-pair cabling between RPMs plugs into the RJ-45 connector labeled MULTITALK. The RJ-11 connector labeled PALMTOP provides a port for a control terminal, which can be either the hand-held Palmtop or a VT-100-compatible terminal.

1.3 For More Information

For further information on the RPM LEDs and diagnostics, see Chapter 3.

This guide assumes you are familiar with the Multiband product with which RPM is installed. You can find an introduction to Multiband Plus in the *Multiband Plus System Guide*. The *Multiband Plus System Guide* also provides instructions on how to install Multiband Plus. Similar information on Multiband is found in the *Multiband System Guide*.

Installation Procedures and Tests

This chapter provides detailed step-by-step procedures for installing an RPM link. Read each step carefully and follow its instructions.

Where necessary, some of the steps refer to more specific instructions in the installation sections of Multiband product guides.

2.1 Installation Planning

For best results, Ascend recommends that you begin with an installation plan including a sketch of the application layout, an equipment list, a wiring plan, and a site plan.

Sketch the location of the equipment and cables to be installed. Include all cables in your sketch, even if you plan to use existing wiring. Make sure that the sketch shows the Multiband product host ports connected by the RPM link.

RPM has two host interfaces with a maximum data composite data rate of 1.536 Mbit/s or 448 kbit/s depending on the distance. If the distance is less than 1700 feet, a single-port application cannot exceed 1.536 Mbit/s, while an application that uses both host ports is limited to 768 kbit/s at each port. If the distance is less than 3000 feet, a single-port application cannot exceed 448 kbit/s, while an application that uses both host port to 368 kbit/s and the other to 64 kbit/s. Each host port can be configured to be electrically compatible with V.35, X.21, or RS-449/RS-422.

2.1.1 Equipment List

All the equipment required by an installation should appear on the equipment list. This section lists the equipment required for the host end and access end of an RPM link. The equipment required by the host end is described first.

Crossover Equipment

Some sites might require the installation of the optional RPM-WJX twisted-pair cable. This cable can provide the necessary crossover wiring between host and access ends of an RPM link. This equipment is included in the RPM kit supplied to sites that require a crossover cable.

Host Location Equipment List

The following list itemizes the equipment that is located with the host. The quantities required for a single RPM link are given. Check whether your application uses the optional equipment:

- One RPM
- One or two host interface cables, depending on the requirements of the host device(s)
- One RPM power cord
- One RPM-WJS twisted-pair cable (or RPM-WJX)
- Optional: A VT-100-compatible terminal or hand-held Palmtop terminal and its cord
- Optional: One HHT-VT-100 cable if a VT-100 is installed

See the system guide of the Multiband product for a list of the different types of host cables. The type of host cable you install is determined entirely by the requirements of the host device.

NOTE: You can install either Multiband or Multiband Plus host cables. However, if you install Multiband host cables, you must also install an adapter cable. The adapter cable model numbers are MBHD-449ADP for the RS-449 host interfaces and MBHD-V35ADP for the V.35 host interfaces.

Access End Equipment List

The following list itemizes the equipment that is located with the Multiband product. The quantities required for a single RPM link are given:

- One RPM
- One RPM power cord
- One RPM-WJS twisted-pair cable
- One HHT-X cable
- When installed with Multiband Plus, one or two RPM-MBHD cables, depending on whether the host device(s) requires one or two host interfaces
- When installed with Multiband, one or two RPM-MB cables, depending on whether the host device(s) requires one or two host interfaces

2.1.2 Wiring Plan

Your wiring plan should describe the type of twisted-pair cables to be installed, their length, and location. Your wiring plan should also include the wiring of any patch panels used. In many cases, existing twisted-pair cables can be used.

Crossover Wiring

You must plan for a single crossover between the ends of the RPM link. You can install a crossover twisted-pair cable, or you can wire the crossover in a patch panel in a wiring closet. The following sections describe both methods.

Twisted-Pair Wiring

Whether you plan to use existing wiring or install new wiring, the wiring installed between the ends of the RPM link must be twisted-pair cable. If you plan to use existing wiring with four twisted pairs, only two pairs are used by RPM.

The characteristics of the twisted-pair cable installed between RPM link endpoints determine the maximum length of the RPM link. Some cables can operate over greater distances than others, but regardless of the cable characteristics, there is a maximum cable length beyond which the link does not operate reliably. Excessive twisted-pair cable length can cause high bit error rates and even can cause the link to lose synchronization.

To complete your wiring plan, consider these points:

• Verify the characteristics of the twisted-pair cables. Ascend recommends Level 3 or Level 4 twisted-pair cable.

NOTE: Level 3 and Level 4 are informal recommendations for 100 Ohm twisted-pair cables. Level 3 should meet EIA/TIA 568 or IEEE 802.3 10 Base T (10 Mbit/s), while Level 4 cable meets these recommendations at 16 Mbit/s.

- If you use existing cables, determine the number of bridge taps installed on that cable. Ascend recommends that no more than six bridge taps exist. Bridge taps degrade the RPM link signal and limit distance between RPM ends.
- You can achieve satisfactory RPM link performance for most applications if the link is installed with Level 3 or Level 4 twisted-pair cable with minimal bridge taps and no other factors exist that degrade link performance.

NOTE: It is beyond the scope of this document to provide a comprehensive list of problems that might degrade link performance, especially at maximum distance. However, ground loops, noise broadcast from nearby equipment or cables, and bad splices are among the possible causes.

- Depending on the distance mode selected, do not exceed 1700 feet (518 m) cable length between ends of the RPM link, or 3000 feet (914 m).
- Operating up to 1700 feet, Distance Mode 1 link has a maximum data rate for single-port applications of 1.536 Mbit/s, while an application that uses both host ports, each port is limited to 768 kbit/s at each port. Operating up to 3000 feet, Distance Mode 2 has a maximum data rate for single-port applications of 448 kbit/s, while an application that uses both host ports, HOST 1 is limited to 368 kbit/s and HOST 2 is limited to 64 kbit/s.

Ascend recommends the twisted-pair cable be equipped with RJ-45 connectors.

The following illustrations shows the twisted-pair wiring for an RPM link where crossover wiring is installed in the patch panel:



Twisted-Pair Cable Drawings

The following schematic shows the wiring of the RPM-WJS cable. Twisted-pair cable installed between the ends of the RPM link should follow this schematic. In this drawing, both ends of the twisted-pair cable are equipped with RJ-45 connectors.

Twisted-pair #3 and #4 on pins 4, 5, 7, and 8 are not shown and are not used by the RPM link:



Twisted Pair #2

Section 2.3 describes the wiring required at the patch panel. If your installation does not include a patch panel, you can substitute a crossover cable.

The following wire list shows the wiring of the RPM-WJX twisted-pair cable, which can provide crossover wiring without a patch panel. If you install a crossover twisted-pair cable, it should follow this schematic. This table assumes that both ends of the cable are equipped with RJ-45 connectors. Twisted-pair #3 and #4 on pins 4, 5, 7, and 8 are not used by the RPM link:

Twisted-Pair	RJ-45 Pin	RJ-45 Pin
1	1	3
1	2	6
9	3	1
2	6	2
3 not used by	4	7
RPM	5	8

Twisted-Pair	RJ-45 Pin	RJ-45 Pin
4 not used by	7	4
RPM	8	5

2.1.3 Site Requirements

This section describes the site requirements when installing an RPM link. Use this section to plan the layout and environment of RPM modules and host equipment. Also use this section to plan RPM's source power.

Source Power

The following source power is required at each location where an external RPM is installed:

Voltage:	90-260 VAC
Phase:	single
Frequency:	47-63 Hz
Power:	20 Watts maximum

The source power plug must be three-pronged with a good earth ground. Proper operation of an RPM link depends upon the quality of the earth ground.

Use a protected power source or add surge protection between the power source and the external RPM.

Environment

Each RPM must be installed in a room where the temperature does not go below 32° or exceed 104° Fahrenheit (0° to 40° Celsius). Storage temperatures of -40° to 176° Fahrenheit (-71.4° to 80° Celsius) are acceptable.

Humidity should be high enough to prevent accumulation of static electricity but low enough to prevent condensation. An operating relative humidity of up to 90% is acceptable.

An RPM link can operate at altitudes of 0 to 14800 ft (0-4500 m).

Site Floor Plan, Access End

At the access end of the RPM link, the RPM should be no more than 4 or 5 feet (1.2 to 1.5 m) from Multiband product. The RPM-to-Multiband product cables are approximately 6 feet (1.8 m) long. Use RPM-MB and HHT-X between RPM and Multiband, or use RPM-MBHD and HHT-X between RPM and Multiband Plus.



Ascend recommends you install RPM within 20 feet (6 m) of the wall jack connection to the twisted-pair cable between RPM link endpoints. The RPM-WJS twisted-pair cable, which connects RPM to the wall jack, is 20 feet long.

If the installation uses external RPMs at the access end, verify the available space for the installation of each RPM. RPM has these dimensions: $1.75" \ge 7.75" \ge 10.25"$ (4.45 cm ≥ 19.7 cm ≥ 26.0 cm).

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Site Floor Plan, Host End
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At the host end of the RPM link, RPM should be located no more than 7 feet (2.1 m) from the host device. The host cable(s), which connect RPM link to the host, are approximately 10 feet (3.0 m) long:



Ascend recommends you position RPM within 20 feet (6 m) of the wall-jack connection to the twisted-pair cable installed between RPM link endpoints. The RPM-WJS twisted-pair cable, which connects RPM to the wall jack, is 20 feet long.

2.2 Installation at the Access End

The following instructions apply to the RPMs located with the Multiband product. Complete the steps in this section before continuing with the installation instructions for the host end of the RPM link.

2.2.1 DIP Switch Settings

Locate the 8-position DIP switch on the left side of RPM's back panel.

If you are running a single-port application, set the RPM switches at the access end as follows. See section 2.6 for detailed information on each switch setting:

Single-Port Application, Access End	
Switch	Setting
#1	see note*
#2	up
#3	up
#4	up
#5	up
#6	up
#7	down
#8	down
*set switch #1 down for Distance Mode 1 or up for Distance Mode 2	

The following illustration shows the RPM access end settings for a single-port application with Multiband Plus:



If you are running a two-port application, set the RPM switches at the access end as follows. In two-port operation under Distance Mode 1, neither port can exceed 768 kbit/s bandwidth. In two-port operation under Distance Mode 2, HOST 1 cannot exceed 384, while HOST 2 cannot exceed 64 kbit/s. See section 2.6 for detailed information on each switch setting:

Two-Port Application, Access End	
Switch	Setting
#1	see note*
#2	down
#3	up
#4	up
#5	up
#6	up
#7	down
#8	down
*set switch #1 down for Distance Mode 1 or up for Distance Mode 2	

The following illustration shows the RPM access end settings for a two-port application with Multiband Plus:



2.2.2 Host Cables

Determine from your installation plan which host port(s) of the Multiband product are connected by the RPM link. Then follow these steps:

- 1 If you are running a single-port application with a Multiband Plus, connect an RPM-MBHD cable between a Multiband Plus host port and the port labeled HOST 1 on the RPM back panel.
- 2 If the single-port application is installed with a Multiband, connect an RPM-MB cable between the Multiband host port labeled PRIMARY and the port labeled HOST 1 on the RPM back panel.
- 3 If you are running a two-port application with a Multiband Plus, connect an RPM-MBHD cable between the Multiband Plus primary host port and the port labeled HOST 1 on the RPM back panel. Connect a second RPM-MBHD cable between the Multiband Plus secondary host port and the port labeled HOST 2. If both host ports are used independently, connect the first independent port of the host device(s) to HOST 1 and the second independent port of the host device(s) to HOST 2.
- 4 If a two-port application is installed with a Multiband, connect an RPM-MB cable between the Multiband host port labeled PRIMARY and the port labeled HOST 1 on the RPM back panel. Connect a second RPM-MB cable between the Multiband host port labeled SECONDARY and the port labeled HOST 2.

2.2.3 HHT-X Cable

Plug one end of the HHT-X cable into one of the PALMTOP ports on the Multiband product and plug the other end of the HHT-X cable into the RPM PALMTOP port. The HHT-X cable is required whenever you use a hand-held or VT-100 terminal located with the host.

NOTE: You cannot use a hand-held terminal at the access end if the Multiband product is a Multiband.

RJ-11 Pin	RJ-11 Pin
2	3
3	2
4	5
5	4
6	6
Pin #1 cannot be connected	

The following schematic shows the wiring of the HHT-X cable:

2.2.4 Twisted-Pair Cable

Connect one end of the twisted-pair RPM-WJS cable to the wall jack and the other end to the MULTITALK port on the RPM. If the 20-foot RPM-WJS cable is not long enough to reach the wall jack, you can add a straight-through extension, or you can substitute a longer straight-through twisted-pair cable for the RPM-WJS. However, verify that the additional cable length is taken into account in your installation plan. See section 2.1.2, which discusses the wiring plan.

Verify that the wall jack connects to the twisted-pair cable running to the other end of the RPM link.

2.2.5 Powering On the RPM

The last step of the access-end installation procedure is to plug the RPM power cord into the rear of the RPM and verify that the RPM **POWER** LED lights. All other LEDs should not light because the installation of the RPM link at the host location has not yet been completed.

2.3 Installation at the Crossover Point

The twisted-pair wiring between the ends of the RPM link requires a single crossover point.

If you insert the crossover connection between ends of the RPM link in a patch panel of the wiring closet, identify the twisted-pair wires coming from the host end and the access end of the RPM link. Connect these wires according to the following table:

Twisted-Pair	RJ-45 Pin	RJ-45 Pin
1	1	3
1	2	6
9	3	1
6	6	2
Only the first two twisted pairs are used in each cable. Pins 4, 5, 7, and 8 are not connected in the panel		

If you insert the crossover point without the use of a patch panel in a wiring closet, you can install the RPM-WJX twisted-pair cable, which provides the crossover wiring shown above.

2.4 Installation at the Host End

The following instructions apply to RPMs located with host equipment. Complete the steps in this section before continuing with the installation test procedures.

2.4.1 DIP Switch Settings

Locate the 8-position DIP switch on the left side of RPM's back panel.

If you are running a single-port application, set the RPM switches at the host end as follows. See section 2.6 for detailed information on each switch setting:

Single-Port Application, Host End	
Switch	Setting
#1	see note*
#2	up
#3	down*
#4	down*
#5	down
#6	down
#7	down
#8	down
*set switch #1 down for Distance Mode 1 or up for Distance Mode 2	
*If you set switches #3 and #4 down, you are choosing not to use terminal timing.	

The following illustration shows the RPM host end settings for a single-port application with Multiband Plus:



If you are running a two-port application, set the RPM switches at the host end as follows. In two-port operation under Distance Mode 1, neither port can exceed 768 kbit/s bandwidth. In two-port operation under Distance Mode 2, HOST 1 cannot exceed 384, while HOST 2 cannot exceed 64 kbit/s. See section 2.6 for detailed information on each switch setting:

Two-Port Application, Host End		
Switch	Setting	
#1	see note*	
#2	down	
#3	down**	
#4	down**	
#5	down	
#6	down	
#7	down	
#8	down	
*set switch #1 down for Distance Mode 1 or up for Distance Mode 2		
**If you set switches #3 and #4 down, you are choosing not to use terminal timing.		

The following illustration shows the RPM host end settings for a two-port application:



2.4.2 Host Cables

Follow these steps when installing the host cables between RPM and the host equipment:

- 1 If you are running a single-port application, connect the host cable between the host's data port and the port labeled HOST 1 on the RPM back panel. If your host has a separate RS-366 port, also plug the host cable into that port. Host cables that support separate RS-366 or X.21 interfaces have two connectors on the host side and one connector on the RPM side.
- 2 If you are running a two-port application, connect one host cable between each of the host's data ports and ports labeled HOST 1 and HOST 2 on the RPM back panel. If your host has a separate RS-366 port, also plug the host cable into that port. The cable that supports V.25 bis, RS-366, or X.21 should be connected to the RPM's HOST 1 port.

NOTE: If you are running a dual-port application to a video codec, you must connect HOST 1 to the codec's primary port and HOST 2 to the codec's secondary port.

Some host cables with RS-366 interfaces have two connectors on the host side and one connector on the RPM side. Other RS-366 cables are made with a single connector for combined V.35/RS-366 or RS-449/RS-366. Check the installation plan. If it calls for a VT-100 control terminal, plug one end of the HHT-VT-100 cable into the RPM PALMTOP port and the other end into the terminal. The following wire list shows the wiring of the HHT-VT-100 cable:

RJ-11 Pin	DE-9S Pin
2	1, 6*
3	4
4	2
5	3
6	5
*RJ-11 Pin #1 cannot be connected, DE-9S Pins #7, 8, 9 not connected	

If the installation plan calls for a hand-held terminal, use the standard cable supplied with the hand-held Palmtop terminal instead of the HHT-VT-100 cable. Plug one end of the Palmtop cable into the RPM PALMTOP port and the other end into the hand-held terminal.

2.4.3 Twisted-Pair Cables

Connect one end of the twisted-pair RPM-WJS cable to the wall jack and connect the other end to the MULTITALK port on the RPM. If the 20-foot RPM-WJS cable is not long enough to reach the wall jack, you can add a straight-through extension, or you can substitute a longer twisted-pair cable for the RPM-WJS. However, verify that the additional cable length is taken into account in your installation plan.

Verify that the wall jack connects to the twisted-pair cable running to the other end of the RPM link.

2.4.4 Powering the RPM

The last step of the host-end installation is to plug the RPM power cord into RPM and to verify that the RPM **POWER** LED lights.

2.5 Installation Test Procedure

Perform the following test procedures after you have completed the RPM link installation. Perform each of the following three phases:

- RPM Test 2 from the access end
- RPM Test 2 from the host end
- local Multiband product loopback

2.5.1 RPM Test 2 from the Access End

The purpose of this test is to verify a test signal transmitted at access end of the RPM link operation is recognized by the host end, and that the proper response is received at the access end. To perform Test 2 from the access end, follow these steps:

- 1 Locate the 8-position DIP switch on the back panel of the RPM located with Multiband product. Set switch #8 to the up position.
- 2 Verify that the **TEST** LED at the access end blinks quickly for a moment and then becomes solidly lit, indicating you have activated an RPM test mode. Also verify that the **TEST** LED of the RPM at the host end blinks slowly, indicating that it is responding to test signals on the RPM link. If the **TEST** LED of the RPM at the host end does not blink slowly, RPM Test 2 is not activated and the installation is faulty. The **SYNC** LEDs at both ends of the RPM link should remain lit. If the **SYNC** LEDs turn off or flicker, the installation is faulty.

After verifying the TEST LEDs and SYNC LEDs do not change state for at least one minute, deactivate RPM Test 2 by returning switch #8 to the down position.

See section 3.3 for procedures to follow to correct faulty installations.

2.5.2 RPM Test 2 from the Host End

The purpose of this test is to verify a test signal transmitted at host end of the RPM link operation is recognized by the access end, and that the proper response is received at the host end. To perform RPM Test 2 from the host end, follow these steps:

- 1 Locate the 8-position DIP switch on the back panel of the RPM located with the host equipment. Set switch #8 in the up position.
- 2 Verify that the **TEST** LED at the host end blinks quickly for a moment and then becomes solidly lit, indicating you have activated an RPM test mode. Also verify that the **TEST** LED of the RPM at the access end of the RPM link blinks slowly, indicating that it is responding to test signals on the RPM link. If the **TEST** LED of the RPM at the access end does not blink slowly, RPM Test 2 is not activated and the installation is faulty. The **SYNC** LEDs at both ends of the RPM link should remain lit. If the **SYNC** LEDs turn off or flicker, the installation is faulty.
- 3 After verifying the TEST LEDs and SYNC LEDs do not change state for at least one minute, deactivate RPM Test 2 by returning switch #8 to the down position.

See section 3.3 for procedures to follow to correct faulty installations.

2.5.3 Local Loopback of Multiband Product

This test checks the data integrity across the entire RPM link by activating a local loopback at the Multiband product. To perform this test, follow these steps:

- 1 Use the hand-held or VT-100 terminal to find the menu option that controls the Multiband product's local loopback. On Multiband Plus models, this is a Port Diag menu option. On Multiband models, this is a Diagnostics menu option.
- 2 Activate the local loopback on the Multiband product host port(s) connected to the RPM link. All data sent from the host over the RPM link is now being sent back to your host through a loopback in the Multiband product.
- 3 Use a bit-error-rate-test set or other equipment at the host end to verify that the data transmitted over the RPM link is looped back with the desired degree of data integrity.
- 4 This step concludes the RPM link installation procedure.

2.6 DIP Switch Reference

Each of the eight DIP switch positions controls a separate RPM functionality. The following table lists these functionalities:

Position	Up Functionality	Down Functionality	
1	Distance Mode 2	Distance Mode 1	
	Choose down if cable length is less than 1700 feet. Choose up if cable length is between 3000 and 1700 feet.		
2	Support one host port (HOST 1 only)	Support two host ports (HOST 1 and HOST 2)	
	Distance Mode 1: When two host ports are supported and you select down, each port is limited to a 768 kbit/s bandwidth When only one host port is supported and you selec up, the port provides up to 1536 kbit/s bandwidth.		
	Distance Mode 2: When two host ports are supported and you select down, HOST 1 is limited to a 384 kbit/s bandwidth, while HOST 2 is limited to 64 kbit/s. When only one host port is supported and you select up, the port pro- vides up to 448 kbit/s bandwidth.		
3	Use Terminal Timing signal received by RPM on HOST 1	Do not use Terminal Timing signal received by RPM on HOST 1	
	Choose up or down if connected to host, depending on whether host supplies Terminal Timing signal. Choose down if RPM is connected to a Multiband, or choose up if connected to any other Multiband product.		

Position	Up Functionality	Down Functionality
4	Use Terminal Timing signal received by RPM on HOST 2	Do not use Terminal Timing signal received by RPM on HOST 2
	Choose up or down if cor on whether host supplies Choose down if RPM is co choose up if connected to product. Not applicable if switch p	inected to host, depending Terminal Timing signal. onnected to a Multiband, or any other Multiband
5	Get HOST 1 receive clock from Rx signal.	Get HOST 1 receive clock from far-end RPM.
	Choose up if RPM connected to Multiband product. Choose down if RPM connected to host equipment.	
6	Get HOST 2 receive clock from Rx signal.	Get HOST 2 receive clock from far-end RPM.
	Choose up if RPM connected to Multiband product. Choose down if RPM connected to host equipment. Not applicable if switch position 2 is up.	
7	Run Test mode 1.	Do not run Test mode 1.
8	Run Test mode 2.	Do not run Test mode 2.

2.7 Cable Model Number / Part Number Reference

The following table gives the correspondence between the Ascend model number and part number for RPM cables:

Model Number	Part Number
RPM-MBHD	2510-0083-001
RPM-WJX	2510-0084-001

Model Number	Part Number
RPM-WJS	2510-0085-001
ННТ-Х	2510-0086-001
RPM-MB	2510-0087-001
HHT-VT-100	2510-0088-001

2.8 Multiband Plus Configuration

Except for some security considerations and terminal timing constraints, you configure Multiband Plus the same whether it is connected directly to the host or to an RPM link. This section describes these considerations and constraints that apply when configuring Multiband Plus.

See the *Multiband Plus Operating Guide* for further information on configuration of Multiband Plus.

Port Profiles

Set the **Term Timing** port profile parameter to the value *No* for any Multiband Plus port that is connected to an RPM link.

Security Profiles

If you install a Palmtop or VT-100 terminal at the host end of the link for Multiband Plus control, you should review your security profiles, especially the Default security profile. You might want to restrict the operations this profile allows the user to perform, since it does not require a password.

2.9 Multiband Configuration

Configuration of Multiband call, line, system, and security profiles is the same whether or not Multiband is connected directly to a host or to an RPM link.

2.10 For More Information

For more information on troubleshooting an RPM installation, see Chapter 3 of this guide. Chapter 3 also describes the RPM loopback tests in greater detail.

3 RPM Diagnostics and Troubleshooting

This chapter describes RPM features used in testing, diagnosing, and troubleshooting an RPM link. See section 2.5 for a test procedure which can be used to verify an existing or new RPM installation.

3.1 RPM Tests

RPM diagnostics are controlled by setting the #7 and #8 switches on 8-position DIP switch located on the left side of the RPM back panel:



In normal operating mode, both switches #7 and #8 are in the down position. Always return switches #7 and #8 to the down position when you have completed testing.

3.1.1 RPM Test 1

Test 1 verifies RPM's control terminal interface is functioning.

To activate RPM Test 1, set switch #7 up. Leave switch #8 down. Do not change the positions of switches #1 through #6.

When you set switch #7 up to run Test 1, the RPM's TEST LED goes on. As long as RPM Test 1 is active, the local TEST LED remains on.

When in RPM Test 1, any characters you type on the VT-100 or hand-held Palmtop terminal of the local RPM are echoed back to you. But unlike Test 2, the characters are not transmitted over the link.

3.1.2 RPM Test 2

Test 2 verifies that a test signal transmitted by the local RPM over the RPM link is recognized by the remote RPM, and that the proper response is received by the local RPM. Test 2 also verifies RPM's control terminal interface is functioning.

To activate RPM Test 2, set switch #8 up. Leave switch #7 down. Do not change the positions of switches #1 through #6.

As soon as you set switch #8 up, you might notice that the RPM's **TEST** LED blinks quickly for a moment before RPM Test 2 becomes established. When RPM Test 2 is established, the **TEST** LED turns on and remains on, while the **TEST** LED of the remote RPM blinks slowly.

When in RPM Test 2, any characters you type on the VT-100 or hand-held Palmtop terminal at the local RPM are echoed back to you over the RPM link. This is true regardless of what equipment is connected to the host port of the RPM loopback master.

3.2 RPM LEDs

RPM has four LEDs on its front panel. The following drawing illustrates their location:



• DATA

The green **DATA** LED indicates RPM is receiving a signal from the far end of the link. The **DATA** LED does not indicate the presence of user data, but like a modem's carrier detect, it indicates user data could be received.

• SYNC

When fully lit, the green **SYNC** LED indicates RPM is receiving an adequate signal from the RPM at the other end of the link, so that it should be able to transmit and receive data over the link.

If the **SYNC** LED is dimly lit, flickering, or off, a trouble condition exists and RPM is losing its synchronization with the far-end RPM. This trouble condition can be caused by wiring problems, interference, or by a failure in an RPM. If the **SYNC** LED is flickering, dimly lit, or off, see section 3.3.

TEST

The yellow **TEST** LED lights when RPM is running diagnostic Test 1 or Test 2. During normal operation, this LED must be off.

The **TEST** LED indicates an active RPM test mode by turning off and on or remaining solidly on. The frequency at which the **TEST** LED turns off and on indicates the test mode:

• off and on quickly

This condition means that the local RPM is in Test 1, or the local RPM is commanding the other end of the RPM link to begin Test 2. If Test 1 has been established, any characters typed on the hand-held or VT-100 terminal of this RPM are echoed back to the terminal. During Test 2, this condition should only last for a moment until the other end responds. on continuously

When the **TEST** LED is in this state, the RPM link is in Test 2, and the local RPM is controlling the test.

Any characters typed on the hand-held or VT-100 terminal of this RPM are echoed back to the terminal. If Test 2 has been established, the echo travels over the full RPM link.

off and on slowly

When the **TEST** LED turns off and on slowly, the RPM link is in Test 2, and the local RPM is the test slave. That is, this RPM is not controlling the test.

• POWER

The green **POWER** LED is lit when the power cord is connected and RPM is receiving power. If the **POWER** LED is not lit when you think it should be, see section 3.3 for more information.

3.3 RPM Troubleshooting

This section lists typical trouble indications and describes possible causes for each. See the system guide of the Multiband product for information on troubleshooting its network and host interfaces.

Problem: DATA LED is off

RPM might not be receiving a carrier signal from the RPM at the other end of the link. This might be caused by a bad cable between RPMs, disconnected cable, or by a cable that is much too long. If the RPM at the other end has lost power, the **DATA** LED would also turn off.

Problem: LEDs indicate normal operation, but user data is not being transmitted or received

Check to determine your host cable is plugged into the correct port. Try unplugging the RPM end of the host cable at HOST 2 and plugging it into HOST 1. Then take the cable that was plugged into HOST 1 and plug it into HOST 2.

Problem: SYNC LED is flickering, dimly lit, or off

The **SYNC** LED can indicate bad cabling, cabling that is too long, or bad connectors between RPMs. Check to make sure that all connectors are properly seated and secure. Poor grounding of the RPMs might also cause this symptom. If neither the physical connection between RPMs nor the grounding is the problem, the cause could be a faulty RPM.

Problem: The green POWER LED is off

RPM is not receiving power. Check the AC power source. If the AC power is OK, check the RPM fuse housed beside the AC power plug on the back panel. The fuse size has a 1.6 Amp value.

Problem: The RPM link does not reliably transmit data over the required distance

The performance of the RPM link depends upon the quality of the cabling and its installation. Ascend recommends you use Level 3 or Level 4 twisted-pair cabling between RPMs. See section 2.1.2 for further information.

3.4 For More Information

For further information on troubleshooting, see the system guide of your Multiband product.

-A-

Access end

The end of an RPM link that is connected to or installed within a Multiband product

-H-

Host end

The end of an RPM link that is connected to host equipment

-**R**-

RPM link

A serial communications device that extends the maximum distance host equipment can be installed from a Multiband product

An RPM link consists of a twisted-pair communications cable terminated by a Multiband RPM module at both ends. One end of the RPM link is connected to host equipment and the other end is connected to a Multiband product.

-T-

Two-port application

An application of an RPM link in which both host ports are required

-V-

Video codec

A videoconferencing device that encodes and decodes video images into a serial digital data format.

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