



# PIAFS Wireless Data Protocol Version 2.1 for Cisco MICA Modems

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## Feature History

Release	Modification
12.1(2)XH	This feature was introduced.
12.2(2)XA	New Modem States and Link Information Parameters were added for Version 2.1 (supported on Cisco AS5300 universal access servers only).
12.2(2)XB1	This feature was supported on Cisco AS5800 platforms.
12.2(11)T	This feature was integrated into Cisco IOS Release 12.2(11)T.

This document describes the Personal Handyphone Internet Access Forum Standard (PIAFS), Version 2.1 feature using Cisco MICA modems for Cisco AS5300 and Cisco AS5800 universal access servers. PIAFS Version 2.1 is supported with Cisco IOS Software Release 12.2(2)XB1 or 12.2(11)T.

This document includes the following sections:

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## Feature Overview

This feature adds support for the PIAFS 2.1 protocol (T1 only) with Cisco MICA modems on Cisco AS5300 Cisco AS5800 universal access servers. PIAFS provides data connectivity between a client computer and a remote access server (RAS) using the Personal-Handyphone-System (PHS) digital cellular

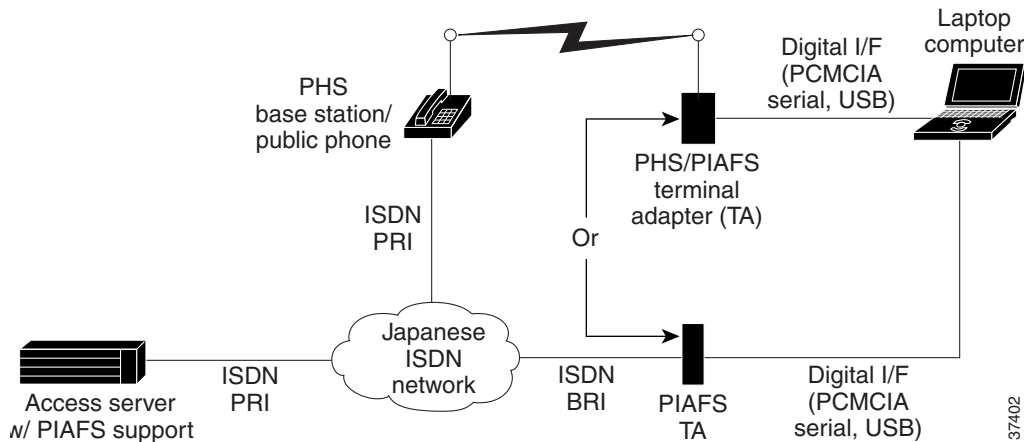


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telephone system. PIAFS 2.1 allows the modem to shift speed during a connection between 32,000 and 64,000 bps when initiated by a remote terminal adapter (TA). PIAFS provides data connectivity between a client computer and remote access server (RAS) using the PHS digital cellular telephone system. Figure 1 shows a typical PIAFS RAS environment.

**Figure 1** PIAFS Configuration



**Note**

Cisco MICA Portware Version 8.2.x.x does not support modem modulations (for example, V.90), V.110, or fax. If non-PIAFS features are desired, other portware images, such as Cisco MICA Portware Version 2.7.3.0 can be loaded onto other Hex Modem Modules (HMMs) or Double Density Modem Modules (DMMs) in your Cisco AS5x00 universal access server. See the [Restrictions](#) section for more information.

The following PIAFS 2.1 features are supported on the Cisco AS5x00 platforms:

- In-band negotiation and synchronization of variable-speed Type 2 data transmission. This allows variable Type 2 devices such as Cisco MICA modems to connect with Type 1 and Type 2 initiating devices. A PIAFS 2.1 connection can be with two Type 2 devices, two Type 1 devices, or a Type 1 and a Type 2 device. Operational Cisco MICA is always Type 2, but it can communicate with Type 1 and Type 2 devices as well as with systems running PIAFS 1.x and 2.0.

A Type 2 device cannot directly sense traffic channels (TCH). The TCH is the number of 32k channels bound to a call. If the Type 2 device loses synchronization, the device assumes that the speed has changed, so the device periodically switches its I.460 (1988 ITU-T standard) intermediate rate adaptation function on and off while it is out of synchronization until it achieves sync or fails to resynchronize. An originating Type 2 device switches every 1.6 to 1.8 seconds; a receiving Type 2 device switches every 200 milliseconds. A Type 2 device is notified of speed changes from within the PIAFS protocol.

A Type 1 device directly senses the number of 32k radio frequency (RF) channels bound to a call. It can either sense the total number of channels that are currently bound (TCH) or issue an early warning of TCH change (a Preliminary Signal, or PS). If a Type 1 device senses a TCH speed change, it will directly switch to the new speed, turning its I.460 intermediate rate adaptation on or off as necessary. If a PS change is sensed, the device sends a protocol message before switching its I.460 logic. Both the originating and the receiving device can be Type 1, depending on whether each device can sense TCH or PS.

- Fixed user rate negotiation with PIAFS 2.0 and 1.X clients.

- Real-time statistics for negotiated parameters and speed changes.
- Mixed Cisco MICA (PIAFS and modem/fax/data) images on a DFC. A Cisco AS5300 universal access server running Cisco IOS Release 12.2.(2)XA will support both PIAFS 2.1 and modem calls together, on different SPEs in a multiple SPE configuration. See the [Restrictions](#) section for more information.
- **AT** commands (modemcaps)—PIAFS is controlled by entering the `MSC=&F&D2` modemcap. Enter the **no flush-at-activation** command in the line configuration if Point-to-Point Protocol (PPP) is desired.
- S34 S-register—The S34 S-register interfaces with new PHS or TA devices in the field by selectively inhibiting or enabling parts of the PIAFS 2.1 protocol. This S-register allows the use of non standard values.

For more information about S-registers and **AT** commands, refer to the *AT Command Set and Register Summary for MICA Six-Port Modules with PIAFS*.

For information about configuring PIAFS version 2.1, refer to the *Release Notes for Cisco MICA Portware Version 8.2.3.0 on Cisco AS5300 Universal Access Servers with PIAFS Support*.

## PIAFS Protocol

The PHS PIAFS feature specifies a transmission system that uses the PHS 64,000 bps/32,000 bps unrestricted digital bearer, which allows dynamic data rate change between 32 and 64 kbps during a call. The PIAFS protocol allows for these dynamic data rate changes. The PIAFS terminal adapter (TA) module works like a modem or a V.110 module by using the same call-setup Q.931 message, but differs by its use of the 32k and 64k user rate and the ability to support ISDN bearer channel capability and calling party subaddress.



### Note

PIAFS Version 2.1 with Cisco IOS Release 12.2(2)XA, 12.2(2)XB1, or 12.2(11)T requires Cisco IOS Plus images. See the [Restrictions](#) section.

With the PIAFS protocol, a call is initiated from the client computer or personal digital assistant (PDA) through a terminal adapter (TA), which is typically connected to the computer using a PCMCIA slot, serial interface, or USB interface. The TA contains PIAFS functionality and either is connected (or integrated) with a PHS handset for wireless communications, or is connected directly to the telco network using an ISDN BRI line. For wireless operation, the PHS base station allocates either a 32- or 64-kbps (user rate) channel for the connection with the client TA. The client and RAS perform PIAFS synchronization and feature negotiation to set up an error-correcting communication channel with optional V.42bis data compression.

PHS manages the user channel capacity based on the aggregate bandwidth used at the local base station to maximize the number of supported users. In return, the channel capacity for each user is reduced. PIAFS 2.1 allows the user rate to change during a call as base station use changes. In previous PIAFS versions, the data rate was established at call setup and remained fixed during the call. The dynamic user rate change capability introduced in PIAFS 2.1 uses RF channel capacity more efficiently and reduces the occurrence of call denial in heavily utilized cells.



### Note

Some TAs support both PIAFS 2.0 and 2.1 protocols, but the negotiation message that is sent to the initiated server unit can indicate a preference for 2.0. Cisco MICA might create a 2.0 connection rather than a 2.1 connection, if a 2.0 preference is indicated. This is a normal Cisco MICA occurrence. Cisco MICA continues to support earlier protocol versions and works with older PHSs and TAs.

## Benefits

### New Link Information Parameters

The Connect Protocol (in the Static group and also accessed by entering the **show modem operational-status** command) now differentiates between PIAFS 1.x or 2.0 and PIAFS 2.1.

### New Modem States

Two new modem states have been defined for Cisco AS5300 universal access servers in this release:

- Steady PIAFS Resync (with a value of 80)—Indicates that a PIAFS channel has lost synchronization and is performing a resynchronization.
- Steady PIAFS Speedshift (with a value of 85)—Indicates that a PIAFS channel has just negotiated a speed shift change (for example, from 32,000 bps to 64,000 bps or from 64,000 bps to 32,000 bps).

These states are displayed when you enter the **show modem log** command. The states are displayed under the Modem State event heading. The modem states tell you when the network changed the connection speed (added or subtracted 32k channels). The number of 32k channels bound to a call is also known as traffic channel (TCH).




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**Note** Speedshifting must be initiated by the client or Telco.

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### No Changes to Configuration

There are no new configuration parameters necessary to use the PIAFS 2.1 capabilities.

## Restrictions

Cisco MICA Portware Version 8.2.x.x supports the PIAFS protocol only and does not support modem modulations (for example, V.90), V.110, or fax. Similarly, standard (non-PIAFS) Cisco MICA portware versions cannot support the PIAFS protocol.

The following additional restrictions apply to this release:

- PIAFS Version 2.1 with Cisco IOS Release 12.2(2)XAm 12.2(2)XB1, or 12.2(11)T requires Cisco IOS Plus images. The following Cisco IOS Plus images are supported with this feature:
  - Desktop Plus
  - Desktop Voice Plus
  - Enterprise Plus
  - Enterprise Plus IPSEC 56
  - Enterprise Voice Plus
  - IP Plus
  - IP Plus IPSEC 56
  - IP/Voice Plus
- PIAFS and non-PIAFS functionality cannot be mixed on the same SPE. Each SPE can only support one version of Cisco MICA portware at a time. A single SPE (6 Cisco MICA modem sessions with an HMM, or 12 Cisco MICA modem sessions with a DMM) can support only one of the following:
  - PIAFS 2.1 calls with Portware Version 8.2.3.0

Or

- Modem modulations using standard (non-PIAFS) Cisco MICA modem portware releases (for example, Version 2.7.3.0).

The portware you are running determines SPE functionality.

- PIAFS 2.1 is only supported over a T1 Interface with isdn switch-type set to **primary-ntt**.
- Resource services must be used with Cisco MICA modems.
- Modem pooling and resource pool management are not compatible.
- Only the V.42bis data compression protocol is supported.
- Real-Time Transport Protocol (RTP), user-control frames, and continuous frames are not supported.
- The PIAFS protocol is contained in a special Cisco MICA PIAFS only image with no modem/fax support.

## Related Documents

- *AT Command Set and Register Summary for Cisco MICA Six-Port Modules with PIAFS*
- *Configuring the NAS for Basic Dial Access*
- *Release Notes for Cisco MICA Portware Version 8.2.3.0 on Cisco AS5x00 Universal Access Servers*
- *SPE and Firmware Download Enhancements*
- Cisco AS5300 universal access servers Cisco MICA release notes index page
- Configuration documents for Cisco AS5800
- Cisco AS5x00 Cisco MICA 6-Port and 12-Port Modem Module Portware/Cisco IOS Software Compatibility Matrixes
- Cisco AS5300 access servers, Appendix A, “Managing Modems,” and Appendix B, “Rom Monitor,” in the *Cisco AS5300 Universal Access Server Software Configuration Guide*
- *Modem Management Commands*
- *Cisco IOS Dial Services Command Reference*
- Cisco IOS Dial Technologies Configuration Guide, Release 12.2
- *Quick Start Guide, Cisco AS5300 Universal Access Server Install and Configure*
- V.90 and RFC-2217 dialout support for fax/data

**Note**

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The Cisco DialOut Utility (CDU) is no longer supported. Refer to the *Sample NAS Configurations for Cisco DialOut Utility* document for information about RFC-2217 reverse TELNET support.

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## Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract. For PIAFS protocol support, contact Cisco.com Japan:  
<http://www.cisco.com/jp/>

**Determining Platform Support Through Cisco Feature Navigator**

Cisco IOS software is packaged in feature sets that are supported on specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

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<http://www.cisco.com/register>

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

**Availability of Cisco IOS Software Images**

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

## Supported Platforms

- Cisco AS5300
- Cisco AS5800

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## Supported Standards, MIBs, and RFCs

### Standards

No new or modified standards are supported by this feature.

### MIBs

- CISCO-MODEM-MGMT-MIB
- CISCO-CALL-RESOURCE-POOL-MIB

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

### RFCs

No new or modified RFCs are supported by this feature.

## Prerequisites

- You must have Cisco MICA Portware Version 8.2.3.0 or higher.
- You must be running Cisco IOS Release 12.2(2)XA, 12.2(2)XB1, or 12.2(11)T.
- A minimum of 64 MB must be available on the DMM cards.
- PHS 64,000 bps requires the allocation of two 32k channels.

- PIAFS portware images are not bundled with Cisco IOS software, so you must copy the image to Flash memory, and specify the image to use using **spe** commands.  
Refer to the Cisco document, *SPE and Firmware Download Enhancements* for more information about using the **spe** commands to download portware images.

**Note**

The Cisco AS5300 requires 128MB of memory for systems using Cisco IOS Release 12.1(5)T and later releases.

## Configuration Tasks

See the following sections for configuration tasks for the PIAFS feature. Each task in the list is identified as either required or optional.

- [Configuring PIAFS](#) (required)
- [Verifying PIAFS](#) (optional)
- [Configuring a Resource-Pool Group Resource](#) (optional)
- [Verifying Resource-Pool Group Resource](#) (optional)

**Note**

When configuring a voice port, use the following configuration designations:  
For the Cisco AS5300, port designation is *port*.

## Configuring PIAFS

To configure PIAFS, use the following commands in interface configuration mode.

	Command	Purpose
<b>Step 1</b>	Router(config)# <b>interface serial controller:channel</b>	Enters interface configuration mode for a D-channel serial interface.
<b>Step 2</b>	Router(config-if)# <b>isdn piafs-enabled</b>	Enables the Primary Rate Interface (PRI) to take PIAFS calls on Cisco MICA modems.
<b>Step 3</b>	Router(config-if)# <b>exit</b>	Exits interface configuration mode.

## Verifying PIAFS

Use the following **show** commands in privileged EXEC mode:

- Step 1** Enter the **show modem operational-status slot/port** command to view PIAFS call information.

```

piafs_diald# show mod op 1/3
Modem(1/3) Operational-Status:

Parameter #0 Disconnect Reason Info: (0x0)
    Type (=0 ): <unknown>
    Class (=0 ): Other
    Reason (=0 ): no disconnect has yet occurred

```



```

Parameter #1 Connect Protocol: PIAFS 2.1
Parameter #2 Compression: V.42bis both
Parameter #3 EC Retransmission Count: 0
Parameter #4 Self Test Error Count: 0
Parameter #5 Call Timer: 36 secs
Parameter #6 Total Retrains: 0
Parameter #7 Sq Value: 7
Parameter #8 Connected Standard: ISDN
Parameter #9 TX,RX Bit Rate: 64000, 64000
Parameter #11 TX,RX Symbol Rate: 0, 0
Parameter #13 TX,RX Carrier Frequency: 0, 0
Parameter #15 TX,RX Trellis Coding: (n/a), (n/a)
Parameter #16 TX,RX Preemphasis Index: 0, 0
Parameter #17 TX,RX Constellation Shaping: (n/a), (n/a)
Parameter #18 TX,RX Nonlinear Encoding: (n/a), (n/a)
Parameter #19 TX,RX Precoding: (n/a), (n/a)
Parameter #20 TX,RX Xmit Level Reduction: 0, 0 dBm
Parameter #21 Signal Noise Ratio: 0 dB
Parameter #22 Receive Level: 0 dBm
Parameter #23 Frequency Offset: 0 Hz
Parameter #24 Phase Jitter Frequency: 0 Hz
Parameter #25 Phase Jitter Level: 0 degrees
Parameter #26 Far End Echo Level: 0 dBm
Parameter #27 Phase Roll: 0 degrees
Parameter #28 Round Trip Delay: 0 msecs
Parameter #30 Characters transmitted, received: 14, 0
Parameter #32 General Portware Information: 0
Parameter #33 PPP/SLIP packets transmitted, received: 0, 0
Parameter #35 PPP/SLIP packets received (BAD/ABORTED): 0
Parameter #36 EC packets transmitted, received OK: 1, 0
Parameter #38 Moving Average of EC packets (Received BAD/ABORTED): 0
Parameter #39 Robbed Bit Signalling (RBS) pattern: 0
Parameter #40 Digital Pad: (n/a)
        Digital Pad Compensation          : None
Parameter #42 SS7/COT Status: 0
Parameter #43 V110/PIAFS frames received bad: 0
Parameter #44 V110/PIAFS frames received good: 3578
Parameter #45 V110/PIAFS frames transmitted: 3578
Parameter #46 V110/PIAFS sync lost: 0
Parameter #93 PIAFS RTF: 11
Parameter #120 Total Speedshifts: 0
Line Shape:
*
```

**Step 2** Enter the **show modem log** command in privileged EXEC mode:

```

piafs_diald# show mod log 1/3
Modem 1/3 Events Log:
*Mar 30 01:48:42.207: ISDN incoming called number: 2015551111
*Mar 30 01:48:42.563: Modem State event:
                    State: Call Setup
*Mar 30 01:48:42.563: Modem State event:
                    State: Connect
*Mar 30 01:48:42.563: Modem State event:
                    State: Link
*Mar 30 01:48:42.563: Modem State event:
                    State: Train Up
*Mar 30 01:48:42.563: Modem State event:
                    State: EC Negotiating
*Mar 30 01:48:54.567: Modem State event:
                    State: Steady
*Mar 30 01:48:54.567: Static event:
        Connect Protocol: PIAFS 2.1
        Compression: V.42bis both
```

```

Connected Standard: ISDN
TX,RX Symbol Rate: 0, 0
TX,RX Carrier Frequency: 0, 0
TX,RX Trellis Coding: (n/a), (n/a)
Frequency Offset: 0 Hz
Round Trip Delay: 0 msec
TX,RX Bit Rate: 64000, 64000
Robbed Bit Signalling (RBS) pattern: 0
Digital Pad: (n/a)
Digital Pad Compensation : None
*Mar 30 01:48:54.567: Dynamic event:
Sq Value: 7
Signal Noise Ratio: 0 dB
Receive Level: 0 dBm
Phase Jitter Frequency: 0 Hz
Phase Jitter Level: 0 degrees
Far End Echo Level: 0 dBm
Phase Roll: 0 degrees
Total Retrans: 0
EC Retransmission Count: 0
Characters transmitted, received: 0, 0
General Portware Information: 0
PPP/SLIP packets transmitted, received: 0, 0
PPP/SLIP packets received (BAD/ABORTED): 0
EC packets transmitted, received OK: 0, 0
Moving Average of EC packets (Received BAD/ABORTED): 0
V110/PIAFS frames received bad: 0
V110/PIAFS frames received good: 27
V110/PIAFS frames transmitted: 28
V110/PIAFS sync lost: 0
PIAFS RTF: 11
Total Speedshifts: 0

```

## Configuring a Resource-Pool Group Resource

	Command	Purpose
Step 1	Router(config)# <b>resource-pool group resource piafs</b>	Creates a resource group (piafs) for resource management.
Step 2	Router(config-resource)# <b>exit</b>	Exits configuration mode.

## Verifying Resource-Pool Group Resource

Enter the **show resource-pool group resource piafs** command to view resource-pool group resource information:

```

Router# show resource-pool resource piafs
0 resources in the resource group
0 resources currently active
0 calls accepted in the resource group
0 calls rejected due to resource unavailable
0 calls rejected due to resource allocation errors
never since last clear command

```

# Configuration Examples

The following example shows common PIAFS and resource-pool group configuration output from entering the **show running-configuration** command:

```
version 12.2
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
service password-encryption
!
hostname travis-nas-01
!
aaa new-model
aaa authentication login default local
aaa authentication login NO_AUTHENT none
aaa authorization exec default local if-authenticated
aaa authorization exec NO_AUTHOR none
aaa authorization commands 15 default local if-authenticated
aaa authorization commands 15 NO_AUTHOR none
aaa accounting exec default start-stop group tacacs+
aaa accounting exec NO_ACCOUNT none
aaa accounting commands 15 default stop-only group tacacs+
aaa accounting commands 15 NO_ACCOUNT none
enable secret 5 $1$LsoW$K/qBH9Ih2WstUxvazDgmY/
!
username admin privilege 15 password 7 06455E365E471D1C17
username gmcilla password 7 071824404D06140044
username krist privilege 15 password 7 0832454D01181118
!
!
!
!
call rsvp-sync
shelf-id 0 router-shelf
shelf-id 1 dial-shelf
!
!
!
resource-pool disable
!
resource-pool group resource piafs
```

## Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS Dial Technologies Command Reference* at [http://www.cisco.com/en/US/docs/ios/dial/command/reference/dia\\_book.html](http://www.cisco.com/en/US/docs/ios/dial/command/reference/dia_book.html). For information about all Cisco IOS commands, go to the Command Lookup Tool at <http://tools.cisco.com/Support/CLILookup> or to the *Cisco IOS Master Commands List*.

- **isdn piafs-enabled**

# Glossary

**CSM**—Call Switching Module.

**DMM**—Double Density Modem Module. A Cisco MICA hardware package with 12 modems on a daughter board unit.

**E1**—European equivalent of T1. Thirty two channels of 64000 Hz—one for framing, one for signaling.

**HMM**—Hex Modem Module. A Cisco MICA hardware package with six modems on a daughter board unit.

**I.460**—(1988 ITU-T standard). Specifies procedures used to adapt a PIAFS 32k stream to a 64k ISDN B-channel.

**IR**—intermediate rate. Data rate used to communicate between the PHS base station and the client TA. The two rates supported are 32 and 64 kbps.

**ISDN**—Integrated Services Digital Network.

**LLC**—logical link control.

**MICA**—Modem ISDN channel aggregation.

**PDA**—personal digital assistant

**PHS**—Personal-Handyphone-System.

**PIAFS**—PHS Internet Access Forum Standard. ITU-T standard for support by ISDN of data terminal equipment with V-series type interfaces.

**Portware**—Software that runs on the Cisco MICA HMM or DMM.

**PPP**—Point-to-Point Protocol.

**PRI**—Primary Rate Interface.

**PS**—preliminary signal. This signal, if present, gives advance notice of speed changes to a Type 1 device.

**Q.931**—ISDN User-Network Interface Layer 3 specification for basic call control.

**RAS**—remote access server.

**TCH**—traffic channel. The 32k bearer channel for user data. PIAFS 2.1 can bundle up to 2 channels of data for a total data rate of 64k. For PIAFS 2.1, the total number of channels can be shifted up or down dynamically during a call. PIAFS 2.1 on Cisco MICA, however, cannot sense the total number of TCHs, seeing only the loss of synchronization that occurs when the channels shift. Standard PIAFS algorithms (switching IR every 200 msec) allow PIAFS 2.1 on Cisco MICA to synchronize to a new speed without sensing the total number of TCHs. When PIAFS 2.1 on Cisco MICA is originating PIAFS 2.1 calls (TEST), it locks to a particular IR, simulating a TCH change. PIAFS 2.1 on Cisco MICA is not intended to originate calls in an operational mode, so TCH sensing and T010/T011 timers are not implemented.

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