

Appendix HSSI

M500 High Speed Serial Interface Addendum

Revision History

Rev 0.10	3-30-2008	Initial Release.
Rev 0.11	4-4-2008	Added cable and test information.

1.0 Optional HSSI Overview

The installation of the optional High Speed Serial Interface or HSSI Card provides the M500 Class modems (PSM-500/500H/500L and variants) with a high speed synchronous serial interface designed for higher data rates than are possible with standard serial interface protocols like V.35, RS-449 and EIA530. This optional Interface card is designed to be installed inside the main modem assembly in the option interface position. It can be installed alone or “stacked” on a SnIP interface card providing additional interface options.

HSSI is an industry standard interface type that is usually associated with connection to routers, such as the Cisco 3600 series, for higher data rates on WAN links. The standard itself describes communications at up to 52 Mbps over cable lengths up to 50 feet. Since the M500 series of modems is capable of up to 29.52 Mbps when equipped with the M523 Feature Set then use of this optional interface allows full utilization of the M500 capabilities. Note that the standard serial synchronous interfaces supplied with the M500 series are only useful up to approximately 10 Mbps.

There is only one version of the HSSI interface card. It is internally installed and automatically recognized by the modem controller.

The Term “M5” refers to the PSM-4900, 4900H, 4900L and its variants, while the Term “M500” refers to the PSM-500, 500H, 500L and its variants. The HSSI interface described here is unique to and for use only with M500 series of satellite modems.

1.1 Overview - Quick Start Guide

If the HSSI interface card is not already installed in the modem refer to Section 3 for installation information.

Typically use of the HSSI interface is very simple because connection is possible to only specific DTE equipment with this same interface type. We assume that it is being used to connect the M500 series modem to a router with an installed HSSI module.

The router with HSSI interface will have an HD50, 50 pin SCSI-2 type high density connector that looks just like the one on the modem’s HSSI interface card at the rear. A Cisco CAB1-HSSI interface cable or equivalent is connected between the router and the modem. The modem parameters are checked to insure that the HSSI interface is selected, and the transmit and receive clocks are set to “Internal” and “Receive” respectively. The router is set to use the HSSI network module, completing the connection.

1.2 HSSI Inter-Operability and Compatibility

HSSI is simply a physical and electrical interface standard that permits high speed synchronous connections between equipment. The traffic that is carried on the interface determines inter-operability. Normally the traffic is packet based using HDLC or Cisco HDLC protocols. The other end of the link can then be any device that can accept this traffic type and the data rate used. Thus if the data rate was within the limitation of a WIC card using V.35, for example, then the other end of the link could use that connection type between its modem and a router equipped with a WIC card. The other end could also be the Datum Systems’ SnIP interface card since it

can be configured to work with Cisco WAN type packet protocols. See the SnIP documents for more information on working with Routers.

2.0 HSSI Setup and Operation

The addition of a the HSSI interface card provides a high speed physical and electrical interface capable of operating up to the maximum speed of the M500 series of modems.

Modems with the HSSI interface installed automatically recognize its presence. Selection of HSSI as the currently active interface is accomplished by using the front panel or the remote control protocols.

From the front panel you would select **<Intf: I/O – Mode>** for the HSSI option. This is accomplished by pressing the Int’f button to the right of the LCD display, then scroll right to display “I/O” in the upper left of the display, and down if necessary to display “Mode” in the upper right of the display. To select HSSI you can then either press “9” and “Enter”, or press the “Edit” key and scroll up or down until “HSSI” is displayed in the LCD lower line, pressing “Enter” to select that option.

Refer to Appendix B for the protocol elements that are used to select the interface type.

When using the HSSI interface it is normal for the modem to provide both the transmit and receive clocks to the router or other DTE equipment. To check or set these parameters use the **<Mod: Data – Clk Source>** and **<Demod: Data – Clk Source >** parameters and set them to “Internal” and “RCV Clock” respectively.

2.1 Making Connections to the HSSI Interface

The following shows a typical connection to a router.

The M500 option interface will appear as one of the following depending on whether the HSSI is installed alone or “stacked” on the SnIP interface option card.

Figure 1 M500 rear panel HSSI Interface

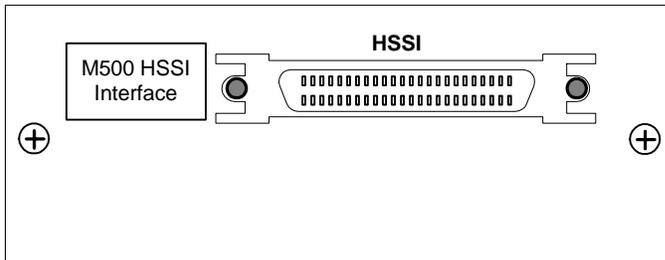
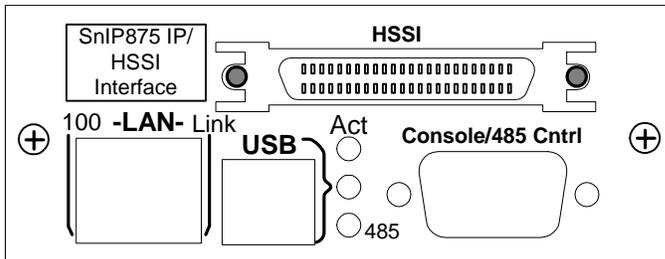


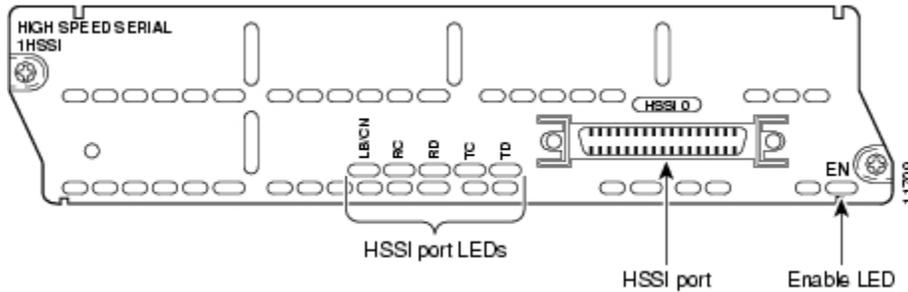
Figure 2 M500 rear panel HSSI and SnIP Interface



Cisco type routers use a serial HSSI WAN interface cards, for example the Network Module NM-1HSSI interface for the Cisco 3600 and 3700 series, provide high speed serial connections to remote sites. These cards can connect directly to the M500 series modem HSSI interface.

The 1-port High-Speed Serial Interface (HSSI) network module (see Figure 3) provides connectivity for fractional DS3 rate links and slower.

Figure 3 Cisco HSSI Network Module



Connection between the Router and the modem's HSSI interface connector is via a Cisco CAB-1HSSI cable or equivalent. This cable has the same 50 pin SCSI-2 type connector on both ends. Connect the cable and insure that the retaining clips are engaged on both ends.

2.1.1 HSSI Cable Information

The standard HSSI SCSI-2 type cable designed to connect between a DTE Device like a router and a DCE such as the M500 modem is a 25 pair cable with shield. This cable is connected as a 1:1 pin connection between the two male cable connectors. That means that pin 1 on one end goes to pin 1 on the other, pin 2 to 2 through pin 50 to pin 50.

There is another cable made for use with routers and it is a "null modem" cable designed to connect two DTE devices such as two routers back to back. This type cable will not work between a router and the HSSI interface card in a PSM-500 Modem..

2.2 Controlling the Optional HSSI Interface Functions

The PSM-500 Modems automatically recognize the presence of the HSSI card when installed. The only control available is selection of this as the current active data interface as shown in the Setup section above.

2.3 HSSI Performance and Limitations

With the default settings the HSSI interface has been tested at sustained speeds up to the M500 series maximum of 29.52 Mbps. The actual settable data rate is however also limited by other factors including the Feature Set, Modulation, Code Rate and FEC used. The M505 Feature Set is limited to 5 Mbps, while the M511 is limited to 10 Mbps. Only the M523 is capable of 29.52 Mbps. Installation of the HSSI does not override these limitations.

The interface does not contain any of the loop-back circuitry or capabilities in the full specification.

3.0 Installation

The HSSI interface is normally factory installed, but can be field installed by technical personnel. The option card itself is an approximate 3.5-inch by 4.1 inch printed circuit board designed to be mounted in the interface option position inside the modem chassis.

For users who require both the HSSI and the SnIP interface cards, both can be installed in a “stacked” configuration. There are two types of rear option plates as shown in Figures 1 and 2 for the two installation types.

Remove the modem unit from service before installation of the HSSI option. Unplug the modem unit and remove the power cord from the rear for safety.

Place the unit on a flat surface and remove the 8 flathead screws holding the cover to the main chassis using a number 2 Philips screwdriver. The location for the option card installation is shown in the diagram below.

WARNING: Failure to remove power from the modem unit before removal of the cover can expose the operator to hazardous voltages and result in harm to personnel and equipment.

3.1 Installing the HSSI Interface Card Alone

Position the rear option plate supplied into the chassis and align the mounting plate holes with the holes in the chassis rear panel. Just start inserting the two #4 panhead screws without lock washers to hold the plate in place.

Slide the HSSI interface assembly into the chassis and line up the HSSI high density connector with its opening on the rear plate. Slide the interface back and align the card’s standoffs with the 3 standoffs in the chassis. Now use two #4 pancake screws to attach the HD50 connector to the plate.

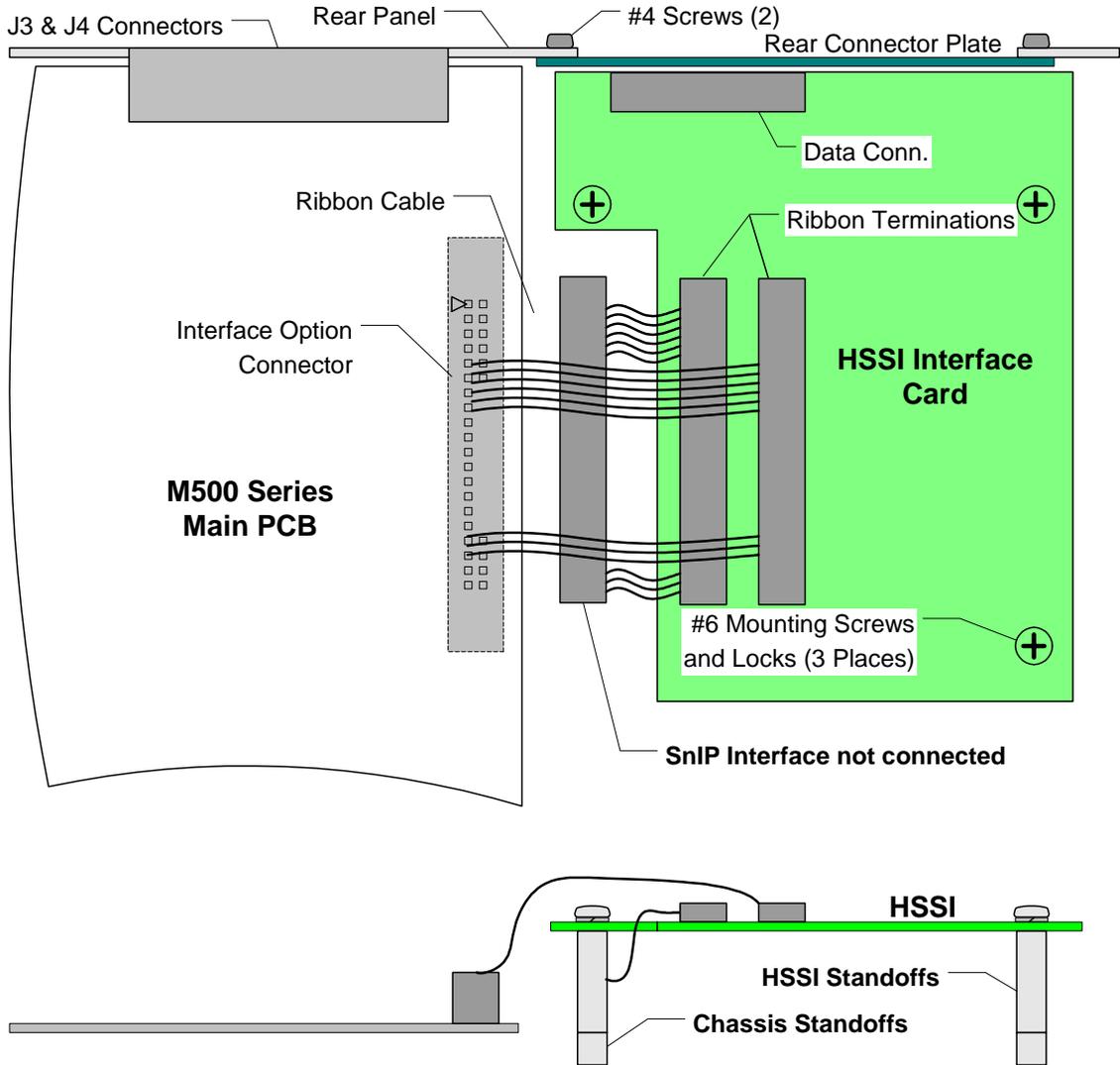


Figure 4 – HSSI Installation

Mount the HSSI card to the chassis using the three #6 mounting screws with lockwashers. An additional flat washer may be required to keep the PCB mounting screws from extending beyond the chassis bottom. Tighten the rear plate mounting screws and then the PCB mounting screws.

Connect the upper 40 pin ribbon cable connector to the main PCB header and press down to close the latches. Care must be taken to avoid bending the installed FEC card which is very close to one latch. The lower ribbon cable is not connected unless the SnIP card is also installed.

Re-install the cover and plug the unit in. Using the front panel arrow keys scroll down to the interface parameter and verify that the modem recognizes the newly installed card. The modem is now ready to be put into service.

3.2 Installing the HSSI Interface Card “Stacked” with the SnIP Interface

Remove the modem unit from service before installation of the HSSI option. Unplug the modem unit and remove the power cord from the rear for safety.

Position the HSSI card above the SnIP outside of the chassis and mate the inner 40 pin ribbon cable between the two cards. The HSSI PCB mounted standoffs should line up with the holes in

the SnIP card. One or two of the mounting screws can be used to hold the cards in alignment. Position the rear option plate supplied over the connectors on the two cards and press lightly to force the tension contacts on the RJ-45 connector through the hole. Then install the two jackscrews on the SnIP's DB9 connector using locktite. Now use two #4 pancake screws to attach the HD50 connector to the plate.

Slide the partially assembled interface assembly into the chassis and line up the mounting plate holes with the holes in the chassis rear panel. Attach the interface plate to the rear panel using two #4 panhead mounting screws without lock washers.

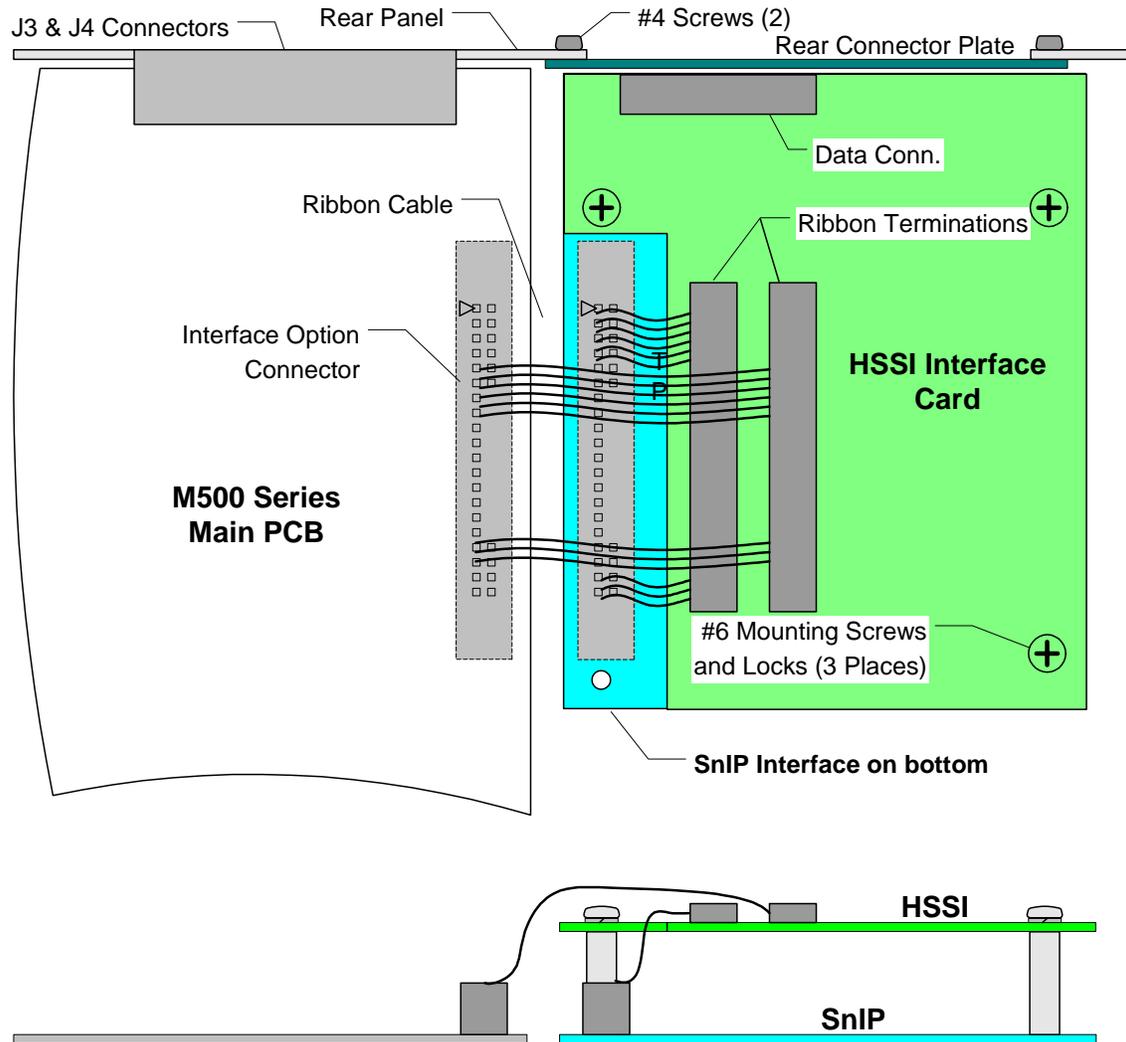


Figure 5 – Stacked HSSI and SnIP Installation

Mount the two boards to the chassis using the three #6 mounting screws with lockwashers and tighten. Insure that all of the rear plate screws are tightened.

Connect the remaining upper 40 pin ribbon cable free connector to the main PCB header and press down to close the latches. Care must be taken to avoid bending the installed FEC card which is very close to one of the latches.

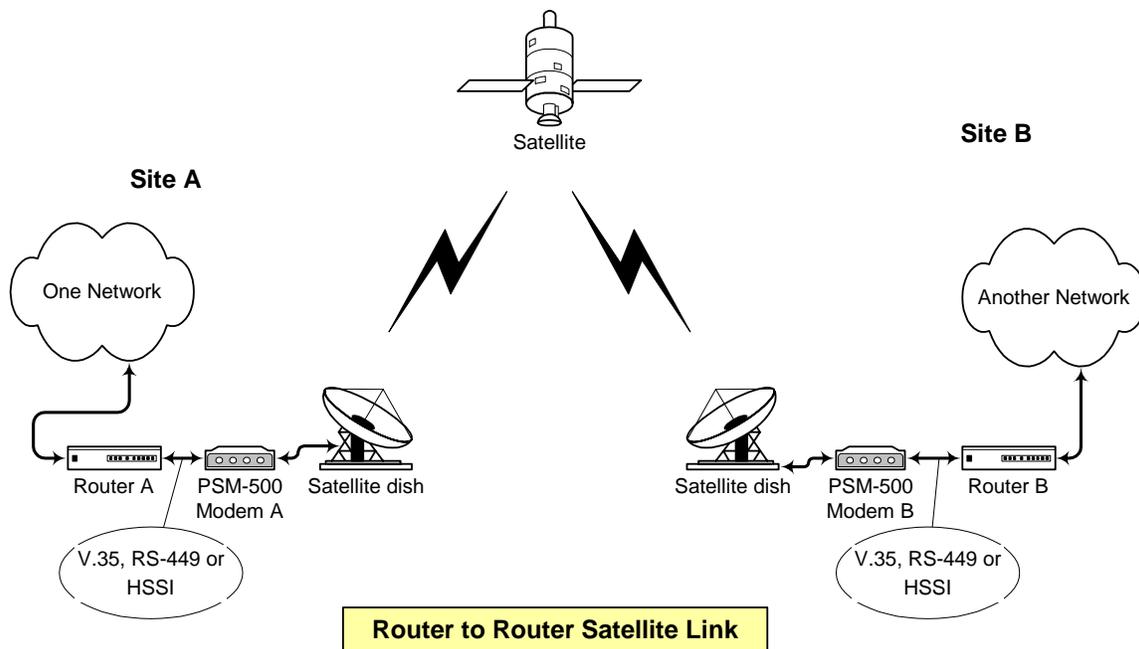
Re-install the cover and plug the unit in. Using the front panel arrow keys scroll down to the interface parameter and verify that the modem recognizes the newly installed card. The modem is now ready to be put into service.

4.0 Testing and Connection Verification

Some Background Information - Although the HSSI interface is normally used for router connections it is a “dumb” interface type. That means that it knows nothing about the data sources or sinks, nothing about traffic types, protocols, IP addresses or even framing. It is a simple data pump – that is for each clock cycle it transfers one information bit. The modem itself operates the same way except that it has sophisticated procedures to try to insure that bits entering one end of a satellite link are identical to those leaving on the other end.

This means that for a whole class of synchronous serial interfaces, the data is independent of the interfaces used. Thus you could theoretically use a V.35 router connection on one end of a link and a HSSI on the other assuming they were all at the same data rate in each direction. Logical connectivity is determined at higher levels in the OSI stack layers.

The rest of this discussion assumes a simple series of devices as shown below. The entire modem-to-modem chain including its interfaces is simply an extended cable between the two DTE devices, routers in this case.



There are two basic types of link interfaces between the router and the modem – Ethernet and synchronous serial, like V.35 and high speed serial like HSSI. The testing below focuses on HSSI, but is equally applicable to V.35 or RS-449 or EIA530 interfaces. Standard synchronous serial typically uses a WIC interface in the router while HSSI uses a HSSI network module.

4.1 Logical Connectivity Tests

If two routers are connected via a satellite link using Cisco HDLC protocols, then the periodic “keep alive” messages should tell you if the link is properly connected. Additionally the status of control lines can be used by the protocols to determine communication equipment status. In Cisco routers this is typically shown as the “Link” status and the “Protocol” status. When the clocks are present and control lines are good then the router will declare that the Link is “UP”. When the keep-alive messages are transmitted and answered then the router will declare that the protocol is “UP”.

Logical connectivity as evidenced by both the link and protocol being “up” normally means that the physical connectivity is also good. A network “ping” test between network type equipment not only shows connectivity, but also a simple sample of how good that connectivity is. For example, if the clock synchronization is not correct between the router and modem then the ping may work, but show lost packets. Router A in our link above could ping one of the interfaces in router B or a device in the remote network if the routing rules permit.

4.2 Physical Connectivity Tests

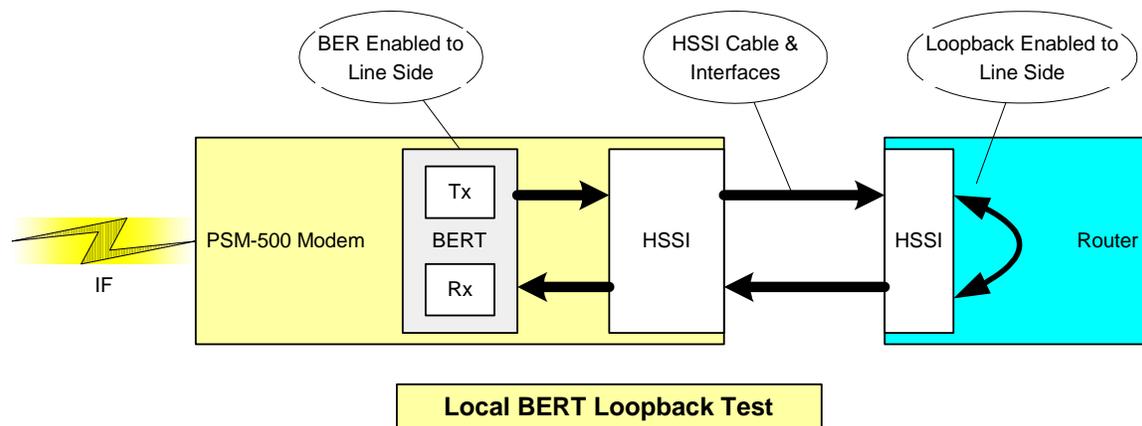
Physical testing can check the physical data connection between two points. These can be all items between and including the drivers and receivers in the DTE (router) equipment on both link ends. This includes the cables, connectors and the modems themselves.

You can perform two BER test from the BER test sets built into the Modem A and B (PSM-500 modems) to the Cisco router with the HSSI interface. They should both pass data with no errors. The router was set to loop back on the HSSI interface with the following commands given on the management port as follows:

```
> enable <password>
# config terminal
# interface hssi 1/0
# loopback line
    <later you will use "no loopback" and "exit, exit" to back out>
```

Test 1 - Local line BER test to check cable, and interfaces in modem and router

This first test checks the local interfaces and cable and does not require a satellite link or other stations equipment. The basic diagram is shown below:



The Modem is set to transmit and receive BER on the line side by using the following settings from the front panel. These commands are in the form of **<function:column – row > = value(#)**. The function is one of the 4 main buttons on the front panel to the right of the LCD, the column is shown in the upper left of the LCD display while the row is shown in the upper right. The value is displayed in the lower line of the LCD and can be selected by editing and using the up and down arrow keys or by simply pressing the number in parenthesis “(#)”.

```
<Intf:Test - BER Direction > = Terrestrial (1)
<Intf: Test - Mod BER > = 2047 (1)
<Intf: Test - Dem BER > = 2047 (1)
<Mod:Data - Clk Source > = Rcv Clk (4)
```

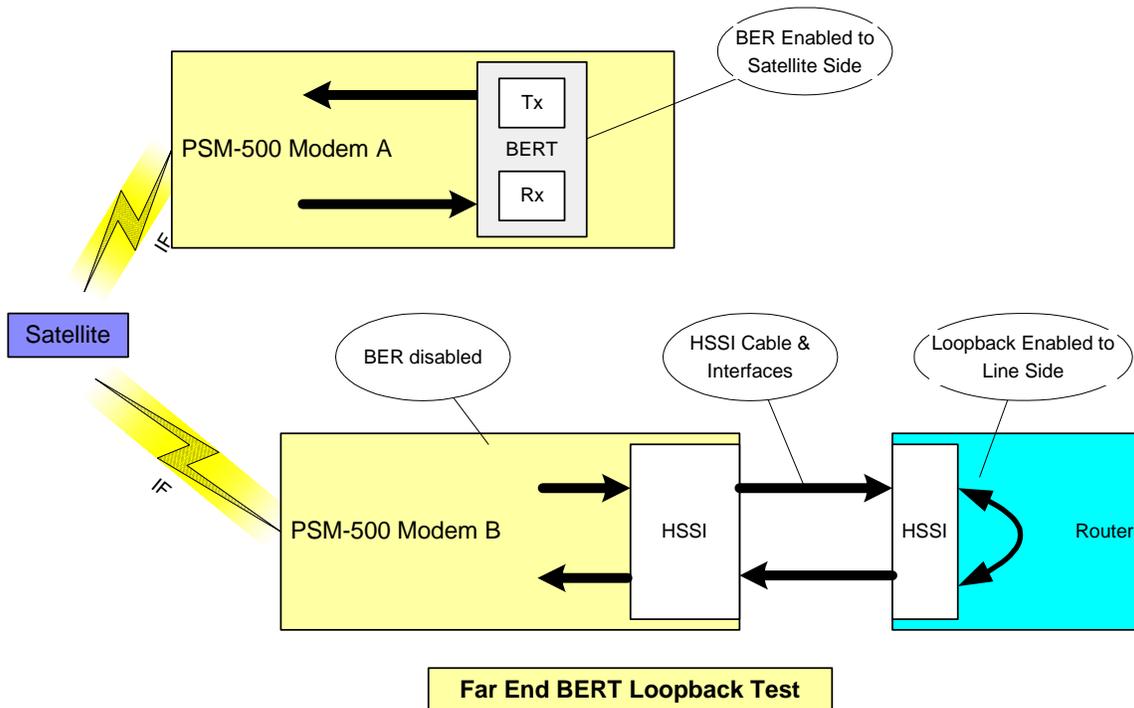
Note: Setting the Mod Data clock source is needed to sync the two clock sources.

Then by moving the front panel display to **<Intf:Status>** you can scroll up and down through the BER measurements. You should be able to quickly get a few billion bits going out the HSSI interface, through the Cisco HSSI network module and looped back into the modem's HSSI interface. There should be 0 errors, 0 sync losses, etc, which indicates that both HSSI interfaces are good, and the cable connection is good. As a test, temporarily set the Mod Data Clock Source back to "internal". You should now have periodic bit errors and sync losses.

Once finished you remove the BER test set by just entering selection #0 into each of the 4 changes you made above. Leave the loopback in the router for now if you want to perform the link test shown below.

Test 2 - Link BER test to check link, modems, cable, and interfaces in modem and router.

If the local test worked well then you can use the PSM-500 on the other side of the link (Modem A) and set up the BER test the same except the first entry for BER Direction will be towards the Satellite (select option 0). Make sure the other modem parameters are set and both modems are locked in each direction. The diagram for this test is shown below.



Running a few billion bits through the Modem A, the satellite link, Modem B, the modem HSSI interface, the HSSI cable and the Cisco HSSI interface and back again should verify that all of this works correctly.

When finished remove the Modem A BER setup, and the Router loopback. Don't forget to return the Modem B Modulator Clock Source to "Internal". Running this second test in both directions with success should mean that any problem remaining is in router configuration only.

Errors in the above tests could be due to a faulty modem or configuration. The modem can be tested using the BER Tests toward the satellite side and performing an IF loopback. For example Modem A in the diagram above should pass this BER Test by itself.