Cisco G.SHDSL High Speed WAN interface Card with IEEE 802.3ah EFM Support for Cisco Integrated Services Routers

Cisco® Integrated Services Routers (ISRs) and Integrated Services Routers Generation 2 (ISR G2) offer a wide variety of WAN connectivity modules to accommodate the range of application needs in customer networks. The Cisco single port 4-pair G.SHDSL High Speed WAN Interface Card (HWIC-4SHDSL-E) offers G.SHDSL-based WAN connectivity using the 802.3ah Ethernet in the First Mile (EFM)-compliant extended rate symmetric high-bit-rate DSL (SHDSL) EFM (2BASE-TL) technology for modular routers deployed in small to medium-sized businesses and enterprise branch offices.

Overview

The Cisco 4-pair G.SHDSL High Speed WAN Interface Card is designed to deliver high-speed Ethernet services over SHDSL access. HIWC-4SHDSL-E allows bonding to achieve higher data rates as defined by IEEE 802.3ah, and it is typically used in scenarios where individual links are aggregated using the 802.3ah loop aggregation. This card is supported in all Cisco ISR (except the Cisco 3825 and 2811) and ISR G2 routers that have HWIC slots.

The HWIC-4SHDSL-E comply with 2BASE-TL, which is based on the IEEE 802.3ah EFM standard. The 2BASE-TL standard uses the technology standard based on ITU recommendation G.991.2 bis.

The HWIC-4SHDSL-E cost-effectively allows service providers and enterprise customers to deliver Ethernet services to sites with no access to fiber by using bonded copper pairs with symmetrical bandwidth at rates up to 4 x 5.696 Mbps.

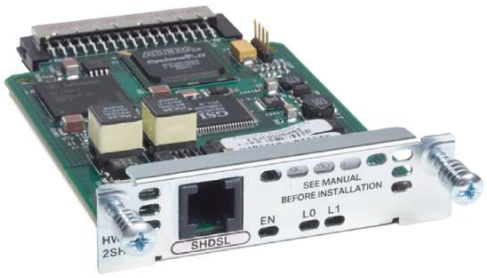
The HWIC-4SHDSL-E together with Cisco ISRs provides businesses the necessary bandwidth for critical traffic such as voice and video conferencing, and enables customers to save money by integrating voice and data traffic on the same WAN link. Service providers can increase subscriber revenue by bundling services and offering differentiated service levels through service-level agreements (SLAs).

This Interface Card enables point-to-point Ethernet connectivity, which uses existing infrastructure of copper wires spanning a typical carrier service area (CSA) of 9,000 to 12,000 feet from a central office to the customer premises.

The symmetric DSL, G.SHDSL has been an accepted worldwide technology standard based on ITU recommendation G.991.2. The 4-pair G.SHDSL EFM HWIC is designed to transport rate-adaptive symmetrical data across a single copper pair and EFM bonding with Annexes F and G up to 4 x 5.696 Mbps. These rates cover applications traditionally served by HDSL, single-line DSL (SDSL), T1, E1, and services beyond E1. Refer to Table 2 for the data rates supported by the 4-pair interface card (HWIC-4SHDSL-E) under different configurations.

Figure 1 shows the Cisco 4-Pair G.SHDSL EFM HWIC.

Figure 1. Cisco 4-Pair G.SHDSL EFM HWIC (HWIC-4SHDSL-E)



Feature Summary

- Complies with standard based on ITU Recommendation G.991.2
- Supports G.SHDSL Annexes A (U.S. signaling) and B (European signaling)
- Supports Annexes F and G
- Offers symmetrical WAN speeds up to 1 x 2304 kbps over a single copper pair, up to 2 x 2304 kbps over two copper pairs, up to 3 x 2304 kbps over three copper pairs, and up to 4 x 2304 kbps over four copper pairs using ITU-T G.991.2 Annexes A and B
- Offers symmetrical WAN speeds up to 1 x 5696 kbps over a single copper pair, up to 2 x 5696 kbps over two copper pairs, up to 3 x 5696 kbps over three copper pairs, and up to 4 x 56964 kbps over four copper pairs using ITU-T G.991.2 Annexes F and G
- Supports EFM bonding; supports up to four SHDSL pairs bonding
- Supports dying gasp
- Supports point-to-point configuration
- Supports 802.1Q, QinQ, trunk, and VLAN tagging
- Support IP quality-of-service (QoS) features, 802.1P, and differentiated services code point (DSCP)
- Supports EFM (IEEE 802.3ah) operation, administration, and maintenance (OA&M)
- Offers ability to configure multiple G.SHDSL EFM HWICs per Cisco 1841,1861, 2800, 3800, 1921, 1941, 2900, and 3900 (except, Cisco 3825 and 2811) router chassis
- Provides single RJ-45 connector system requirements

System Requirements

- The **4-Pair** G.SHDSL EFM HWICs are supported on all modular Cisco ISR and ISR G2s routers: the Cisco 1841, 1861, 2801, 2821, 2851, 3845, 1921, 1941, 2901,2911,2921,2951,3925,3945 .
- The **4-Pair** G.SHDSL EFM HWICs are supported in all Cisco IOS® Software feature sets.
- The routers listed previously need to run Cisco IOS Software Release 15.1(1)T. The system requires no additional flash or DRAM memory other than the specified minimum memory for the previously mentioned Cisco IOS Software releases.
- The **4-Pair** G.SHDSL EFM HWIC can be inserted into any HWIC slot in any Cisco integrated services router.

Cisco Integrated Services Router with G.SHDSL EFM HWIC Applications

Business-Class DSL with Backup WAN

The Cisco ISR and ISR G2 routers with the 4-Pair G.SHDSL EFM HWIC provide a business-class DSL solution for WAN access along with the option of a backup WAN interface (asymmetric DSL [ADSL] and ADSL2+, VDSL2, ISDN Basic Rate Interface [BRI], T1/E1, analog modem, cable modem, etc.) for mission-critical applications. The bonding feature offered on the G.SHDSL EFM HWIC allows service providers to bond two or more pairs of G.SHDSL links to offer differentiated bandwidth based on SLAs.

Business-Class Security

The Cisco 1841,1861, 2800, 3800, 1921, 1941, 2900, and 3900 ISR G2 routers with the G.SHDSL EFM HWICs can be optimized for Internet security with the Cisco IOS Firewall supporting stateful-inspection-firewall and intrusion-prevention-system features. These platforms can also be optimized for VPNs to allow for secure use of the Internet for communications with the same policies and levels of security and performance as a private network. VPNs provide security through encryption tunneling, and the Cisco routers support hardware-based Triple Data Encryption Standard (3DES) IP Security (IPsec), Advanced Encryption Standard (AES), and Secure Sockets Layer VPN (SSL VPN). Encryption features can be enabled on the routers with the Advanced Security or any later feature set of the Cisco IOS Software.

Differentiated Service Offerings Through IP

Using Cisco QoS features, including Class-Based Weighted Fair Queuing (CBWFQ), Low-Latency Queuing (LLQ), Weighted Random Early Detection (WRED), etc., the Cisco 1841,1861, 2800, 3800, 1921,1941, 2900, and 3900 Integrated Services Routers with HWIC-4SHDSL-E help service providers and resellers offer services that can differentiate bandwidth based on a specific application or a specific user.

Converged Platform for Small to Medium-Sized Business and Enterprise Branch-Office Applications

The Cisco 1841, 1861, 2800, 3800, 1921,1941,2900, and 3900 Integrated Services Router platforms with the G.SHDSL EFM HWICs offer customers a choice of converged platforms that offer best-of-class data, security, WAN access, and voice services in a single system. The Cisco 2800, 3800, 2900, and 3900 Series routers embed voice functions directly inside the router, enabling customers to deploy voice services by installing Cisco High-Density Packet/Voice Digital Signal Processor (DSP) Modules (PVDM3) and Cisco Integrated Services Modules (ISM) for IP telephony conferencing, voice gateways, and Cisco Unity® Express voicemail and Automated Attendant. For call processing, customers can enable the Cisco Unified Communications Manager Express solution as part of Cisco IOS Software and reconfigure the same software to support Cisco Survivable Remote Site Telephony (SRST) for centralized call processing with Cisco Unified Communications Manager. Such an integrated solution rapidly enables service deployment, increases efficiency of network operations, and provides opportunities to protect, grow, and optimize the business.

G.SHDSL EFM Feature

Table 1 lists the features of the G.SHDSL EFM HWIC.

Table 1. G.SHDSL EFM HWIC Features

Features	Parameters
Annexes A and B	Yes
Annexes F and G	Yes
Support for 2-wire mode	Yes
EFM bonding	Yes

Features	Parameters
Connecter	RJ-45
Dying gasp	Yes
Wetting current	Yes
Line coding	16- and 32-TCPAM (Trellis Coded Pulse Amplitude Modulation)
Rate adaption	Yes
Termination	Central office (CO) and CPE
Data rate	192-5696 kbps per pair
G.SHDSL chipset	Connexant

Data Rates Supported with 4-Pair G.SHDSL EFM HWIC

Table 2 gives data rates for the 4-pair G.SHDSL EFM HWIC.

Table 2. IEEE 802.3ah Loop Aggregation EFM Bonding

Note: Actual data rates depend upon factors such as loop length, line conditions, DSL Access Multiplexer (DSLAM) line card and chipset, and data rates provisioned by the service provider.

Configuration Mode	HWIC-4SHDSL-E
2-wire (1 pair) Annexes A and B	From 192 to 2304 kbps
4-wire (2 pair EFM bonding) Annexes A and B	From 2 x 192 to 2 x 2304 kbps
6-wire (3 pair EFM bonding) Annexes A and B	From 3 x 192 to 3 x 2304 kbps
8-wire (4-pair EFM bonding) Annexes A and B	From 4 x 192 to 4 x 2304 kbps
2-wire (1 pair) Annexes F and G	From 768 to 5696 kbps
4-wire (2 pair EFM bonding) Annexes F and G	From 2 x 768 to 2 x 5696 kbps
6-wire (3 pair EFM bonding) Annexes F and G	From 3 x 768 to 3 x 5696 kbps
8-wire (4 pair EFM bonding) Annexes F and G	From 4 x 768 to 4 x 5696 kbps

Data Rates Supported with TCPAM Configuration Option

Table 3 gives data rates for the G.SHDSL EFM HWIC with the TCPAM configuration option.

Table 3. Supported Data Rates with TCPAM Configuration Option

Note: Actual data rates depend upon factors such as loop length, line conditions, DSLAM line card and chipset, and data rates provisioned by the service provider.

Annex	TCPAM	Data Rate Range per Pair
A or B	16	192 to 2304 kbps
F or G	16 32 Auto	2304 to 3840 kbps 768 to 5696 kbps 768 to 5696 kbps
A-F or B-G or A-B-F-G	16 32 Auto	192 to 3840 kbps 768 to 5696 kbps 192 to 5696 kbps

Interoperability

The G.SHDSL EFM HWIC is based on the Connexant chipset, and it operates when connected to a DSLAM. Table 4 lists the DSLAMs that have been tested and are supported for interoperability. This table will be updated as more DSLAMs, line cards, and firmware versions are tested and supported in the future.

Table 4. DSLAM Interoperability

DSLAM	Line Card	Firmware	Chip Set	HWIC-4SHDSL-E
Huawei 5603	SHEB	1.4.13	Infineon	G100
Alcatel ISAM 7302	NSLT-A	1.3.5 (Feature Group 3.4)	Infineon	G100
Hatteras HN4000e	HN4000e	6.2.1	Infineon	G100

Platform Support

Table 5 gives platform support details for the G.SHDSL EFM HWICs.

Table 5. Platform Support Details

	HWIC-4SHDSL-E	
Platforms supported	Cisco 1841,1861, 2801, 2821, 2851, 3845,1921, 1941, 2901, 2911, 2921, 2951, 3925, 3925E, 3945, and 3945E	
Onboard HWIC slots on all platforms	Yes	

Maximum G.SHDSL HWICs per Platform

Table 6 gives the maximum number of G.SHDSL HWICs per platform.

Table 6. Maximum Number of G.SHDSL HWICs per Platform

Platform	Maximum Number of G.SHDSL HWICs per Platform
Cisco 1861	1
Cisco 1841, 2801, 1921, 1941, and 2901	2
Cisco 2821 through 2851 and Cisco 3845	4
Cisco 2911 through 2951 and Cisco 3925 and 3945	4
Cisco 3925E and 3945E	3

Software Requirements

The minimum Cisco IOS Software Release required for the G.SHDSL EFM HWIC (HWIC-4SHDSL-E) on the Cisco 1841, 1861, 2800, 3800, 1921,1941, 2900, and 3900 Integrated Services Routers is listed in Table 7. The recommended T-train Cisco IOS Software Release is 15.1(1)T. The 4-pair G.SHDSL EFM HWIC is supported in all Cisco IOS Software feature sets.

Table 7. Minimum Cisco IOS Software Release

Platform	Minimum Cisco IOS Software Release	Recommended Cisco IOS Software Release	Cisco IOS Software Feature Set
Cisco 1841, 1861, 2801, 2821, 2851, 3845, 1941, 1921, 2901, 2911, 2921, 2951, 3925, 3925E, 3945, and 3945E	15.1(1)T .	15.1(1)T	IP Base and later

Product Number and Ordering Information

Table 8 gives product ordering information.

Table 8. Ordering Information

Product Number	Description
HWIC-4SHDSL-E, HWIC-4SHDSL-E=	One port, 4-pair G.SHDSL EFM HWIC

4-Pair G.SHDSL EFM HWIC Hardware Specifications

Table 9 gives product hardware specifications.

Table 9. Hardware Specifications

	HWIC-4SHDSL-E
G.SHDSL EFM chipset	Ikanos
Dimensions (H x W x D)	(17.8 x 7.11 x 10.28cm)
Firmware version	G100
Weight	0.22 lb
LEDs	• One EN/LP (HWIC OK) LED; four link-status LEDs (one LED per physical link pair) • Link-status LED color coding: ◦ Green on: Link on/active ◦ Off: Link disabled ◦ Amber: Link alarm ◦ Blinking green: Link training ◦ Amber and green blinking simultaneously: Loopback mode Note: EN/LP will also be amber
Ports	Single RJ-45 connector
Cabling	RJ-45 to dual RJ-11 breakout line cord
Network Equipment Building Standards (NEBS) compliance	No

Safety, EMC, Telecom, Network Homologation, Power, Environmental Requirements, and Regulatory Approvals

When installed in a Cisco 1841,1861, 2800, or 3800,1921,1941,2900,3900 router, the 4-pair G.SHDSL EFM HWIC (HWIC-4SHDSL-E does not change the standards (safety, EMC, telecom, network homologation, power, environmental requirements, and regulatory approvals) of the router itself. Refer to the Cisco 1841, 1861, 2800, 3800, 1921,1941, 2900, and 3900 data sheets for additional information about mechanical, environmental, and agency certifications.

- For Cisco 1800 Series (modular): http://www.cisco.com/en/US/prod/collateral/routers/ps5853/product_data_sheet0900aecd8016a59b.html.
- For Cisco 2800 Series: http://www.cisco.com/en/US/prod/collateral/routers/ps5854/ps5882/product_data_sheet0900aecd8016fa68_ps5854_Products_Data_Sheet.html.
- For Cisco 3800 Series: http://www.cisco.com/en/US/prod/collateral/routers/ps5855/product_data_sheet0900aecd8016a8e8.html.
- For Cisco 1900 Series: http://www.cisco.com/en/US/prod/collateral/routers/ps10538/data_sheet_c78_556319.html.
- For Cisco 2900 Series: http://www.cisco.com/en/US/prod/collateral/routers/ps10537/data_sheet_c78_553896.html.
- For Cisco 3900 Series: http://www.cisco.com/en/US/prod/collateral/routers/ps10536/data_sheet_c78_553924.html.

Country Support

- This worldwide-accepted technology is based on ITU Recommendation 991.2.
- Refer to the following URL or contact your local Cisco representative for country-specific approval status: http://tools.cisco.com/cse/prdapp/jsp/externalsearch.do?action=externalsearch&page=EXTERNAL_SEARCH.

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