Cisco Connected Grid Multimode VDSL2, ADSL2/2+ and Symmetric High-Bitrate (G.SHDSL) DSL GRWIC for Cisco 2010 Connected Grid Router

The Cisco® Connected Grid portfolio of solutions is designed specifically for the harsh, rugged environments often found in the energy and utility industries. These solutions include the Cisco 2010 Connected Grid Router (CGR 2010), which has been designed to support the communications infrastructure needs of the energy delivery infrastructure across the generation, transmission, and distribution sectors. Designed for highly secure, reliable, and scalable infrastructure, the CGR 2010 is an ideal platform to support Smart Grid and other energy delivery infrastructure needs of customers. The CGR 2010 has been extensively tested to meet the challenging substation compliance standards including IEEE 1613 and IEC 61850-3. The CGR 2010 offers four module slots to utilize Grid Router WAN Interface Cards (GRWIC). These GRWICs support legacy WAN interfaces (such as ISDN, DSL, Serial, etc) as well as new WAN technologies such as 4G Long Term Evolution (4G LTE).

Product Overview

Cisco Connected Grid Multimode VDSL2 and ADSL2/2+ GRWIC

The Cisco Multimode VDSL2 and ADSL2/2+ GRWICs provide 1-port multimode VDSL2 and ADSL2/2+ WAN connectivity. In combination with the CGR 2010, this GRWIC provides high-speed digital data transmission between remote energy infrastructure and the central office (DSL access multiplexer [DSLAM]), usually located on the service provider premises. This capability helps enable the energy operations to take advantage of the business-class WAN connection features such as security, differentiated classes of service (QoS), and managed access with Cisco IOS® Software over existing telephony infrastructure. These value-added features, along with the flexible manageability and reliability of Cisco IOS Software, provide mission-critical networking features that energy organizations need.

Cisco Symmetric High-Bitrate (G.SHDSL) GRWIC

The 2-pair (GRWIC-2SHDSL) symmetric high-bit-rate DSL GRWIC provides two ports of 2-wire or one port of 4-wire G.SHDSL connectivity to a WAN. G.SHDSL technology offers customers high-speed, symmetrical WAN connectivity at a lower cost than traditional WAN circuits. Together with the CGR 2010, the GRWIC provides energy infrastructure organizations with the necessary bandwidth for critical traffic and helps enable the option for point-to-point DSL that does not require a service provider.

The first standardized multirate symmetric DSL, G.SHDSL has been an accepted worldwide technology standard based on International Telecommunication Union's (ITU) recommendation G.991.2. G.SHDSL is designed to transport rate-adaptive symmetrical data across a single copper pair at data rates up to 2.304 Mbps for a

single pair, or up to 4.608 Mbps over two pairs. This rate covers applications traditionally served by HDSL,SDSL, T1, E1, and services beyond E1. Figure 1 displays the Cisco Connected Grid Multimode VDSL2 & ADSL2+ and G.SHDSL GRWICs

Figure 1. Multimode VDSL2 & ADSL2+ and G.SHDSL GRWICs

Platform Support

The GRWIC is a ruggedized module supported on the Cisco 2000 Series Connected Grid Router. Table 1 outlines the minimum Cisco IOS Software release support for this GRWIC module.

Table 1. Minimum Cisco IOS Software Release Supported

	Cisco 2010 Connected Grid Router
Minimum Cisco IOS Release	15.2(3)T
Minimum Cisco IOS Technology Package	IP Base

DSL Specifications for VDSL2 and ADSL2/2+ GRWIC (G.SHDSL section below)

Tables 2 through 5 list the DSL feature specifications and DSLAM interoperability support for the Cisco Multimode VDSL2 and ADSL2/2+ GRWIC.

Table 2. Multimode ADSL2/2+ and VDSL2

Product	GRWIC-VA-DSL-x
Multimode DSL (VDSL2 and ADSL2/2+)	Broadcom chipset • One RJ-11 VDSL2 interface • Dying gasp • IEEE 802.1q VLAN tagging • Independent DSL firmware loading VDSL2: • ITU G.993.2 (VDSL2) • 997 and 998 band plans • VDSL2 profiles: 8a, 8b, 8c, 8d, 12a, 12b, and 17a • U0 band support (25 to 276 kHz) • Ethernet packet transfer mode (PTM) based only on IEEE 802.3ah 64/65 octet encapsulation • Support for double-ended line testing (DELT) diagnostics mode • DSL Forum TR-067 compliance • Support for downstream speeds up to 100 Mbps in Ethernet PTM and up to 50 Mbps upstream ADSL2/2+: • ADSL over plain old telephone service (POTS) with Annex A and Annex B ITU G. 992.1 (ADSL), G.992.3 (ADSL2), and G.992.5 (ADSL2+) • ADSL over POTS with Annex M (extended upstream bandwidth) G.992.3 (ADSL2) and G.992.5

Product	GRWIC-VA-DSL-x
	(ADSL2+) ◦ Cisco Multimode VDSL2 and ADSL2/2+ EHWIC (EHWIC-VA-DSL-M) is optimized for power spectrum density (PSD) mask EU-64 M9 ◦ Cisco Multimode VDSL2 and ADSL2/2+ EHWIC (EHWIC-VA-DSL-M) supports UK Annex M ◦ G.994.1 ITU G.hs ◦ Reach-extended ADSL2 (G.922.3) Annex L for increased performance on loop lengths greater than 16,000 feet from central office ◦ T1.413 ANSI ADSL DMT issue two compliance ◦ DSL Forum TR-067, and TR-100 conformity ◦ Impulse noise protection (INP) and extended INP ◦ Downstream power backoff (DPBO) ◦ Asynchronous transfer mode (ATM) only

Table 3. VDSL2 over ISDN DSLAM Interoperability for Cisco Multimode VDSL2 and ADSL2/2+ GRWIC (GRWIC-VA-DSL-A, GRWIC-VA-DSL-B, and GRWIC-VA-DSL-M)

DSLAM	VDSL2 over ISDN and Basic Telephone Service Line Card Chipset
ZTE 9806	Broadcom
Alcatel ISAM 7302	Ikanos
Alcatel ISAM 7302	Conexant
Huawei 5603	Broadcom

Table 4. ADSL over ISDN DSLAM Interoperability for Cisco Multimode VDSL2 and ADSL2/2+ GRWIC (GRWIC-VA-DSL-B)

DSLAM	ADSL2/2+ over ISDN Line-Card Chipset
Alcatel ASAM7300	Broadcom
ECI Hi-Focus 480	Infineon
Ericsson ECN320	Broadcom
Siemens HiX 5300	Infineon

Table 5. ADSL over POTS DSLAM Interoperability for Cisco Multimode VDSL2 and ADSL2/2+ GRWICs (GRWIC-VA-DSL-A and GRWIC-VA-DSL-M)

DSLAM	ADSL2/2+ over Basic Telephone Service Line-Card Chipset
Alcatel ASAM7300	Broadcom
Alcatel ISAM 7302	Broadcom
Ericsson EDA2.1	Broadcom
ECI Hi-Focus 480	Infineon
Fujitsu FDX Hub 1000	Infineon
Fujitsu FDX Hub 1000	Texas Instruments
Huawei MA5600	Conexant
Lucent Stinger	Conexant
Nokia D500	Globespan

Application-Aware Networking with IP Quality of Service

Using Cisco quality-of-service (QoS) features, including Class-Based Weighted Fair Queuing (CBWFQ), Low-atency Queuing (LLQ), Weighted Random Early Detection (WRED), etc., the Cisco 2000 Series Routerswith the

Cisco Multimode VDSL2 and ADSL2/2+ GRWIC can help service providers and resellers offer services that can differentiate bandwidth based on the specific application or user.

Performance

VDSL2 and ADSL2/2+ performance is a function of many variables, including the DSLAM line card, DSLAM software version, VDSL profile and band plan, line-noise conditions, loop length, and other environmental factors.

Platform Support

Multimode DSL (VDSL2 and ADSL2/2+) GRWICs are supported only in the onboard GRWIC slots of the modular CGR 2010 platofrm. Table 6 provides platform support details.

Table 6. Platform Support and Maximum Number of GRWICs per Platform

Product Number	Maximum Number of GRWIC slots
CGR 2010	4

Table 7 provides partner number details.

Table 7. Multimode DSL (VDSL2 and ADSL2/2+) Ordering Information

Connected Grid Router WIC Product Part Numbers	
GRWIC-VA-DSL-A	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex A
GRWIC-VA-DSL-A=	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex A, spare
GRWIC-VA-DSL-B	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex B
GRWIC-VA-DSL-B=	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex B, spare
GRWIC-VA-DSL-M	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex M
GRWIC-VA-DSL-M=	Cisco Connected Grid VDSL2 and ADSL2/ADSL2+ GRWIC - Annex M, spare

Table 8 offers details on DSL specifications.

Table 8. DSL Specifications (for G.SHDSL)

Product	HWIC-2SHDSL
Symmetric High-Bitrate (G.SHDSL) DSL	Based on ITU Recommendation G.991.2 • Offers symmetrical WAN speeds up to 2.304 Mbps over a single copper pair and up to 4.608 Mbps over two copper pairs using ITU-T G.991.2 Annex A and Annex B • Offers symmetrical WAN speeds from 768 kbps to 5.696 Mbps over a single copper pair and from 1.536 to 11.392 Mbps over two copper pairs using ITU-T G.991.2 Annex F and Annex G • Supports Wetting Current (Section A.5.3.3 of G.991.2) • Supports G.SHDSL Annex A (U.S. signaling) and Annex B (European signaling) • Supports “dying gasp;” uses power status bit (section 7.1.2.5.3 of G.991.2) for signaling • Offers ability to configure multiple G.SHDSL GRWICs per Cisco CGR 2010 chassis • Offers extensive ATM class-of-service (CoS) and IP QoS support • Sustains up to eight permanent virtual circuits (PVCs) per GRWIC • Provides single RJ-11 connector

Differentiated Service Offerings Through IP and ATM QoS

Using Cisco QoS features including Class-Based Weighted Fair Queuing (CBWFQ), Low-Latency Queuing (LLQ), Weighted Random Early Detection (WRED), etc., the Cisco CGR 2010 with the G.SHDSL GRWICs help energy infrastructure organizations differentiate bandwidth based on a specific application or a specific user. In addition to

IP QoS features, the Cisco CGR 2010 with the G.SHDSL HWICs map IP QoS to ATM CoS features, including support for constant bit rate (CBR), Variable Bit Rate non-realtime (VBR-nrt), Variable Bit Rate realtime (VBR-rt), Unspecified Bit Rate (UBR), and UBR+. These features help manage core ATM network infrastructures to deliver scalable, cost-effective services with QoS guarantees to customers. Per-virtual-circuit traffic shaping and queuing allows further optimization of the existing bandwidth between customers and various services.

Data Rates Supported with 2-Pair G.SHDSL GRWIC

Table 9 details the data rates for 2-pair G.SHDSL HWICs. Note that actual data rates depend upon factors such as loop length, line conditions, DSL Access Multiplexer (DSLAM) linecard and chipset and data rates provisioned by the service provider.

Table 9. Data Rates for 2-Pair G.SHDSL HWICs

Configuration Mode	Speed
2-wire (1 pair) Annex A and Annex B	192 kbps to 2.304
4-wire (2 pair) Annex A and Annex B	384 kbps to 4.608 Mbps
2-wire (1 pair) Annex F and Annex G	768 kbps to 5.696 Mbps
4-wire (2-pair) Annex F and Annex G	1.536 to 11.392 Mbps

Interoperability

Table 10 lists the DSLAMs that have been tested and will be supported for interoperability. This table will be updated as more DSLAMs, line cards, and firmware versions are tested and supported in the future.

Table 10. DSLAM Interoperability Information for the G.SHDSL HWICs

DSLAM	Line Card	Firmware
Alcatel ASAM 7300	SMLT-A	LDP7AA46.017
ECI HiFocus SAM 480	STUC-16	S3_8.10.10
Lucent Stinger FS	STGR-LIM-SL-72, STGR-LIM-SL-48	9.7.3 (R3.0.2)

Platform Support

Symmetric High-Bitrate GRWICs are supported only in the onboard GRWIC slots of the modular CGR 2010 platform. Table 11 provides platform support details.

Table 11. Platform Support and Maximum Number of GRWICs per Platform

Product Number	Maximum Number of GRWIC slots
CGR 2010	4

Product Part Numbers

Table 12 provides the product part numbers to use when ordering.

Table 12. Symmetric High-Bitrate (G.SHDSL) Ordering Information

Connected Grid Router WIC	
GRWIC-2SHDSL	Cisco Connected Grid G.SHDSL GRWIC
GRWIC-2SHDSL=	Cisco Connected Grid G.SHDSL GRWIC, spare

Common Specifications

Table 13 provides the specifications that apply to the all DSL GRWICs.

Table 13. Specifications

Feature	Specification
Environmental Specifications	
Operating Conditions	
Operating Temperature	32º F to 104º F (0 to +40º C) continuous operating temperature range
Shock and Vibration	30G @11 ms
Altitude	10,000 ft (3,048 m); maximum operating temperature is de-rated with increasing altitude per IEEE1613a-2008
Relative Humidity	5 to 85 percent non-condensing
Non-operating Conditions	
Temperature	32º F to 104º F (0 to +40º C) continuous operating temperature range
Relative Humidity	5 to 95 percent non-condensing
Altitude	10,000 ft (3048 m); maximum operating temperature is de-rated with increasing altitude per IEEE1613a-2008
Non-Operating Free-fall Drop	4 in. (100 mm) per ENG-339611
Operating Seismic Earthquake	IEC 61850-3 section 5.5
Non-Operating Shock and Vibration	40-50G (3.26 m/s minimum)
Regulatory Compliance and Safety*	
Immunity	• EN61000-6-2 • EN61000-4-2 (ESD) • EN61000-4-3 (RF) • EN61000-4-4 (EFT) • EN61000-4-5 (SURGE) • EN61000-4-6 (CRF) • EN61000-4-11 (VDI) • EN 55024, CISPR 24 • EN50082-1
Electromagnetic Compliance	• 47 CFR, Part 15 • ICES-003 Class A • EN55022 Class A • CISPR22 Class A • AS/NZS 3548 Class A • VCCI V-3 • CNS 13438 • EN 300-386
Safety	• USA: UL 60950-1 • Canada: CAN/CSA C22.2 No. 60950-1 • Europe: EN 60950-1 • China: GB 60950-1 • Australia/New Zealand: AS/NZS 60950-1 • Rest of World: IEC 60950-1 • CSA certified to UL/CSA 60950-1, 2nd Ed. • CB report to IEC60950-1, 2nd Ed., covering all group differences and national deviations
Telecommunication	• US: TIA-968-A • CA: CS-03

Feature	Specification
	• EU: TBR1, 2, 4, 12, 13 • RTTE Directive • Australia: AS/ASIF S016, S038 • Japan: JATE
Physical Specifications	
Form Factor	Single-wide GRWIC, no slot restrictions
Dimensions	3.25 in. X 2.0 in. X 8.5 in. (W X H X D)
Weight	0.4 Kg (0.9 lb)

* For more information, consult the Product Approval Database http://www.ciscofax.com or consult your local Cisco representative (Cisco.com login required).

Ordering Information

These products can be ordered by a Cisco authorized partner. For more information about product availability, please contact your Cisco representative.

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For More Information

For more information on the Cisco CGR 2010 please visit: http://www.cisco.com/go/cgr2000

For more information on the Multimode VDSL2, ADSL2/2+ and Symmetric High-Bitrate (G.SHDSL) DSL GRWIC for the Cisco 2010 Connected Grid Router please visit http://www.cisco.com/en/US/products/ps10977/products_relevant_interfaces_and_modules.html

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