

## Cisco MWR 1941-DC-A Mobile Wireless Edge Router

Cell-Site Access Platform Custom-Designed for IP Optimization of Radio Access Networks

### Introduction

The Cisco® MWR 1941-DC-A Mobile Wireless Edge Router is a cell-site access platform specifically designed to optimize, aggregate, and transport mixed-generation Radio Access Network (RAN) traffic. It allows mobile wireless operators to significantly lower existing operating expenses (OpEx); cost-efficiently deploy new radio technologies such as UMTS/HSDPA and WiMAX voice and data networks; generate revenue from new cell-site IP-based services; and enable rapid deployment of next-generation mobile services.

Custom designed for the cell site, the Cisco MWR 1941-DC-A features a small form factor, extended operating temperature, and cell-site DC input voltages. It comprises a high-performance architecture, driven by a powerful MIPS RISC processor coupled with an optional ATM network processing engine, combined with application-specific Cisco IOS® Software-based operating software tailored for IP RAN transport. The Cisco MWR 1941-DC-A has a modular design, providing flexibility and a variety of connectivity options at the cell site through support for select modules from the Cisco 2800 and 3800 Series Integrated Services Router platforms.

The Cisco MWR 1941-DC-A enables a variety of RAN solutions by extending IP connectivity to GSM/GPRS/EDGE base transceiver stations (BTSs), UMTS/HSDPA Node Bs, CDMA/CDMA-2000/EV-DO BTSs, and other ancillary cell-site equipment. It transparently and efficiently transports cell-site voice, data, and signaling traffic over IP using traditional T1/E1 circuits, including leased line, microwave, and satellite, as well as alternative backhaul networks, including DSL, EFM, Metro Ethernet, and WiMAX. It also supports standards-based Internet Engineering Task Force (IETF) Internet protocols over the RAN transport network, including those standardized at the Third-Generation Partnership Project (3GPP) for IP RAN transport.

The primary Cisco IP Optimized RAN transport solutions, which may be deployed separately or in combination to suit the operator's specific network and business needs, include:

- Optimized RAN transport over IP: Maximizes GSM/GPRS/EDGE, UMTS/HSDPA, and 4G voice and data call density per T1/E1 over the RAN transport network to reduce backhaul transmission costs, which are typically the largest operational expenses in the network.
- Broadband and Ethernet RAN backhaul: Allows for a variety of backhaul transport media enabling higher-capacity and/or lower-cost alternative RAN transport for GSM, CDMA, and UMTS networks, such as DSL, WiMAX, and Metro Ethernet. Higher-speed broadband backhaul, such as DSL and Metro Ethernet, is ideally suited for transport of HSDPA, CDMA EV-DO, and WiMAX data traffic.
- Cell-site operations support networks: Enables telemetry to cell sites for remote operations and network element management of the ancillary cell-site equipment to reduce costly site visits and improve operational efficiency.

- Cell-site IP points of presence (POPs): Offer new revenue-generating IP services and applications at every cell site.

Table 1 lists the advantages and benefits of the Cisco IP Optimized RAN solutions for mobile wireless operators.

**Table 1.** Important Advantages and Benefits of the Cisco IP Optimized RAN Solutions

Solution	Advantage	Benefit
Optimized RAN Transport over IP	50% measured T1/E1 efficiency gain on GSM and UMTS Reduced bandwidth needs Bit-transparent RAN vendor independent No change to existing RAN design Cisco Optimized Pseudo-Wire Emulation (PWE) Statistical multiplexing T1/E1 "bonding" with MLPPP Single converged IP backhaul serving 2G/3G/4G QoS by traffic type and radio Dynamic bandwidth sharing Decouple RAN technology from transport IMA termination at the cell site Enhanced reliability 3GPP-compliant transport Investment protection	Substantial OpEx reduction Growth in GSM revenue without increasing costs Expanded call-carrying capacity of existing T1/E1 RAN Utilization of existing T1/E1 capacity from GSM to also handle UMTS Ability to begin Node B rollouts immediately and pre-wire additional UMTS capacity Faster rollouts Loss of T1/E1 span does not result in loss of service Multiple traffic classes supported on common network Per-technology bandwidth monitoring and tracking Seamless support for natural 2G to 3G migration Broadband and Ethernet backhaul-ready Utilize standards as broadband and Ethernet backhaul become available Reduced ATM spending, investment in IP – the future Risk-free BSS upgrades Positioning for 3G evolution to native IP
Broadband and Ethernet RAN backhaul	Backhaul media independent (xDSL, EFM, Metro Ethernet, WiMAX, etc.) UMTS, HSPA, EVDO, WiMAX offload Cisco optimized PWE and IETF PWE3 ATM PVC routing for UMTS Rapid network expansion Single converged IP/Ethernet/MPLS backhaul	Lower-cost broadband IP backhaul options Substantial OpEx reduction Quick response to growth demands Simplified network management and backhaul provisioning Ability to route different traffic types over different backhaul media types Optimal matching of backhaul network capacity and SLA Multi-radio/multi-backhaul capability Load-balancing across backhaul options Backup paths
Cell-site IP POPs and operations support networks	New revenue-generating services Intelligent IP services Cell-site telemetry and LAN extension 4G-ready	Ability to reach new customers RAN security Fewer site visits and shorter mean time to repair (MTTR) Rapid deployment of next-generation services

The Cisco MWR 1941-DC-A Mobile Wireless Edge Router (Figure 1) delivers a compact, high-performance, and modular cell-site access platform designed specifically for IP optimization of RANs, enabling profit-enhancing solutions for today's mobile networks and offering flexibility to evolve as future growth and business needs require.

**Figure 1.** Cisco MWR 1941-DC-A Mobile Wireless Edge Router



### **Cisco MWR 1941-DC-A Mobile Wireless Edge Router Overview**

The primary hardware and software features of the Cisco MWR 1941-DC-A Mobile Wireless Edge Router are described in the following overviews.

#### **Hardware Overview**

The Cisco MWR 1941-DC-A includes the following hardware features:

- Stackable, low-power, 1-rack-unit (RU), 12.5-inch-deep, 19-inch rack-mount form factor with front-to-back airflow
- Time-division multiplexing (TDM) backplane
- Common clock distribution across the chassis
- Front-panel access cabling and LED indicators
- Two integrated 10/100BASE-T LAN ports
- Three integrated WAN interface card (WIC) slots that support select modules from the Cisco MWR 1900 Series, and the Cisco 2800 and 3800 Series
- One network module slot supporting select network modules from the Cisco 2800 and 3800 Series
- One ATM Advanced Integration Module (AIM) processor card (required for UMTS)
- 115.2-Kbps console and auxiliary ports
- -10 to 55°C (-4 to 131°F) extended operating temperature
- 20 to 60V DC ( $\pm$ ) universal power supply
- MIPS RISC processor
- Support for the Cisco 2-Port T1/E1 RAN Voice/WAN Interface Card providing a dedicated TDM hardware processor for Cisco GSM Abis/Ater Optimization over IP, CESoPSN, and SAToP
- 256 MB DRAM, 128 MB external compact flash memory
- T1/E1 protection switching on Abis, Ater, lub, and backhaul T1/E1s between 1:1 redundant Cisco MWR 1941-DC-A platforms
- Simple GUI-based management with Cisco Mobile Wireless Transport Manager (MWTM)

## Software Overview

The software available for the Cisco MWR 1941-DC-A supports Cisco IOS Software running on the MIPS RISC processor, and microcode running on the optional Cisco AIM network processor to provide hardware-acceleration to increase performance of ATM network services such as ATM cell segmentation and reassembly (SAR), ATM AAL0 (for AAL2 voice/data), AAL5, and IMA v1.0 and v1.1.

The software for the Cisco MWR 1941-DC-A is tailored for IP RAN transport, and includes several Cisco IOS Software features specifically developed for such applications. These features include Cisco patent-pending Optimized Pseudowire Emulation (PWE), or GSM Abis/Ater and UMTS Iub Optimization over IP, which provides optimization to improve backhaul transport efficiency. Another important feature is Cisco ATM PVC Routing, which provides the ability to route different types of 3G traffic over different types of backhaul media, while providing load-balancing and backup paths. For example, in some DSL backhaul networks the downlink supports much higher capacity than the uplink. Cisco ATM PVC Routing optimally matches HSDPA transport to these asymmetric backhaul networks by routing higher-bandwidth downstream traffic over DSL links, while the lower-bandwidth upstream traffic is routed over "bonded" T1/E1 links. In addition, the software supports Cisco patented redundancy and failover logic, diagnostics functions, and relay control enabling inter-router T1/E1 protection switching, which provides 99.9998 percent availability using the Cisco T1/E1 Protection Switching VWICs (product codes: VWIC-2T1/E1-RAN, VWIC-2MFT-T1-DIR, and VWIC-2MFT-E1-DIR).

The Cisco IOS Software features supported on the Cisco MWR 1941-DC-A include:

- Cisco Optimized Pseudowire Emulation (PWE)
- Cisco Abis/Ater and Iub Optimization over IP
- ATM Pseudowire Emulation Edge to Edge (PWE3) over MPLS and L2TPv3; Transparent Cell Transport Service/ATM Port Mode; ATM AAL5 CPCS-SDU Mode; ATM AAL5-SDU Mode; ATM N:1 and 1:1 VCC cell mode; ATM Port Cell Relay Service; ATM VCC Cell Relay Service
- Structure Agnostic TDM over Packet (SAToP) and Circuit Emulation Service over Packet Switched Network (CESoPSN)
- Ethernet PWE3 over MPLS; VLAN mode and port mode
- ATM, TDM, and Ethernet PWE3 redundancy
- IEEE 802.1q and IEEE 802.1p
- Multiprotocol Label Switching (MPLS)
- Layer 2 Tunneling Protocol Version 3 (L2TPv3)
- Generic Routing Encapsulation (GRE)
- Point-to-Point Protocol (PPP) and Multi-link PPP (MLPPP)
- Asymmetric PWE3, PWE3 over MLPPP, and PWE3 over GRE for HSDPA Offload
- User Datagram Protocol (UDP) and compressed Real Time Protocol/compressed UDP (cRTP/cUDP), Address and Control Field Compression (ACFC)
- Inverse Multiplexing over ATM (IMA v1.0, 1.1), ATM cell packing, ATM SAR, ATM AAL0 (for AAL2 voice/data), AAL5, ATM Class of Service (CoS) features CBR, VBR-nrt, VBR-rt, and UBR, per virtual circuit (VC) queuing, pre-ATM VC shaping for VBR-nrt, IP CoS map to ATM QoS services, ATM PVC Routing

- High-Level Data Link Control (HDLC)
- Hot Standby Routing Protocol (HSRP), Open Shortest Path First (OSPF) protocol, Border Gateway Protocol (BGP), Routing Information Protocol (RIP), IP Multicast, Bidirectional Forwarding Detection (BFD), IS-IS
- IP Precedence, traffic shaping and policing, Priority Queuing (PQ), Weighted Fair Queuing (WFQ), Class-Based Weighted Fair Queuing (CBWFQ), Low Latency Queuing (LLQ), Weighted Round Robin (WRR), DiffServ
- PPP over Ethernet (PPPoE), PPP Authentication Protocol (PAP), Challenge Handshake Authentication Protocol (CHAP), Secure Shell (SSH) Protocol Version 2, access control lists (ACLs)
- Network Timing Protocol (NTP)
- Network Address Translation (NAT), Dynamic Host Configuration Protocol (DHCP), IP Control Protocol (IPCP)

Table 2 lists important features and benefits of the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 2.** Important Features and Benefits of Cisco MWR 1941-DC-A

Feature	Benefit
<b>Custom-Built for the Cell Site</b>	
Small form factor	<ul style="list-style-type: none"> <li>• 1-RU/12.5-in.-deep chassis preserves limited rack space available at the cell site</li> </ul>
Universal DC power supply	<ul style="list-style-type: none"> <li>• Compatible with the range of DC input voltages specifically available at cell sites</li> <li>• Facilitates deployment at either 27 VDC or –48 VDC cell sites</li> </ul>
Extended operating temperature	<ul style="list-style-type: none"> <li>• Functions reliably in cell sites subject to higher operating temperatures</li> <li>• Low power operation makes more efficient use of cell-site batteries and produces less heat</li> </ul>
Front panel access cabling and LED indicators	<ul style="list-style-type: none"> <li>• Facilitates easy access and at-a-glance activity status</li> </ul>
<b>High-Performance Architecture Designed for RAN Aggregation, Optimization, and Transport</b>	
Hardware-accelerated network services	<ul style="list-style-type: none"> <li>• Provides hardware-accelerated GSM Abis/Ater and UMTS Iub transport over T1/E1 or IP backhaul with up to 50-percent traffic optimization or greater, CESoPSN, SAToP, ATM PWE3 over MPLS and L2TPv3, and Ethernet PWE3 over MPLS</li> <li>• Enables ATM segmentation and reassembly and IMA</li> </ul>
Hardware-accelerated network services	<ul style="list-style-type: none"> <li>• Achieves proven transparency in GSM, UMTS, and CDMA networks</li> </ul>
Unique software bundle for RAN transport and optimization	<ul style="list-style-type: none"> <li>• Customized Cisco IOS Software-based software boosts performance and availability of IP optimized RAN applications and backhaul-independent transport</li> </ul>
<b>Cell-Site IP Connectivity</b>	
Optimized RAN transport over IP Broadband and Ethernet RAN backhaul Cell IP POPs	<ul style="list-style-type: none"> <li>• Maximizes voice and data call density per T1/E1</li> <li>• Provides higher-capacity and lower-cost alternative RAN transport backhaul media</li> <li>• Enables new revenue-generating IP services and applications; cell-site telemetry</li> </ul>
<b>Investment Protection</b>	
Modular architecture	<ul style="list-style-type: none"> <li>• Combination of WICs and network modules gives greater flexibility to customize for specific network requirements, and to create new configurations as requirements change</li> <li>• Network interfaces are field-upgradeable to accommodate future technologies</li> </ul>
Cisco IOS Software	<ul style="list-style-type: none"> <li>• Supports Cisco IOS Software features in common with the Cisco 2800 and 3800 Series routers</li> <li>• New releases of Cisco IOS Software add support for new services and applications</li> <li>• World-class Cisco IOS quality of service (QoS) features allow concurrent GSM/UMTS or CDMA and IP application traffic to be transported over a common backhaul network without any impact to GSM/UMTS or CDMA traffic and voice/data quality</li> </ul>

Feature	Benefit
<b>Platform Manageability</b>	
Cisco MWTM	<ul style="list-style-type: none"> <li>Allows simplified and scalable network element management, performance monitoring, and advanced statistics reporting</li> </ul>
<b>High Availability</b>	
Inter-router T1/E1 protection switching	<ul style="list-style-type: none"> <li>Provides 99.9998-percent availability for less than one minute per year of downtime with 1:1 redundant configuration using Cisco T1/E1 RAN VWICs</li> </ul>

## Specifications

Table 3 lists the system specifications for the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 3.** Cisco MWR 1941-DC-A System Specifications

Description	Specification
Processor types	MIPS RISC processor
Performance	Up to 6 GSM/CDMA BTS-facing TDM T1/E1 links or 8 UMTS Node B-facing ATM T1/E1 links
Flash memory (compact flash memory)	External: 128 MB
System memory	256 MB (DRAM default)
Integrated WIC slots	3
Network module slots	1
AIM slots	1
Onboard LAN ports	2 10/100 Fast Ethernet ports
Console port	1 (up to 115.2 Kbps)
Auxiliary port	1 (up to 115.2 Kbps)
Power	DC only
Dimensions (H x W x D)	1.72 x 12.5 x 17.5 in. (4.37 x 31.75 x 44.45 cm)
Weight (without network modules or WICs)	10.5 lb
Rack mounting	19 in.
Standard components	Front-to-back airflow 1-RU-high chassis Front-panel access cabling and LED indicators

Table 4 lists the power specifications for the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 4.** Cisco MWR 1941-DC-A Power Specifications

Description	Specification
DC-input power and power dissipation	47W maximum
DC-input voltage rating	20 to 60 VDC, 27 VDC or -48V DC nominal, 60 VDC maximum
DC-input current rating	2.5A maximum
Power connector	Phoenix 1754452 (P1 = +Power, P2 = Ground, P3 = -Power), compatible with Phoenix 1754465 cable connector

Table 5 lists the environmental specifications for the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 5.** Cisco MWR 1941-DC-A Environmental Specifications

Description	Specification
Operating temperature	–10 to 55°C (–4 to 131°F) except WIC-2A/S card, which has an operating temperature range of 0 to 50°C (32 to 122°F), and NM-1A-OC3SMI, NM-1A-T3, and NM-16ESW cards, which have operating temperature ranges of 0 to 40°C (32 to 104°F)
Non-operating temperature	–40 to 85°C (–40 to 185°F)
Relative humidity	5 to 90 percent non-condensing, ±5 percent
Operation altitude	1600 m/5248 ft, 3000 m/9840 ft, maximum 113°F (45°C) ambient
Noise level	59 dB
Airflow	32 cfm

Table 6 lists the regulatory standards compliance specifications for the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 6.** Cisco MWR 1941-DC-A Regulatory Standards Compliance

Description	Specification
Safety	UL/CUL 60950 CAN/CSA-C22.2 No. 950 EN 60950 IEC 60950 AS/NZS 3260 CE Marking
EMC	FCC Part 15 (CFR 47) Class A CISPR22 Class A ICES-003 Class A EN55022 Class A EN300386 Class A EN55024 EN50082-1 EN61000-3-2 EN61000-3-3 EN61000-6-1 VCCI Class A AS/NZS 3548 Class A CE Marking

Table 7 describes the network modules supported on the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 7.** Cisco MWR 1941-DC-A Network Modules

Network Module Part Number	Description
NM-2W	Network module with 2 WAN card slots
NM-1A-OC3SMI	ATM OC-3 network module
NM-1A-T3	DS-3 ATM network module
NM-16ESW	16-port 10/100 EtherSwitch network module

Table 8 describes the WICs and VWICs supported on the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 8.** Cisco MWR 1941-DC-A WICs and VWICs

WIC and VWIC Part Number	Description
VWIC-2T1/E1-RAN	2-port T1/E1 Protection Switching RAN VWIC, optimized PWE, PWE3
VWIC-2MFT-T1-DIR	2-port T1 with CSU/DSU, drop and insert (1/0 multiplexing), and protection switching relays
WIC-2A/S	2-port asynchronous/synchronous serial WIC

Table 9 describes the Advanced Integration Modules (AIMs) supported on the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 9.** Cisco MWR 1941-DC-A AIMs

AIM Part Number	Description
AIM-ATM-8	8-T1/E1 high-performance ATM segmentation and reassembly (SAR) advanced integration module

Table 10 describes the network management software available for the Cisco MWR 1941-DC-A Mobile Wireless Edge Router.

**Table 10.** Cisco MWR 1941-DC-A Network Management

Software Part Number	Description
MWTM-6.0-BASE-K9	Mobile Wireless Transport Manager 6.0 Base Media Kit
MWTM-6.0RA-STBY-K9	Mobile Wireless Transport Manager 6.0 Standby Mode Software License for IP RAN
RANO-MWR-RTU	Manageability for MWR 1941-DC-A License

## Ordering Information

Table 11 describes the ordering information for Cisco MWR 1941-DC-A Mobile Wireless Edge Routers.

**Table 11.** Cisco MWR 1941-DC-A Mobile Wireless Edge Router

Cisco MRW1941-DC-A Part Number	Description
MWR-1941-DC-A	High-performance, 10/100 dual Ethernet mobile wireless edge router with extended temperature, 20 to 60 VDC, 3 WIC slots, 1 network module slot, 1 AIM slot
MWR-1941-DC-2T1/E1	Bundle: MWR 1941-DC-A and 1 RAN VWIC (2 T1/E1 ports)
MWR-1941-DC-4T1/E1	Bundle: MWR 1941-DC-A and 2 RAN VWICs (4 T1/E1 ports)
MWR-1941-DC-6T1/E1	Bundle: MWR 1941-DC-A and 3 RAN VWICs (6 T1/E1 ports)
MWR-1941-DC-8T1/E1	Bundle: MWR 1941-DC-A and 4 RAN VWICs (8 T1/E1 ports)
MWR-1941-DC-10T1/E	Bundle: MWR 1941-DC-A and 5 RAN VWICs (10 T1/E1 ports)

## Summary

In current cellular networks, the RAN accounts for a significant percentage of total operational expenditures. By using the Cisco MWR 1941-DC-A Mobile Wireless Edge Router, operators can simplify and optimize their current RANs with a compact, high-performance, and modular cell-site access platform, reducing operating costs and enhancing profit opportunities. These flexible and agile RANs can easily adapt to accommodate new radio and networking technologies and services as future growth and business needs require.



## Service and Support

The award-winning service and support offerings from Cisco provide presales network-audit planning, design consulting, network implementation, operational support, and network optimization. By including service and support when purchasing the Cisco MWR 1941-DC-A Mobile Wireless Edge Router, customers can confidently deploy a network architecture using Cisco expertise, experience, and resources.



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