Parvus DuraMAR 5915 (“2X”Series)

Rugged Cisco 5915 Mobile IP Router Subsystem
with Integrated Cisco ESS 2020 Ethernet Switch

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Key Features

- Rugged Cisco 5915-based mobile IP router with integrated Cisco ESS 2020 Ethernet switch
- 23 x ports (2 x router, 21 x switch)
- Cisco IOS router + switch management/ security software with data, video, voice services
- Qual tested to MIL-STD-810G, MIL-STD-461F, DO-160 (severe environmental and EMI conditions)
- Size, weight and power (SWaP) optimized
- Rugged aluminum IP67 (dust/water proof)
- Chassis with MIL-DTL-38999 circular connectors
- Vehicle and aircraft compatible power supply (per MIL-STD-704F and MIL-STD-1275D)
- Data zeroization to erase sensitive data

Applications

- In-vehicle/aircraft IP network routing/ switching
- Network-centric operations/situational awareness
- Extreme environments (cold/hot temperatures, humidity, rain, dust, shock, vibration)
- Transparent mobile data, voice and video in-vehicle communications and on-demand network connectivity
- Fixed/rotary wing (un)manned air vehicles
- Tactical ground vehicles/maritime platforms
- C4ISR technology refresh/LRU upgrades

Overview

The Parvus® DuraMAR® 5915 is a rugged Commercial Off the Shelf (COTS) Cisco IOS-managed secure mobile network router integrating Cisco’s 5915 Embedded Services Router (ESR) card in an ultra-rugged chassis optimized for harsh military and civil vehicle/aircraft installations. The “2X” model series (MAR-5915-2X) integrates an expanded port-count, all Cisco IOS managed routing and switching architecture with an integrated Cisco ESS 2020 Ethernet switch (as integrated in the standalone DuraNET® 30-2020 switch) for a total of 23 Ethernet ports. An ideal solution for IP networking technology refresh and situational awareness applications deployed at the tactical network edge, the DuraMAR 5915 enables prime defense contractors and civil agencies to deploy Cisco Mobile Ready Net capabilities, including data, video, and voice services virtually anywhere LAN or WAN connectivity may be required, especially in mobile, airborne, ground, manned or unmanned vehicle and sensor applications.

The MAR-5915-2X series provides an all-Cisco network routing and switching architecture with enterprise features, performance, security, Quality of Service (QoS), high availability, and manageability that customers expect from Cisco IOS-based technology. The familiar Cisco IOS software interface minimizes training requirements and provides extensive support for Layer 2/3 IPv4 and IPv6 networking protocols, IP multicasting, Radio Aware Routing (RAR), Dynamic Link Exchange Protocol (DLEP), encrypted data (AES/IPSec/NSA Suite B/VPN), remote VoIP, Firewall/IPS/IDS, and Mobile Ad Hoc Networking (MANET) for connectivity in Comms on the Move (COTM) applications.

Optimized for SWaP sensitivity as well as mechanical robustness, the DuraMAR 5915 2X Series is qualified to meet extreme MIL-STD-810G, MIL-STD-461F, and DO-160G conditions for environmental and EMI compliance (thermal, shock, vibration, humidity, altitude, conducted and radiated emissions and susceptibility). Leveraging stackable PC/104 subassemblies and a modular enclosure design, the unit is completely sealed against dust and water ingress (IP67), requires no active cooling, provides interfaces over proven MIL-DTL-38999 connectors, and features a military-grade power supply supporting aircraft (MIL-STD-704F/DO-160G) and ground/marine vehicle (MIL-STD-1275D) voltage inputs, spikes, and transient levels, as well as MIL-STD-461F/DO-160G EMI/EMC filtering.

For applications requiring higher LAN bandwidth, see DuraMAR 5915 “3X Series” product sheet for MAR-5915-3X variant which integrates a Vitesse-based GbE Switch. For a standalone Cisco 5915 ESR-based system (5x total 10/100 ports), see DuraMAR 5915 “0X Series” or DuraMAR 31-5915 product sheets.

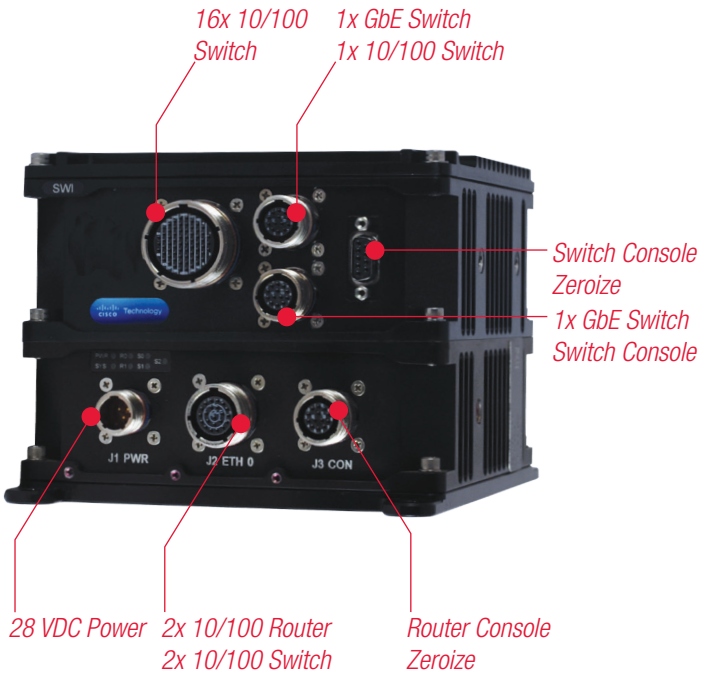

Figure 1: Ethernet ports, serial, zeroize, and power brought out on DTL-38999 connectors

Features

Cisco technology

- Cisco IOS-managed Embedded Services router (ESR) and switch combination: Cisco 5915 ESR (as in MAR-5915-0X) + Cisco ESS 2020 Switch (as in DuraNET 30-2020)
- Cisco 5915 Advanced Enterprise IOS and ESS 2020 LAN base IOS for robust information assurance, dynamic Layer 3 IPv4/IPv6 routing, QoS management, MANET, remote call manager, radio aware routing (RAR)
- Integrated services router (ISR) features support concurrent data, video, and voice services, firewall, hardware accelerated AES encryption/NSA Suite B in IOS
- Modular, open architecture rugged COTS PC/104 hardware design
- High port count: 23 x ports (2 x 10/100 router, 2 x GbE switch, 19 x 10/100 switch)
- Cisco 5915 ESR is FIPS 140-2 Level 1 approved and Common Criteria Evaluation and Validation Scheme (CCEVS) validated; Cisco 5915, Cisco ESS 2020, Parvus DuraMAR 5915 Router and Parvus DuraNET 30-2020 Switch are listed on US DoD APL

Ruggedization

- Qual tested to meet extreme MIL-STD-810G, DO-160 environmental compliance for shock, vibration, thermal, altitude, humidity
- -40 to +71°C fanless extended temp operation with no moving parts
- Corrosion-resistant, aluminum chassis IP67 sealed against water, dust
- Circular MIL-DTL-38999 connectors for reliable network connections
- Filtered, transient and EMI-protected MIL-STD-1275/704/DO-160 compliant power supply for aircraft and ground vehicle use
- Validated to meet MIL-461 and DO-160 conducted/radiated emissions and susceptibility
- Data zeroization support to erase sensitive information
- Conformal coating for humidity/tin-whisker mitigation
- Flexible/robust mounting – base flange mount or side boss mount
- Export jurisdiction: ITAR-free, U.S. Commerce EAR controlled

Figure 2: Front view

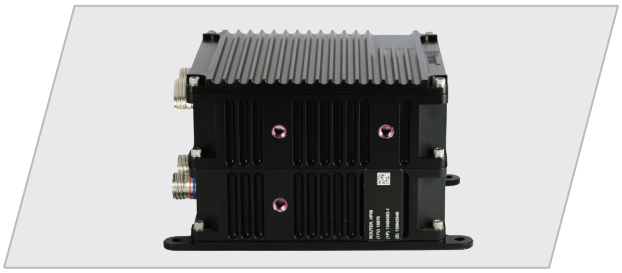

Figure 3: Side view (note mounting features on side and bottom)

Target Applications

- Civil and military tactical in-vehicle LAN switching/WAN routing - 24V/28V ground vehicle/aircraft/maritime platforms with SWaP constraints
- Extending Cisco systems enterprise networking infrastructure beyond the reach of traditional fixed-networks into mobile and embedded networking applications
- MANET - on-demand network connectivity in mobile deployments when connected to UHF, VHF, Wi-Fi and tactical radio platforms
- Aggregation of peripheral devices (cameras, sensors, computers) from outdoor and embedded IP network infrastructure into a manageable, highly secure IP network
- C4ISR situational awareness/technology refresh/LRUs
- Technology migration path for legacy Cisco 3200 (3230/3250/3270)-based router and Cisco catalyst 2955-based networking subsystems, including DuraMAR 1000, DuraMAR 3230, and DuraNET 2955
- Cisco IOS-managed Layer 3 IP network routing and Layer 2 LAN Ethernet switching in harsh temperature and vibration environments for IP-enabled equipment (i.e. on-board computers, cameras, sensors, radios, SatCom modems, monitoring devices, and command-and-control gear)
- SWaP-constrained mobile, tactical, airborne, and vehicle networking applications upgrading situational awareness and/or network centric capabilities at network edge in demanding embedded networking environments (e.g. defense, homeland security, energy, industrial, oil and gas platforms, underground mining equipment, offshoring drilling rigs, shipping vessels, electric utility substations, railway train rolling stock, fleet transportation, outdoor embedded networks, etc)
- Remote IP telephony on vehicles or outdoor locations using Cisco unified Communications Manager Express (CME)

Cisco IOS Technology

Router

Cisco 5915 Embedded Services Router (ESR), rugged PC/104 card

- Cisco 5915 Enterprise IOS base/advanced services image, including option, CME license
- Support for IPv6 routing, VoIP/CME, VPN/firewall/IPS, mobile IP, IPSec exclusive to advanced IOS only (see Cisco 5915 datasheet/Cisco feature navigator for complete software feature comparison)

Switch

Cisco ESS 2020 Embedded Services Switch, rugged PC/104 base + expansion card

- Non-blocking OSI data Layer 2 Ethernet switch with Cisco IOS LAN base software image (includes support for advanced security, IPv6 management, QoS, static IPv4 Layer 3 routing) (see Cisco ESS 2020 datasheet/Cisco feature navigator for complete list of supported software features)

Ports

MAR-5915-2X Series (Cisco 5915 Router + Cisco ESS 2020 Switch)

- 2 x 10/100 Mbps fast Ethernet WAN router ports, IEEE 802.3 compliant (from 5915 ESR)
- 2 x 10/100 Mbps fast Ethernet switched LAN ports, IEEE 802.3u compliant (from 5915 ESR)
- 17 x 10/100 Mbps fast Ethernet switched LAN ports, IEEE 802.3u compliant (from ESS 2020 switch)
- 2 x 10/100/1000 Mbps GbE switched LAN ports, IEEE 802.3ab compliant (from ESS 2020 switch)
- 2 x console ports, RS-232 (1 x for router on DTL-38999, 1 x for switch – via DB-9 or DTL-38999 interface)
- Additional 2 x Ethernet ports connected internally: 1 x 10/100 switched port of 5915 ESR connected to 1 x 10/100 switched port of ESS 2020 switch (this connection can optionally be disabled for standalone router/switch functions and total of 24 external Ethernet ports through internal DIP switch setting change; additional 5915 10/100 LAN port is already pinned out to external DTL-38999 connector)

Performance

Router

- Routing throughput: ~170Kpps (performance varies based on security/voice/data services enabled)
- Ethernet ports: 2 x 10/100 routed, 2 x 10/100 switched (+1 additional switched 10/100 port connected to ESS 2020)

Switch

- Forwarding rate: 5.5 Mpps with 64-bytes packets; forwarding bandwidth: 3.7 Gbps; egress buffer: 2 MB
- Unicast MAC addresses: 8000; IGMP multicast groups: 255; max VLANs: 255
- Ethernet ports: 2 x GbE and 17 x 10/100 switched ports (+1 x additional switched 10/100 port connected to 5915 ESR)

Cisco Switch (ESS 2020)

- L2 switching: IEEE 802.3/u/ab (Ethernet, fast Ethernet, gigabit Ethernet), IEEE 802.3ad Link Aggregation (LACP), Resilient Ethernet Protocol (REP), IEEE 802.1D/w/s (STP, RSTP, MSTP), IEEE 802.1p Layer 2 COS prioritization; IEEE 802.1q VLAN; IEEE 802.1AB Link Layer Discovery Protocol (LLDP, VLAN Trunking Protocol v2 (VTPv2), Network Time Protocol (NTP), UDLD, flex links, VLAN Trunking Protocol v3 (VTPv3), EtherChannel, Voice VLAN
- Multicast: IGMPv1, v2, v3 snooping, IGMP querier
- Management: web device manager, SmartPort, MIB, SNMP, syslog, RMON, DHCP server, remote switched port analyzer (RSPAN), voice VLAN (VVID), L2 IPv6 host, L2 HTTP over IPv6, SNMP over IPv6, customized TCAM/SDM size
- Security: unicast MAC filtering, SCP, SSH, SNMPv3, TACACS+, RADIUS server/client, MAC address notification, BPDU Gguard, SPAN session, 802.1x Multi-Domain Authentication (MDA), 802.1x guest VLAN, storm control, port-security, DHCP snooping, IP source guard, dynamic Arp inspection, guest VLAN, MAC authentication bypass, trust boundary
- QoS: ingress policing, rate-limit, egress queueing/shaping, AutoQoS
- L3 routing: IPv4 static routing

Cisco Router (5915 ESR)

Routing/Bridging

- IPv4 and IPv6 routing (IPv6 features available in Advanced Enterprise IOS image only)
- Routing protocols: Routing Information Protocol (RIP) v1/v2; Open Shortest Path First (OSPF); Enhanced Interior Gateway Routing Protocol (EIGRP)-IP, Border Gateway Protocol (BGP), Cisco Discovery Protocol, IP policy routing, IP Multicast Protocol Independent Multicast (PIM) v1/v2, Internet Group Management Protocol (IGMP) v1/v2, IP multicast load splitting, Cisco Group Management Protocol (GMP), Telnet, Dial-On-Demand routing (DDR), UDP Telnet
- Encapsulations: PPP over Ethernet (PPPoE) client and server for fast Ethernet, 802.1q VLAN trunking support, Generic Routing Encapsulation (GRE)
- VLAN: Virtual LAN logical segmentation of network for optimal use of bandwidth

Mobility (Advanced Enterprise IOS only)

- Radio Aware Routing (RAR): optimize IP routing over fixed/temporary radio networks, factor radio link metrics into route calculations, and immediately recognize/adapt to changes in network neighbor status via Dynamic Link Exchange Protocol (DLEP), Router Radio Control Protocol (R2CP), RFC 5578
- MANET: OSPFv3/EIGRP enhancements for mobile temporary networks via (PPPoE extensions)
- Mobile IP routing: home agent and mobile router redundancy, mobile router preferred interfaces, mobile router reverse tunnelling, mobile router asymmetric links, mobile router static and dynamic networks, static co-located care-of address, AAA server, Cisco Mobile NAT traversal over mobile IP

Management and Monitoring

- Base/advanced enterprise Cisco IOS software with Command Line Interface (CLI)
- Configuration management via serial console or Ethernet port through terminal emulation application
- SNMPv2/v3, Telnet, RADIUS, TACACS+, Cisco Service Assurance Agent, Syslog, response time reporter, NTP client, TFTP client and server, DHCP client and server, DHCP relay, HSRP
- Network address translation; address conservation; DHCP client address negotiation, easy IP Phase I

Security

- Authentication: route, PAP, CHAP, MS-CHAP local password, IP access lists, time-based ACLs
- Generic routing encapsulation; fast switching, Cisco Express Forwarding, process switching, STAC/RTP compression
- Advanced Enterprise IOS only: stateful inspection firewall; intrusion detection system; easy VPN for client/server/remote; MPLS VPN; hardware accelerated crypto: IPSec, 3DES, AES, IKE protocols; port-to-application mapping; tunnel endpoint discovery; Secure Shell (SSH) protocol client and server

Quality of Service

- Quality of Service (QoS) classification/prioritization of data, guaranteeing determinism for mission-critical data: generic traffic shaping, class-based Ethernet matching, mobile access routing (802.1p Class of Service), committed access rate, flow-based WRED, low-latency/priority/weighted fair queuing, dial backup, dialer profiles, dialer idle time-out, dial on Demand, Class-Based Weighted Fair Queuing, Traffic policing RSVP; 802.1Q VLAN) trunking and encapsulation support

Voice Services

- Cisco Unified Communications Manager Express for remote IP telephony/command and control comms, 5/25/50 - user license support (5915 Advanced IOS add-on option), capable of supporting up to 48 phones

Information Assurance

- DuraMAR 5915 with Cisco IOS Rel. 15.2GC TN 1429401 is listed on the US Department of Defense DISA UC APL (Unified Capabilities Approved Product List) as a Customer Edge Router (CER); DuraNET 30-2020 with Rel. IOS 15.2E TN 1429402 is listed on the US Department of Defense DISA UC APL as an Access Internet Protocol (IP) Switch
- Cisco 5915 ESR card is Federal Information Processing Standard (FIPS) 140-2 Level 1 approved, Common Criteria Evaluation and Validation Scheme (CCEVS) EAL2 product validated, and DISA UCAPL approval; Cisco ESS 2020 Switch is US UCAPL approved
- NSA Suite-B support in Cisco 5915 IOS Software cryptography, including Suite-B-GCM-128, Suite-BGCM-256, Suite-B-GMAC-128, and Suite-B-GMAC-256 as described in RFC-4869
- Hardware Encryption Supporting IP Security (IPsec), Secure Sockets Layer with transparent LAN services (SSL/TLS), Secure Real-time Transport Protocol (SRTP), Triple Digital Encryption Standard (3DES), Advanced Encryption Standard (AES), Internet Key Exchange (IKE) protocols (supported in Advanced Enterprise IOS only)
- Data zeroization support (initiated by offboard signal trigger) – Advanced IOS only

Power

- 28V nominal power input voltage (12-36 VDC continuous)
- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, and surges for normal, transfer, abnormal, emergency, starting, and power failure
- MIL-STD-1275D 28 VDC compliant for ground vehicle operation: steady state DC voltage variations, no fault/single fault conditions, ripple voltage susceptibility on input power leads, imported voltage spikes, over-voltage and under-voltage surges, starting disturbances, electrostatic discharge (ESD) immunity
- RTCA/DO-160 compliant for aircraft operation (Sections 16-18, 25): power input, voltage spikes, audio frequency conducted susceptibility-power inputs, electrostatic discharge
- < 30W maximum power consumption
- Grounding lug for connection to system chassis ground

Environmental

Validated to meet MIL-STD-810G and RTCA/DO-160G:

- Operating temperature: -40 to +71°C (-40 to +160ºF) ambient (per MIL-STD-810G Methods 501.5 and 502.5) and -40 to +70°C (per DO-160G, Section 4 Category A2 and D2 and Section 4.5.5, Category V/Table 4-1)
- Storage temperature: -40 to +85ºC (-40 to +185ºF) (per MIL-STD-810G Method 502.5 and Method 501.5) and -55 to +85ºC (per DO-160G, Section 4, Category A2)
- Humidity (operating/transport): up to 95% RH @ 40ºC, non-condensing (per MIL-STD-810G, Method 507.5, Procedure II; DO-160G, Section 6, Category B, Section 6.3.2)
- Operating shock: 40g, 11ms, 3 pos/neg per axis, 18 terminal peak shock pulses per MIL-STD-810G Method 516.6, Procedure I; 6g, 11ms, terminal peak shock pulses per DO-160G, Section 7, Class A)
- Crash hazard shock: 75g, 11ms, 12 terminal peak shock pulses, 2 pos/neg per axis (per MIL-STD-810G Method 516.6, Procedure V)
- Random vibration: 3 axes, 1 hour/axis (per MIL-STD-810G, Method 514, per Procedures I and II and DO-160G Section 8, Category S, Curve B3 per combined jet-helo-tracked vehicle profile)
- Ingress (dust/sand): no ingress (designed for compliance to IP67, MIL-STD-810G Method 510.5, Procedure I and II, DO-160G, Section 12, Category S)
- Water immersion: no leakage per 1 meter submersion, 30 minutes (similar to IP67 and MIL-STD-810G, Method 512.5, Procedure I (1 meter, 30 minutes))
- Operating altitude: up to +50,000 ft (15,240 meters) (per DO-160G, Section 4, Category D2, Section 4.6.1) and +30,000 ft (9,144 meters) (per MIL-STD-810G, Method 500.5, Procedures I-II)
- Storage altitude: up to 60,000 ft (18,288 meters) (per MIL-STD-810G, Method 500.5, Procedures I-II)

EMI/EMC Isolation

Validated to meet MIL-STD-461G and RTCA/DO-160G:

- Conducted emissions: MIL-STD-461F, CE102, power leads, 10 KHz to 10MHz, basic curve, Figure CE102-1; DO-160G Sec. 21; conducted RF emissions, 150 kHz to 152 MHz, Category L; Figures 21-1, 21-2
- Conducted susceptibility: MIL-STD-461F, CS101, power leads, 30 Hz to 50 KHz, Curve 2, Figure CS101-1 (28V and below) DO-160G Sec. 20; conducted susceptibility, 10 kHz to 400 MHz, Category M; Figure 20-6
- Radiated emissions: MIL-STD-461F, RE102, electric field, 10 KHz to 18 GHz, fixed wing internal < 25 meters, Figure RE102-3; DO-160G Sec. 21; radiated RF emissions, 100 MHz to 6 GHz, Category L; Figure 21-7
- Radiated susceptibility: RS-103, electric field, 2 MHz to 18 GHz, 200V/m, Table VII, RS103 limits; DO-160G Sec. 20; radiated susceptibility, 100 MHz to 8 GHz, Category R; Figure 20-10

Physical Specifications

- Dimensions (H x D x W, excluding connectors/mounts) (estimated):
  - 5.00” x 6.75” x 6.25” (~12.7 x ~17.15 x ~15.88cm)
- Weight (approx): < 9 lbs. (< 4.08 kg)
- Installation: base flange mount or side boss mount (90° rotated orientation)
- Connectors: MIL-DTL-38999 Series III
- Cooling: passive natural convection, no moving parts
- Ingress protection: dust and water proof (similar to IP67)
- Enclosure/finish: corrosion resistant, aluminium alloy with black anodize finish per MIL-A-8625

Other Specifications

Status indication

- LED indicators for PWR and LNK of 5915 ESR router ports

Reliability

- Designed and manufactured using AS9100 Aerospace Grade/ISO 9001:2000 certified quality program
- No moving parts; passive cooling; conformal coated boards for humidity and tin whisker mitigation
- No moving parts, no active cooling required

Mean Time Between Failure (MTBF) calculated per MIL-HDBK-217F: TBD - ROM estimate:

- Ground benign, +25°C: 657,557 hours (75.1 years)
- Ground mobile, +25°C: 68,536 hours (7.8 years)
- Airborne inhabit, +25°C: 14,906 hours (1.70 years
- Airborne rotary, +25°C: 12,096 hours (1.38 years)

Export

- ITAR-Free: U.S. Commerce Export Administration Regulations (EAR) controlled

Warranty

- Standard 90-day return to depot warranty
- Extended, multi-year service agreements available which bundle Cisco SmartNET (access to IOS software updates)

Ordering Information

Ordering codes

- MAR-5915-20: DuraMAR 5915 Router with ESS 2020 Switch (MAR-5915-00 + DUNET-30-2020-01), 2020 LAN BaseIOS, 5915 BaseIOS
- MAR-5915-21: DuraMAR 5915 Router with ESS 2020 Switch (MAR-5915-01 + DUNET-30-2020-01), 2020 LAN BaseIOS, 5915 AdvIOS
- MAR-5915-22: DuraMAR 5915 Router with ESS 2020 Switch (MAR-5915-02 + DUNET-30-2020-01), 2020 LAN BaseIOS, 5915 AdvIOS CME5
- MAR-5915-23: DuraMAR 5915 Router with ESS 2020 Switch (MAR-5915-03 + DUNET-30-2020-01), 2020 LAN BaseIOS, 5915 AdvIOS CME25
- MAR-5915-24: DuraMAR 5915 Router with ESS 2020 Switch (MAR-5915-04 + DUNET-30-2020-01), 2020 LAN BaseIOS, 5915 AdvIOS CME50
- CBL-MAR-5915-20: breakout cable set for MAR-5915-2X (mating MIL-38999 to RJ-45, DB-9, power)

Note: “CME” is Cisco Communications Manager Express (CME) license for 5/25/50 users (for remote VoIP call manager services)

Special order options

- MIL-DTL-38999 connector caps, mechanical changes, custom metal finishes
- Program-specific delta qual (additional MIL-certifications/ environmental testing)

Starter cable set

- CBL-MAR-5915-20: optional starter breakout cable set mates with MIL-DTL-38999 connectors for Ethernet, console, and power signals, transitioning to traditional RJ-45/DB-9/ power (for lab or bench testing purposes)

Related Products

- For standalone C5915 router subsystem (without ESS 2020 Switch), see DuraMAR 5915 0X (MAR-5915-0X) or DuraMAR 31-5915
- For standalone ESS 2020 switch subsystem (without 5915 Router), see DuraNET 30-2020
- For C5915 ESR-based router integrated with Vitesse GbE-based switch (total of 23 ports), see DuraNET 5915 3X (MAR-5915-3X)
- For combined Intel Core i7-based mission processor with DuraMAR 5915 router, see DuraWORX 80-41 product

Line Drawings