# OneConnect OCm14000-OCP Adapters

## Installation Manual

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Costa Mesa, CA 92626

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# 1. Introduction

This manual describes the Emulex® OneConnect® OCm14000 series of Open Compute Project (OCP) mezzanine adapters. The OCm14000-OCP adapters adhere to the original mezzanine card specification and the newer mezzanine card 2.0 specification. These Peripheral Component Interconnect Express (PCIe) Converged Network Adapters (CNA) provide Ethernet networking, RDMA over Converged Ethernet (RoCE), internet Small Computer System Interface (iSCSI) functionality, and Fibre Channel over Ethernet (FCoE) functionality for convergence of Fibre Channel (FC) traffic onto an Ethernet fabric. The Ethernet OCP adapters support Ethernet and RoCE protocol support.

Table 1-1 lists the OCm14000-OCP adapters.

**Table 1-1** OCm14000-OCP Adapters

| Adapter Models | Number of Ports | Supported Protocols | Cable Type |
|---|---|---|---|
| OCm14101-NX-OCP | 1x10GbE | NIC (network interface card)<br>RoCE | 10GbE SFP+ Passive Direct-attach Copper (DAC) Cable<br>10GbE SFP+ Active DAC Cable<br>10GbE SFP+ Active Optical Cable (AOC)<br>10GbE SFP+ fiber optic cable with LC connector |
| OCm14102-NX-OCP | 2x10GbE | NIC<br>RoCE | |
| OCm14102-UX-OCP | 2x10GbE | NIC<br>RoCE<br>iSCSI<br>FCoE | |

## Notes

- For optical adapter support, you must order an Emulex accessory transceiver kit. See “Emulex OneConnect Accessories” on page 16 for more information.
- Illustrations in this manual are only examples. The actual hardware may vary.

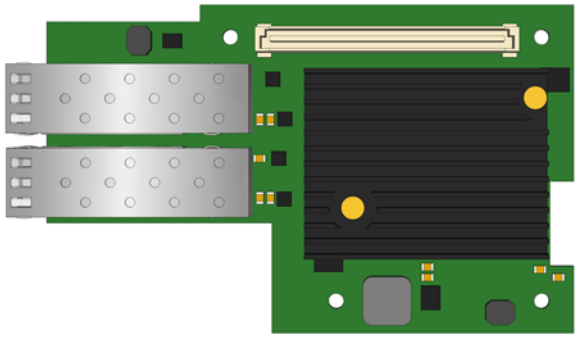


**Figure 1-1** Emulex OCm14102-OCP Adapter

The Emulex OCP mezzanine adapter supports NIC single root I/O virtualization (SR-IOV) and utilizes a PCIe Rev. 3.0/2.0/1.1 x8 bus. CNAs combine two major

functional components: a 10GbE networking media access control (MAC) sublayer and an FC I/O controller (IOC) to interface with a unified lossless Ethernet switch. Adapters serve as a common interface for both storage and Internet Protocol (IP) traffic retaining familiar FC and networking software stacks, OS drivers, and management.

# Features

## General Features

- Eight-lane (x8) Generation 3 PCIe interface at 8, 5.0, and 2.5GT/s (auto-negotiated with system)
- Parts and construction are compliant to the European Union Directive of RoHS, and similar regulatory requirements for other countries.
- On-board flash memory: The flash contains the firmware, VPD, and Boot BIOS images. You can update the flash with Emulex utilities.
- The CNA interoperates with existing FC SAN infrastructures – switches, arrays, SRM tools (including Emulex utilities), SAN practices, and so forth.
- Host interface support is provided through Emulex standard drivers
- Support for RoCE NIC operating system drivers (Windows Server and Linux)
- As supported, a comprehensive array of NIC, iSCSI, and FCoE operating system drivers, including support for the following:
  - Windows
  - Red Hat Enterprise Linux
  - SUSE Linux Enterprise Server
  - Oracle Linux
  - VMware vSphere
  - Oracle Solaris
  - CentOS
  - Debian (NIC mode only, storage not supported)
  - Ubuntu (NIC mode only, storage not supported)
  - FreeBSD (NIC mode only, storage not supported)

### OCm14101-NX-OCP Adapter

- Up to eight PCIe functions per adapter, individually configurable to NIC and RoCE personalities.
- SFF-8431 Small Form Factor Pluggable Module SFP+ compliant

### OCm14102-NX-OCP or OCm14102-UX-OCP Adapter

- Up to 16 PCIe functions per adapter
  - OCm14102-NX OCP is individually configurable to NIC and RoCE personalities

- OCm14102-UX-OCP is individually configurable to NIC, RoCE, iSCSI, or FCoE personalities
- SFF-8431 Small Form Factor Pluggable Module SFP+ compliant

## Protocol-Specific Capabilities

- NIC capabilities include
  - NDIS 6.0, 6.2, and 6.3-compliant Ethernet functionality
  - IPv4/IPv6 TCP, UDP checksum offload
  - IPv4/IPv6 RSS
  - IPv4/IPv6 LRO
  - IPv4/IPv6 LSO
  - Dynamic VMQ (Windows Server 2012 Hyper-V) and NetQueue (VMware vSphere)
  - Programmable MAC and VLAN addresses
  - Up to 128 MAC/VLAN addresses per port
  - Supports hash-based multicast MAC address filters
  - Supports hash-based broadcast frame filters per port
  - VLAN offloads (insertion and extraction)
  - MTU (jumbo) packet support up to 9000 bytes
- Converged Enhanced Ethernet (CEE) and Datacenter Bridging (DCB) capabilities include
  - IEEE 802.1Qbb Priority Flow Control (PFC)
  - IEEE 802.1Qaz Enhanced Transmission Selection (ETS)
  - IEEE 802.1Qaz Data Center Bridging Exchange (DCBX)
  - IEEE 802.1Qau Congestion Notification (QCN)
  - Absolute per-priority rate control option, and configuration
- PCIe interface capabilities include
  - PCIe 3.0 x8 (8, 5.0, and 2.5 GT/s per lane) compliant interface:
    - Up to 64 Gbps full duplex bandwidth
    - Configurable width and speed to optimize power versus bandwidth
  - Support for up to 16 PCIe physical functions (PFs)
  - Support for x1, x2, x4, and x8 links widths
  - NIC SR-IOV
  - Up to 63 virtual functions (VFs) per port
  - Message Signal Interrupts Extended (MSI-X)
  - Advanced Error Reporting (AER)
  - Completion Timeout (CTO)
  - Function Level Reset (FLR)
  - Alternative Routing-ID Interpretation (ARI)

- iSCSI capabilities include
  - Hardware offload for iSCSI protocol
  - Header and data digest support
  - Up to 4K outstanding commands (iSCSI adapter-only mode)
  - Up to 512 offloaded iSCSI connections (iSCSI adapter-only mode)
  - Support for multipath I/O
  - Operating system-agnostic INT13-based iSCSI boot and iSCSI crash dump support
  - RFC 4171 Internet Storage Name Service (iSNS)
  - Support for both IPv4 and IPv6 connections
  - Maximum transmission unit (MTU) packet size support up to 8342 bytes
  - Concurrent iSCSI and FCoE support on each port
- FCoE capabilities include
  - Hardware offload for FCoE protocol
  - ANSI T11 FC-BB-5 Compliant (FCoE)
  - Programmable World Wide Name (WWN)
  - Support for FIP and FCoE Ether Types
  - Concurrent Logins (RPI): up to 8K per adapter (FCoE adapter-only mode)
  - Open Exchanges (XRI): up to 4K per adapter (FCoE adapter-only mode)
  - For single-port and dual-port adapters, up to 255 N_Port ID Virtualization (NPIV) interfaces per port
  - Concurrent FCoE and iSCSI support on each port
- Management, boot support capabilities include
  - vCenter management plug-in support
  - Role-based management, integrated with Active Directory and Lightweight Directory Access Protocol (LDAP)
  - Multi-channel configuration and bandwidth control
  - UEFI and x86 remote boot support including Preboot Execution Environment (PXE) v2.1, Unified Extensible Firmware Interface (UEFI) 2.3.1
  - MAC statistics gathering (SNMP, Ethernet Management Information Base [MIB, MIB2], Remote Monitoring [RMON, RMON2])
  - Offline and online firmware updates
  - Network Controller Sideband Interface (NC-SI) support
  - Integrated Thermal Sensor for thermal monitoring per OCP mezzanine v2.0 specification
- RoCE capabilities include
  - Direct data placement in application buffers without CPU intervention
  - Supports IBTA RoCE specifications
  - Supports Linux Open Fabrics Enterprise Distribution (OFED)
  - Supports Linux Network File System (NFS) over RoCE

- Supports Linux iSCSI Extensions for RDMA (iSER)
- Windows Server SMB Direct (SMB over RDMA)

- I/O Virtualization includes
  - Stateless L2, L3, and L4 offloads for frame-in-frame encapsulation (Virtual extensible LAN [VXLAN] and network virtualization using generic routing encapsulation [NVGRE])
  - PCI-SIG Address Translation Service (ATS) v1.0
  - Support for up to 512 hardware queues
  - Virtual Switch Port Mirroring for diagnostic purposes
  - Virtual Ethernet Bridging (VEB)
  - Virtual Ethernet Port Aggregator (VEPA)
  - Emulex Universal Multi-Channel (UMC), also known as network partitioning, with support for up to sixteen PCIe functions per adapter that can be individually configurable to support NIC, iSCSI, or FCoE offload features with the following considerations:
    - OCm14101 1-port adapter supports eight NIC functions
    - OCm14102 2-port adapters support up to sixteen functions, when the system supports alternative routing-ID interpretation (ARI)
  - NIC SR-IOV
    - Up to 63 VFs per port
  - Quality of Service (QoS) for controlling and monitoring bandwidth assigned to and used by virtual entities
  - Configurable control of network bandwidth by physical port, queue, or protocol
  - Traffic shaping and QoS across each VF and PF

# Adapter Identification

Each adapter ships with several numbers clearly marked on the board. Emulex recommends recording these numbers before installation.

- Institute of Electrical and Electronics Engineers (IEEE) address – a unique 64-bit identifier used for system configuration
- WWN – derived from the IEEE address; the FC industry uses the WWN for FC connectivity.
- Serial number – assigned by Emulex and used when communicating with Emulex

If the adapter has two ports, it has two IEEE addresses and two WWNs, one for each port.

# Abbreviations

| | |
|---|---|
| AER | Advanced Error Reporting |
| AOC | active optical cable |
| ARI | alternative routing-ID interpretation |
| ATS | Address Translation Service |
| BIOS | basic input/output system |
| CNA | Converged Network Adapter |
| CPU | central processing unit |
| CRC | cyclic redundancy check |
| DAC | direct-attach copper |
| DCBX | Data Center Bridging Capabilities Exchange |
| DDR3 | double data rate type three |
| ESD | Electrostatic Discharge |
| ETS | enhanced transmission selection |
| FC | Fibre Channel |
| FCoE | Fibre Channel over Ethernet |
| FIP | FCoE Initialization Protocol |
| FLR | Function Level Reset |
| GB | gigabyte |
| Gb | gigabit |
| GbE | gigabit Ethernet |
| Gbps | gigabits per seconds |
| GT/s | gigatransfers per second |
| IBTA | InfiniBand Trade Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| IOC | I/O controller |
| IP | Internet Protocol |
| iSCSI | Internet Small Computer System Interface |
| iSER | iSCSI Extensions for RDMA |
| iSNS | Internet Storage Name Service |
| LDAP | Lightweight Directory Access Protocol |
| LED | light-emitting diode |
| LRO | large receive offload |
| LSO | large segment offload |
| MAC | Media Access Control |
| Mbit | megabit |

| | |
|---|---|
| MIB | Ethernet Management Information Base |
| mm | millimeters |
| MSI-X | Message Signal Interrupts Extended |
| MTU | maximum transmission unit |
| NC-SI | Network Controller Sideband Interface |
| NDIS | Network Driver Interface Specification |
| NFS | Network File System |
| NIC | network interface card |
| NPIV | N_Port ID Virtualization |
| NVGRE | network virtualization using generic routing encapsulation |
| OCP | Open Computer Project |
| OFED | OpenFabrics Enterprise Distribution |
| PCBA | printed circuit board assembly |
| PCIe | Peripheral Component Interconnect Express |
| PCIe CEM | PCIe Card Electromechanical |
| PDU | protocol data unit |
| PF | physical function |
| PFC | priority flow control |
| POST | power-on self-test |
| PXE | Preboot Execution Environment |
| QCN | Congestion Notification |
| QoS | Quality of Service |
| QSFP+ | Quad Small Form Factor Pluggable |
| RDMA | remote direct memory access |
| RH | relative humidity |
| RMON | Remote Monitoring |
| RoCE | RDMA over Converged Ethernet |
| RoHS | Restriction of Hazardous Substances |
| RSS | receive-side scaling |
| SAN | storage area network |
| SDRAM | synchronous dynamic random-access memory |
| SFP | small form-factor pluggable |
| SMB | server message block |
| SNMP | Simple Network Management Protocol |
| SPI | Serial Peripheral Interface |
| SR-IOV | single root I/O virtualization |
| SRM | storage resource management |

| | |
|---|---|
| T10 PI | T10 Protection Information |
| TCP | Transmission Control Protocol |
| TOR | top of rack |
| UDP | User Datagram Protocol |
| UMC | Emulex Universal Multi-Channel |
| VEPA | virtual Ethernet port aggregator |
| VF | virtual function |
| VLAN | virtual local area network |
| vNIC | virtual network interface card |
| VPD | vital product data |
| VXLAN | Virtual extensible LAN |
| UEFI | Unified Extensible Firmware Interface |
| WWN | World Wide Name |

# 2. Installation

See the documentation that accompanied the server for installing OCP mezzanine adapters. Some servers may provide an I/O bracket for the mezzanine card while others may not. An I/O bracket is not provided.

The OCm14000-OCP adapter is designed with four mounting locations (Figure 2-1 on page 14). Emulex does not provide an installation bracket.

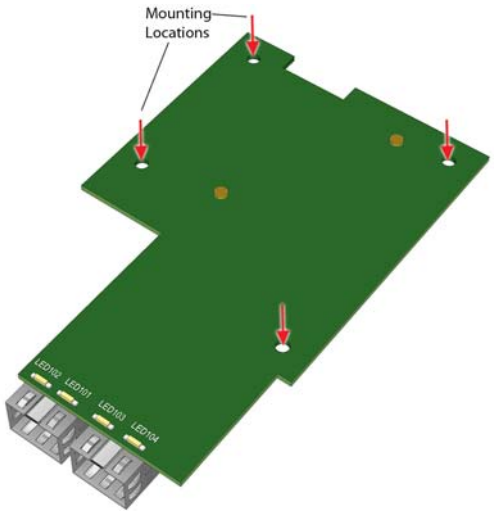



**Figure 2-1** Mounting Locations in the Emulex OCm14000-OCP Adapter

# 3. Attaching Devices to the Adapter

An adapter does not allow normal data transmission on a copper link, unless it is connected to a compatible copper interface connection. The following sections describe how to connect devices to the adapter using different cable types.

## Connecting Devices to Adapters Using a DAC or AOC Cable

The following adapters can be connected to a DAC or AOC cable:

- OCm14101-NX-OCP
- OCm14102-NX-OCP
- OCm14102-UX-OCP

The cable and connector specifications are listed in Table 3-1 on page 15.

**Table 3-1** DAC and AOC Cable and Connector Specifications

| Cable Type | Maximum Length (meters) | Minimum Length (meters) | Connector |
|---|---|---|---|
| 10GbE SFP+ Passive DAC Cable | 5 | 0.5 | DAC |
| 10GbE SFP+ Active DAC Cable | 10 | 0.5 | DAC |
| 10GbE SFP+ Active Optical Cable | 7 | 1 | AOC |

To attach devices to the adapter:

1. Connect the cable to the adapter. When connecting a DAC or AOC cable, ensure that the SFP+ cages do not have optical transceivers installed in them.
2. After confirming that there are no optical transceivers installed, insert the DAC or AOC transceiver into the SFP+ cage on the OCm14100-OCP adapter.
3. After the cable is connected to the adapter, connect the other end of the cable to a suitable device, such as a TOR switch.

   After the device is connected to the adapter, you are ready to apply power to the computer. See "Applying Power and Viewing the LEDS" on page 18.

   After the device is powered on, you can view the LED indicators. See "Viewing the LEDs" on page 18.

## Emulex OneConnect Accessories

Table 3-2 on page 16 provide model number, name, interface, and required quantities, if you need optical 10GBASE-SR or 10GBASE-LR support and need to order SFP+ optical transceivers.

**Table 3-2** Emulex OneConnect Accessories

| Model Number | Model Name | Quantity | Interface |
|---|---|---|---|
| OC10-SR-OPT-1 | Emulex OneConnect 10Base-SR Optical SFP+ Transceiver | 1 pc | 10GBASE-SR Optical |
| OC10-SR-OPT-2 | Emulex OneConnect 10Base-SR Optical SFP+ Transceivers (2 pcs) | 2 pcs | 10GBASE-SR Optical |
| OC10-LR-OPT-1 | Emulex OneConnect 10Base-LR Optical SFP+ Transceiver | 1 pc | 10GBASE-LR Optical |

### Notes

- Only Emulex accessories are warranted and fully supported by Emulex Technical Support
- For optical adapter support, you must order an Emulex OneConnect accessory transceiver kit.

# Connecting Devices to Adapters Using an Optical Cable with LC Connectors

The OCm14000-OCP adapters can be connected to the cables and connectors listed in Table 3-3 on page 16. For DAC or AOC cables, see Table 3-1 on page 15.

**Table 3-3** Optical Cable and LC Connector Specifications

| Cable Type | Maximum Length (meters) | Minimum Length (meters) | Connector |
|---|---|---|---|
| Fiber Optic Cable (Ethernet Only)<br>Long Range, LC-LC Singlemode Fiber (SMF)<br>10Gbps | 10,000 | 2 | LC |
| OM3 – Multimode 50/125 micron fiber (2000 $MH_z$*km bandwidth cable) with LC connectors: | | | |
| 1Gbps (Not specified by IEEE 802.3) | 550 | 2 | LC |
| 10Gbps | 300 | 2 | LC |
| OM2 - Multimode 50/125 micron fiber (500 $MH_z$*km bandwidth cable) with LC connectors: | | | |
| 1Gbps | 550 | 2 | LC |
| 10Gbps | 82 | 2 | LC |

**Table 3-3** Optical Cable and LC Connector Specifications (Continued)

| Cable Type | Maximum Length (meters) | Minimum Length (meters) | Connector |
|---|---|---|---|
| OM1 - Multimode 62.5/125 micron fiber (200 $MH_Z$*km bandwidth cable) with LC connectors: | | | |
| 1Gbps | 275 | 2 | LC |
| 10Gbps | 26 | 2 | LC |

To attach devices to the adapter:

1. Connect the optical cable to the adapter. When connecting an optical cable, ensure that the cages have optical transceivers installed in them.
2. After the optical transceivers are installed, insert the optical cable into the LC connectors on the adapter.
3. After the appropriate cable is connected to the adapter, connect the other end of the cable to a suitable device, such as a TOR switch.

   After the device is connected to the adapter, you are ready to apply power to the computer. See "Applying Power" on page 18.

   After the device is powered on, you can view the LED indicators. See "Viewing the LEDs" on page 18.

# 4. Applying Power and Viewing the LEDS

This section provides instructions on how to apply power and how to interpret the LEDs for various adapter models.

## Applying Power

To apply power:

1. Verify that the adapter is securely installed in the computer.
2. Verify that the correct device is attached.
3. Plug in and turn on the computer.
4. Observe the boot banner for POST results.

## Viewing the LEDs

The LED indicators in Figure 4-1 on page 18 pertain to the following adapter models:

- OCm14101-NX-OCP
- OCm14102-NX-OCP
- OCm14102-UX-OCP

Each port connector has two LEDs: an amber LED and a green LED.


**Figure 4-1** Port and Adapter LED Indicators

## Ports and LED Indicators

On an adapter with one port, only port 0 is populated. The adapter has four LEDs to show the status of the two ports.

### Port 0 LEDs

- LED104 - Speed (Green indicates 10Gbps, Amber indicates 1Gbps)
- LED103 - Link/Activity (Green indicates the link is up and there is activity)

### Port 1 LEDs

- LED101 - Speed (Green indicates 10Gbps, Amber indicates 1Gbps)
- LED102- Link/Activity (Green indicates the link is up and there is activity)

# 5. References

## Specifications

Table 5-1 on page 20 provides information for OCm14101-NX-OCP, OCm14102-NX-OCP, and the OCm14102-UX-OCP adapters.

**Table 5-1** Adapter Specifications

| Parameter | Range |
|---|---|
| **Physical Dimensions** | Compatible to both the OCP Mezzanine 1.0 and 2.0 mechanical form factors (approximately 110 x 65 mm) |
| **Power Requirements** | ❍ 9.2 Watts (typical optical, 10GbE)<br>❍ 8.2 Watts (typical passive 10GbE DAC cable) |
| **Temperature and Airflow** | 0°C to 35°C (for front end application, fresh cooling air) (minimum 150 LFM airflow)<br>0°C to 45°C (for back end application, preheated cooling air) (minimum 250 LFM airflow)<br>-40°C to 70°C (non-operating)<br>**Note:** Operating the adapter in higher temperatures or lower airflow may result in premature failures. |
| **Humidity** | Operating: 10% to 90% RH, non-condensing, 22°C wet bulb<br>Non-operating: 5% to 95% RH, non-condensing, 22°C wet bulb |
| **Agency Approvals** | • Class 1 Laser Product per DHHS 21CFR (J) & EN60825-1 when equipped with approved optical devices<br>• UL recognized to UL60950-1 2nd Edition<br>• cUR recognized to CSA 22.2, No. 60950-1-07<br>• TUV certified to EN60950-1:2006 +A11 +A1 +A12+A2<br>• FCC Rules, Part 15, Subpart B, Class A<br>• Industry Canada, ICES-003, Class A<br>• EMC Directive 2004/108/EC and 2014/30/EU (CE Mark)<br>EN55022:2010, Class A<br>EN55024:2010<br>• Australian EMC Framework (RCM Mark)<br>AS/NZS CISPR22:2009 +A1, Class A<br>• Japan VCCI, Class A<br>• Taiwan BSMI, Class A<br>• Korea MSIP, Class A<br>• RoHS Compliant (Directive 2011/65/EU)<br>• China RoHS compliant |
| **Vibration, peak acceleration** | 0.25g (5 Hz to 500 Hz)<br>(Sweep Rate = 1 octave/min.) |

# FCC and Regulatory Notices

## OCm14000-OCP Adapters

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party:

Jeff Benck, President and Chief Executive Officer

Emulex Corporation (714) 662-5600

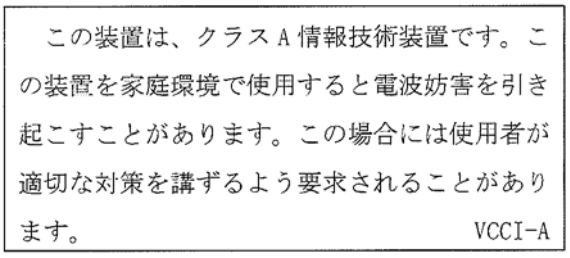
3333 Susan St. Costa Mesa, CA. 92626 USA

**Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. The reader is cautioned that changes or modifications made to the equipment not expressly approved by Emulex could void the user's authority to operate this equipment. The above statement applies to products marketed in the USA.

This class A digital apparatus meets all requirements of the Industry Canada (IC) Interference - Causing Equipment Standard (ICES-003).

Cet appareil numérique de la classe A respecte toutes les exigences du règlement sur le matériel brouilleur du Canada. CAN ICES-3 (A)/ NMB-3 (A)

## Notice for Japan and Translations (VCCI)




Translation:

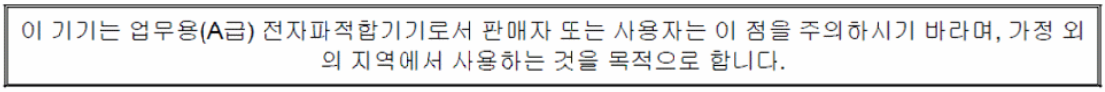
This is a Class A product. If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective action. VCCI—A.

### Notice for Taiwan and Translations (BSMI)


Translation:

This equipment is a Class A ITE, and operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

### Notice for South Korea and Translations (MSIP)




Translation:

Sellers and users of this equipment take note that this equipment is EMC approved for Class A industrial use, and as such is not intended for residential use.

# Declarations of Conformity

## OCm14000-OCP Adapters

This equipment complies with CISPR22/EN55022 Class A.

**WARNING:** This is a class A product. In a domestic environment, this product may cause radio interference requiring the user to take adequate measures.

**Note:** Changes or modifications not expressly approved by Emulex Corporation, including the use of non-Emulex approved optical transceivers, could void the user's authority to operate this equipment.

### DECLARATION OF CONFORMITY

**Manufacturer:** Emulex Design and Manufacturing Corporation
3333 Susan Street
Costa Mesa, CA. 92626 USA

**declares under sole responsibility that the product:**

**Product Name:** OneConnect® UCNA
**Regulatory Model:** P007838
**Assembly Number:** P007838-xxx *(x=alphanumeric)*

**To which this Declaration relates is in conformity with the following standards or other documents for Informa Technology Equipment (ITE):**

**Product Safety:**
UL Recognized to UL 60950-1:2007, Second Edition
cUR Recognized to CSA 22.2, No. 60950-1-07
IEC 60950-1:2005 +A1 +A2 (CB Scheme)
EN 60950-1:2006 +A11 +A1 +A12 +A2
EN 60825-1:2007*
CFR Title 21, Laser AEL Class 1, FDA/CDRH*
** when equipped with approved optical transceivers*

**Electromagnetic Compatibility (Class A):**
FCC Rules, CFR Title 47, Part 15, Subpart B
Industry Canada, ICES-003:2012 (Issue 5)
EN55022:2010 / CISPR 22:2008
EN55024:2010 / CISPR 24:2010
AS/NZS CISPR22:2009+A1
VCCI:2014
CNS 13438:2006 (complete), KN22, KN24

**Hazardous Substances:**
The object of this declaration described above is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, and has been validated per EN 50581:2012.

**Supplementary Information:**
1. The product was tested in a typical configuration.
2. The product is in compliance with the following directives:
   - European Union Low Voltage Directives 2006/95/EC and 2014/35/EU
   - European Union EMC Directives 2004/108/EC and 2014/30/EU
   - European Union RoHS Directive 2011/65/EU
   - Australian RCM Mark framework

**March 10, 2015**
**Costa Mesa, CA**

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# Laser Safety Notice

Emulex products incorporating optical laser transceivers contain Class 1 laser devices, which comply with DHHS/CDRH 21CFR Sub-chapter J, and the international laser safety standard EN/IEC 60825-1. Class 1 laser devices are not considered to be hazardous.

The use of non-Emulex approved optical transceivers, or transceivers which do not comply with the Class 1 radiation performance requirements defined in DHHS/CDRH 21CFR Sub-chapter J and IEC 60825-1, may expose the user to hazardous laser radiation, and such devices should not be used with Emulex products.