Open edge chassis

Revision 1.4

Author: Tomi Männikkö, Nokia

1 License (OCP CLA Option)

Revision history

Revision	Editor	Description
V0.1 (Sep 18, 2018)	T. Männikkö	First draft
V1.0 (Dec 11, 2018)	T. Männikkö	Typo corrections Update to sled mechanics: Chapter 4.2 Update to signal descriptions: Chapter 4.3.2, 5.1.2, 6.4
V1.1 (Feb 17, 2019)	T. Männikkö	Clarifications following workshop feedback: Power Supplies: Chapter 5.1 Air Flow Direction: Chapter 7.2 Key Environmental and Regulatory Specifications, Chapter 8
V1.2 (Feb 20, 2019)	T. Männikkö	Clarified BBU: Chapter 4.3 Added PSU SKUs: Table 1, 5.1
V1.3 (Aug 23, 2019)	T. Männikkö	Corrected description of signal SMB_PMBUS_BBU_SDA in Table 7 Corrected backplane guide pin manufacturer in Chapter 4.4
V1.4 (Oct 27, 2020)	T. Männikkö	Added specifications for 2U chassis

Contents

2 Overview

This document describes the technical specifications of the Open edge server chassis. Open edge server is a compact, high-performance server platform optimized for installation to edge sites, where facilities are limited in floor space, cooling capacity and power feed capacity.

Main features of the Open edge server chassis

- 2RU or 3RU high enclosure, Depth 430 mm
- compatible with standard 19" mechanics
- support for 1U or 2U, half width sleds
- Redundant power feed, AC or DC
- Air flow direction configurable from front to rear or rear to front
- Chassis management controller, RMC

The key requirements guiding the design of Open edge chassis and sled hardware are listed below

Edge site requirements

- Limited floor space (-> small form factor)
- Varying thermal conditions (-> extended temperature range)
- Limited power feed capacity (-> system scalability from one chassis to multiple racks)
- Varying types of power feed (-> DC, AC, 3-phase, 1-phase, adaptation to site power supply is done using a variety of PDUs)
- VRAN/ MEC accelerator capability (-> support for FHHL/FHFL up to 400/700 W power per sled)

OCP design principles

- Centralized power feed
- Front access
- Tool-les maintenance
- Vanity free design

An Open edge 3U chassis supports up to five 1U, half width sleds that can have various of functions, for example servers, switches, gateways, JBODs etc. A 2U chassis supports up to three 1U, half width sleds. Also, 2U, half width sleds are supported in both chassis form factors. Chassis management (sleds, PSUs) is done in a centralized manner through a rack management controller unit (RMC) via backplane. Another key function of the backplane is to feed power to the sleds, via the power distribution board.

The Open edge chassis is shown in Figure 1. All operations are done at the front side of the chassis. All units (PSUs, RMC, sleds) are inserted and removed from the front. All interfaces are also in the front.

Figure 2 illustrates 1U and 2U server sleds.

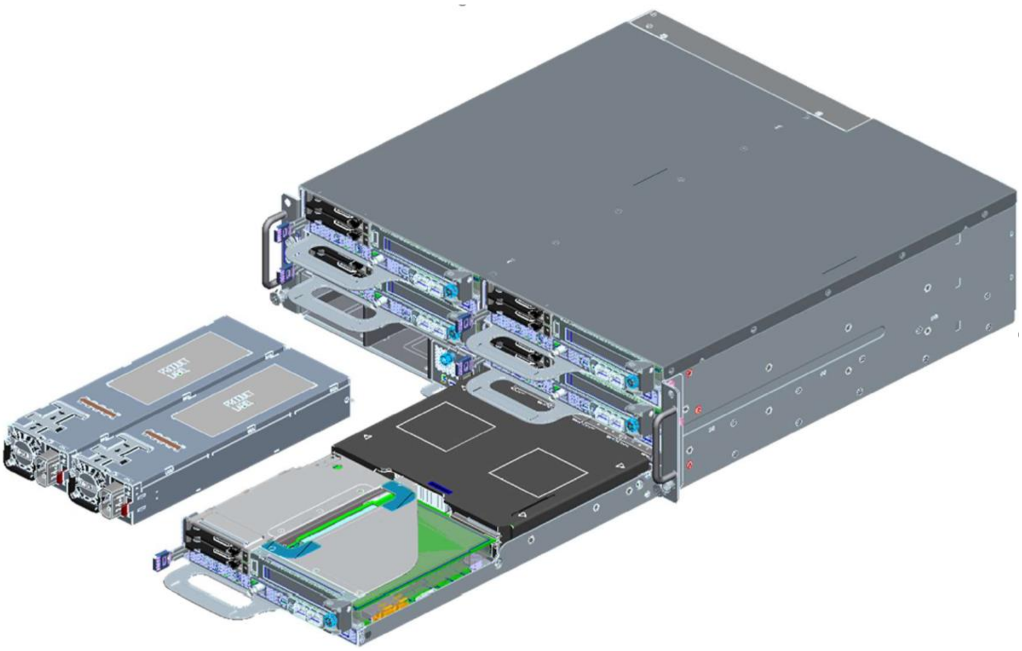

Figure 1 Open edge server chassis

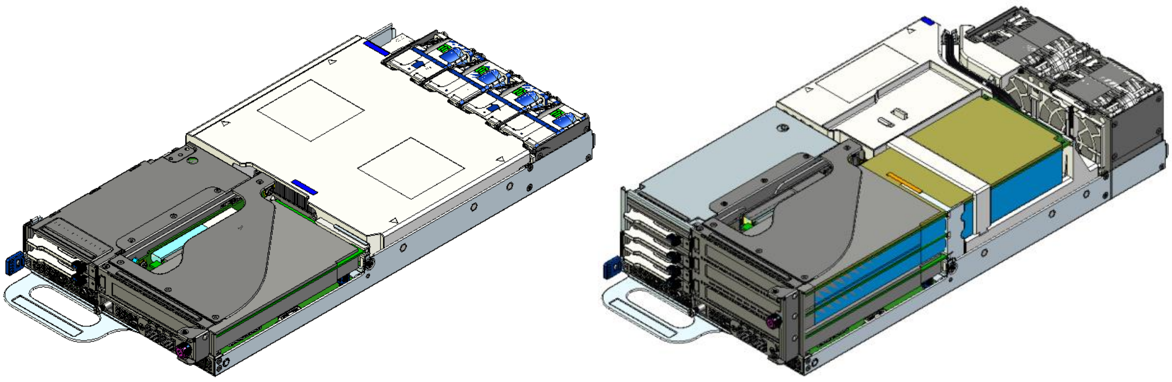

Figure 2 Open edge server sleds, 1U (left) and 2U (right)

3 Rack Compatibility

The Open edge chassis is compatible with standard 19” four-post racks (EIA-310). The chassis occupies 2 or 3 rack units (RU). The practical minimum depth for a rack is 600 mm.

Installation is done using a shelf. An adjustable shelf solution supports installation to racks having various depths. The distance between rack’s front and rear posts can vary in the range of 450 mm to 750 mm.

The Open edge chassis has front cabling, requiring 100 to 150 mm of space in front side of the rack. Depending on the site installation requirements, front posts of rack may need be recessed accordingly.

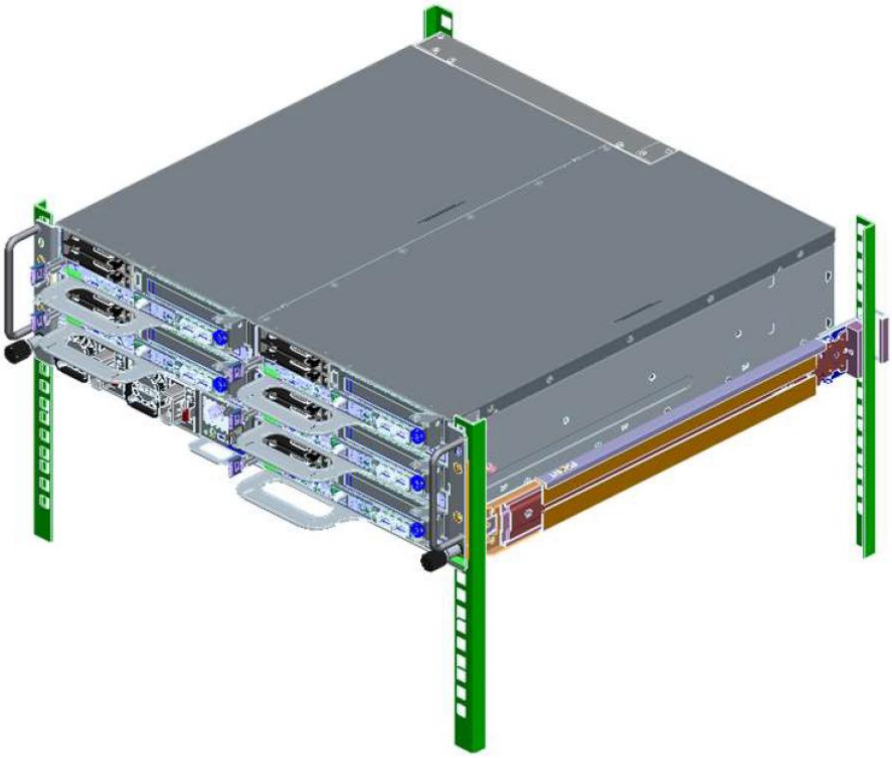

Figure 3 Open edge chassis installed in 19” rack frame using an adjustable shelf

4 Chassis Specifications

The key specifications of Open edge 3U chassis and sleds are shown in Table 1. Similarly, specifications for the 2U chassis are shown in Table 2.

Table 1 Key specifications of Open edge 3U chassis

Technical specifications	
Form factor	3U, 19" rackmount
Server sled bays	Possible server configurations • 5 x 1U sled • 1 x 2U sled + 3 x 1U sled • 2 x 2U sled + 1 x 1U sled

Power supply	Dual, high efficiency, 1+1 redundant, hot-plug PSUs, front-to-rear or rear-to-front air flow supported
	Available PSU options *)
	• 230 VAC, 80+ platinum
	  ○ operating voltage range 180 VAC…264 VAC, output power 2000 W,
	  ○ operating voltage range 90 VAC…140 VAC, output power 1000 W
	• -48 VDC
	  ○ operating voltage range -40…-72 VDC, output power 2000 W

Sled power feed capacity	400 W max (1U sled), 700 W max (2U sled)
Cooling	Autonomous fan units on sleds and PSUs, front-to-rear or rear-to-front air flow supported

HW management (RMC)	Integrated HW management controller (AST2520) supporting
	• Ethernet interface for chassis management
	  ○ 2 x 10 Gbit/s (SFP+) and 1 x 1 Gbit/s (RJ45) front panel interfaces for uplinks or chaining multiple chassis
	  ○ 1 Gbit/s management Ethernet interface to RMC and all sleds via backplane
	• USB serial port for debug
	• Redfish, IPMI

Operating conditions	Chassis, PSUs, RMC: • Operating temperature range: -5 C …+45 C [ETSI EN300 019-1-3 Class 3.2] • Short term operating temperature: -5 C to +55 C [GR-63-CORE] • Non-operating temperature *): -25 C to +70 C • Operating humidity: 5 % to 95 % • Non-operating humidity *): 10 % to 100 % • System startup temperature: min +5 C *) Non-operating means conditions during transportation and storage (device is in its transportation package)
Weight	9.2 kg (empty chassis)
Dimensions	440 mm x 130.55 mm x 430 (W x H x D)

*) Open edge compatible PSUs are available from multiple manufacturers, including BelPower and Flex. Please check suppliers for detailed product specifications and availability.

Table 2 Key specifications of Open edge 2U chassis

Technical specifications	
Form factor	2U, 19" rackmount
Server sled bays	Possible server configurations • 3 x 1U sled • 1 x 2U sled + 1 x 1U sled

Power supply	Dual, high efficiency, 1+1 redundant, hot-plug PSUs, front-to-rear or rear-to-front air flow supported
	Available PSU options *)
	• 230 VAC, 80+ platinum
	  o operating voltage range 180 VAC…264 VAC, output power 2000 W,
	  o operating voltage range 90 VAC…140 VAC, output power 1000 W
	• -48 VDC
	  o operating voltage range -40…-72 VDC, output power 2000 W

Sled power feed capacity	400 W max (1U sled), 700 W max (2U sled)
Cooling	Autonomous fan units on sleds and PSUs, front-to-rear or rear-to-front air flow supported

HW management (RMC)	Integrated HW management controller (AST2520) supporting
	• Ethernet interface for chassis management
	  o 2 x 10 Gbit/s (SFP+) and 1 x 1 Gbit/s (RJ45) front panel interfaces for uplinks or chaining multiple chassis
	  o 1 Gbit/s management Ethernet interface to RMC and all sleds via backplane
	• USB serial port for debug
	• Redfish, IPMI

Operating conditions	Chassis, PSUs, RMC: • Operating temperature range: -5 C …+45 C [ETSI EN300 019-1-3 Class 3.2] • Short term operating temperature: -5 C to +55 C [GR-63-CORE] • Non-operating temperature *): -25 C to +70 C • Operating humidity: 5 % to 95 % • Non-operating humidity *): 10 % to 100 % • System startup temperature: min +5 C *) Non-operating means conditions during transportation and storage (device is in its transportation package)
Weight	6.2 kg (empty chassis)
Dimensions	440 mm x 86.3 mm x 430 (W x H x D)

*) Open edge compatible PSUs are available from multiple manufacturers, including BelPower and Flex. Please check suppliers for detailed product specifications and availability.

The block diagram of Open edge 3U chassis is shown in Figure 4. Power supplies (PSUs) connect to the system through a power distribution board (PDB). Sleds are connected through a backplane (BP). A rack management controller (RMC) has the task of managing the PSUs and providing management Ethernet connectivity to the sleds.

Each sled has a hard-coded physical address [1…5] assigned to it through the backplane connector.

The block diagram of the 2U chassis is identical to that of 3U chassis, with the exception that only sleds 1...3 are supported.

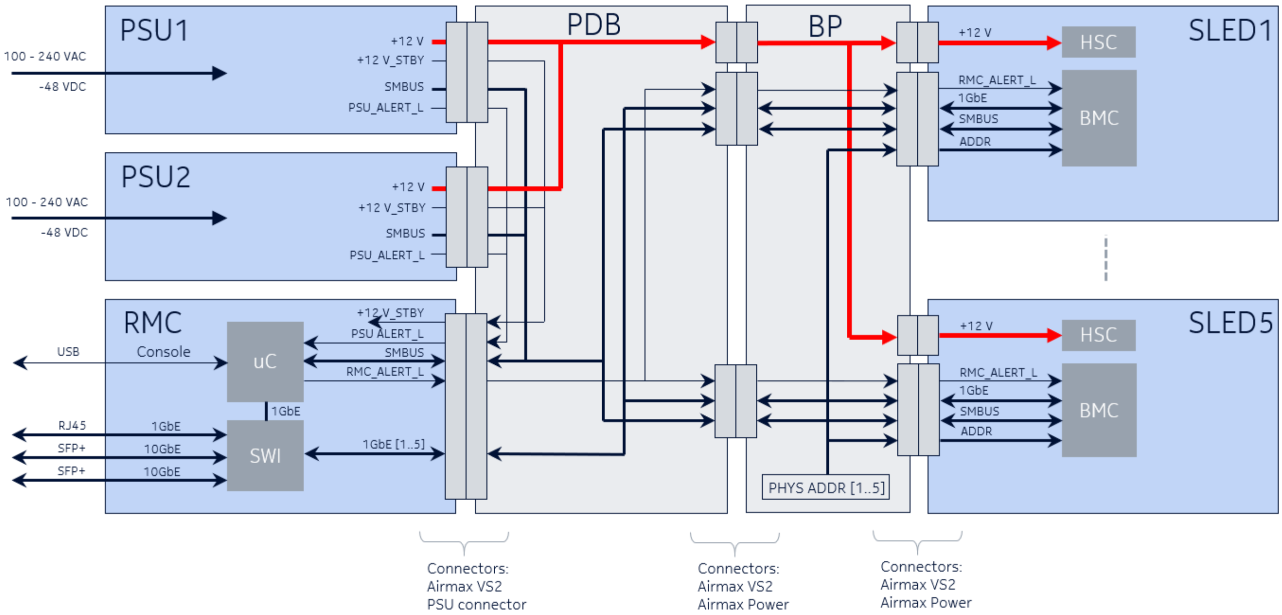

Figure 4 Block diagram of Open edge 3U chassis

4.1 Chassis mechanics

Open edge chassis mechanical design is simple, consisting of only few components. The power distribution board, backplane assembly and mounting brackets are attached to a steel enclosure.

The complete chassis assembly is shown in Figure 5. The 2U chassis is shown in Figure 6.

The rear wall of the chassis is perforated to allow front-to-rear or rear-to-front cooling air flow. For rack installation, a shelf is needed. The mounting brackets alone are not capable of carrying the entire weight of a fully populated chassis. A dedicated, adjustable sliding shelf is available for installation the Open edge chassis into a standard 19” rack, but a generic L-bracket is also usable.

The outer dimensions of the chassis are shown in Table 1.

Table 3 Outer dimensions of the Open edge chassis

	Dimension
Height	130.55 mm (3U), 86.3 mm (2U)
Width	440 mm
Depth	430 mm

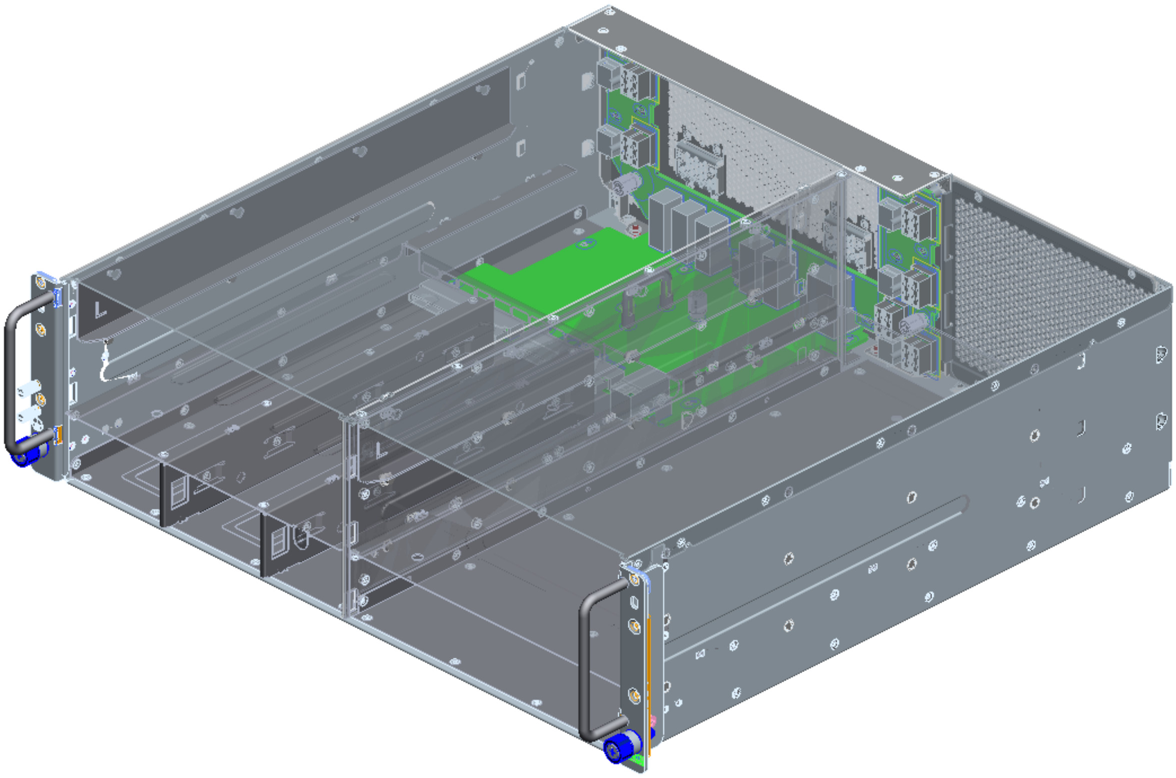

Figure 5 Open edge 3U chassis with power distribution board and backplane

Figure 6 Open edge 2U chassis

The Open edge chassis supports two types of sleds, 1U and 2U. One 2U sled can be installed in place of two 1U sleds. 1U sleds in the top row have support brackets on the inner sides of the chassis. When a 2U sled is installed, the support brackets are removed. Removal and installation are tool-les. Removal is illustrated in Figure 7.

Note that due to different construction of the 2U and 3U chassis, their support brackets have slightly different material thicknesses, and are thus not interchangeable.

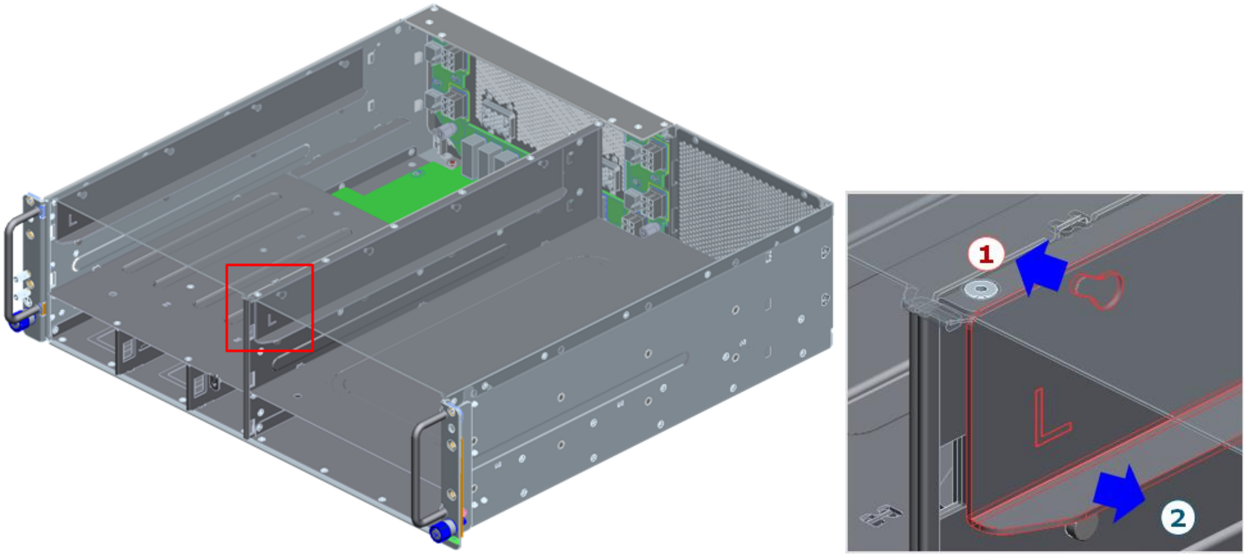

Figure 7 Removal of support brackets of uppermost 1U sleds of the 3U chassis

The supported combinations of 1U and 2U sleds in an Open edge chassis are shown in Figure 8 through Figure 13. Physical addresses for the sled locations is also shown.

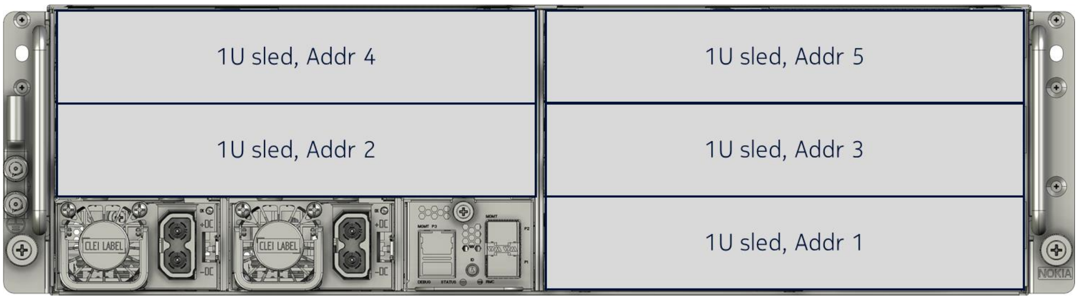

Figure 8 Open edge 3U chassis with five 1U sleds

Figure 9 Open edge 3U chassis with three 1U sleds and one 2U sled, option 1

Figure 10 Open edge 3U chassis with three 1U sleds and one 2U sled, option 2

Figure 11 Open edge 3U chassis with one 1U sled and two 2U sleds

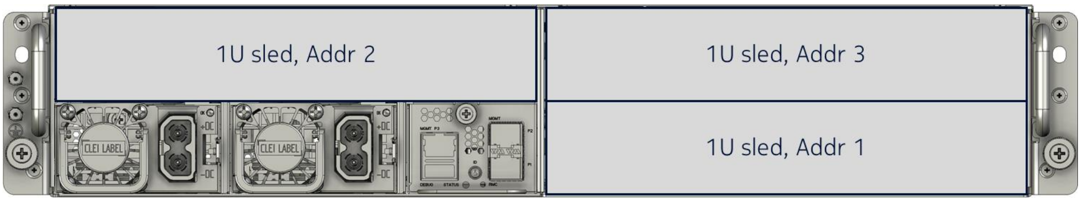

Figure 12 Open edge 2U chassis with three 1U sleds

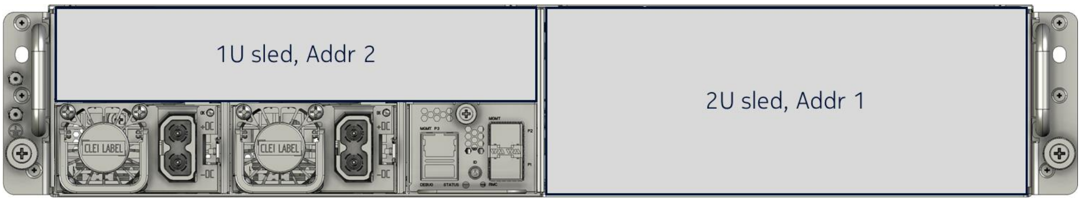

Figure 13 Open edge 2U chassis with one 1U sled and one 2U sled

For an empty 1U slot in the chassis, a filler sled is used. The purpose of the filler sled is to act as an EMI shield, serve as an air blocker for the server sled below and to provide protection against fire spread.

4.2 Sled mechanics

The sled consists of a sheet metal tray with a handle, and the release latch mechanism. Other key aspects of the sled design are location of backplane connectors (Figure 14), vertical positioning of the circuit board and release latch (Figure 15) and the latch design overall (Figure 16).

It is critical from the point of view of system interoperability that these details are implemented according to the mechanical specifications of the sled. In other respects, the tray can be designed mechanically to meet other product requirements, such as location of circuit board support pillars, fixing points for sub-assemblies or front panel design.

The front panel of the sled shall provide the necessary EMC shielding.

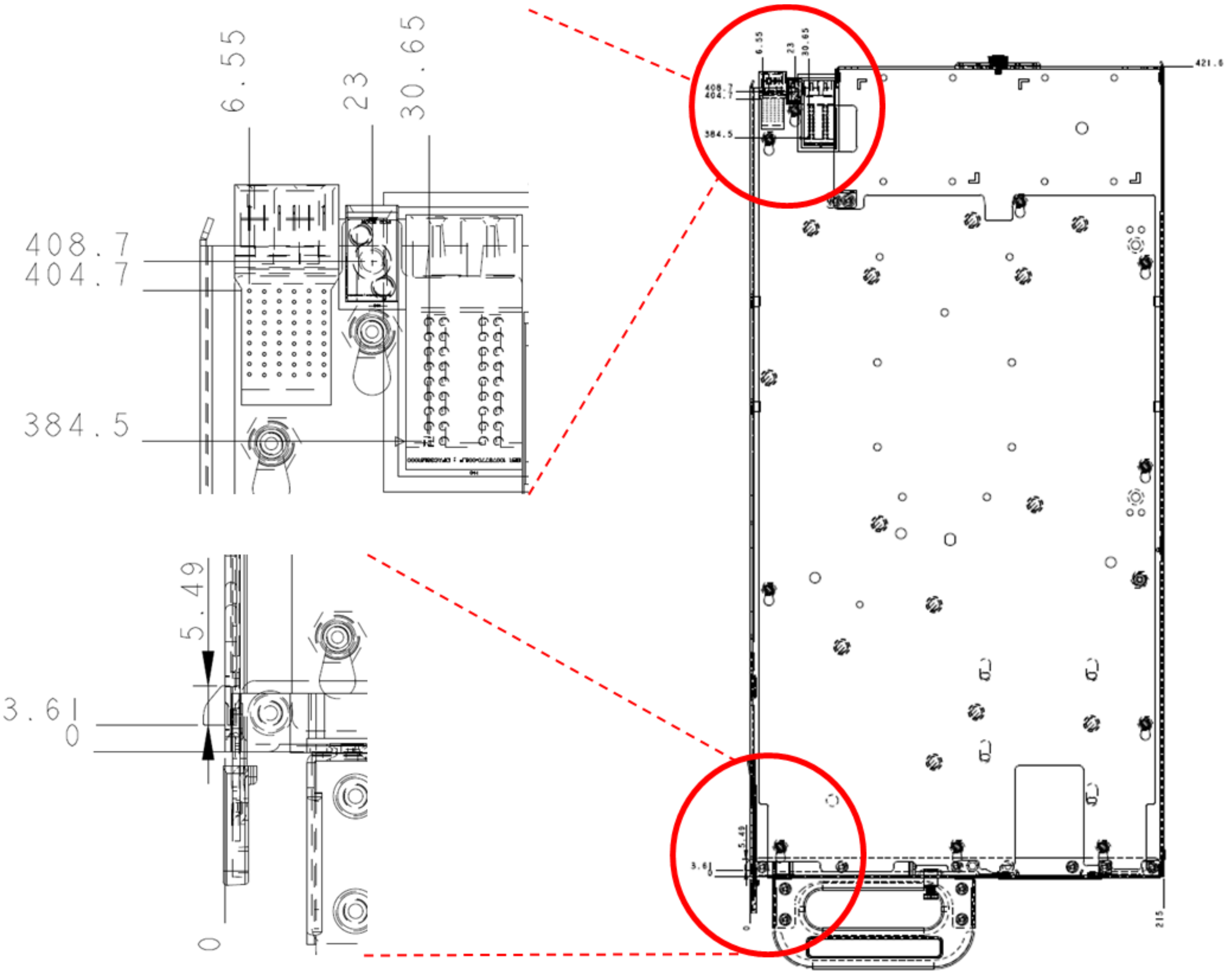

Figure 14 Open edge sled connector locations

Table 4 Outer dimensions of the Open edge sled

	Dimension, max
Height	41 mm (1U), 83.55 mm (2U)
Width	215 mm
Depth	427.5 mm

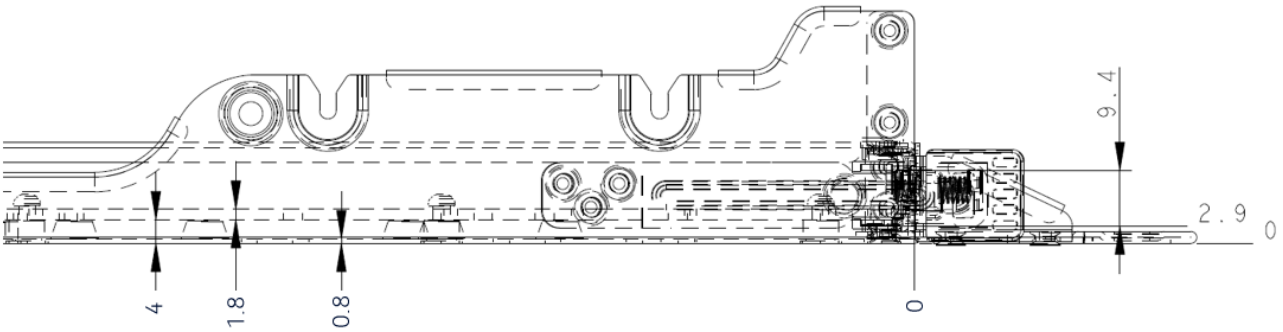

Figure 15 Vertical displacement of PCB and release latch tongues

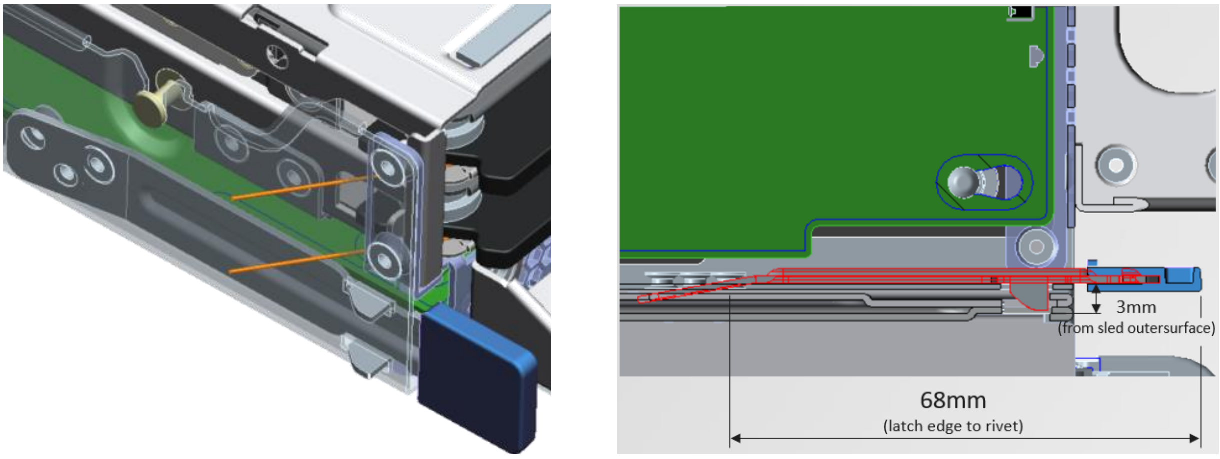

Figure 16 Sled release latch

The sides of the sled slots in the chassis have guide pins. The purpose of the guide pins is to keep the sled horizontal during insertion and removal of sled, see Figure 17. The left and right edges of the sled base lean against the guide pins.

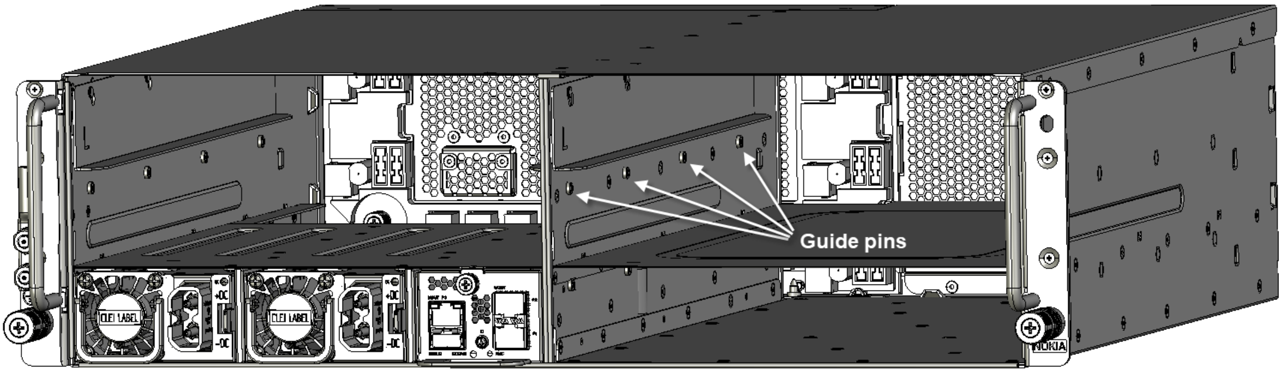

Figure 17 Sled guide pins shown with arrows

Due to the guide pins, the height of the sled edge (at its rear end) is limited to 29.25 mm. Also, the edge should be even, without any cut-outs. This area, 220 mm in length, is shown in Figure 18. The height of the sled at the front panel line shall be 41 mm to provide the necessary EMC shielding. Within the distance of 30.55 mm from the front panel towards the rear of sled, the height of sled edge can be up to 41 mm.

In the middle area, marked by A, the height of the sled edge may be less than 29.25 mm. This area may have cut-outs, if required by the design.

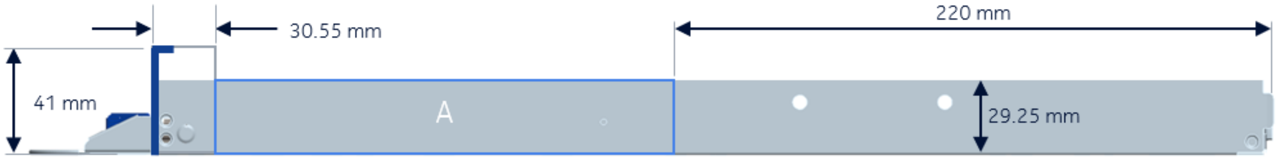

Figure 18 Sled side profile

4.3 Chassis backplane

The Open edge chassis backplane provides power feed to the sleds and signalling between the sleds and RMC. There is one power connector and one signal connector for interfacing each sled. Sled 1 has an extra power connector for possible future use. A BBU is a planned use for this connector but is currently only reserved.

The backplane connects directly to the power distribution board via AirMax power and signal connectors. The board has 8 layers for power delivery. Thickness of copper is 70 um/ 2 Oz.

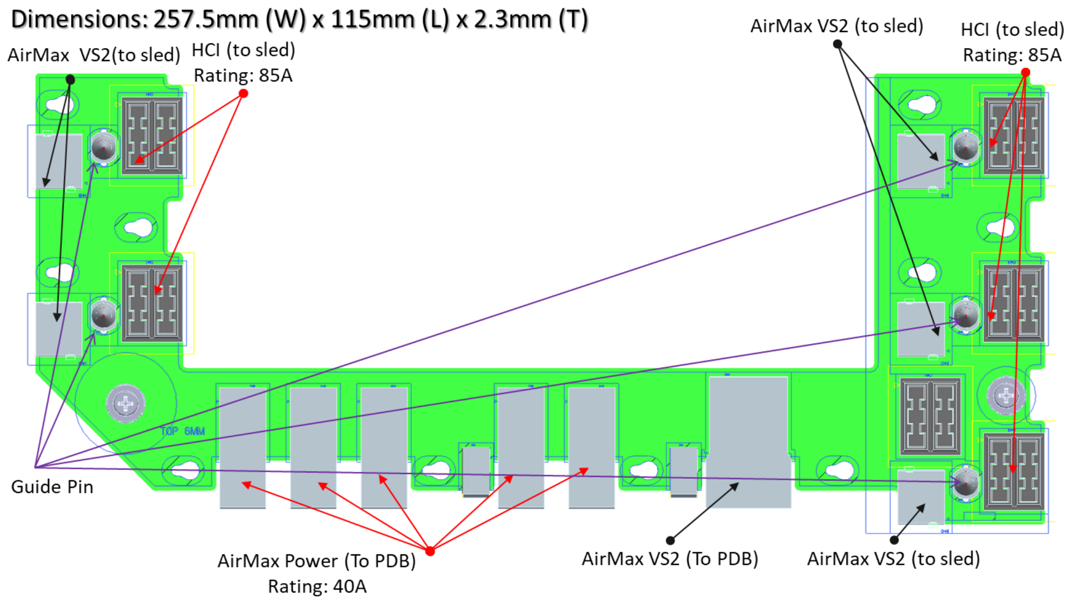

Figure 19 3U backplane connector placement

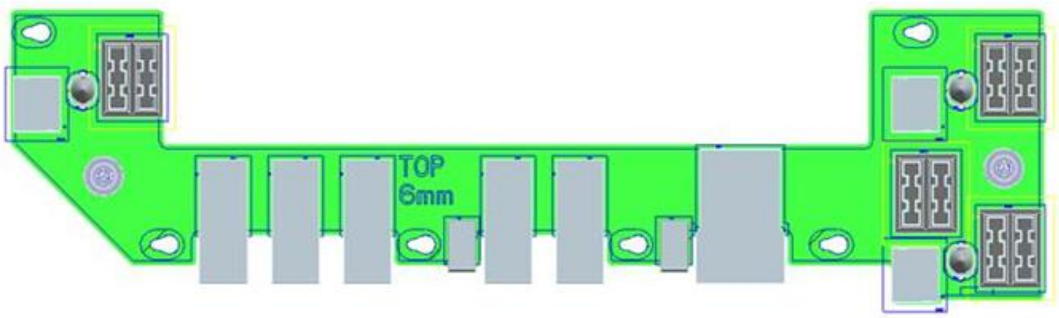

Figure 20 2U backplane connector placement

STACKUP									
			Target Z (ohms) - MicroStrip					50	Breakout
			Target Z (ohms) - StripLine					50	
			Z tolerance					±10%	
			Z Type					Single	Single
Layer#	Material	Description	Copper Weight (oz)	Thickness (mil)	Tolerance (mil)	Glass Fabric	Er	Width	Width
		Soldermask		0.60			3.8		
1		TOP	0.5+plating	1.95				4.5	4
	IT-170GRA1	PP		2.70	±0.709	1080x1	3.8		
2		GND	2 (RTF)	2.60					
	IT-170GRA1	CORE		4.00	±0.709	106x2	3.8		
3		IN1	2 (RTF)	2.60				5	4
	IT-170GRA1	PP		14.25	±1.97	2116x3	3.9		
4		VCC	2 (RTF)	2.60					
	IT-170GRA1	CORE		28.00	±2.52	7628x4	4.1		
5		VCC1	2 (RTF)	2.60					
	IT-170GRA1	PP		14.25	±1.97	2116x3	3.9		
6		IN2	2 (RTF)	2.60				5	4
	IT-170GRA1	CORE		4.00	±0.709	106x2	3.8		
7		GND1	2 (RTF)	2.60					
	IT-170GRA1	PP		2.70	±0.709	1080x1	3.8		
8		BOTTOM	0.5+plating	1.95				4.5	4
		Soldermask		0.60			3.8		
			Total	90.60	±10%				

Table 5 PCB stack up of backplane board

4.3.1 Backplane power connector

The chassis backplane will distribute +12 V power to the sleds. Power feed capacity is 400 W for a 1U sled and 700 W for a 2U sled. Power is fed through HCI High Power connector (FCI 10078768-001LHLF, or equivalent) having current capacity of 85 A.

The corresponding power connector on the sled is FCI 10078770-002LHLF, or equivalent.

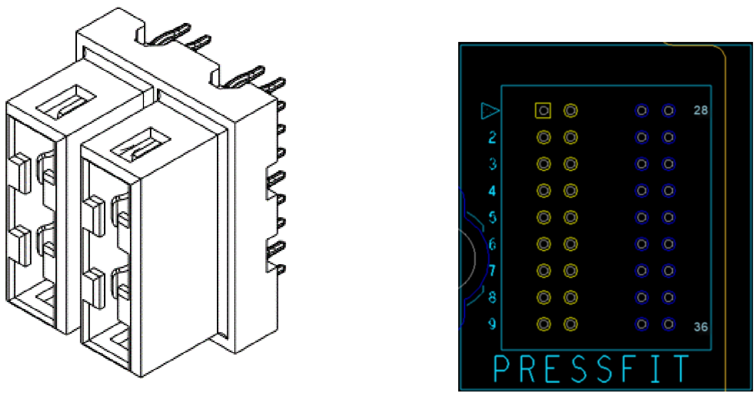

Figure 21 Backplane power connector (HCI) with board layout

Table 6 Pin assignment of backplane power connector

Pin	Signal name	Description
1-18	P12V_PSU	+12 VDC power feed to sled
19-36	GND	Ground, +12 VDC return

4.3.2 Backplane signal connector

The signal connector between backplane and sled is a 6 x 9 pin AirMax VS2 connector (FCI 10130665-102LF, or equivalent). The corresponding signal connector on the sled is FCI 10124149-102LF, or equivalent. The backplane connector is shown in Figure 22.

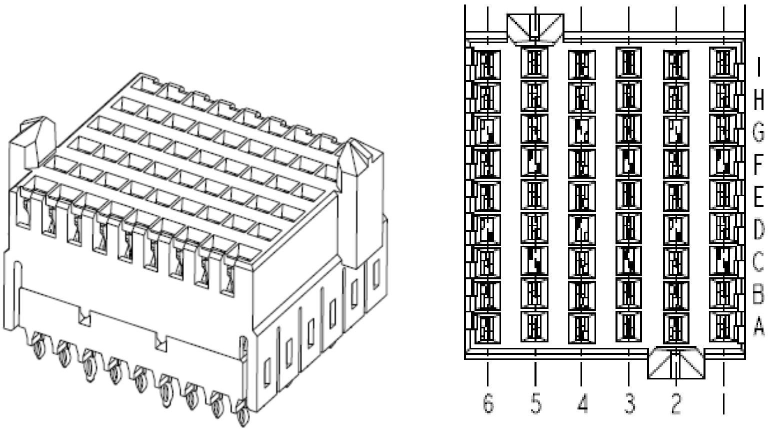

Figure 22 Backplane signal connector with pin map

Table 7 Pin assignment of backplane signal connector (connector for sled 1 shown)

GND (sled only)	NC	GND (sled only)	NC	GND (sled only)	NC	J
PD_SLED1_PRSNT_RETURN	GND	NC	GND	LAN_SLED1_MDIN3	GND	I
PD_BBU_A0	SMB_SLED_BUF_SDA	PD_SLED1_CHASSIS_INTRUSION	FM_BMC_SLED1_READY_N	LAN_SLED1_MDIP3	LAN_SLED1_MDIN2	H
GND	SMB_SLED_BUF_SCL	GND	FM_RMC_GPIO_2	GND	LAN_SLED1_MDIP2	G
FM_BBU_PRSNT_N	GND	NC	GND	NC	GND	F
SMB_BBU_ALERT_R_N	NC	NC	FM_RMC_GPIO_1	SB_SLED1_ADDR_2	LAN_SLED1_MDIN1	E
GND	NC	GND	FM_RMC_GPIO_0	GND	LAN_SLED1_MDIP1	D
SMB_PMBUS_BBU_SDA	GND	NC	GND	SB_SLED1_ADDR_1	GND	C
SMB_PMBUS_BBU_SCL	NC	NC	FM_SLED1_PRSNT_N	SB_SLED1_ADDR_0	LAN_SLED1_MDIN0	B
GND	P3V3_SLED1	GND	IRQ_RMC_ALERT_N	GND	LAN_SLED1_MDIP0	A
6	5	4	3	2	1	

Table 8 Backplane signal connector descriptions (signal direction I/O/bidir from backplane perspective)

Signal	Type	Description
SB_SLED1_ADDR_[2..0]	Output	Physical address from backplane to sled. The signal has 4K7 pull-up to P3V3_SLED1 or 1K pull-down to GND on backplane board. P3V3_SLED1 is fed to the backplane board by sled baseboard.
LAN_SLED1_MDIP[3..0]	Bidir	1000BASE-T between RMC and sled.

LAN_SLED1_MDIN[3..0]		Magnetics are required on sled baseboard.
FM_RMC_GPIO_[2:0]	Output	General purpose I/O signals driven by RMC to all sled baseboards. LVTTL/LVCMOS. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. The input circuit design on sled shall prevent leakage current flow from RMC, e.g. during sled hot plug. GPIO[2:0] are used to indicate the status and air flow direction of PSUs to sleds according to the following table: 000: PSU1 not present, PSU0 front to rear (F-R) 001: PSU1 not present, PSU0 rear to front (R-F) 010: PSU0 not present, PSU1 F-R 011: PSU0 not present, PSU1 R-F 100: PSU0 /1 present, PSU0 /1 F-R 101: PSU0 /1 present, PSU0 /1 R-F 110: PSU0 /1 present, PSU0 F-R, PSU1 R-F 111: PSU0 /1 present, PSU0 R-F, PSU1 F-R
FM_BMC_SLED1_READY_N	Input/ OD	BMC status signal from sled to RMC. Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. The output circuit design on sled shall prevent leakage current flow from RMC, e.g. during sled hot plug.
FM_SLED1_PRSNT_N	Input	Sled presence status. Active low. The signal is used to inform RMC whether a sled is present in a slot. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
PD_SLED1_PRSNT_RETURN	Output	Return signal for FM_SLED1_PRSNT_N. Connects to ground on backplane board, pulling FM_SLED1_PRSNT_N (or FM_BBU_PRSNT_N) low when sled is inserted to chassis.
IRQ_RMC_ALERT_N	Output/ OD	Alert signal from RMC to sleds (common to all sleds). Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. The purpose of the signal is to provide means to alert sleds e.g. in case of PSU failure or low input voltage.
PD_SLED1_CHASSIS_INTRUSION	Output	Signal used to detect removal of sled. Active high. Connects to GND in backplane. The signal can be used to record an event of server sled tampering (removal from chassis). The circuit is located on sled baseboard and is powered by the

		back-up (RTC) battery. The implementation varies with e.g. the used CPU architecture.
SMB_SLED_BUF_SDA	Bidir/ OD	SMBUS data between RMC and sleds (common to all sleds). Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. An I2C buffer (PCA9617A, or equivalent) is required on sled to act as bus repeater and to prevent leakage current flow from RMC, e.g. during sled hot plug.
SMB_SLED_BUF_SCL	Output/ OD	SMBUS clock from RMC to sleds (common to all sleds). Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. An I2C buffer (PCA9617A, or equivalent) is required on sled to act as a bus repeater and to prevent leakage current flow from RMC, e.g. during sled hot plug.
PD_BBU_A0	Output	Physical address bit for BBU unit. The signal has 1K pull-down to GND on backplane board. The signal is present in sled1 connector only and is to be used by BBU only.
FM_BBU_PRSNT_N	Input	BBU presence signal to RMC. Active low. The signal is connected to GND on BBU board. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. The signal is present in sled1 connector only and is to be used by BBU only.
SMB_BBU_ALERT_R_N	Input	Alert signal from BBU to RMC. Active low. The signal has 4K7 pull-up to P3V3_RMC_STBY on backplane board. The signal is present in sled1 connector only and is to be used by BBU only.
SMB_PMBUS_BBU_SDA	Bidir/ OD	SMBUS data between RMC and BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
SMB_PMBUS_BBU_SCL	Output/ OD	SMBUS clock from RMC to BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
P3V3_SLED1	Power	3V3 auxiliary voltage from sled to backplane. Used as pull-up voltage for slot address.
GND	Power	Ground

4.4 Backplane guide pin

A guide pin in the backplane enables reliable mating of power and signal connectors between the backplane and sled. The guide pin is of type Starconn D11402-200000-Z1, or equivalent. The receptacle on the sled is of type Starconn D11403-000A00-Z1, or equivalent.

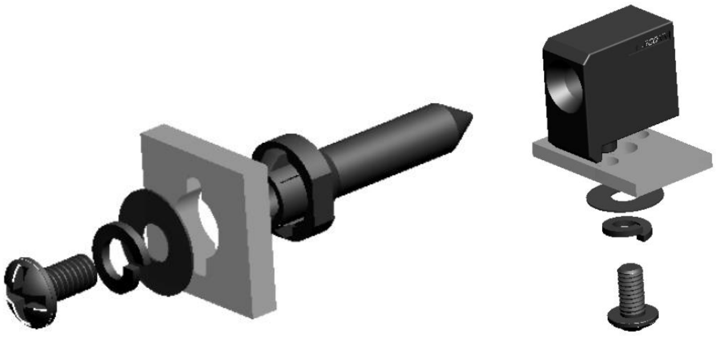

Figure 23 Guide pin in backplane and receptacle on sled board.

4.5 Chassis power distribution board

The power distribution board connects PSUs and RMC to rest of the system. The backplane is attached vertically to AirMax rear power and signal connectors.

The board has 8 layers for power delivery. Thickness of copper is 70 um/ 2 Oz.

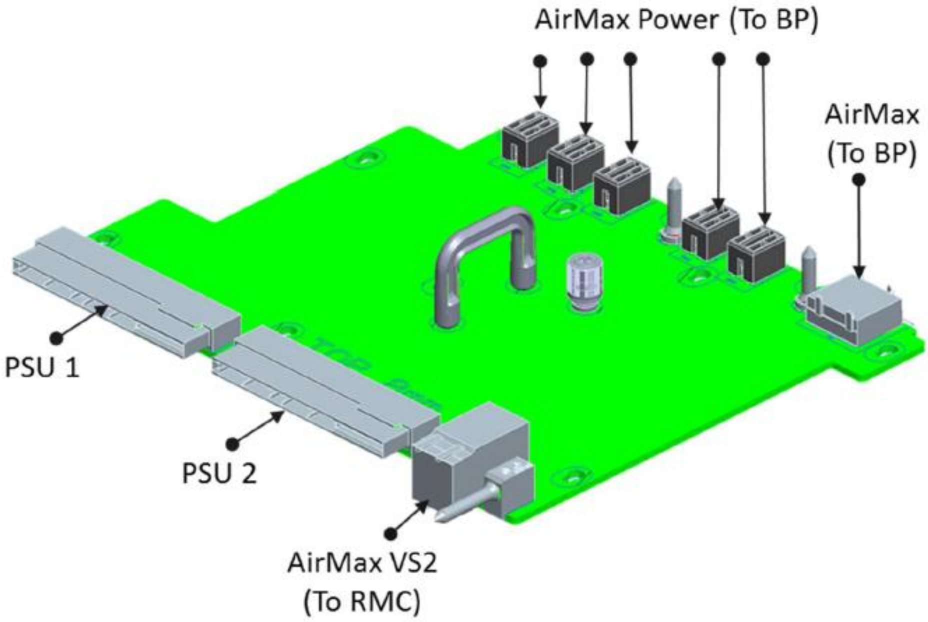

Figure 24 Open edge power distribution board

STACKUP									
			Target Z (ohms) - MicroStrip					50	Breakout
			Target Z (ohms) - StripLine					50	
			Z tolerance					±10%	
			Z Type					Single	Single
Layer#	**Material**	**Description**	**Copper Weight (oz)**	**Thickness (mil)**	**Tolerance (mil)**	**Glass Fabric**	**Er**	**Width**	**Width**
		Soldermask		0.60			3.8		
1		TOP	0.5+plating	1.95				4.5	4
	IT-170GRA1	PP		2.70	±0.709	1080x1	3.8		
2		GND	2 (RTF)	2.60					
	IT-170GRA1	CORE		4.00	±0.709	106x2	3.8		
3		IN1	2 (RTF)	2.60				5	4
	IT-170GRA1	PP		14.25	±1.97	2116x3	3.9		
4		VCC	2 (RTF)	2.60					
	IT-170GRA1	CORE		28.00	±2.52	7628x4	4.1		
5		VCC1	2 (RTF)	2.60					
	IT-170GRA1	PP		14.25	±1.97	2116x3	3.9		
6		IN2	2 (RTF)	2.60				5	4
	IT-170GRA1	CORE		4.00	±0.709	106x2	3.8		
7		GND1	2 (RTF)	2.60					
	IT-170GRA1	PP		2.70	±0.709	1080x1	3.8		
8		BOTTOM	0.5+plating	1.95				4.5	4
		Soldermask		0.60			3.8		
			Total	**90.60**	**±10%**				

Table 9 PCB stack up of power distribution board

5 Power feed

Power feed of Open edge chassis is described in this chapter.

5.1 Power supplies

The open edge server chassis provides a redundant power feed. Both AC and DC power supplies are supported. Nominal output power is 2000 W. If one power feed or PSU fails, the remaining PSU can feed all power to the chassis.

It is possible for mixed AC/DC configuration to be used, AC and DC are functionally identical. Active-Active and Active-Standby are standard operating modes in the Open edge chassis, and it is recommended that all PSU's used in Open edge chassis support them.

There are PSU variants for front-to-rear air flow and rear-to-front air flow. The selection is made based on site cooling requirements. The primary direction of air flow is from front to rear. If the airflow direction is from rear to front, the handles of the PSU should be red to clearly identify this.

Open edge compatible PSUs are available from multiple manufacturers, including BelPower and Flex. Please check suppliers for detailed product specifications and availability.

5.1.1 PSU dimensions

The outer dimensions of Open edge power supplies are shown in Table 10. Drawings of PSU are shown in Figure 25, Figure 26 and Figure 27.

Table 10 Outer dimensions of the PSU

	Dimension, max
Height	40 mm
Width	73.5 mm
Depth	265 mm

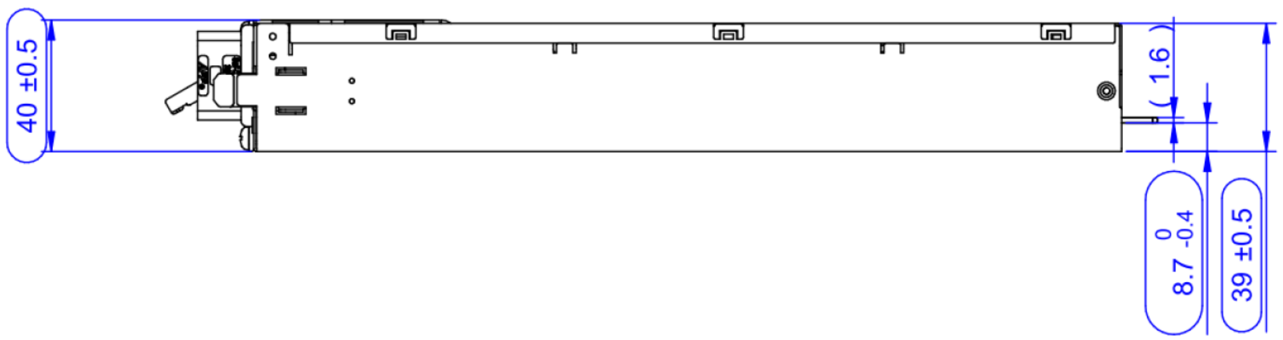

Figure 25 PSU side view

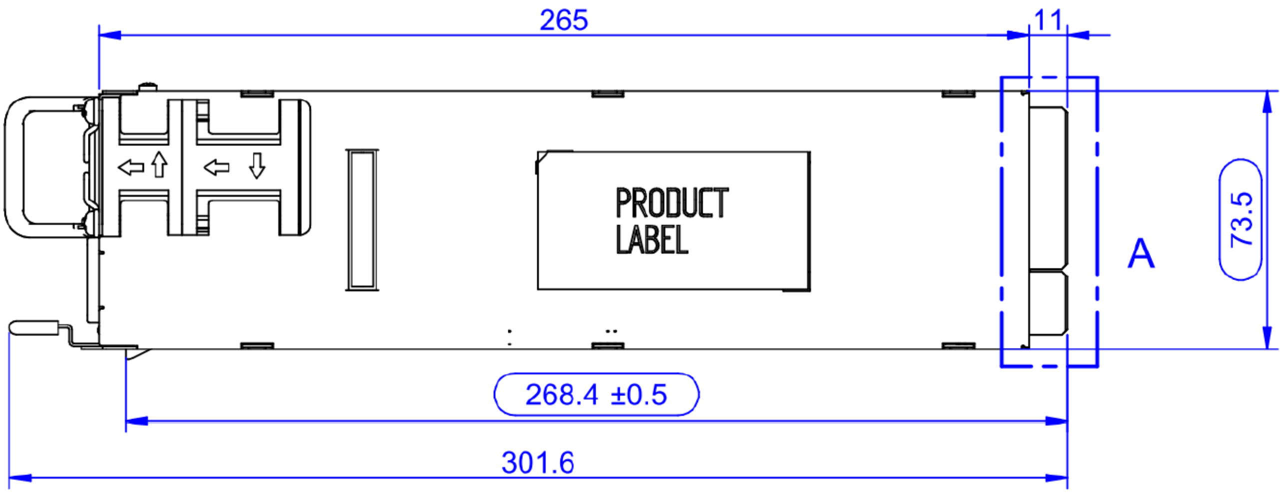

Figure 26 PSU top view

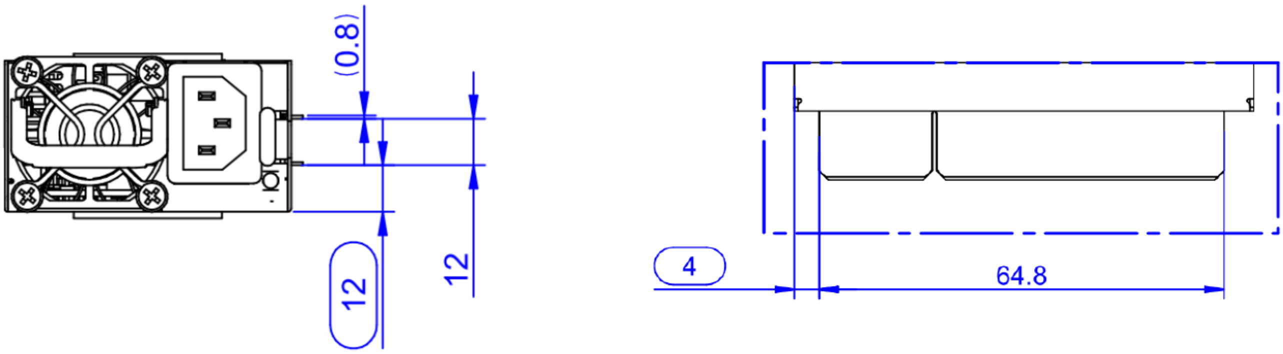

Figure 27 PSU front view (left), detail A of PSU edge connector (right)

5.1.2 PSU mating connector on power backplane

The mating connector on Open edge power distribution board is shown in Figure 28. The connector type is High Power Card Edge (FCI 10130248-005LF, or equivalent), having separate power (P) and signal (S) contact zones. Currently, these PSU's are available from multiple suppliers. Pin assignment of the connector is shown in Table 11.

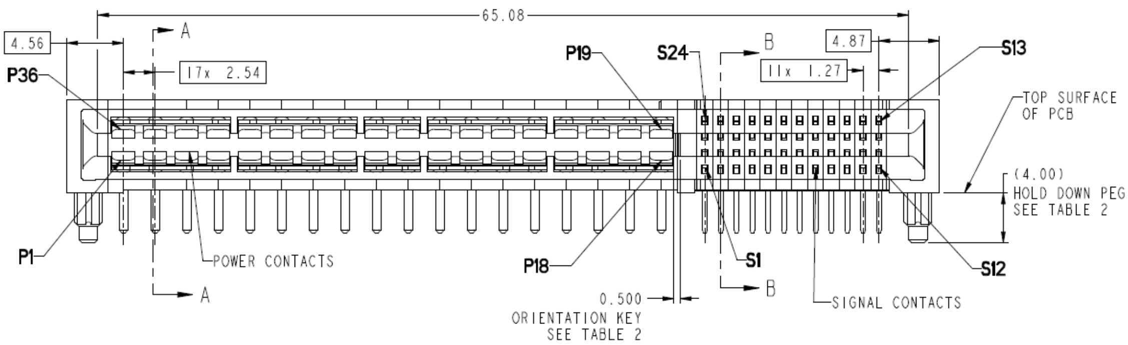

Figure 28 PSU mating connector

Table 11 Pin assignment of PSU mating connector on Open edge power distribution board (signal direction I/O/bidir from PDB perspective)

Pin	Signal name	Type	Description	Mating order *)
P1-P10	GND	Power	+12 VDC return, signal ground	1
P29-P36	GND	Power	+12 VDC return, signal ground	1
P11-P18	P12_PSU	Power	+12 VDC main input from PSU to PDB	2
P19-P28	P12_PSU	Power	+12 VDC main input from PSU to PDB	2
S1	PD_PSU_A0	Output	PMBUS address bit A0. The signal has pull-up in PSU. 1K pull-down to GND on PDB is used to set bit low.	2
S2	PD_PSU_A1	Output	PMBUS address bit A1. The signal has pull-up in PSU. 1K pull-down to GND on PDB is used to set bit low.	2
S3-S4	P12V_PSU_STBY	Power	+12 VDC stand-by input from PSU to PDB	2
S21-S22	P12V_PSU_STBY	Power	+12 VDC stand-by input from PSU to PDB	2
S5	PSU_HOTSTANDBYEN_H	Bidir	Hot standby enable output. Active-high. Connected to PSU_HOTSTANDBYEN_H signal of redundant PSU on PDB. Enables one of the PSUs to disable its output under certain load conditions to improve efficiency of the other PSU.	2
S6	PSU_ISHARE	Analog	Analog current share bus. Connected to PSU_ISHARE signal of redundant PSU on PDB.	2
S7	N.C.		Not connected	2
S8	FM_PSU_PRSNT_R_N	Input	Power supply seated. Active-low. The signal is connected to GND (through a 100 Ohm pull-down) in PSU. There is a 4K7 pull-up to P3V3_RMC_STBY on PDB to set the signal high if PSU is not present.	3
S9	PD_PSU_A2	Output	PMBUS address bit A2. The signal has pull-up in PSU. 1K pull-down to GND on PDB is used to set bit low.	2
S10-S15	GND	Power	+12 VDC return, signal ground	1
S16	PWR_PSU_PWROK_R	Input/ OD	Power OK signal from PSU to RMC. Active high. Open drain. The signal has pull-up in PSU.	2
S17	PSU_REMOTE_SENSE_P	Analog	Main output positive sense. The signal connects to P12_PSU for output regulation.	2
S18	PSU_REMOTE_SENSE_R	Analog	Main output negative sense.	2

			The signal connects to GND for output regulation.	
S19	RQ_PSU_ALERT_R_N	Input/ OD	Alert signal from PSU to RMC. Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on PDB board.	2
S20	PD_PSU_PSON_N		PSU on. Active-low. The signal has 1K pull-down to GND on PDB. PSU on/off control is done via PMBUS.	3
S23	SMB_PSU_SCL	Output/ OD	PMBUS clock from RMC to PSU/BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.	2
S24	SMB_PSU_SDA	Bidir/ OD	PMBUS data between RMC and PSU/BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.	2

*) 1 = first, 3 = last

5.2 Sled backplane power feed specifications

An Open edge sled design must allow safe removal and insertion without disturbing the rest of the system. All sled designs shall have a hot-swap controller (HSC) circuitry, such as the one used on Tioga Pass OCP server sled. The main tasks of the HSC include

- inrush current limiting during sled insertion and power-up
- overcurrent protection (OCP)
- under voltage protection (UVP), overvoltage protection OVP)
- voltage and current metering
- power metering

The following tables provide specifications for the voltage range, nominal current and over current protection limits for Open edge 1U and 2U sleds.

Table 12 Power feed specifications for 1U sled

Nominal input voltage	Minimum operating input voltage	Maximum operating input voltage	Maximum input current	Overcurrent limit, recommended
12.0 V DC	10.8 V DC	13.2 V DC	37 A	42 A

Table 13 Power feed specifications for 2U sled

Nominal input voltage	Minimum operating input voltage	Maximum operating input voltage	Maximum input current	Overcurrent limit, recommended
12.0 V DC	10.8 V DC	13.2 V DC	65 A	72 A

5.3 Grounding

Open edge chassis has two grounding points, one in the front and another in the rear side. Suitable grounding point can be selected based on the used rack and grounding solution. A grounding cable is connected to the chassis using a two-hole lug. Stud spacing is 16 mm and stud size 6 mm.

When DC power feed is used, grounding the chassis to site ground is mandatory. Grounding path is from PSU GND output to chassis via power distribution board.

The front and rear grounding points are shown in Figure 29.

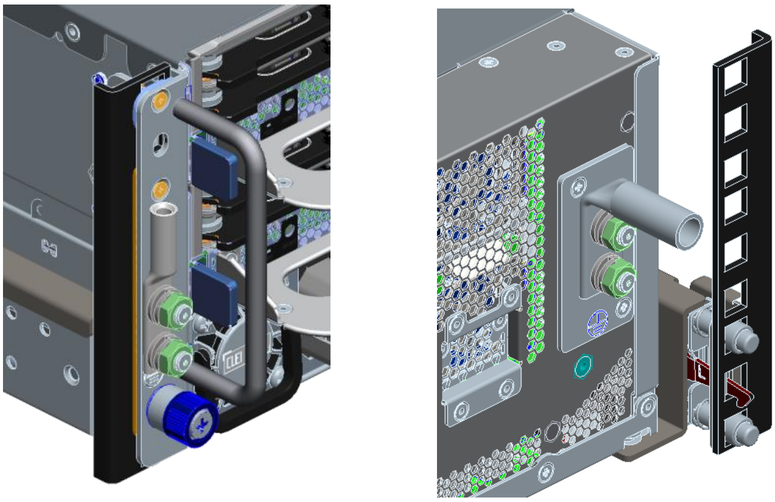

Figure 29 Open edge chassis front (left) and rear (right) grounding points

6 Chassis HW management

HW management functions of Open edge chassis are performed via the rack management controller (RMC) unit. The main task of RMC is to manage the PSUs. In addition, RMC provides management Ethernet connectivity to all sleds via a single interface.

Note, that other than providing Ethernet connectivity, RMC is not involved in HW management of sleds. Instead, it is the responsibility of a higher layer datacentre management software entity.

RMC is hot-swappable. In case the RMC is removed during a maintenance operation, PSUs and all sleds will continue to operate normally.

A high-level block diagram of RMC and the connectivity between RMC and sleds is shown in Figure 30.

6.1 Sled HW management

As mentioned above, RMC provides HW management connectivity to the sleds, but the responsibility of the management function lies elsewhere in the system. The RMC contains an unmanaged Ethernet switch that provides connectivity from the front panel to the BMC of all sleds and the microcontroller of RMC. The physical media within the chassis is 1000BASE-T. Magnetics are used on sleds.

There is also an SMBUS interface from RMC's microcontroller to the sleds that could act as a backup connection or it could be used for simple housekeeping tasks in case the sled has no BMC. In addition, there are few I/O pins connected from RMC to sleds for future use.

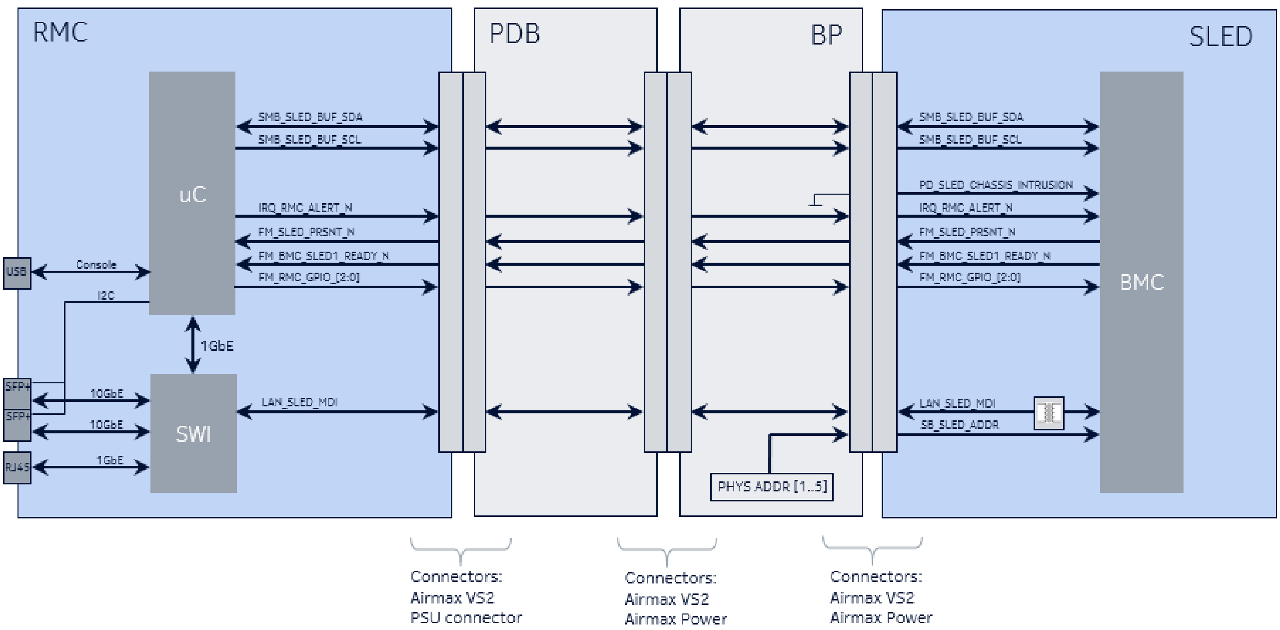

Figure 30 Sled HW management connectivity

In larger systems, multiple chassis can be chained together using the dual 10 Gbit/s Ethernet ports in the RMC front panel. This provides an alternative to using an external HW management switch to implement the required connectivity.

6.2 PSU HW management

HW management of PSUs is performed by the RMC unit. The interface is PMBUS and an alert/interrupt signal. In addition, PSUs indicate power OK/NOK using a hardwired signal. The RMC is powered from the stand-by power output of the PSUs.

The RMC monitors various PSU sensors, such as temperatures, input /output voltages, input /output currents, input power and fan speed. The RMC can also command a PSU to enter/exit stand-by mode and upgrade firmware.

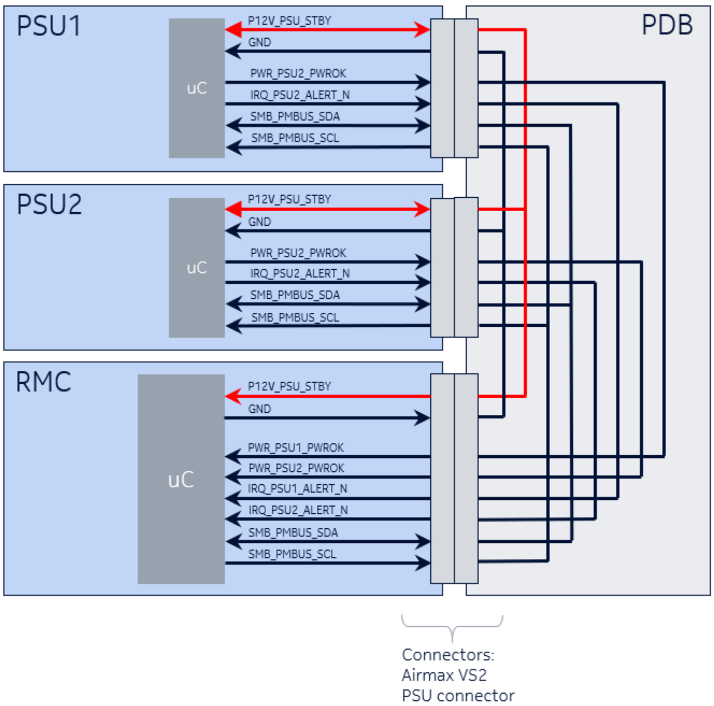

Figure 31 PSU management

6.3 RMC mechanics

The RMC consists of the circuit board and a metal enclosure. The RMC located on the right side of the PSUs, connecting to the power distribution board (PDB).

The outer dimensions of the RMC are shown in Table 14.

Table 14 Outer dimensions of the RMC

	Dimension, max
Height	41 mm
Width	58 mm
Depth	270 mm

6.4 RMC connector interface

The connector between the RMC and power distribution board is 8 x 13 AirMax VS2 (FCI 10133027-101LF, or equivalent). The corresponding connector on the RMC is FCI 10136593-102LF, or equivalent. The connector is shown in Figure 32.

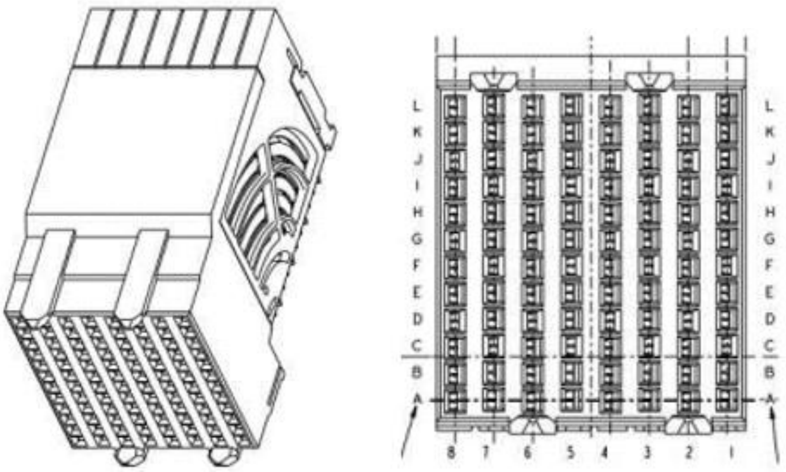

Figure 32 RMC signal connector with pin map

Pin assignment of the connector interface is shown in Table 15.

Table 15 Pin assignment of backplane signal connector

GND		GND		GND		GND		M
SMB_SLED_COMBINE_SDA	FM_SLED1_PRSNT_N	FM_RMC_GPIO_2	GND	LAN_SLED4_MDIP3	GND	LAN_SLED2_MDIN3	GND	L
SMB_SLED_COMBINE_SCL	IRQ_RMC_ALERT_N	FM_RMC_GPIO_1	LAN_SLED5_MDIP3	LAN_SLED4_MDIP3	LAN_SLED3_MDIP3	LAN_SLED2_MDIP3	LAN_SLED1_MDIP3	K
FM_PSU2_PRSNT_N	IRQ_PSU2_ALERT_N	FM_RMC_GPIO_0	LAN_SLED3_MDIN3	GND	LAN_SLED3_MDIN3	GND	LAN_SLED1_MDIN3	J
FM_BBU_PRSNT_N	GND	FM_BMC_SLED5_READY_N	GND	LAN_SLED4_MDIN2	GND	LAN_SLED2_MDIN2	GND	I
SMB_BBU_ALERT_N	IRQ_PSU1_ALERT_N	FM_BMC_SLED4_READY_N	LAN_SLED5_MDIN2	LAN_SLED4_MDIN2	LAN_SLED3_MDIN2	LAN_SLED2_MDIN2	LAN_SLED1_MDIN2	H
FM_PSU1_PRSNT_N	PWR_PSU2_PWROK	FM_BMC_SLED3_READY_N	LAN_SLED5_MDIP2	GND	LAN_SLED3_MDIP2	GND	LAN_SLED1_MDIP2	G
SMB_PMBUS_SDA	GND	FM_BMC_SLED2_READY_N	GND	LAN_SLED4_MDIP1	GND	LAN_SLED2_MDIN1	GND	F
SMB_PMBUS_SCL	PWR_PSU1_PWROK	FM_BMC_SLED1_READY_N	LAN_SLED5_MDIN1	LAN_SLED4_MDIN1	LAN_SLED3_MDIN1	LAN_SLED2_MDIP1	LAN_SLED1_MDIN1	E
GND	P12V_PSU_STBY	FM_SLED5_PRSNT_N	LAN_SLED5_MDIP1	GND	LAN_SLED3_MDIP1	GND	LAN_SLED1_MDIP1	D
P12V_PSU_STBY	GND	FM_SLED4_PRSNT_N	GND	LAN_SLED4_MDIP0	GND	LAN_SLED2_MDIN0	GND	C
P3V3_RMC_STBY	P12V_PSU_STBY	FM_SLED3_PRSNT_N	LAN_SLED5_MDIN0	LAN_SLED4_MDIN0	LAN_SLED3_MDIP0	LAN_SLED2_MDIP0	LAN_SLED1_MDIN0	B
GND	P12V_PSU_STBY	FM_SLED2_PRSNT_N	LAN_SLED5_MDIN0	GND	LAN_SLED3_MDIN0	GND	LAN_SLED1_MDIP0	A
8	7	6	5	4	3	2	1	

Table 16 RMC pin assignment in power distribution board (signal direction I/O/bidir from PDB perspective)

Signal	Type	Description
LAN_SLED[5..1]_MDIP[3..0] LAN_SLED[5..1]_MDIN[3..0]	Bidir	1000BASE-T between RMC and sled. Magnetics are required on sled baseboard.
FM_RMC_GPIO[2:0]	input	General purpose I/O signals driven by RMC to all sled baseboards. LVTTL/LVCMOS. The signal has 4K7 pull-up P3V3_RMC_STBY on RMC board. The input circuit design on sled shall prevent leakage current flow from RMC, e.g. during sled hot plug. GPIO[2:0] are used to indicate the status and air flow direction of PSUs to sleds according to the following table: 000: PSU1 not present, PSU0 front to rear (F-R) 001: PSU1 not present, PSU0 rear to front (R-F) 010: PSU0 not present, PSU1 F-R 011: PSU0 not present, PSU1 R-F 100: PSU0 /1 present, PSU0 /1 F-R 101: PSU0 /1 present, PSU0 /1 R-F 110: PSU0 /1 present, PSU0 F-R, PSU1 R-F 111: PSU0 /1 present, PSU0 R-F, PSU1 F-R
FM_BMC_SLED[5..1]_READY_N	Output/ OD	BMC status signal from sled to RMC. Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.

		The output circuit design on sled shall prevent leakage current flow from RMC, e.g. during sled hot plug.
FM_SLED1_PRSNT_N	Output	Sled presence status. Active low. The signal is used to inform RMC whether a sled is present in a slot. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
IRQ_RMC_ALERT_N	Input/ OD	Alert signal from RMC to sleds (common to all sleds). Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. The purpose of the signal is to provide means to alert sleds e.g. in case of PSU failure or low input voltage.
IRQ_PSU[2..1]_ALERT_N	Output/ OD	Alert signal from PSU to RMC. Active low. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on PDB board.
PWR_PSU[2..1]_PWROK	Output/ OD	Power OK signal from PSU to RMC. Active high. Open drain. The signal has pull-up in PSU.
SMB_SLED_COMBINE_SDA	Bidir/ OD	SMBUS data between RMC and sleds (common to all sleds). Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. An I2C buffer (PCA9617A, or equivalent) is required on sled to act as bus repeater and to prevent leakage current flow from RMC, e.g. during sled hot plug.
SMB_SLED_COMBINE_SCL	Input/ OD	SMBUS clock from RMC to sleds (common to all sleds). Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board. An I2C buffer (PCA9617A, or equivalent) is required on sled to act as a bus repeater and to prevent leakage current flow from RMC, e.g. during sled hot plug.
FM_BBU_PRSNT_N	Output	BBU presence signal to RMC. Active low. The signal is connected to GND on BBU board. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
SMB_BBU_ALERT_N	Output/ OD	Alert signal from BBU to RMC. Active low. Open drain The signal has 4K7 pull-up to P3V3_RMC_STBY on backplane board.

SMB_PMBUS_SDA	Bidir/ OD	PMBUS data between RMC and PSU/BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
SMB_PMBUS_SCL	Input/ OD	PMBUS clock from RMC to PSU/BBU. Open drain. The signal has 4K7 pull-up to P3V3_RMC_STBY on RMC board.
P12V_PSU_STBY	Power	+12 V standby voltage from PSUs to RMC. Power supply to RMC.
P3V3_RMC_STBY	Power	3V3 standby voltage from RMC to PDB (generated from P12V_PSU_STBY)
GND	Power	+12 V return, signal ground

7 Cooling

The open edge chassis supports both front-to-rear and rear-to-front cooling. The chassis does not have fans, instead fans are integrated on sleds and PSUs. The design of sleds and PSUs must support both air flow directions.

Rear wall of the chassis is perforated with honeycomb pattern in the areas shown in Figure 33. Perforation ratio is 64.4%. There are no air filters in Open edge HW.

Figure 33 Chassis rear wall with backplane in place, front view (top), rear view (bottom)

7.1 Thermal design considerations for sled

Each sled has its own, independent fan control. A sled must be able to operate at full specified capacity within the specified environmental conditions, including operating temperature, humidity and altitude.

Fan control must adapt to the environmental conditions in a way that provides adequate cooling with minimum fan power consumption and acoustic noise.

A sled must be able to tolerate failure of a single fan.

At high or low temperatures, the sled must remain operational as long as possible. A thermal shutdown should be performed only when critical temperature levels of components are exceeded. A shutdown should not be performed based on sled’s inlet temperature.

The height of Open edge sleds of 41 mm (1U) and 83.55 mm (2U) allow using single or dual rotor fan modules with heights 38/40 mm and 80 mm, respectively.

7.2 Air flow direction

Depending on the site installation requirements, e.g. concerning hot/cold isle arrangements of the equipment room, the direction of cooling air through the Open edge chassis may need to be configured to be either from front to rear or from rear to front.

Air flow direction of a sled should be selectable as a factory option. It is recommended that air flow direction is configurable also in the field, because sometimes the site requirements are not fully known at the time of ordering the HW. Also, for PSUs, field-configurability of air-flow direction is the preference, but if this is not feasible, different SKUs with different air flow options should be made available. SKU's with rear to front airflow must have red handles to visually reinforce the airflow.

The sled itself must be aware of the selected air flow direction and provide the information as a sensor value. When needed, the sled must automatically re-define the roles of sensors, e.g. inlet and outlet temperature sensors.

Typical Open edge sled designs may have hot-plug storage and networking interfaces in the front panel and the CPU and memories at the rear of the unit. Depending on air flow direction, components either get fresh or pre-heated cooling air. During sled development both air-flow directions shall be carefully evaluated. Any limitations to sled configurations, performance or environmental conditions shall be stated by the sled supplier.

8 Environmental and regulatory specifications

Edge servers can be in varying environments, where datacentre or central office-like conditions may not be always guaranteed. Hence environmental requirements are set slightly higher than for typical datacentre server products. Also, seismic tolerance is addressed.

Table 17 summarizes the key environmental and regulatory specifications for Open edge chassis and sleds.

NOTE: In order to meet all the key environmental and regulatory specifications, it is necessary to test an Open edge chassis together with sleds.

Table 17 Key environmental and regulatory specifications of Open edge chassis and sleds

	Specification
Operating conditions	Operating temperature range: -5 C …+45 C [ETSI EN300 019-1-3 Class 3.2] Short term operating temperature: -5 C to +55 C [GR-63-CORE] Operating humidity: 5 % to 95 %
Storage	ETSI EN 300 019-1-1, Class 1.2 (weather protected, not temperature-controlled storage)
Transport	ETSI EN 300 019-1-2, Class 2.2 (careful transportation)
Seismic tolerance	Earthquake risk zone 4 [GR-63-CORE]
Safety	IEC 62368-1:2014 GR-1089-CORE (electrical safety, grounding and bonding)
Fire resistance	GR-63-CORE (shelf level criteria)
EMC	EN300386 (v1.6.1) FCC CFR47 15 (class A), CISPR 22 (class A) CISPR 24 TEC/EMI/TEL-001/01/FEB-09 and TEC/IR/SWN-2MB/07/MAR-10 GR-1089-CORE
Acoustic noise	GR-63-CORE (equipment room criteria)
Material safety	RoHS 2011/65/EU, Article 7b (EN 50581, 2012)