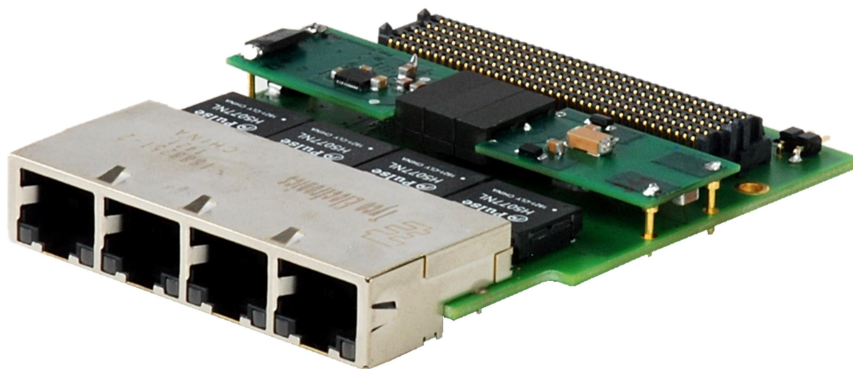# NAT-FMC-PoE
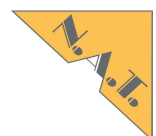
FMC ETHERNET SWITCH MODULE WITH PoE

DESIGNED BY N.A.T. GMBH

TECHNICAL REFERENCE MANUAL V1.0

HW REVISION 2.X

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. PREFACE

1.1. Disclaimer

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Note:

The release of the Hardware Manual is related to a certain HW board revision given in the document title. For HW revisions earlier than the one given in the document title please contact N.A.T. for the corresponding older Hardware Manual release.

1.2. About This Document

This document is intended to give an overview on the **NAT-FMC-PoE's** functional capabilities.

Preface

General information about this document

Introduction

Abstract on the **NAT-FMC-PoE's** main functionality and application field

Quick Start

Important information and mandatory requirements to be considered before operating the **NAT-FMC-PoE** for the first time

Functional Description

Detailed information on the individual devices and the **NAT-FMC-PoE's** main features

Hardware

Description of the connectors, switches, and LEDs located on the **NAT-FMC-PoE** Specifications and Compliances

Detailed list of specifications, abbreviations, and datasheets of components referred to in this document, as well as standards, the **NAT-FMC-PoE** complies to

Document's History

Revision record

Note:

It is assumed, that the **NAT-FMC-PoE** is handled by qualified personnel only!

2. INTRODUCTION

The **NAT-FMC-PoE** is an Ethernet switch module in FMC standard with support for PoE (Power over Ethernet). It is intended to be used on a powerful FPGA based FMC carrier board such as the **NAT-AMC-ZYNQUP-FMC**.

Figure 1 – NAT-FMC-PoE mounted on an FMC carrier board
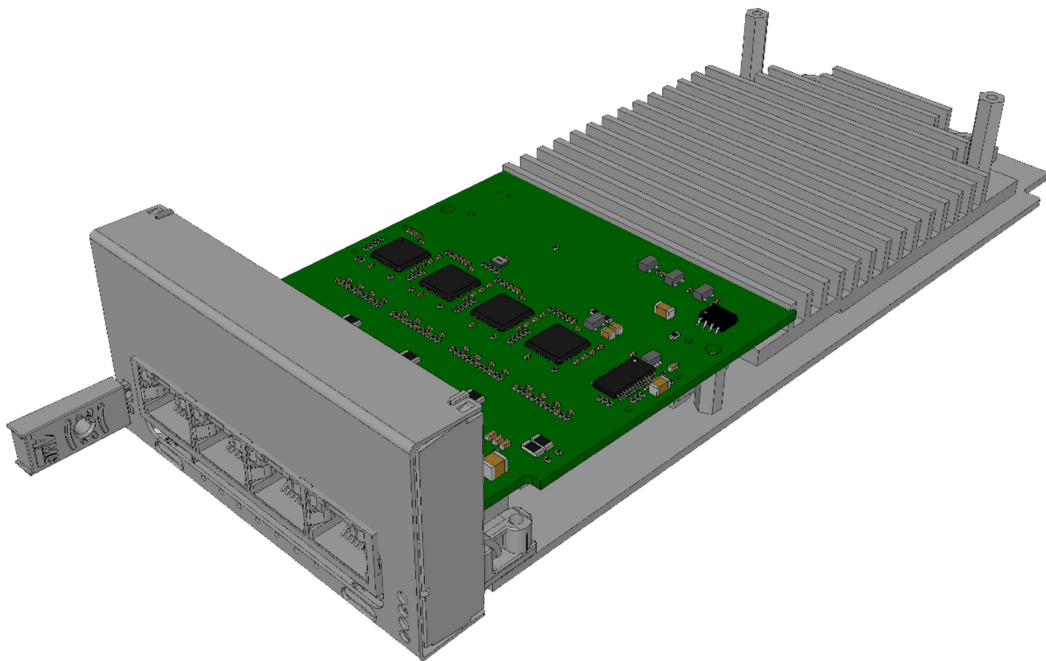
For detailed information on the carrier, please refer to chapter 6.1 Internal Reference Documentation.

2.1. Basic Functionality

Due to their high-speed interconnect topology, FMC modules are the ideal platforms to aggregate and process high bandwidth data streams as provided i.e. by camera links and video streams.

2.2. Applications

As part of the **NATvision** system, which is a complete environment for the development and deployment of sophisticated image and high performance video processing applications, the **NAT-FMC-PoE** is the perfect choice for first level picture or video processing/analysis.

NAT-FMC-P0E

2.3.   Main Features

Table 1 – Technical Data

Form Factor	
	• FPGA Mezzanine Card (FMC)
Physical Layer Circuitry	
	• 4x Marvell Alaska 88E1514 Ethernet Transceiver
	• Texas Instruments Quad Port Power-over-Ethernet PSE Controller
Front Panel	
	• 4x RJ45 connectors with PoE support
	• 20W in total with internal power supply
	• 50W in total with additional auxiliary power (sufficient cooling assumed)
Compliance	
	• IEEE 802.3af
	• FMC Vita 57.1
Environmental	
Operating Environment	• Default: 0°C to +55 °C (with conduction cooling)
	• Humidity: 10% to 90% at +55°C (non-condensing)
Storage Environment	• Default: -40°C to +85°C
	• Humidity: 5% to 95% (non-condensing)

3. QUICK START

To ensure proper functioning of the **NAT-FMC-PoE** during its usual lifetime, take the following precautions before handling the board.

3.1. Unpacking

Electrostatic discharge, incorrect board installation, and uninstallation can damage circuits or shorten their lifetime. Before touching integrated circuits ensure to take all required precautions for handling electrostatic devices.

Avoid touching gold contacts of the connectors to ensure proper contact when mounting the **NAT-FMC-PoE** onto the carrier board.

Make sure that the board and its attachments are undamaged and complete according to delivery note.

3.2. Mechanical Requirements

The **NAT-FMC-PoE** is intended to be operated on an FMC carrier board in AMC form factor. Besides this carrier module, the installation requires an µTCA-Backplane for connecting the carrier AMC, a power supply, and cooling devices.

Before installing or uninstalling the **NAT-FMC-PoE**, read the Installation Guide and the User's Manual of the carrier board used, and of the µTCA system the board will be plugged into.

Check all installed boards and modules for steps that you have to take before turning on or off the power. After taking those steps, turn on or off the power if necessary.

Make sure the part to be installed / removed is hot-swap-capable, if you do not switch off the power.

Ensure that the **NAT-FMC-PoE** is connected to the carrier board with the connector completely inserted.

When operating the board in areas of strong electromagnetic radiation, ensure that the module is bolted to the front panel or rack, and shielded by closed housing.

NAT-FMC-PoE

3.3. Voltage Requirements

3.3.1. Power supply

The power supply for the **NAT-FMC-PoE** provided by the carrier module must meet the following specifications:

+3.3V / 0.5A max.

+12V / 2A (if the PoE option is assembled)

3.3.2. Hot-Swap

It depends on the used FMC carrier, if hot swapping is supported. Please refer to the carrier's installation guide for more information.

NAT-FMC-PoE

4. FUNCTIONAL DESCRIPTION

The structure of the **NAT-FMC-PoE** is rather basic. The following figure gives an overview on the functional blocks.

Figure 2 – Block Diagram
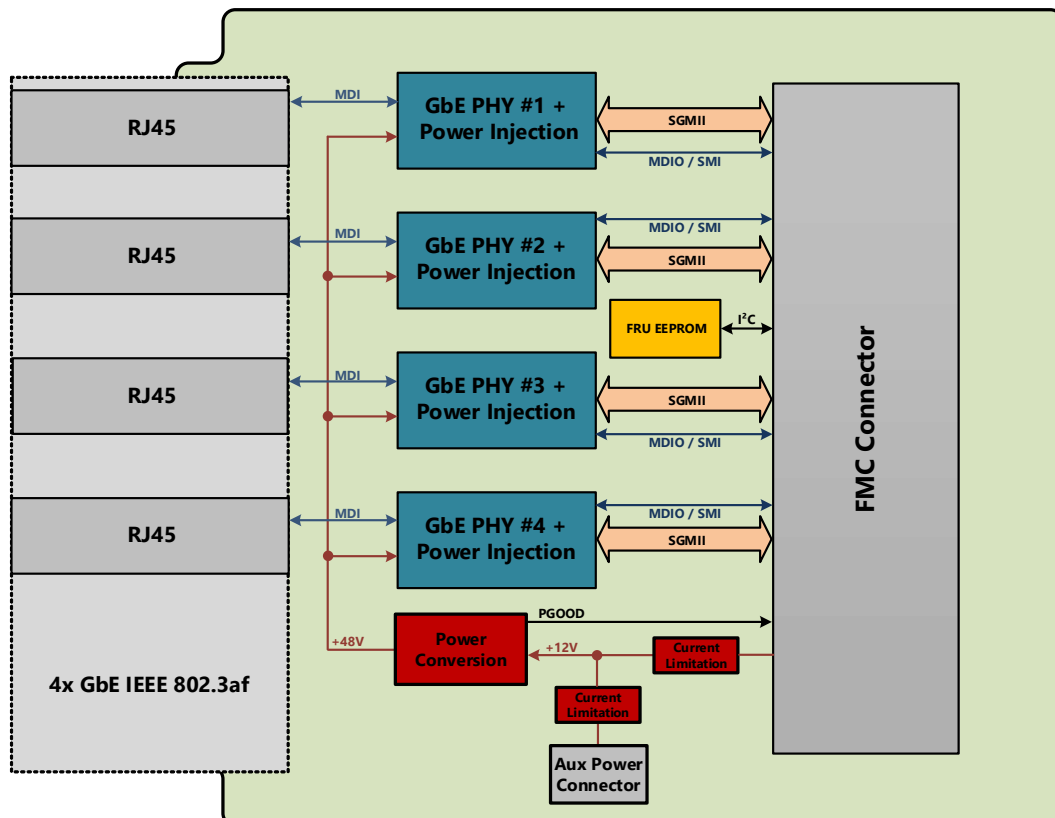
The **NAT-FMC-PoE** is equipped with four RJ45 ports, which offer four GbE-Links with PoE function towards the front panel.

The module features a high-efficient power conversion. The interface complies with the IEEE802.3af standard.

Please note: In case the **NAT-FMC-PoE** is operated with internal power supply via the FMC connector only, the maximum PoE power for all four ports is 20W in total. With additional power feed via the +12V Aux Power Connector, total power increases to 50W if sufficient cooling is provided.

For more information, please refer to chapter 6.2 External Reference Documentation.

NAT-FMC-PₒE

5. HARDWARE

5.1. Front Panel and LEDs

Please note: The **NAT-FMC-PoE** does *not* have an own front panel; the four RJ45 connectors are accessible via a slot in the carrier board's faceplate.

The module features two LEDs in each RJ45 connector, the behaviour is described in the table below.

Table 2 – LED Behaviour

LED	Colour	Controlled by	Function
LEDx1	Green	PHY	ON: no link OFF: Link established
LEDx2	Yellow	PHY	ON: PoE active OFF: no PoE

Note: 'x' is a wildcard for the respective connector A-D

NAT-FMC-PoE

5.2. Component-, Connector-, and Switch-Location

Figure 3 – Location Diagram – Top
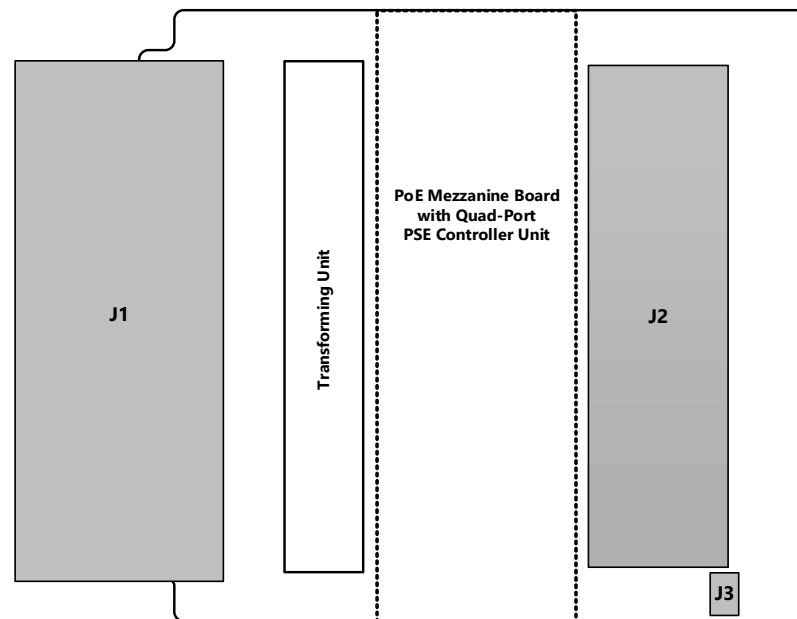
Figure 4 – Location Diagram – Bottom
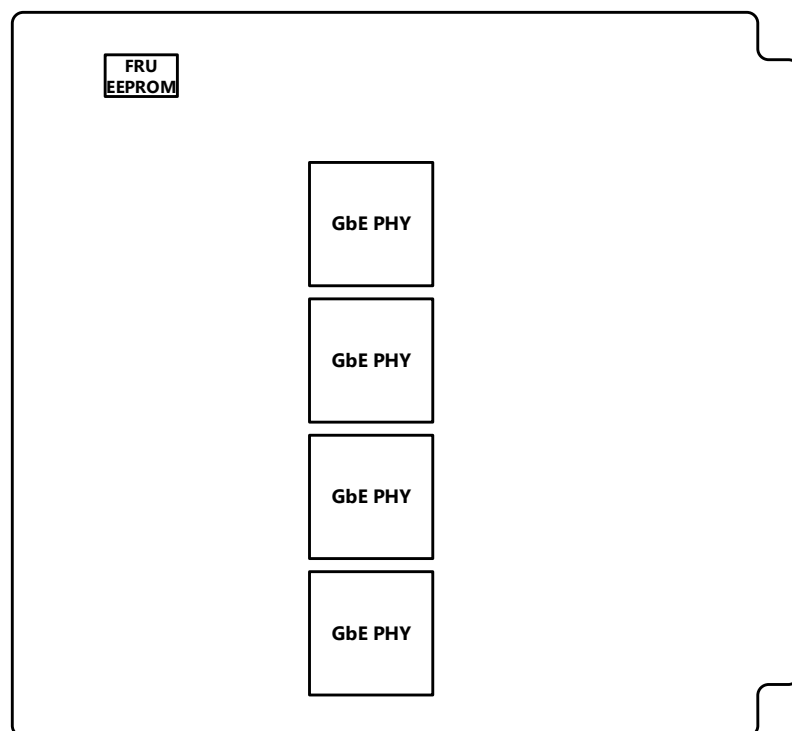
Connectors on top side: drawings imply the board is orientated with the front panel to the ***left*** side

Connectors on bottom side: drawings imply the board is orientated with the front panel to the ***right*** side

Please refer to the following tables to look up the connector pin assignment of the **NAT-FMC-PoE**.

5.2.1. J1 A-D: RJ45 Connectors

Connectors J1 A-D offer four Ethernet interfaces with PoE support towards the front panel.

Table 3 – J1x: RJ45 Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
x1	MAG1_P	LEDx1_GRN	x9
x2	MAG1_N	+48V	x10
x3	MAG2_P	LEDx2_YEL	x11
x4	MAG3_P	+48V	x12
x5	MAG3_N		
A6	MAG2_N		
x7	MAG4_P		
x8	MAG4_N		

Note: 'x' is a wildcard for the respective connector A-D

NAT-FMC-PoE

5.2.2. J2: FMC Connector

Connector J2 connects the **NAT-FMC-PoE** with the carrier board.

Table 4 – J2: FMC Connector – Pin Assignment

	A	B	C	D	E	F	G	H	J	K
1	GND	GND	GND	SIG.PG_C2M	GND	SIG.PG_M2C	GND	nc	GND	nc
2	PHY2.RX_P	GND	PHY1.TX_P	GND	nc	GND	nc	GND	nc	GND
3	PHY2.RX_N	GND	PHY1.TX_N	GND	nc	GND	nc	GND	nc	GND
4	GND	nc	GND	GBTCLK0_M2C_p	GND	nc	GND	nc	GND	nc
5	GND	nc	GND	GBTCLK0_M2C_n	GND	nc	GND	nc	GND	nc
6	PHY3.RX_P	GND	PHY1.RX_P	GND	nc	GND	nc	GND	nc	GND
7	PHY3.RX_N	GND	PHY1.RX_N	GND	nc	nc	nc	nc	nc	nc
8	GND	nc	GND	nc	GND	nc	GND	nc	GND	nc
9	GND	nc	GND	nc	nc	GND	PHY3.MDIO	GND	nc	GND
10	PHY4.RX_P	GND	PHY1.MDIO	GND	nc	nc	nc	nc	nc	nc
11	PHY4.RX_N	GND	PHY1.MDC	PHY4.MDIO	GND	nc	GND	nc	GND	nc
12	GND	nc	GND	PHY4.MDC	nc	GND	nc	GND	nc	GND
13	GND	nc	GND	GND	nc	nc	nc	nc	nc	nc
14	nc	GND	PHY2.MDIO	PHY1_INTn	GND	nc	GND	nc	GND	nc
15	nc	GND	PHY2.MDC	PHY2_INTn	nc	GND	nc	GND	nc	GND
16	GND	nc	GND	GND	nc	nc	nc	nc	nc	nc
17	GND	nc	GND	PHY3_INTn	GND	nc	GND	nc	GND	nc
18	nc	GND	PHY3.MDIO	PHY4_INTn	nc	GND	nc	GND	nc	GND
19	nc	GND	PHY3.MDC	GND	nc	nc	nc	nc	nc	nc
20	GND	nc	GND	nc	GND	nc	GND	nc	GND	nc

NAT-FMC-PoE

|	A	B	C	D	E	F	G	H	J	K
21	GND	nc	GND	nc	nc	GND	nc	GND	nc	GND
22	PHY2.TX_P	GND	nc	GND	nc	nc	nc	nc	nc	nc
23	PHY2.TX_N	GND	nc	PHY_RSTn	GND	nc	GND	nc	GND	nc
24	GND	nc	GND	nc	nc	GND	nc	GND	nc	GND
25	GND	nc	GND	GND	nc	nc	nc	nc	nc	nc
26	PHY3.TX_P	GND	nc	nc	GND	nc	GND	nc	GND	nc
27	PHY3.TX_N	GND	nc	nc	nc	GND	nc	GND	nc	GND
28	GND	nc	GND	GND	nc	nc	nc	nc	nc	nc
29	GND	nc	GND	nc	GND	nc	GND	nc	GND	nc
30	PHY4.TX_P	GND	SIG.SCL	nc	nc	GND	nc	GND	nc	GND
31	PHY4.TX_N	GND	SIG_SDA	nc	nc	nc	nc	nc	nc	nc
32	GND	nc	GND	3P3VAUX	GND	nc	GND	nc	GND	nc
33	GND	nc	GND	nc	nc	GND	nc	GND	nc	GND
34	nc	GND	SIG.GA0	nc	nc	nc	nc	nc	nc	nc
35	nc	GND	12POV	SIG.GA1	GND	nc	GND	nc	GND	nc
36	GND	nc	GND	3P3V	nc	GND	nc	GND	nc	GND
37	GND	nc	12POV	GND	nc	nc	nc	nc	nc	nc
38	nc	GND	GND	3P3V	GND	nc	GND	nc	GND	nc
39	nc	GND	3P3V	GND	VADJ	GND	VADJ	GND	VIO_B_M2C	GND
40	GND	nc	GND	3P3V	GND	VADJ	GND	VADJ	GND	VIO_B_M2C

NAT-FMC-PoE

5.2.3. J3: AUX Power Connector

J3 offers an external power connector located on the PCB.

Figure 5 – J3: AUX Power Connector

```
   4    3
   ■    ■
   ■    ■
   2    1
```
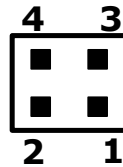
Table 5 – J3: AUX Power Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	12V	12V	2
3	GND	GND	4

6. SPECIFICATIONS AND COMPLIANCES

6.1. Internal Reference Documentation

Please find our internal reference documentation on our website by choosing the desired product or solution: https://www.nateurope.com

- **NAT-AMC-ZYNQUP-FMC**
- **NATvision**

6.2. External Reference Documentation

- Marvell Alaska Gigabit Ethernet Transceiver, Doc. No. MV-S107146-U0, Rev. B, February 23, 2018
- Texas Instruments Quad Port Power-over-Ethernet PSE Controller – SLUSBX9I – 07/2019

6.3. Standards Compliance

- IEEE 802.3af
- FMC Vita 57.1

6.4. Compliance to RoHS Directive

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" (RoHS) predicts that all electrical and electronic equipment being put on the European market after June 30th, 2006 must contain lead, mercury, hexavalent chromium, poly-brominated biphenyls (PBB) and poly-brominated diphenyl ethers (PBDE) and cadmium in maximum concentration values of 0.1% respective 0.01% by weight in homogenous materials only.

As these hazardous substances are currently used with semiconductors, plastics (i.e. semi-conductor packages, connectors) and soldering tin any hardware product is affected by the RoHS directive if it does not belong to one of the groups of products exempted from the RoHS directive.

Although many of hardware products of N.A.T. are exempted from the RoHS directive it is a declared policy of N.A.T. to provide all products fully compliant to the RoHS directive as soon as possible. For this purpose since January 31st, 2005 N.A.T. is requesting RoHS compliant deliveries from its suppliers. Special attention and care has been paid to the production cycle, so that wherever and whenever possible RoHS components are used with N.A.T. hardware products already.

6.5. Compliance to WEEE Directive

Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) predicts that every manufacturer of electrical and electronical equipment which is put on the European market has to contribute to the reuse, recycling and other forms of recovery of such waste so as to reduce disposal. Moreover this directive refers to the Directive 2002/95/EC of the European Commission on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

Having its main focus on private persons and households using such electrical and electronic equipment the directive also affects business-to-business relationships. The directive is quite restrictive on how such waste of private persons and households has to be handled by the supplier/manufacturer; however, it allows a greater flexibility in business-to-business relationships. This pays tribute to the fact with industrial use electrical and electronical products are commonly integrated into larger and more complex environments or systems that cannot easily be split up again when it comes to their disposal at the end of their life cycles.

As N.A.T. products are solely sold to industrial customers, by special arrangement at time of purchase the customer agreed to take the responsibility for a WEEE compliant disposal of the used N.A.T. product. Moreover, all N.A.T. products are marked according to the directive with a crossed out bin to indicate that these products within the European Community must not be disposed with regular waste.

If you have any questions on the policy of N.A.T. regarding the 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" (RoHS) or the Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) please contact N.A.T. by phone or e-mail.

6.6. Compliance to CE Directive

Compliance to the CE directive is declared. A 'CE' sign can be found on the PCB.

6.7. Compliance to REACH

The REACH EU regulation (Regulation (EC) No 1907/2006) is known to N.A.T. GmbH. N.A.T. did not receive information from their European suppliers of substances of very high concern of the ECHA candidate list. Article 7(2) of REACH is notable as no substances are intentionally being released by NAT products and as no hazardous substances are contained. Information remains in effect or will be otherwise stated immediately to our customers.

NAT-FMC-PoE

6.8. Abbreviation List

Table 6 – Abbreviation List

Abbreviation	Description
AMC	Advanced Mezzanine Card
EEPROM	Electrically Erasable Programmable Read Only Memory
FMC	FPGA Mezzanine Card
FPGA	Field Programmable Gate Array
FRU	Field Replaceable Unit
GbE	Gigabit Ethernet
µTCA	Micro Telecommunications Computing Architecture
PCB	Printed Circuit Board
PoE	Power over Ethernet

7. DOCUMENT'S HISTORY

Table 7 – Document's History

Rev	Date	Description	Author
1.0	26.09.2019	initial release	se
	8.10.2019	Fotos updated	se
	13.02.2020	Updated to new layout Added reference to NAT-AMC-ZYNQUP-FMC	se
	16.03.2023	Updated to HW V2.0	se