COMMSCOPE®

Repeaters

Node AM4
4 slots

Network Elements

Manual
MF0121ACP

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Andrew Wireless Systems GmbH, 30-August-2018

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FIGURES AND TABLES

1. General

1.1. Used Abbreviations

3GPP	3rd Generation Partnership Project
BCCH	Broadcast Control Channel
BTS	Base Transceiver Station
CDMA	Code Division Multiple Access
DAS	Distributed Antenna System
DL	Downlink
DoC	Declaration of Conformity
EDGE	Enhanced Data Rates for GSM Evolution
ESD	Electrostatic Discharge
FRU	Field Replaceable Unit
GPS	Global Positioning System
GSM	Global System for Mobile Communication
I2C-Bus	Inter-Integrated Circuit Bus (Philips)
ID No	Identification Number
ISDE	Innovation, Sciences et Développement économique Canada
ISED	Innovation, Science and Economic Development Canada; formerly IC / Industry Canada
LAN	Local Area Network
LED	Light Emitting Diode
LNA	Low Noise Amplifier
MCC	Mobile Country Code
MIMO	Multiple Input Multiple Output
MNC	Mobile Network Code
MS	Mobile Station
OMC	Operation and Maintenance Center
PA	Power Amplifier
PCS	Personal Communication System
PSU	Power Supply Unit
QoS	Quality of Service
RED	Radio Equipment Directive
Rev	Revision
RF	Radio Frequency
RoHS	Directive on Restriction of certain Hazardous Substances
RSSI	Receive Signal Strength Indication
RX	Receiver
TDMA	Time Division Multiple Access
TX	Transmitter
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UPS	Uninterruptable Power Supply
VSWR	Voltage Standing Wave Ratio
WCDMA	Wide Code Division Multiple Access
WEEE	Waste Electrical and Electronic Equipment (Directive)

1.2. Health and Safety

1. **Danger: Electrical hazard. Danger of death or fatal injury from electrical current. Obey all general and regional installation and safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.**

2. **Danger: Electrical hazard. Danger of death or fatal injury from electrical current inside the unit in operation. Before opening the unit, disconnect mains power.**

3. **Caution:** High frequency radiation in operation. Risk of health hazards associated with radiation from the unit's inner conductor of the antenna port(s). Disconnect mains before connecting or replacing antenna cables.

4. **Caution:** High frequency radiation in operation. Risk of health hazards associated with radiation from the antenna(s) connected to the unit. Implement prevention measures to avoid the possibility of close proximity to the antenna(s) while in operation.

1.3. Property Damage Warnings

1. **Attention:** Due to power dissipation, the unit may reach a very high temperature. Do not operate this equipment on or close to flammable materials. Use caution when servicing the unit.
2. **Attention:** Only authorized and trained personnel are allowed to open the unit and get access to the inside.
3. **Notice**: Although the unit is internally protected against overvoltage, it is strongly recommended to ground (earth) the antenna cables close to the antenna connectors of the unit for protection against atmospheric discharge. In areas with strong lightning, it is strongly recommended to install additional lightning protection.

4. **Notice**: ESD precautions must be observed. Before commencing maintenance work, use the available grounding (earthing) system to connect ESD protection measures.
5. **Notice:** Only suitably qualified personnel are allowed to work on this unit and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual.
6. **Notice:** Keep operating instructions within easy reach and make them available to all users.
7. **Notice:** Read and obey all the warning labels attached to the unit. Make sure that all warning labels are kept in a legible condition. Replace any missing or damaged labels.

8. **Notice:** Only license holders for the respective frequency range are allowed to operate this unit.

9. **Notice**: Make sure the repeater settings are correct for the intended use (refer to the manufacturer product information) and regulatory requirements are met. Do not carry out any modifications or fit any spare parts, which are not sold or recommended by the manufacturer.

1.4. Compliance

1. **Attention:** In order to meet the Conducted Emissions requirement according to EN 61000-6-3, the following conditions must be fulfilled for units with PSU DC 680 W or PSU DC 780 W:
   a) The connecting cable to the DC voltage source must be less than 30 m long.
   b) For connecting cables >30m, special material requirements must be observed, e.g. a shielded two-wire line must be used as the input lead or a metal cable channel/installation conduit must be used for installing the input lead.

2. **Notice:** For installations, which have to comply with FCC RF exposure requirements, the antenna selection and installation must be completed in a way to ensure compliance with those FCC requirements. Depending on the RF frequency, rated output power, antenna gain, and the loss between the unit and antenna, the minimum distance D to be maintained between the antenna location and human beings is calculated according to this formula:

$$D_{[cm]} = \sqrt{\frac{P_{[mW]}}{4 * \pi * PD_{[mW/cm^2]}}}$$

   where

   - P (mW) is the radiated power at the antenna, i.e. the max. rated unit output power in addition to the antenna gain minus the loss between the unit and the antenna.
   - PD (mW/cm²) is the allowed Power Density limit acc. to 47 CFR 1.1310 (B) for general population / uncontrolled exposures which is
     - F (MHz) / 1500 for frequencies from 300MHz to 1500MHz
     - 1 for frequencies from 1500MHz to 100,000MHz

   RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3).

   For FCC compliance and meeting the UL requirement of 1 watt EIRP max. for the AWS uplink band, the type of donor antenna must be selected in way not to exceed the 1 watt EIRP. Selection of antenna type and execution of installation has to be done in accordance to relevant FCC part and is in responsibility of the installer.

3. **Notice:** For installations which have to comply with European EN50385 exposure compliance requirements, the following Power Density limits/guidelines (mW/cm²) according to ICNIRP are valid:
    - 0.2 for frequencies from 10 MHz to 400 MHz
    - F (MHz) / 2000 for frequencies from 400 MHz to 2 GHz
    - 1 for frequencies from 2 GHz to 300 GHz

4. **Notice:** For installations which have to comply with FCC/ISED requirements:

English:

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

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Information can be obtained at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Antenna Stmt for ISED:

This device has been designated to operate with the antennas having a maximum gain of 9 dBi. Antennas having a gain greater than 9 dBi are prohibited for use with this device without consent by ISED regulators. The required antenna impedance is 50 ohms.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 100 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

French:

Cet appareil est conforme à FCC Partie15. Son utilisation est soumise à Les deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter Toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s'assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada. Les informations peuvent être obtenues: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-fra.php

Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorité de l'utilisateur à utiliser cet équipement.

Antenne Stmt pour ISDE:

Ce dispositif a été désigné pour fonctionner avec les antennes ayant un gain maximal de 9 dBi. Antennes ayant un gain plus grand que 9 dBi sont interdites pour une utilisation avec cet appareil sans le consentement des organismes de réglementation d'ISDE. L'impédance d'antenne requise est 50 ohms.

L'antenne (s) utilisé pour cet émetteur doit être installé pour fournir une distance de séparation d'au moins 100 cm de toutes les personnes et ne doit pas être co-localisées ou opérant en conjonction avec une autre antenne ou émetteur. Les utilisateurs et les installateurs doivent être fournis avec des instructions d'installation de l'antenne et des conditions de fonctionnement de l'émetteur pour satisfaire la conformité aux expositions RF.

5. **Notice:** Installation of this equipment is in full responsibility of the installer, who has also the responsibility, that cables and couplers are calculated into the maximum gain of the antennas, so that this value, which is filed in the FCC Grant and can be requested from the FCC data base, is not exceeded. The industrial boosters are shipped only as a naked booster without any installation devices or antennas as it needs for professional installation.

6. **Notice:** Corresponding local particularities and regulations must be observed. For national deviations, please refer to the respective documents included in the manual CD that is delivered with the unit.

7. **Notice:** The unit complies with Overvoltage Category II. It also complies with the surge requirement according to EN 61000-4-5 (fine protection); however, installation of an additional medium (via local supply connection) and/or coarse protection (external surge protection) is recommended depending on the individual application in order to avoid damage caused by overcurrent.

   For Canada and US, components used to reduce the Overvoltage Category shall comply with the requirements of IEC 61643-series. As an alternative, components used to reduce the Overvoltage Category may comply with ANSI/IEEE C62.11, CSA Certification Notice No. 516, CSA C22.2 No. 1, or UL 1449. Suitability of the component for the application shall be determined for the intended installation.

8. **Note:** For a Class A digital device or peripheral:
   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.

9. **Note:** For a Class B digital device or peripheral:
   This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference.

10. **Note:** This unit complies with European standard EN60950-1 / EN62368-1.

11. **Note:** This unit must be installed in areas with restricted access for skilled employees only.

Equipment Symbols Used / Compliance

Please observe the meanings of the following symbols used in our equipment and the compliance warnings:

Symbol	Compliance	Meaning / Warning
---	FCC	For industrial (Part 20) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.
		For (Part 90) signal booster: WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.
		For AWS-3: To fulfill the FCC the UL requirement of 1 Watt EIRP max. for the AWS uplink band, the type of donor antenna must be selected in a way not to exceed the 1 Watt EIRP. Antenna type selection and execution of installation, i.e. the maximum antenna height of 10m must not be exceeded, has to be done in accordance to the relevant FCC part and is in responsibility of the installer. For stationary application, an operation in the UL band 1755 to 1780 MHz is strictly prohibited by FCC.
---	ISED	WARNING: This is NOT a CONSUMER device. It is designed for installation by an installer approved by an ISED licensee. You MUST have an ISED LICENCE or the express consent of an ISED licensee to operate this device. AVERTISSEMENT: Ce produit N'EST PAS un appareil de CONSOMMATION. Il est conçu pour être installé par un installateur approuvé par un titulaire de licence d'ISDE. Pour utiliser cet appareil, vous DEVEZ détenir une LICENCE d'ISDE ou avoir obtenu le consentement exprès d'un titulaire de licence autorisé par ISDE.

Symbol	Compliance	Meaning / Warning
CE	CE	To be sold exclusively to mobile operators or authorized installers – no harmonized frequency bands, operation requires license. Intended use: EU and EFTA countries
		Indicates conformity with the RED directive 2014/53/EU and/or RoHS directive 2011/65/EU.
CE 0700	CE	Indicates conformity with the RED directive 2014/53/EU and RoHS directive 2011/65/EU certified by the notified body no. 0700.

WEEE Recycling

Country specific information about collection and recycling arrangements per the Waste Electrical and Electronic Equipment (WEEE) Directive and implementing regulations is available on CommScope's website.

http://www.commscope.com/About-Us/Corporate-Responsibility-and-Sustainability/Environment/#recycling

Required Antenna Distances

Node AM/A+	Antenna gain without cable loss [dBi]	Maximum Distance			
		FCC		ISED	
		m	inches	m	inches
DCM AF 1727E	9	.251	9.88	.386	15.19

1.5. About CommScope

CommScope is the foremost supplier of one-stop, end-to-end radio frequency (RF) solutions. Part of the *CommScope* portfolio are complete solutions for wireless infrastructure from top-of-the-tower base station antennas to cable systems and cabinets, RF site solutions, signal distribution, and network optimization. For patents see www.cs-pat.com.

CommScope has global engineering and manufacturing facilities. In addition, it maintains field engineering offices throughout the world.

Andrew Wireless Systems GmbH based in Buchdorf/Germany, which is part of *CommScope*, is a leading manufacturer of coverage equipment for mobile radio networks, specializing in high performance, RF and optical repeaters. Our optical distributed networks and RF repeater systems provide coverage and capacity solution for wireless networks in both indoor installations and outdoor environments, e.g. tunnels, subways, in-trains, airport buildings, stadiums, skyscrapers, shopping malls, hotels and conference rooms.

Andrew Wireless Systems GmbH operates a quality management system in compliance with the requirements of ISO 9001 and TL 9000. All equipment is manufactured using highly reliable material. To maintain highest quality of the products, comprehensive quality monitoring is conducted at all fabrication stages. Finished products leave the factory only after a thorough final acceptance test, accompanied by a test certificate guaranteeing optimal operation.

Hereby Andrew Wireless Systems declares that the radio equipment type Repeater is in compliance with Directive 2014/53/EU.
The full text of the EU declaration is available at the following internet address: www.commscope.com/collateral/Declarations_of_Conformity/.

According to the DoC, our "CE"-marked equipment can be used in all member states of the European Union.

Note: **Exceptions of and national deviations from this intended use may be possible. To observe corresponding local particularities and regulations, please refer to the respective documents (also in national language) which are included in the manual CD delivered.**

To make the most of this product, we recommend you carefully read the instructions in this manual and commission the system only according to these instructions.

For technical assistance and support, please also contact the local office or *CommScope* directly at one of the addresses listed in the following chapter.

1.6. International Contact Addresses for Customer Support

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2. Introduction

2.1. Purpose

Wireless communication systems provide a two-way information transfer (voice and data) between a base station and multiple mobiles within a given area.

Repeaters are used to extend the transmission range if weak signal transmissions occur within the coverage area due to indoor applications, topological conditions or distance from the transmitter. In the downlink path, the repeater picks up the signal from a donor antenna of an existing cell, amplifies and re-transmits it into the required dark spot. In the uplink direction, the repeater receives signals from mobile stations present in its coverage area and re-transmits the signals to the corresponding base station.

In the downlink (DL), the Node AM4 picks up signals coming from the base station, filters them, amplifies them, and retransmits them to the mobile. In the uplink (UL), it picks up signals from the mobile, filters them, amplifies them, and retransmits them to the base station. The Node AM4 constantly monitors the quality of the signals passing through it.

2.2. The Node AM4 Repeater

☞ **Note:** The denomination "Node AM4" says that this RF repeater is equipped with **slots for 4 RF cards / dummy cards.**

- Universal multi-band, multi-service repeater for mobile applications.
- A coverage solution and a universal choice for selective transmission of interleaved sub-bands for amplification of GSM, EDGE, TDMA, CDMA, WCDMA, HSPA, HSPA+, and LTE signals within multiple frequency bands.
- Supports up to 4 frequency bands (with single-band RF cards only) or currently up to 7-8 frequency bands (with dual-band RF cards) in a single chassis with fully integrated multi-band combiner and modem for remote monitoring and control.
- Software-based repeater platform enables on-the-fly filter changes and development of new features and capabilities without expensive hardware upgrades.
- Channel and band selective automatic gain/ power control for mobile multi-operator and public safety applications.
- Available in both medium and high power classes (for dual-band RF cards, medium power class only) to enhance coverage in trains and ferry applications.
- Automatic Frequency Allocation enable self-acting repeater reconfigurations based on received GPS position.
- Intuitive auto setup and help screens for easy system configuration, minimizing setup time and reliance on expensive and bulky test equipment.

- Advanced statistic reports, including inbound and outbound measurement of channel power/pilot power/RSSI to facilitate set up and verify ongoing system operation.
- Remote alarming through SNMP or SMS using wireless data including GPS positioning.
- Seamless integration with Andrew's Integrated Management and Operating System (A.I.M.O.S.).
- Rated for both indoor and outdoor use with versatile mounting option optimized for train and ferry applications.

2.3. Quick Start Checklist

Read and observe chapter *1.2*.

Setting up the Node AM is quick and easy. The following step-by-step procedure provides a quick overview for a correct setup and optimization.

a. Equipment required

- Node AM
- Donor antenna
- Coverage antenna(s) or distributed antenna system (DAS)
- Coaxial cables
- Connectors (RF, mains)
- Laptop or PC (Win 7, Win8, or Win 10) with Ethernet port and mains cable
- Data cable (CAT5, 100 MBit).

b. Information required

Make sure the following information has been verified and is at hand:

- Important on-site conditions (e. g. mains supply, available space, etc.)
- Operators to be enhanced / amplified
- Data of mandatory fields of Connectivity and Upload page

c. Procedure

1. Install the donor and coverage antennas (or leaky feeder).
2. Install the coaxial cables from the Node AM4 to the antennas.
3. Install the Node AM4 unit; see chapter *3.1 Mechanical Installation*.

   ☞ **Note: Take care to ground the unit correctly as instructed in chapter *3.2.3 Grounding*.**

4. Connect power and the antenna coaxial cables to the Node AM4.
5. Open the small User Interface cover plate
6. Establish a connection from the laptop or computer to the Node AM4.
7. Login to the unit and use the Technician Setup page (see Software manual) for configuration.

3. Installation

3.1. Mechanical Installation

3.1.1. Health and Safety for Mechanical Installation

Read and observe chapter *1.2*.

1. **Caution:** Risk of injury by the considerable weight of the unit falling. Ensure there is adequate manpower to handle the weight of the system.

2. **Caution:** Risk of serious personal injury by equipment falling due to improper installation. The installer must verify that the supporting surface will safely support the combined load of the electronic equipment and all attached hardware and components. Only use sufficiently dimensioned screws for mounting and make sure the mounting material is adequate for the mounting surface.

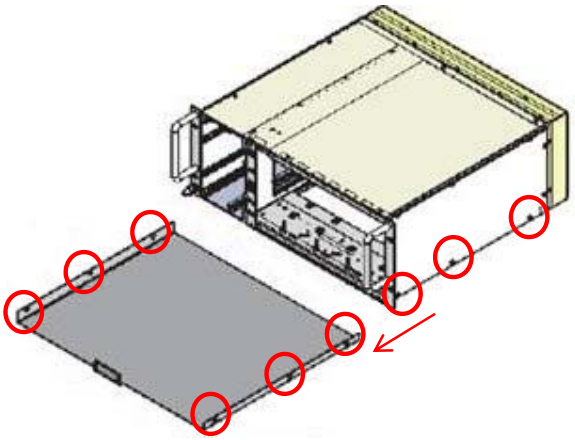
3.1.2. Property Damage Warnings for Mechanical Installation

1. **Attention:** Do not install the unit in a way or at a place where the specifications outlined in the Environmental and Safety Specifications leaflet of the supplier are not met.
2. **Notice:** Due to power dissipation, the unit may reach a very high temperature. Ensure sufficient airflow for ventilation. When mounting the Node AM4 into a train, a temperature test in maximum configuration (i.e. 4 RF cards) must essentially be made. A minimum air flow of 50 m³/h is required where the maximum air flow of the Node AM4 is 220 m³/h which will be reached at an environmental temperature of around 45°C and above. We suggest to supply the repeater at the air inlet with fresh air and to conduct warm air at the air outlet off the Node AM4 without feedback in order to avoid a 'thermal short-circuit'.
3. **Notice:** It is recommended only to use the mounting hardware delivered by the manufacturer. If any different or additional mounting material is used, ensure that the mounting remains as safe as the mounting designed by the manufacturer. Ensure that the static and dynamic strengths are adequate for the environmental conditions of the site. The mounting itself must not vibrate, swing or move in any way that might cause damage to the unit. The specifications for stationary use of the unit must not be exceeded.
   ☞ Note: Exceeding the specified load limits may cause the loss of warranty.
4. **Notice:** Only use sufficiently dimensioned screws for mounting and make sure the mounting material is adequate for the mounting surface.
5. **Notice:** Observe that for M12 connectors the nominal torque is 1.0 N-m.
6. **Notice:** When connecting and mounting the cables (RF, mains, ...) ensure no water can penetrate into the unit through these cables.
7. **Notice:** Do not operate the repeater without terminating the antenna connectors. The antenna connectors may be terminated by connecting them to their respective antennas or to a dummy load.

Unless otherwise agreed to in writing by CommScope, CommScope's general limited product warranty (http://www.commscope.com/Resources/Warranties/) shall be the warranty governing the Node AMs, including the installation, maintenance, usage and operation of the Node AMs.

3.1.3. Removal of Transport Protection Cover

Before starting with the installation, remove the transport protection cover (only installed in units with bottom type fan – see chapter *5.2.7.2*). This cover is retained by 6 screw heads at the Node's sides from which it can be unhinged without having to loosen the screws.



☞ **Note:** Please keep this cover because it is required if the Node has to be sent back, e.g. for a repair or upgrade.

3.1.4. 19 Inch Rack Mounting of the Node AM4

1) 19'' Rack for Node AM4 (and LMR450) rack mounting

2) <u>Mounting material</u>:

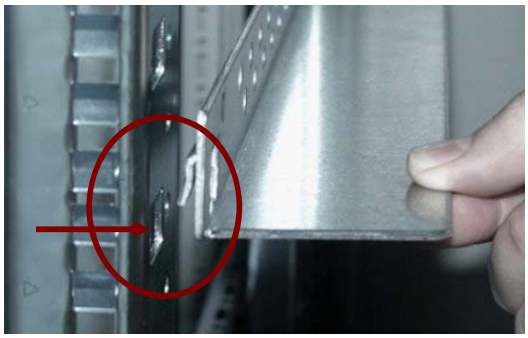
The following components are included in the **Accessory Kit** which is part of the Node AM4 order.

- 1x hex screwdriver angled size 2.5
- 1x AC/DC cable AWG12 3M IP 67
- 6x cage nuts BM3861
- 6x M6.0x16mm raised head screws Pozi recess
- 1x data cable 3 m Cat5e red

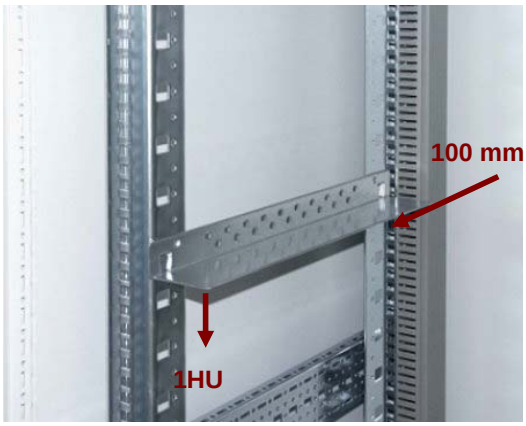
You only need four of each screws/nuts for mounting.

The Accessory Kit does not contain the required guide rails. Please use the guide rails from your original supplier of the 19'' rack.

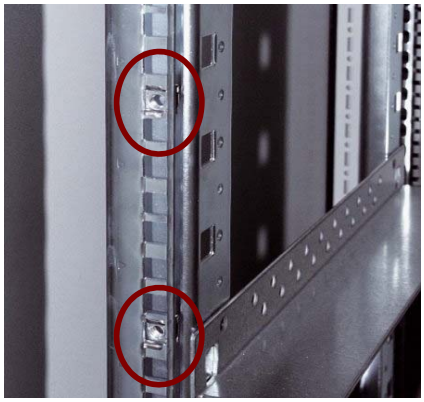
3)
Hook the guide rails into the four holes of the vertical mounting rail of the 19''rack.



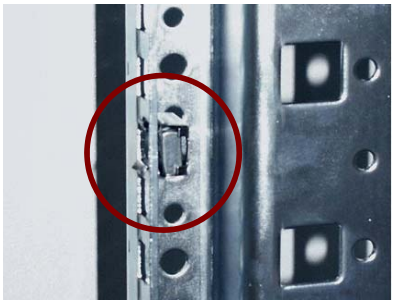
4)
The free space below the guide rails has to be at least 1 HU to ensure sufficient air circulation. The rear side of the Node AM4 needs a distance of the rear side of the 19'' rack of at least 100 mm.



5)
Hook the cage nuts from behind in the vertical mounting rail of the 19'' rack. Pay attention to the distance between the nuts. It must fit with the holes in the Node AM4 so it can be fastened with screws later.



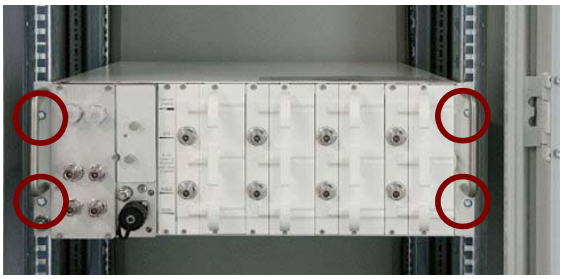
6)
Cage nut mounted (side view):



7)
Cage nut & M6.0x16 mm screw assembly:

D8)
Put the Node AM4 on the rail guides and fasten it with four M6.0x16 mm screws.

Then, install the RF cards as explained in the next chapter.



3.1.5. RF Card Installation

☞ **Note 1:** To ensure shock protection of the DC connectors and main board, the RF cards are packed separately for transport. Installation of the RF cards is recommended after the Node AM unit itself has been mounted according to the following instruction:

Use the guide rails on top and bottom to fit in the RF card smoothly.

Fasten* the four neck-collar screws M3x16 mm tight to ensure watertightness. For the specified torque refer to the according table in chapter 5.2 Replacement of Components.

* First, just slightly tighten the screws crosswise in order to avoid cant, and when all four screws are positioned correctly, fasten them tight.

☞ **Note 2:** Depending on the respective frequency range, the maximum equipment of 4 RF cards is not necessarily required but all unused slots need to be assembled with a dummy card for sufficient airflow and provided IP class.

☞ **Note 3:** It is mandatory that one RF card is installed into slot 1 as a (passive) dummy card does not fit into slot 1. A dummy card has to be installed into slots with no RF card to guarantee correct airflow and watertightness for the active components. For layout please refer to *figure 4 2 Exemplary layout of a Node AM4, maximum equipment* in chapter *4.3 Components*.

☞ **Note 4:** It is recommended to disconnect the Node AM4 from mains (power-supply line) before an RF card is mounted or dismounted. In case the Node AM4 is not allowed to be disconnected from mains, the RF card which needs to be replaced must be disabled via software in the Technician page before removing it. This is to avoid possible damage when inserting the new RF card

☞ **Note 5:** Please observe that the RF cards must always be packed separately for transport.

3.2. Electrical Installation

3.2.1. Health and Safety for Electrical Installation

Read and observe chapter *1.2*.

Danger: Electrical hazard. Danger of death or fatal injury from electrical current. Obey all general and regional installation and safety regulations relating to work on high voltage installations, as well as regulations covering correct use of tools and personal protective equipment.

3.2.2. Property Damage Warnings for Electrical Installation

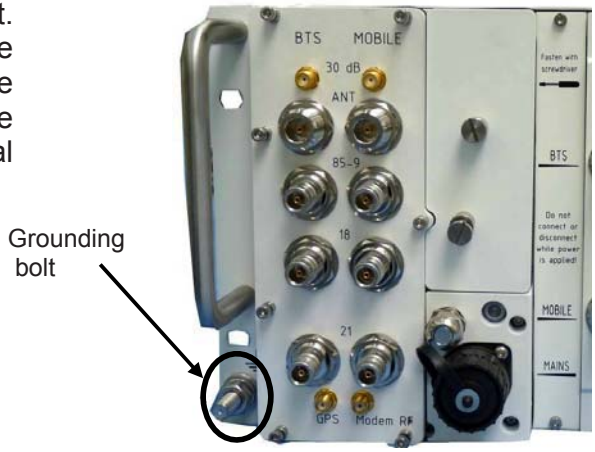
1. **Attention:** It is compulsory to ground (earth) the unit before connecting the power supply. Grounding bolts are provided on the cabinet to connect the ground-bonding cable.
2. **Attention:** If the mains connector of the unit is not easily accessible, a disconnect device in the mains power circuit must be provided within easy reach.
3. **Attention:** A connection of the mains supply to a power socket requires the power socket to be nearby the unit.
4. **Attention:** Before connecting or disconnecting the mains connector at the unit, ensure that mains power supply is disconnected.
5. **Attention:** Make sure that an appropriate circuit breaker acting as a disconnect device (as required by IEC/EN60950-1) and an overcurrent limiting device are connected between mains power and the unit.
6. **Attention:** Incorrectly wired connections can destroy electrical and electronic components.
7. **Notice:** To avoid corrosion at the connectors caused by electrochemical processes, the material of the cable connectors must not cause a higher potential difference than 0.6 V (see electrochemical contact series).
8. **Notice:** Use an appropriate torque wrench for the coupling torques:
   - for N-type connectors (2 N-m / 20 in lb) with 13/16 in opening, e. g. item no. 244379 available from the CommScope e-catalog
   - for 7/16 DIN-type (25 N-m / 19 ft lb) with 1 ¼ in opening, e. g. item no. 244377 available from the CommScope e-catalog

   SMA connectors have a specified torque of 60 N-cm.

   Do NOT use your hands or any other tool (e.g. a pair of pliers). This might cause damage to the connector and lead to a malfunction of the unit.
9. **Notice:** For unstabilized electric networks, which frequently generate spikes, the use of a voltage limiting device is advised.
10. **Notice:** Observe the labels on the front panels before connecting or disconnecting any cables.
11. **Notice:** Unused connectors must be closed with their protective covers to ensure watertightness.

3.2.3. Grounding

Grounding (earthing) must be carried out. Connect an earth-bonding cable to the grounding connection provided at the outside of the unit. Do not use the grounding connection to connect external devices.



After loosening the hex nut, connect the earth-bonding cable between the two washers, and fasten all parts again with the hex nut:

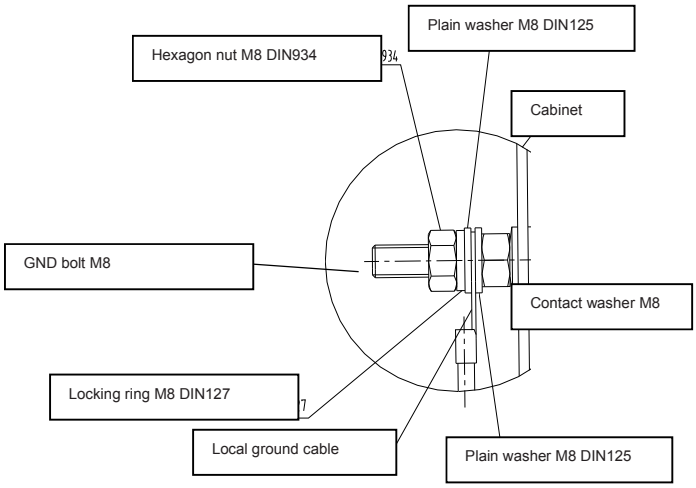


figure 3-1 Grounding bolt

☞ **Note:** The PE cables must have a minimum cross section of 16 mm^2.
The local ground cable requires an adequate ear for the M8 GND bolt.

3.2.4. Interconnection Cabling

The required cables are part of the delivery of the RF cards.
Connect the individual BTS band ports of the combiner (if equipped) to the BTS ports of the according band of the RF cards.
Connect the individual Mobile band ports of the combiner (if equipped) to the Mobile ports of the according band of the RF cards.
However, the antennas may also be mounted directly on the RF card connectors.

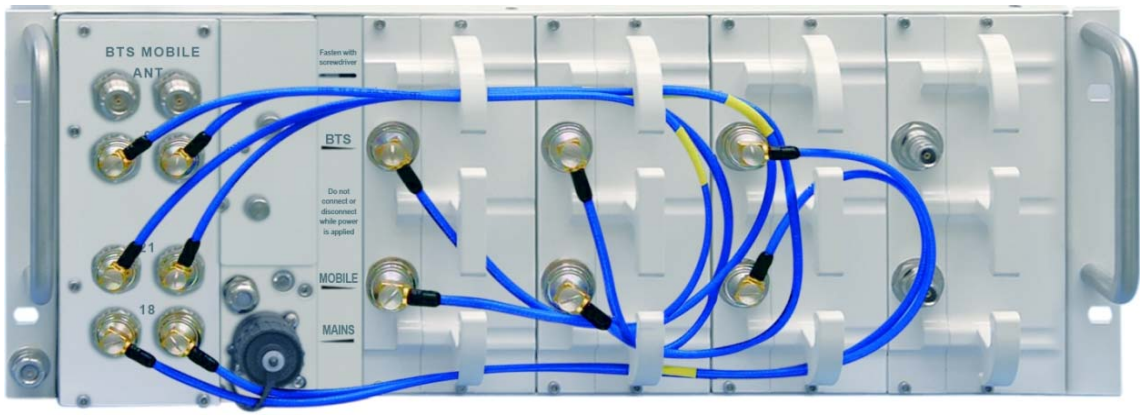


figure 3-2 Example for interconnecting cabling for a Node AM4 (combiner with three pairs of band ports)

3.2.5. Connection of the Antenna Cables

The antenna connectors of the Node AM combiner are N female. However, the antennas may also be mounted directly on the RF card connectors which are QN. All connectors are located at the front of the cabinet.

An operator should refer to the documentation of the cable connector manufacturer for best mating procedures. Furthermore, the bending radius of the antenna cables should be maintained at all times.

There are several issues to be considered when selecting the cable and antenna types.

- In applications such as trains and ferries, it is highly recommended to use directional antennas with good front-back-ratios (40 dB is typical) because they improve isolation and cell-site selectivity.
- Smaller diameter cables are less expensive and easier to install but have worse performance.

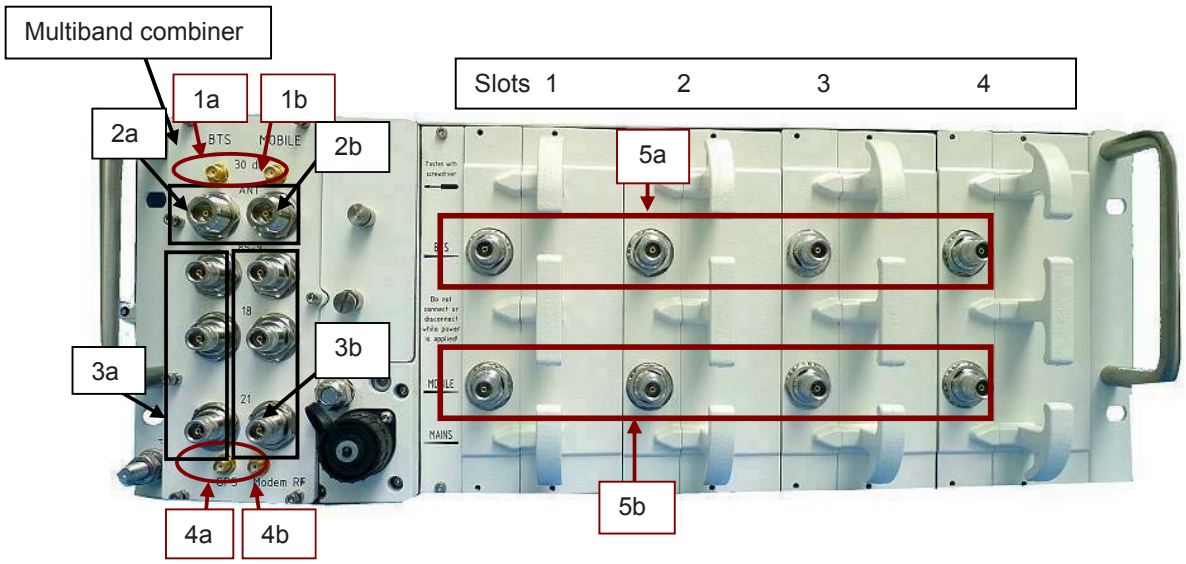


figure 3-3 Front view of Node AM4 antenna connections (combiner with three pairs of band ports)

No.	Description of connector/ port
1a	30 dB coupling probe of antenna ports BTS (for testing only)
1b	30 dB coupling probe of antenna ports Mobile (for testing only)
2a	Antenna connector BTS
2b	Antenna connector Mobile
3a	Band ports BTS *
3b	Band ports Mobile *
4a	GPS port
4b	Modem RF port
5a	BTS ports of RF cards
5b	Mobile ports of RF cards

table 3-1 Description of Node AM4 antenna connectors

* e.g. 900, 1800, 2100; band ports from/to RF cards;
various types of combiner available; examples see chapter 4.3.1

Note:
For special information on MIMO applications contact CommScope Technical Support.

For the location of the antenna connectors (N type), please refer to *figure 3-3 Front view of Node AM4 antenna connections*. For mounting the cable connectors, it is recommended to refer to the corresponding documentation of the connector manufacturer. The bending radius of the cables must remain within the given specifications.

Choose the type of cable best suited for the antenna. Consider that a cable with higher loss is less expensive but impairs performance.

Notice: Use an appropriate torque wrench for the coupling torques:

- for N-type connectors (2 N-m / 20 in lb) with 13/16 in opening,
  e. g. item no. 244379 available from the *CommScope e-catalog*
- for 7/16 DIN-type (25 N-m / 19 ft lb) with 1 ¼ in opening,
  e. g. item no. 244377 available from the *CommScope e-catalog*
- SMA connectors have a specified torque of 60 N-cm.

Do NOT use your hands or any other tool (e.g. a pair of pliers). This might cause damage to the connector and lead to a malfunction of the unit.

Attention: To minimize passive inter-modulation (PIM) distortion, attention has to be paid to the physical condition of the connector junctions:

- Do not use connectors that show signs of corrosion on the metal surface.
- Prevent the ingress of water or dirt into the connector.
- Use protective caps for the connectors when not mounted.
- Before mounting clean the connectors with dry compressed air.
- Before mounting clean the mating surfaces of the connector with a lint-free alcohol-drenched cloth on a wooden or non-metallic item.
- Attach and torque the connectors properly.
- Avoid metallic abrasion when mounting the connectors by only screwing the connecting nut, but not turning the whole connector.
- Use a torque wrench to fasten the connector, see above.
- Clean the protective caps before mounting for antenna cable replacement.

3.2.6. Cleaning Procedure for RF Cable Connectors

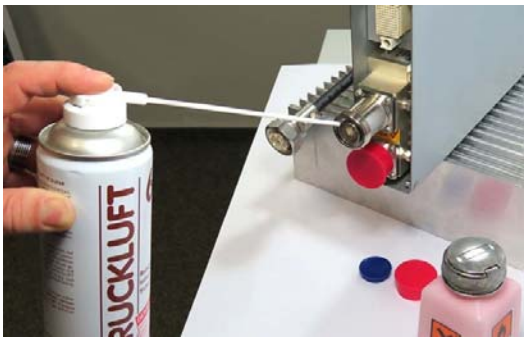
The figures in this chapter illustrate the cleaning procedure and do not show an actual Node AM.

1. What is needed for the cleaning?
   a. Isopropyl alcohol
   b. Compressed air
   c. Lint-free wipe
   d. Cotton buds

2. Remove protective cap from the RF connector.

Caution: Risk of injury by flying particles when compressed air is used. Wear protective clothing, especially protective glasses.

3. Remove metal chips and small particles from the mating and inner surfaces of the connector using compressed air.



Warning: Flammable material. Risk of fire. Keep away from sources of ignition.

Caution: Eye irritant product. Risk of eye irritation. Avoid contact with eyes and skin. Wear protective clothing, especially protective glasses.

4. Clean the connector winding with lint-free wipe drenched with isopropyl alcohol.

5. Clean the lip of the inner ring with a cotton bud drenched with isopropyl alcohol.

6. Clean the inside surface of the inner ring with a cotton bud drenched with isopropyl alcohol.

7. Clean the inside of the center conductor spring tines with a cotton bud drenched with isopropyl alcohol.

8. Clean in the similar way the connector of the connected cable. Remove protective cap from the cable connector first.

9. Remove metal chips and small particles from the mating and inner surfaces of the connector using compressed air.

10. Continue with the winding area using lint-free wipe drenched with isopropyl alcohol.

11. Continue with the inside mating surface of the inner ring.

12. Clean the outside surface of the center pin.

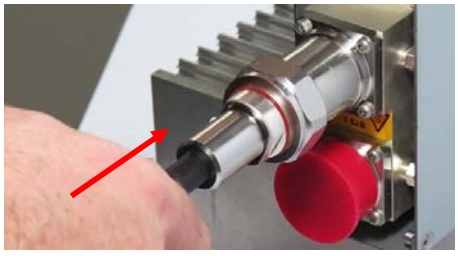
3.2.7. Antenna Cable Connector Assembly

The figures in this chapter illustrate the assembly procedure and do not show an actual Node AM.

1. What is needed for the connector assembly?
   a. Torque wrench.
   b. (Adjustable) counter wrench

2. Join the connectors and turn the coupling nut until the thread grips.

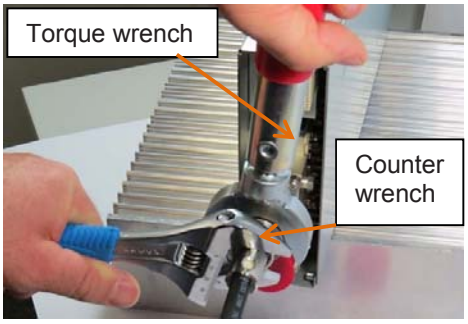
3. Push in the connector until it clicks.



4. Fasten the coupling nut hand-tight. Do not turn the connector but the coupling nut only.

5. Retain the cable connector with the counter wrench and fasten the coupling nut with the torque wrench until the torque is applied (torque wrench clicks).

   For angled antenna connectors use your hand to retain the cable connector and fasten the coupling nut with the torque wrench. Make sure only the coupling nut is turned, not the cable connector.



3.2.8. Power Connection

Before connecting electrical power to the unit, the system must be grounded (earthed) as described in chapter *3.2.3* and connected via external circuit breaker (see table 3-3).

Mains power must be connected at the mains connector. The mains cable (assembled feed line) is included in the Node AM4.

The PIN assignment of the mains connector is as follows:

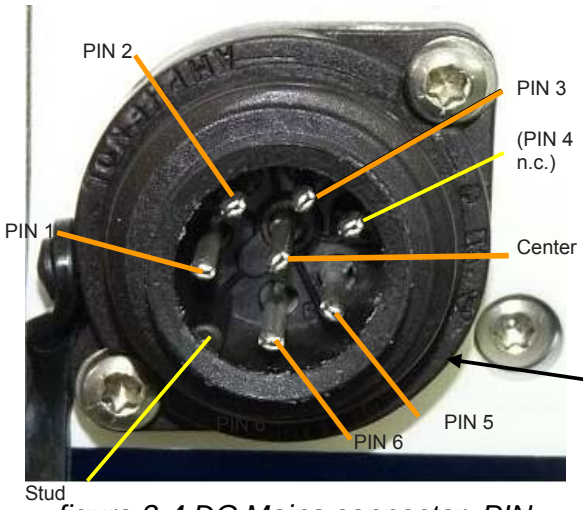


figure 3-4 DC Mains connector, PIN assignment

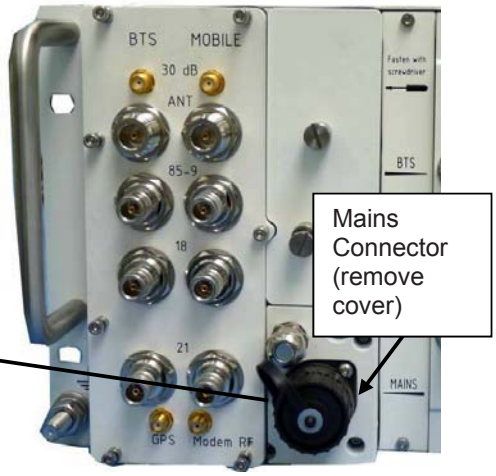


figure 3-5 Mains connector, location

	Mains DC connector	Mains cable 1*		Mains cable 2**
PIN	**Connection**	**Color**	**Marking**	**Color**
1	+V DC	grey	1	red
2	+V DC	grey	1	red
3	+V DC	grey	1	red
4	not connected	---	---	---
5	-V DC	grey	2	black
6	-V DC	grey	2	black
Center	-V DC	grey	2	black

* Grey marking 2 is always the negative potential, grey marking 1 is the positive one.

** Black is always the negative potential while red is the positive one.

PIN	AC Mains Connector		
	Connection	Color	
1	Phase	brown	black
2	Neutral	blue	white
3	not connected	-	--
4	PE	green / yellow	green

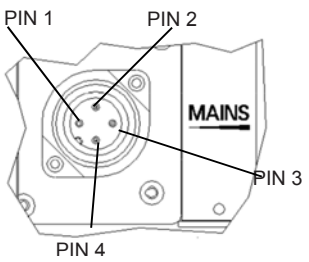


table 3-2 AC Mains connector, PIN assignment

NOTICE

Preferably, a minimum cross section of 4 mm^2 is required for the power supply connection.

Each wire must comply with the applicable national regulations regarding loop impedance, voltage drop, and methods of installation. Make sure to connect the correct voltage to the unit.

Depending on the Node AM4 power class, please refer for the minimum cross section of mains cable and external circuit breaker to the corresponding following tables:

	Node AM4 (system label) nominal voltage/ current	Node AM4 operating voltage range	Mains Cable Cross section	
			Minimal	*Recommended*
AC	100 - 240 V AC / 8.5 A	85 - 264 V AC	3 x 1.5 mm^2	---
DC 680W PSU	24 - 110 V DC / 16 A 24 V DC / 9 A	20.4 - 138 V DC 16.8 - 36 V DC	2 x 4 mm^2 2 x 2.5 mm^2	2 x 4 mm^2 2 x 4 mm^2
DC 780W PSU	24 – 36 V / 22 A 40 – 110 V / 15 A	20.4 - 132 V DC	2 x 4 mm^2	2 x 4 mm^2

	External circuit breaker for Node AM4
AC	external, single phase, 50-60 Hz, AC breaker max. 20 A for 120 V AC; max. 16 A for 240 V AC
DC 680 W PSU	external DC breaker, 24/ 48/ 110 V DC, max. 25 A external DC breaker, 24 V DC, max. 20 A
DC 780 W PSU	external DC breaker, 24 V: max. 32A; external DC breaker, 48 V / 110 V: max. 25 A

table 3-3 Node AM4, voltage range & external breaker

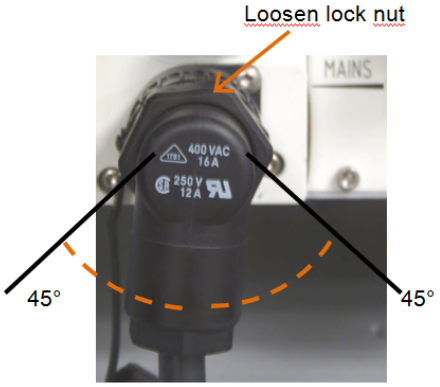
☞ **Note:** Do not connect or disconnect the power cord at the mains connector while power is on. Turn off mains power ** before connecting the power cord at the unit, then, engage mains again.

** Mains power must be interrupted with an external DC breaker.

☞ **Note:** Please pay attention when installing the mains power cord. To prevent heating-up, ensure there is some space between the cables! They must not be wound up or lay close to each other.

The positioning of the power cable with the illustrated connector is adjustable by loosening the 1” lock nut. Use an appropriate torque wrench (wrench size 27 mm) to observe torque of 2 N-m.

The cable can be turned by maximally 45° to the left or right **from the vertical position** as illustrated. This adjustment degree is irrespective of the delivery condition which is not necessarily the vertical position. After the adjustment, tighten the nut again.



3.2.9. Connection to the Node AM

The Node AM is set up, configured and monitored using a PC. The connection to the Node AM can be established locally via an Ethernet cable or remotely via modem. The local connection is easy to set up and much faster in operation. The local connection should be used for initial setup and whenever the operator is at site.

3.2.9.1. Setting up the Local Connection

A standard Ethernet CAT5 cable is supplied with the Main Unit of the Node AM. Connect the cable to the Node AM and the network port on the PC. The Node AM hardware supports 10 or 100 megabit / sec Ethernet connections.

After the connection is made properly, the red and green LEDs near the Node AM network connector will flash. Likewise, the network connector on many PCs has LEDs that indicate when a hardware connection is established. The network hardware will determine the highest speed supported by both devices.

figure 3-6 Connecting the CAT5 cable to the Node AM for the local connection

The operating system of most PCs will automatically establish the hardware and software network connection. No setup or system changes are required on the PC to establish a local connection with the Node AM.

Normally, the connection can be made either before or after the Node AM and PC are powered up. If there are problems, make sure the cable is fully inserted at both ends. Make sure the PC network driver is not fixed at 1 GB/second. With the cable connected restart the PC. If that fails, restart the Node AM.

3.2.9.2. Setting up the Remote Connection

Setting up the remote connection is slightly more involved than setting up the local connection. A separate manual is provided to explain how to setup the remote connection.

Via the remote connection, the operator can monitor and control the Node AM using the Web browser interface remotely.

In addition, the remote connection may be used for an OMC-type software platform and SMS alarm forwarding.

4. Functional Description

4.1. Architecture

The Node AM4 is designed to amplify signals between multiple mobiles and a base station. The unit consists of a filter and amplifier chain in the downlink and one filter and amplifier chain in the uplink. The uplink and downlink paths are connected via a duplexer on both ends of each path. After that the signals are combined by the crossband coupler with the other frequency bands.

In the uplink path, a signal originating from the mobile is divided by the crossband coupler into the different frequency bands and is separated from the downlink signal via the UL IN duplexer. It is then amplified by a low noise amplifier (LNA), which is like the duplexer part of the RF card. The RF card down-converts the signals to the IF and converts the analogue signal into a digital signal. Digital filtering / signal processing is done at the main board of the subrack with single band RF cards, and with dual-band RF cards in the cards themselves. Then, the digital signal is converted into an analogue signal, is up-converted and amplified. Finally, the signal is sent to the PA and combined with the downlink signal. After that the signals from all RF cards are combined at the crossband coupler and forwarded to the Base Station port of the Node AM4 system.

In the downlink path, a signal originating from the base station is divided by the crossband coupler into the different frequency bands and is separated from the uplink signal in the donor duplexer. It is then amplified by a low noise amplifier (LNA), which is like the duplexer part of the RF card. The RF card down-converts the signals to the IF and converts the analogue signal into a digital signal. Digital filtering / signal processing is done at the main board of the subrack with single band RF cards, and with dual-band RF cards in the cards themselves. Then the digital signal is converted into an analogue signal, is up-converted and amplified. Finally, the signal is sent to the PA and combined with the uplink signal. After that the signals from all RF cards are combined at the crossband coupler and forwarded to the mobile port of the Node AM4 system.

Apart from the difference in digital signal processing as explained in the sections above, the functionality of dual band and single band RF cards is principally identical in both the UL and DL paths.

For an overview of the individual components, please refer to chapter *4.3 Components*.

4.2. Features

4.2.1. Digital Channel Filters

The Node AM has a multitude of digital filters. The maximum bandwidth of each filter is 5 MHz. If a greater bandwidth than 5 MHz is required, two or more sub-band filters are linked together without increased amplitude or delay ripple. The number of sub-band filters is automatically allocated and shown by the repeater software (Technician Setup page).

The user has to select the downlink start and stop frequencies (wide-band filter load) or centre frequency and filter bandwidth (narrow-band-filter loads) of each sub-band filter. For further information regarding sub-band filter settings refer to the User's Manual for the Node AM software.

4.2.2. Frequency Hopping

The Node AM repeater supports base band hopping (BBH) and synthesized frequency hopping (SFH) in GSM networks.

For base band hopping (BBH) even channelized digital filters may be used. For synthesized frequency hopping (SFH) band selective filters are needed.

4.2.3. Filter Types

Please observe that the selectivity of the filter types is not yet available with the current software version. At the moment only the filter type "**Normal**" will be active even if another filter is selected. From which software release onwards the selectivity described in the following will be implemented in future is not defined, yet.

In future, there will be different filter types available for each sub-band. These filter types are:

- **Normal** (good selectivity and group delay)
- **Wide** (low selectivity and low group delay)
- **Narrow** (high selectivity and high group delay)
- **Auto** (preferred mode)

It is advisable to select the "Auto" filter. In this case the repeater selects the best filter type (normal, wide or narrow) automatically. The choice of filter type depends on the input signal strength and position of the adjacent channel signals.

If narrow, strong adjacent cannel signals are received, the "**Narrow**" filter is selected. If the adjacent channels are far from the desired band/channel, the "Wide" filter type is used. For all other configurations, the "**Normal**" filter is selected.

4.2.4. Status Information

The *Status and Reports* menu, which is accessible via the home page of the web interface, provides information about the current gain, output level and receive signal strength indication (RSSI) values.

The RSSI provides controlling and monitoring of the receive level of a Base Station (DL RSSI) or user equipment (UL RSSI) to a Node AM. It measures the level of the input signal by detecting the RF and converting the analogue level into a digital value. The data are processed and evaluated by software. A corresponding measurement is also made for the output levels.

RSSI measurements are done for each band segment; for further details please refer to the Node AM/ Node AM SW manual.

4.2.5. Alarm Forwarding

Alarms can be forwarded from the Node AM to a defined phone number or to the OMC via the Ethernet port on the UI2 Board (see chapter *4.3.6*) or via an optional modem. This enables the provider to control and to query the status of the network via packet switched, circuit switched, or LAN connection. Faults and irregularities can be recognized and eliminated.

With a modem equipped the Node AM also provides an SMS feature, by which the unit is able to send out alarm messages as SMS. For further details please contact CommScope.

4.3. Components

The actual configuration of the individual Node AM4 can be seen in the configuration list, which is part of the delivery. It is also available as an electronic list accessible via software.

The following figure shows the layout of a system using single-band RF cards only. If one or more dual-band cards are equipped the only deviation is a different type of multiband combiner (see figure 4-3).

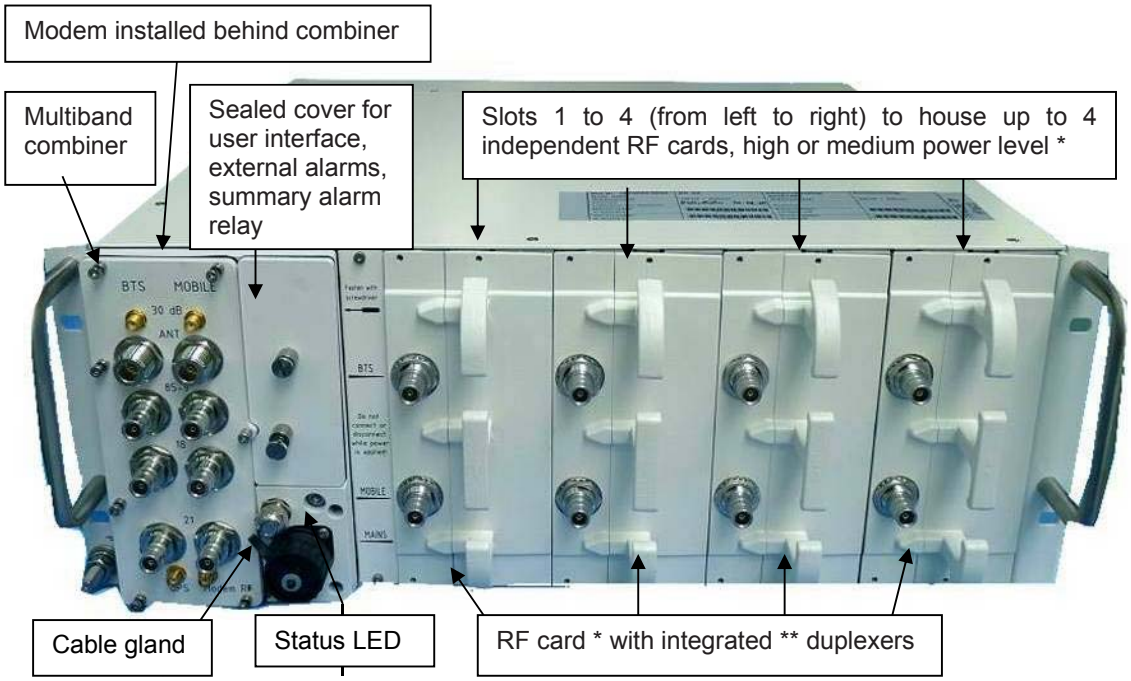


figure 4-1 Layout of a Node AM4 (combiner with three pairs of band ports), maximum equipment

* See also **Notes 2 & 3** in chapter *3.1.5 RF Card Installation*.

** With certain RF cards, use of a slot duplexer (installed in an RF card slot) is obligatory and maximally three RF cards are available. For details on RF card types, see chapter 8.

4.3.1. Multiband Combiner

The task of the multiband combiner is to combine and to separate the individual frequency bands received from the common BTS and Mobile port.

The following figures show a examples of multiband combiners for the Node AM4.

NOTICE

- **DO NOT use the 30 dB coupling probes [3] for modem connection!**
- **DO NOT connect the Modem RF probe [1] on the "Mobile" side of the Node AM repeater with the 30 dB coupling probes [3]!**

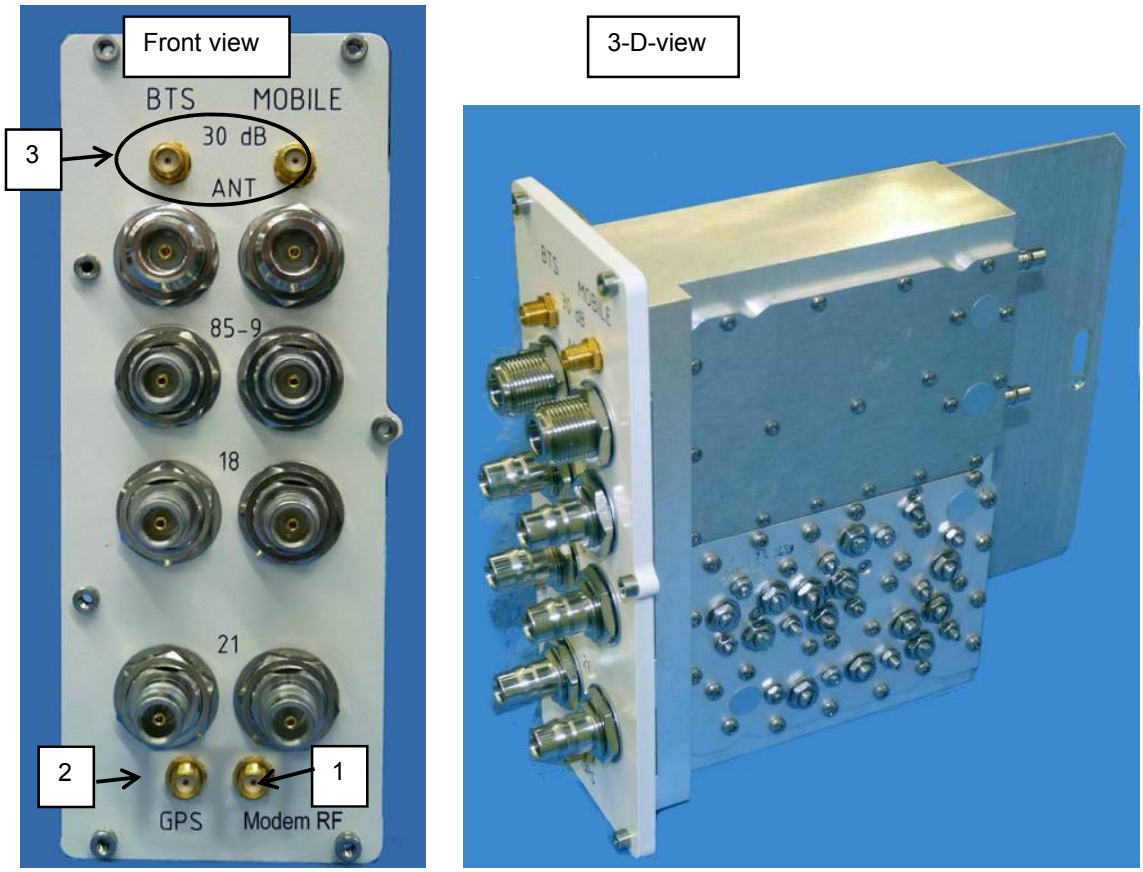
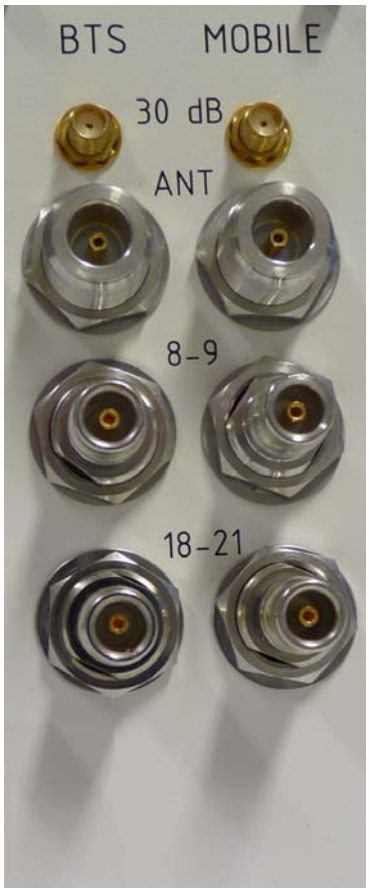


figure 4-2 Node AM4 3-band combiner (850-900, 1800, 2100 MHz) with three pairs of band ports)

Front view



3-D-view

figure 4-3 Node AM4 2-band combiner (800-900 and 1800-2100 MHz) with two pairs of band ports

Via an additional external 10 dB directional coupler the modem can be connected using the direct **Modem RF** port [1]. In case an external 10 dB directional coupler cannot be used, an integrated directional probe (QMA connector at the rear side of the combiner; see also *figure 4-19*) may be used to supply the modem with RF signals. :

Further optional ports of the combiner are the **GPS** port [2] with optional GPS LNA DC supply (for the corresponding connections on the rear side see also *figure 4-19*) as well as two **30 dB** coupling probes [3], which can be used for testing purposes for the antenna ports.

4.3.2. Digital Channel Modules (DCM) / RF Cards

The digital channel module (DCM) is the RF digital-converter in both directions for Downlink and Uplink. The Downlink and Uplink will be separated in the duplexer and the desired signal will be amplified by an LNA which is – like the duplexer – an integrated part of the RF card. The RF card down-converts the signals to the IF and converts the analogue signal into a digital signal. Digital filtering / signal processing is done at the main board of the subrack with single band RF cards, and with dual-band RF cards in the cards themselves. Then, the digital signal is converted into an analogue signal, is up-converted and amplified. Finally, the signal is sent to the PA (internal PA or mounted on the RF card) and combined with the other link in the second duplexer.

The following figure shows the single band DCM, RF cards:

figure 4-4 Single-band DCM, RF card, low / medium power (left) and high power with additional DL amplifier (right)

Optionally, medium power dual band RF cards are available, by which two bands, for instance the 800/900 bands or the 1800/2100 bands, can be combined in one module. Thus, the maximum number of bands per Node AM can be increased to up to 8*.

Apart from the difference in digital signal processing as explained above, the functionality of dual-band and single-band RF cards is principally identical.

* up to 7 with 680 W PSU

figure 4-5 Dual band DCM, RF card (medium power)

With certain RF cards, use of a slot duplexer is obligatory. This duplexer is installed in an RF card slot, i.e. if such a duplexer is equipped, maximally three RF cards are available. For details on the card types see chapter 8.

4.3.3. Dummy Card

figure 4-6 Dummy card

☞ **Note:** All unused slots need to be assembled with a dummy card for sufficient airflow and provided IP class.

☞ **Note:** Empty slots of the Node AM will generate an alarm.

☞ **Note:** Do not install the dummy card into slot 1.

☞ **Note:** Depending on type of fan unit (bottom or backside) different dummy cards need to be equipped in empty slots.

4.3.4. Power Supply Unit

The power supply unit is mounted in the interior cabinet of the Node AM4. This device transforms mains power into predefined DC voltages. When performing maintenance, ensure that all circuits are voltage-free and that the Node AM4 is disconnected from mains.

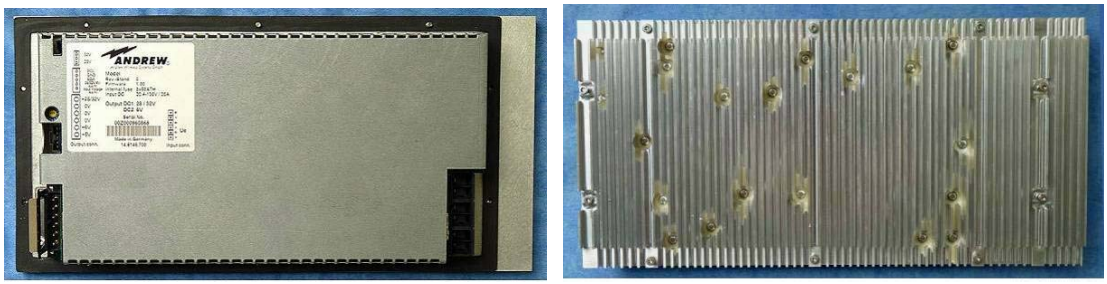


figure 4-7 Power supply (DC/DC type), front and back

In units with a 680 W power supply (AC or DC), observe the RF card limitations specified in chapter 7.1. With the 780 W DC PSU there are only limitations for a mains voltage from 24 to 36 Vdc which are also specified in chapter 7.1. To decide which type of PSU is equipped, look up the HID of the PSU on the *Serial and ID Numbers* page of the SW (PSU IDs see Spare Parts List in chapter 8) or check the power consumption value on the type label on top of the Node AM:

PSU Type	***680 W***	***780W***
Label:	Input 24-110 V⎓ 16 A	Input 24-36 V⎓ 22 A 40-110 V⎓ 15 A

4.3.5. User Interface Board (UI1 Board)

The UI1 board is used as communication interface between the Node AM controller and modem or local user, and for general purpose functions of the repeater, as well.

figure 4-8 UI-board for general applications, installed

All SW functions available with the general UI1 Board (illustrated above and in *figure 4-9*) are part of the SW manual M0121ALx for the Node SW. For special applications, other types of UI1 Board may be equipped. For these, observe the additional Applications Notes, which are available on request or included on the Manual CD.

Functions of the UI1-board:

1. Collection of external alarms and summary alarm
2. Status LED
3. Local Ethernet port
4. Voltage supply and communication (RS232/USB) to the modem
5. Battery disconnect push-button to disconnect the internal battery in order to power down the controller completely or to prevent the battery from complete discharge in case of system power-down. Observe that an alarm is raised once this button is pressed and the unit is powered up again. To delete the false alarm, the unit has to be shut down and powered up again. During shutdown, the battery disconnect button must not be pressed (see also notice in chapter 5.2.2).

The following figure illustrates the general type; of UI1 Board.

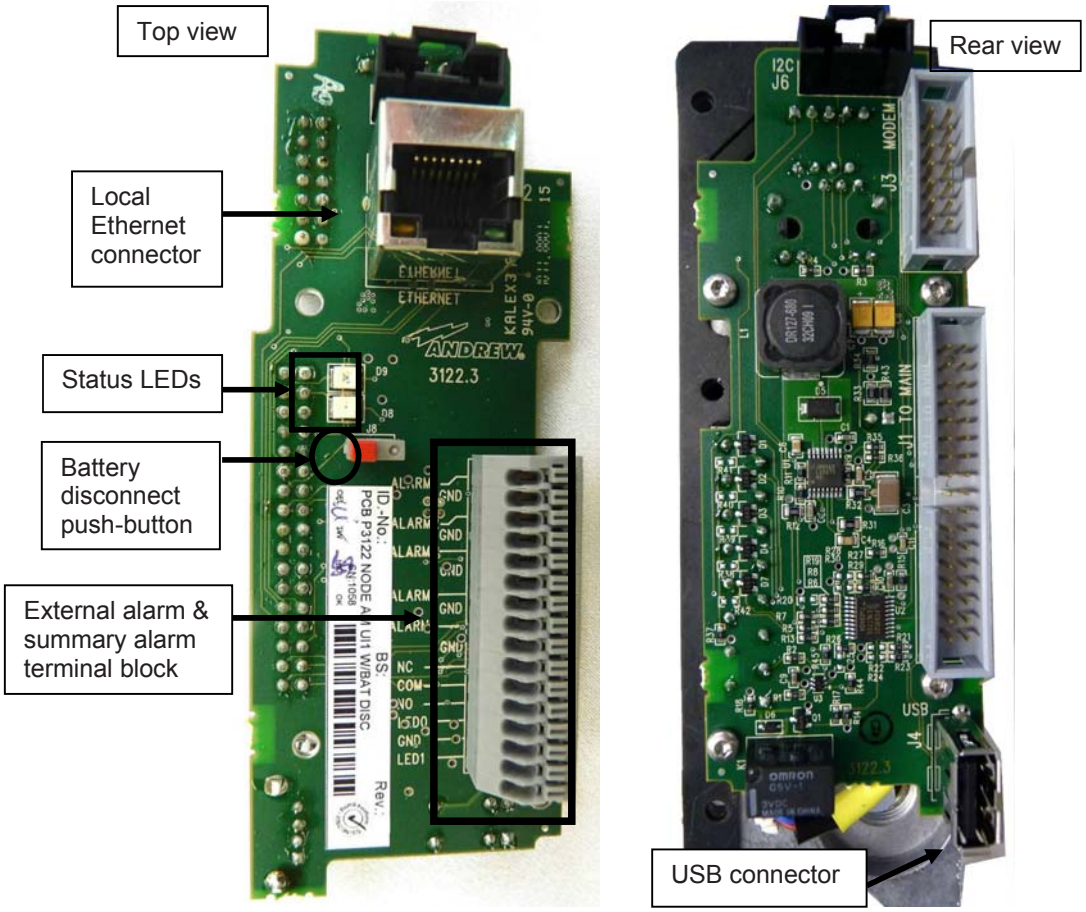


figure 4-9 UI-board for general applications, top and rear view

4.3.5.1. External Alarms

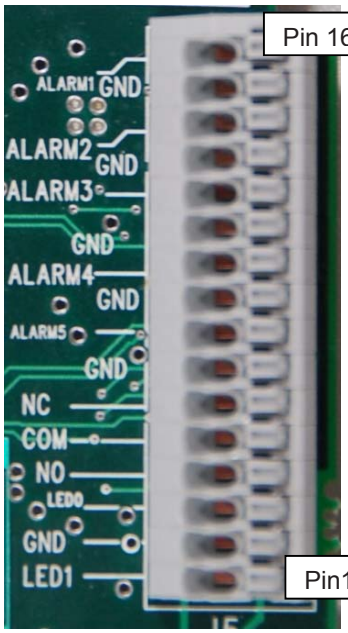
The external alarms are used to monitor the status of one or more external devices via the Node AM. A UPS or entry alarm is among the items that might be connected to the contact relay and monitored via the Node AM4. The cage clamp connectors are located on the UI1-board.

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.4 - 0.8 mm^2 (AWG 26-20). Do not use wire-end sleeves.

All external alarms are defaulted to high (3.3V TTL) without connection. This setting may be changed on the external alarm page to active high or active low. The severity levels of the external alarms may be set via the web page. More information about the external alarm settings is available in the web page and online help.

External Alarms 1 to 5	
Input voltage range	0 to 5 Vdc
Recommended input line	Potential free
Nominal sink current to ground	15 mA
Active level	High or low set via software
Connectors	Cage clamps

16	Ext_Alarm_1
15	GND
14	Ext_Alarm_2
13	GND
12	Ext_Alarm_3
11	GND
10	Ext_Alarm_4
9	GND
8	Ext_Alarm_5
7	GND



6	Summary Alarm: normally closed PIN (open in alarm condition) *
5	Summary Alarm: common pin
4	Summary Alarm: normally open PIN (closed in alarm condition) *
3	LED_UI0
2	GND
1	LED_UI1

* galvanically isolated

figure 4-10 PIN assignment

External alarm clamps

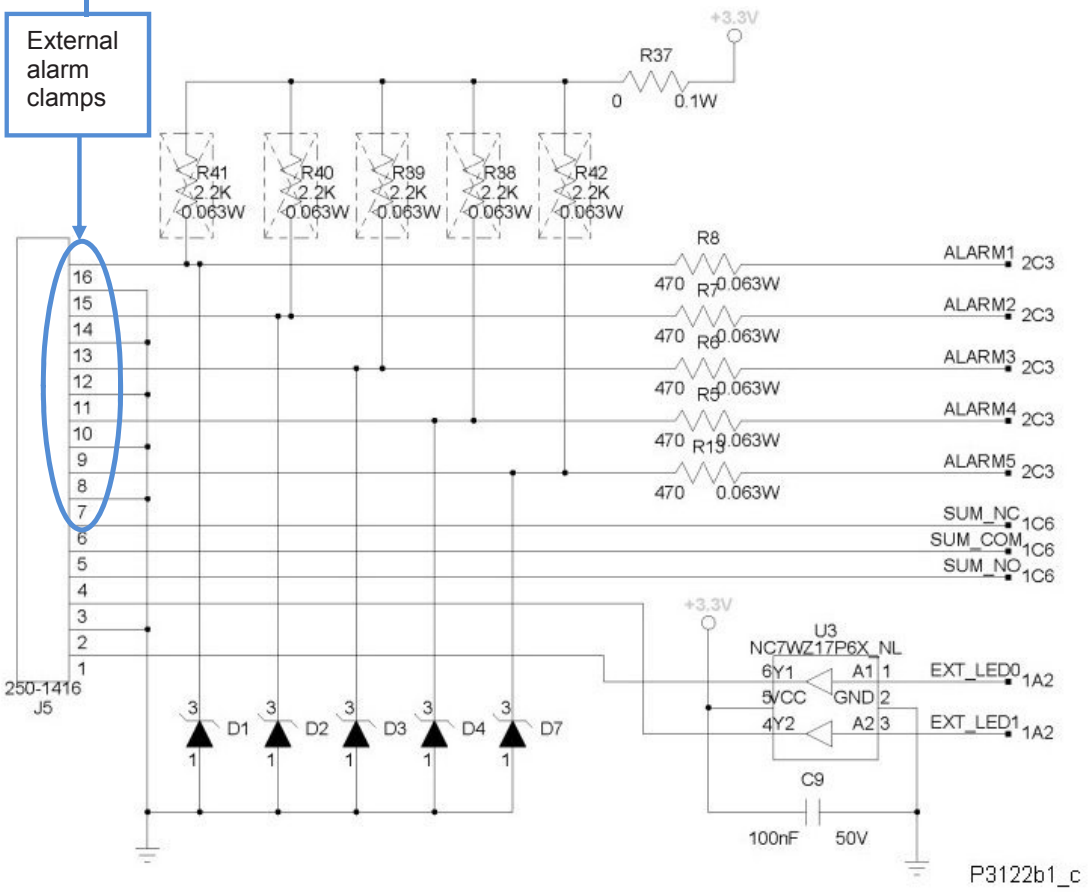


figure 4-11 Schematics of external alarm clamps

There is one external cable gland at the front of the Node AM, which may be used to connect the external devices. The recommended cable diameter for the connection cable is 4 - 6 mm. Please note that connecting the external devices by a wrong type of cable may result in a loss of the watertightness.

All external alarms are defaulted to high (3.3V TTL) without connection. This setting may be changed on the external alarm page to active high or active low. The severity levels of the external alarms may be set via the web page. More information about the external alarm settings is available in the web page and online-help.

figure 4-12 External cable gland

Make sure that external alarms which are not required are set to active low or disabled; otherwise the status will always show an alarm.

The names for each external alarm are user-definable on the external alarm page; renaming them to indicate the use of these alarms is recommended.

4.3.5.2. Summary Alarm

☞ **Note:** With alarm severity setting *'disabled'* it is possible to decide which alarms do not activate the summary alarm. For more details please refer to the Node AM/ Node AM Software manual that is part of the delivery.

The summary alarm is a DC potential-free contact relay.

Observe that the cross-sectional area of the wires to be connected must be in the range from 0.4 – 0.8 mm^2 (AWG 26-20).

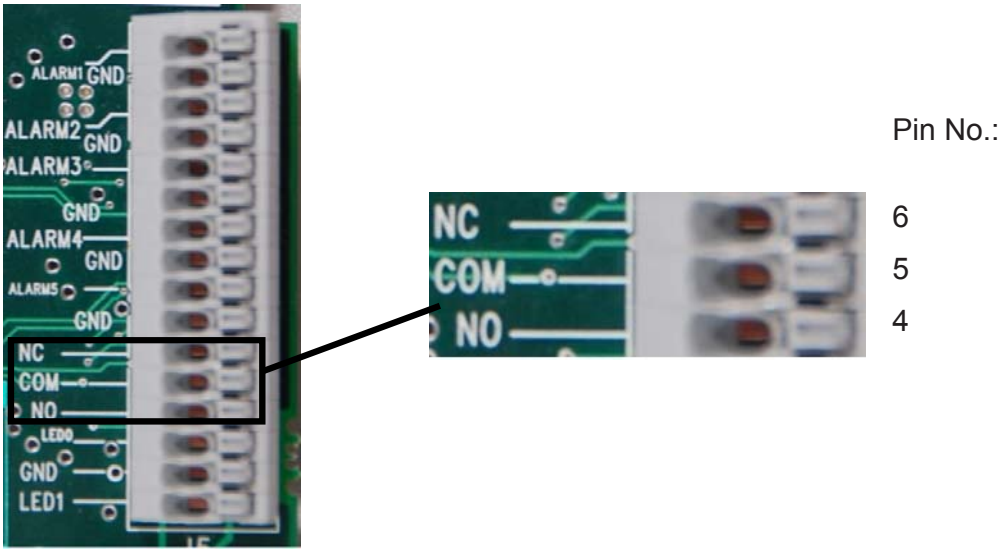


figure 4-13 Summary alarm relay

The following table describes the three-connector PIN out.

Pin No.	Contact	Maximum Resistive Load
4	Open in normal condition	Max. 0.5 A @ 60 VDC
5	Common	
6	Closed in normal condition	

table 4-1 Pin assignment of relay contacts

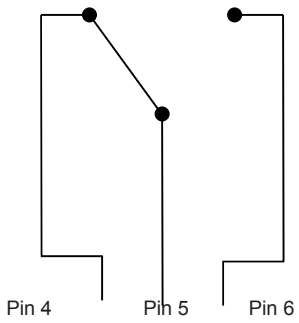


figure 4-14 Relay contacts, alarm condition

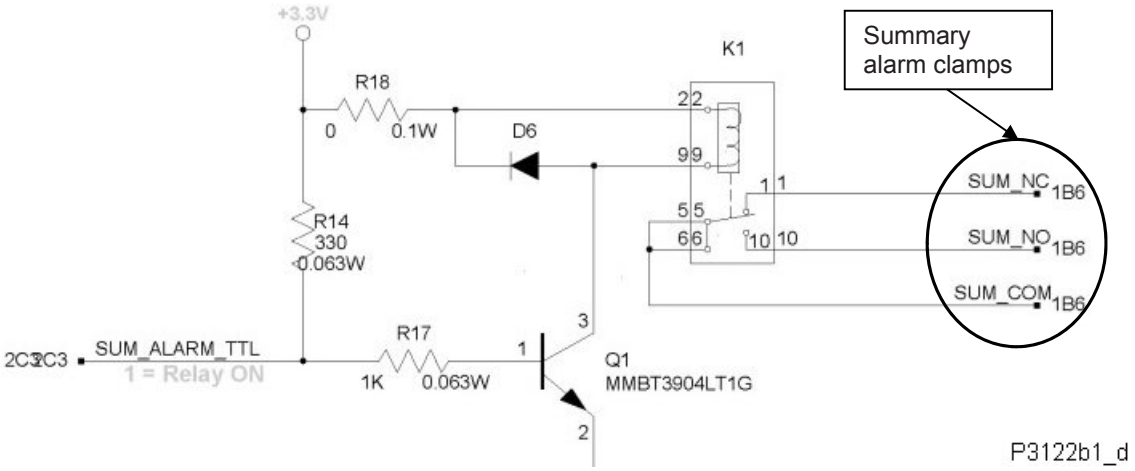


figure 4-15 Schematics of summary alarm clamps

4.3.6. User Interface 2 Board with Optional Features

The User Interface 2 (UI2) board is equipped on a carrier plate together with the optional features of the Node AM4. These are the VSWR module, the Battery Backup option, and the modem. Besides, the UI2 board offers additional USB ports and an Ethernet port.

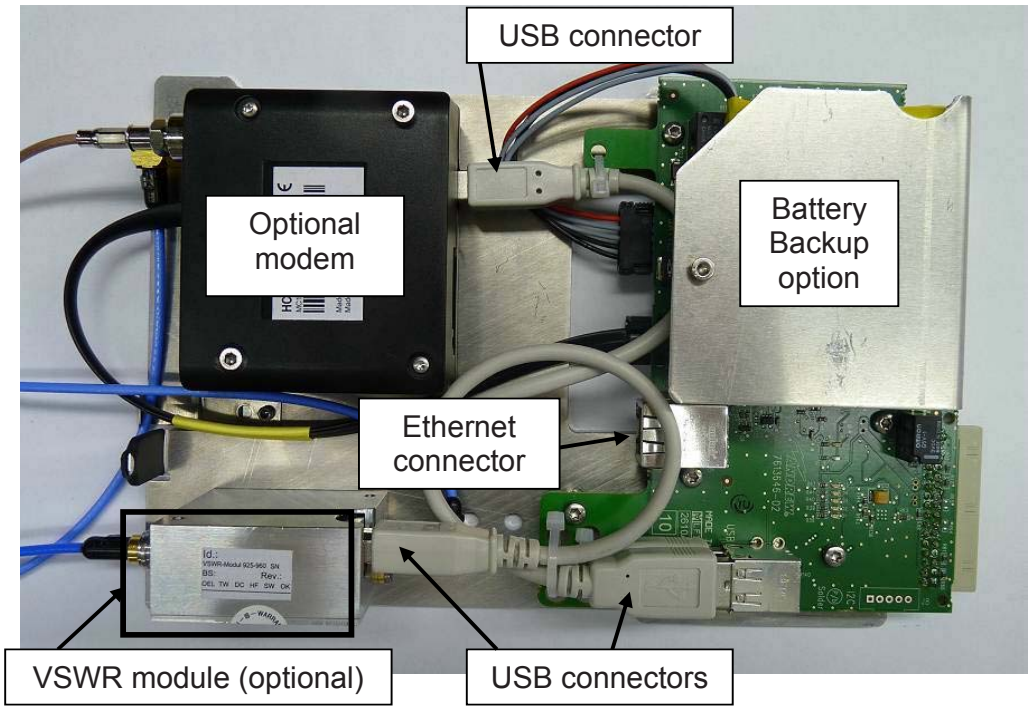


figure 4-16 UI2 Board kit, layout

UI2 board revisions are supported by certain SW versions, i.e. new HW revisions may not be supported by older SW versions. In case of such an incompatibility of HW and SW the message “User Interface 2 HW failure” will be prompted.

4.3.6.1. VSWR Module Option

The VSWR module monitors the VSWR of the Node AM4 coverage port. The module communicates with the controller through USB while measuring the forward and reverse RF signal at the combiner output.

4.3.6.2. Battery Backup Option

The battery backup unit (BBU) including the battery pack is installed on top of the User Interface 2 (UI2) board and located underneath the cover sheet. The BBU ensures that the Node AM4 can log-off from a Network Management system in case the mains voltage will be switched off.

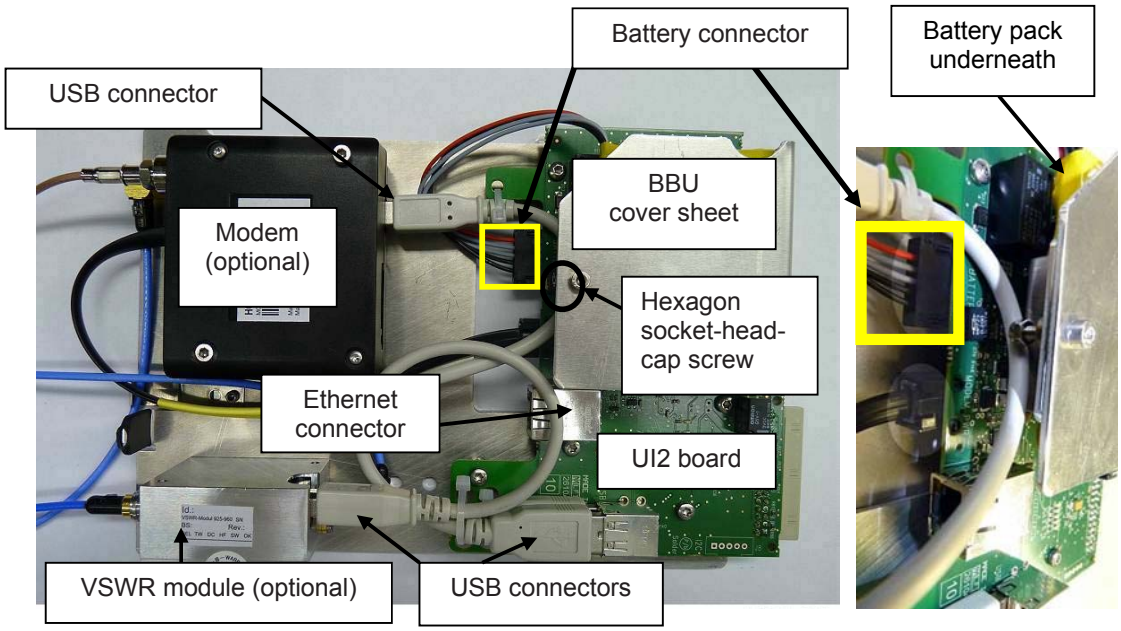


figure 4-17 Position of UI2 Board and BBU

☞ **Note:** We recommend replacing the battery pack **after 4 years** of operation.

1. **Caution**: Electrolyte inside. Risk of health hazards associated with electrolyte leakage. Do not disassemble, puncture, modify, drop, throw, or cause other unnecessary shocks to batteries.

2. **Caution**: High current if shorted. Risk of injury by high current. Do not short circuit the batteries.

3. **Caution:** The batteries might be hot. Risk of burns by hot surface. Do not touch the batteries before they have sufficiently cooled down.

Notice: For the replacement procedure, also observe the health and safety warnings in chapters *5.1* and *5.2.1* as well as the notes in chapter *5.2*.

Do not put the batteries to the garbage but dispose of them properly according local and/or regional regulations.

To **replace the battery pack,** first uninstall the multiband combiner as explained in chapter *5.2.1*. Then, proceed as follows:

- Unplug the complete module on which the battery pack is installed. Disconnect the battery cable at the UI2 board.
- Just *loosen* the M3x16 hexagon socket-head-cap screw on top of the cover of the battery pack. It is not necessary to unscrew this screw entirely!
- Then the battery pack can be removed easily.
- Insert the new battery pack and fasten the M3x16 hexagon socket-head-cap screw again.
- Reconnect the DC connector to the "Battery" connector at the UI2 board.

4.3.6.3. Optional Modems

☞ **Note:** As optional modem, different types can be used for the Node AM: PHS8 (successor of HC25), PLS8 (for LTE), TRM-5, and MC88 modems. The layout of all types is alike. In the following, the general term "modem" is shortly used, referring to any of these types. GPS is only supported by PHS8 (formerly HC25) and PLS8. Modem type RV50X is supported but it is not available from CommScope. It can only be ordered directly from the manufacturer.

A wireless modem is used to establish a remote connection to the Node AM. The connection may be circuit switched or packet switched and is used to change the parameters of the unit, check and clear alarms, or collect measurement and quality statistics. Furthermore, the modem is requested at the Node AM to alert the operator when there is an alarm.

The modem settings (i.e. which type of modem, Initstring, etc.) may only be changed locally. Should a different modem be used, the operator should ensure that the settings are changed prior to leaving the site.

For technical data of the individual modems, see chapter *7.5.1 HC25 / PHS8 / PLS8 / MC88 / TRM-5*. For the technical data of type RV50X, refer to the data sheet of the manufacturer.

Initstrings

The initialization string (abbreviated by initstring) depends on the operator's network and the modem. It may be necessary to adjust the initstring in the field.
When a modem is selected in the Node AM web interface the default initstring for this modem is suggested. The initstrings for the different modems are listed in the software description for the Node AM.

Modem Installed (valid for HC25 / PHS8 / PLS8 / MC88 / TRM-5)

The modem allows remote control and maintenance of the Node AM.

Parameters may be changed; alarm and measurement statistics may be acknowledged and collected by the OMC.

The modem is installed in the side tube of the unit. To avoid a collision between modem connectors and combiner (especially with 4-way combiners), an adapter kit for modem installation is used (see chapters *5.2.2* and *8*).

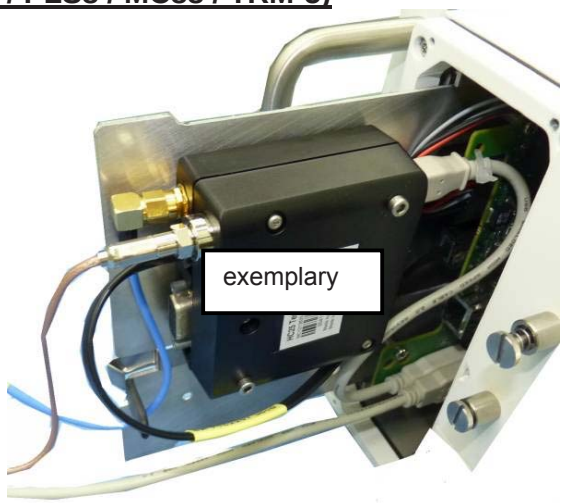


figure 4-18 Modem installed, exemplary

The modem output is connected to the modem coupler port on the rear side of the multiband combiner, or – in case an external modem antenna or directional coupler is used – to the modem RF port; see following exemplary illustration:

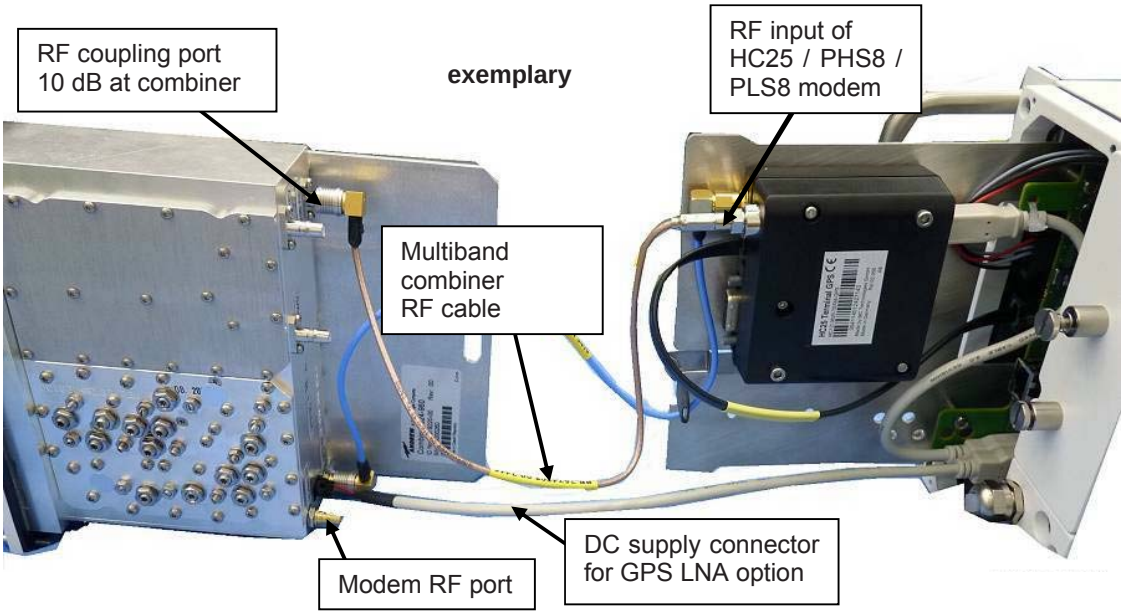


figure 4-19 Cable from the modem to the multiband combiner, exemplary

Connect the wires, cables and connectors of the HC25 / PHS8 / PLS8 modem kit according to the following wiring illustration (both types are identical except the fact that the RS232 connector must not be used with the PHS8/PLS8 types):

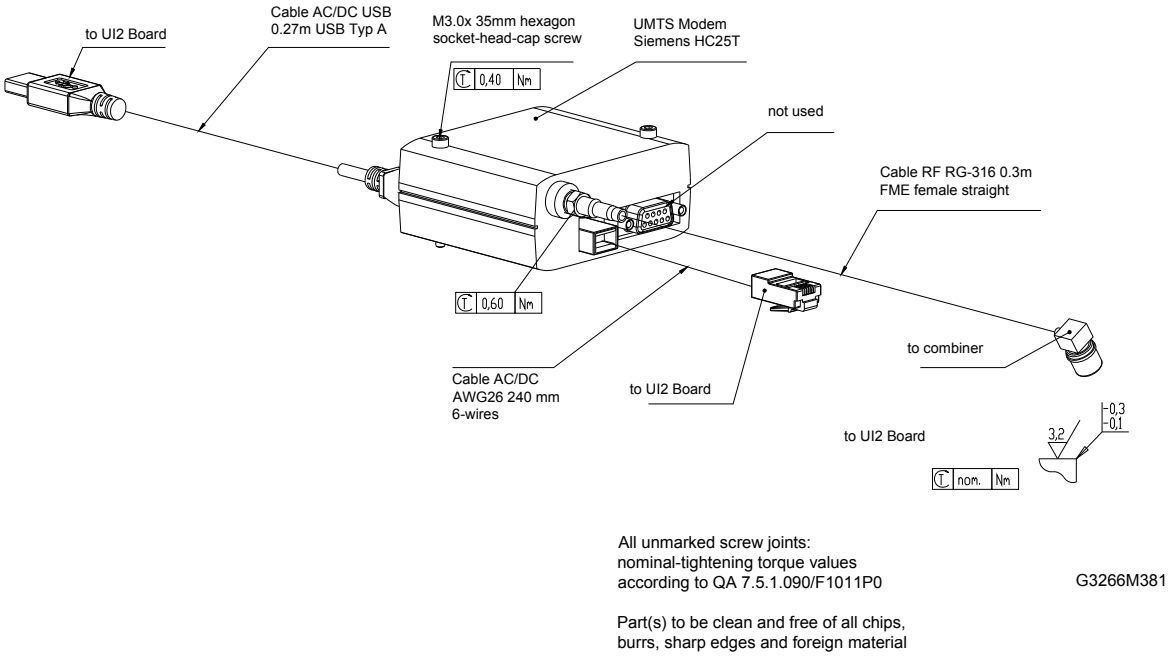


figure 4-20 Modem Kit HC25 / PHS8 / PLS8 Node AM, schematic wiring

Connect the wires, cables and connectors of the MC88 / TRM-5 modem kit according to the following wiring illustration:

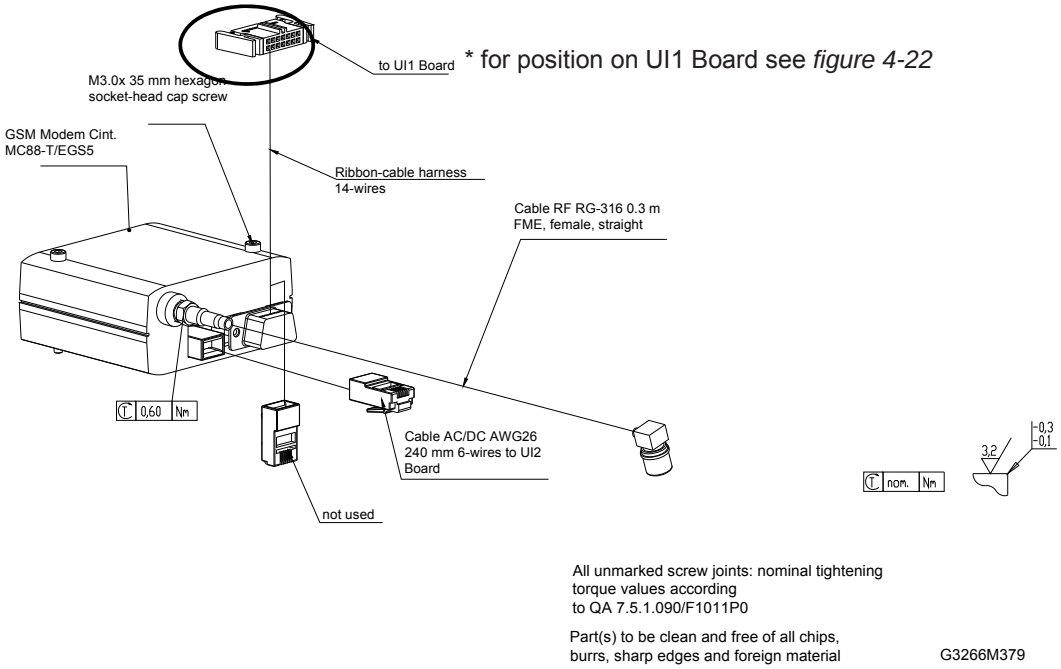


figure 4-21 Modem Kit MC88/TRM-5 Node AM, schematic wiring

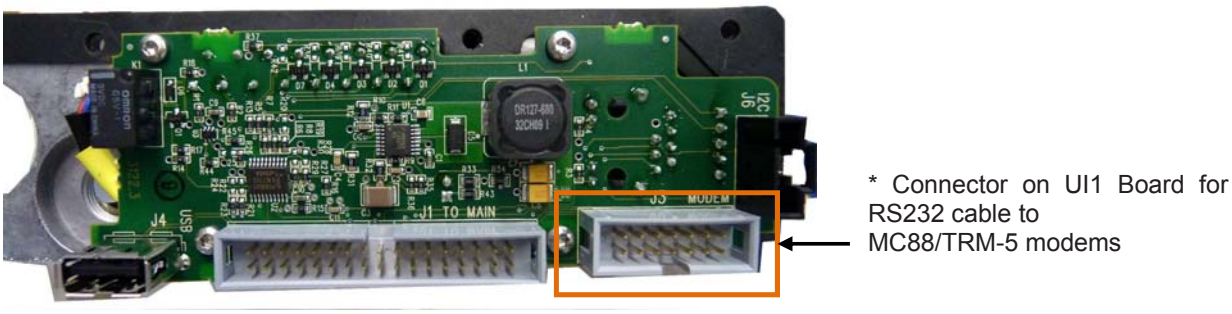


figure 4-22 UI1 Board, position of modem RS232 connector

SIM Card

To insert the SIM card, use a pen and press the small yellow button.
Then, the SIM-card drawer will come out and the SIM-card can be inserted.
Carefully push the drawer to its original position.

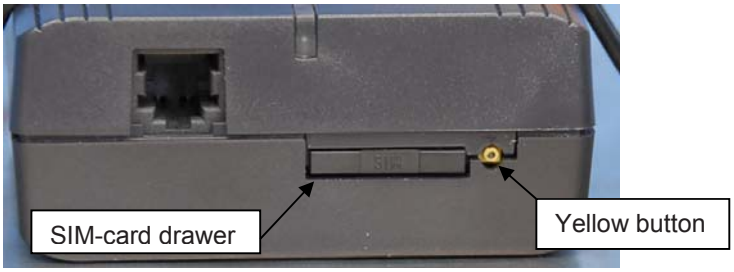


figure 4-23 SIM-card drawer

Installation of modem RV50X

This modem type is not available from CommScope. It can only be ordered directly from the manufacturer. For the installation, proceed as illustrated in the following:

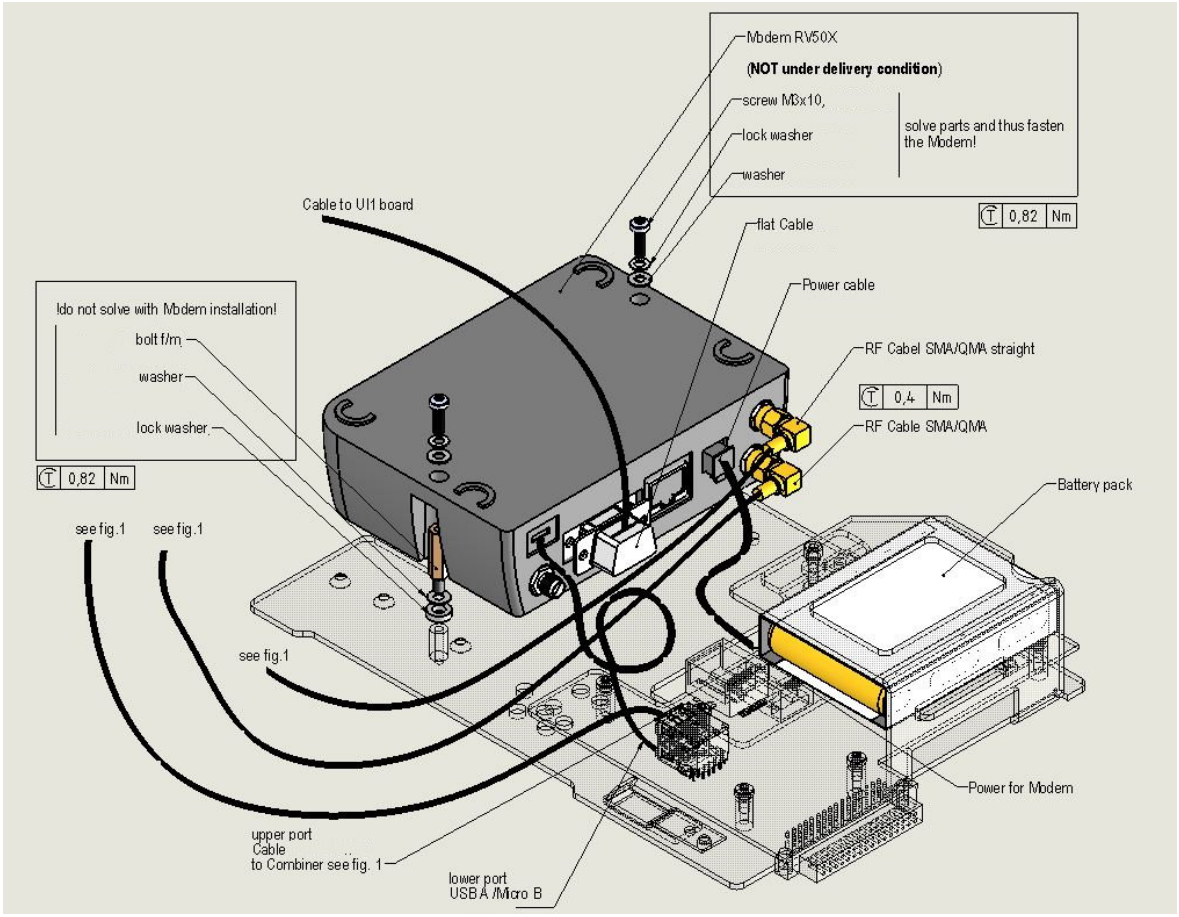


figure 1 final state with Modem

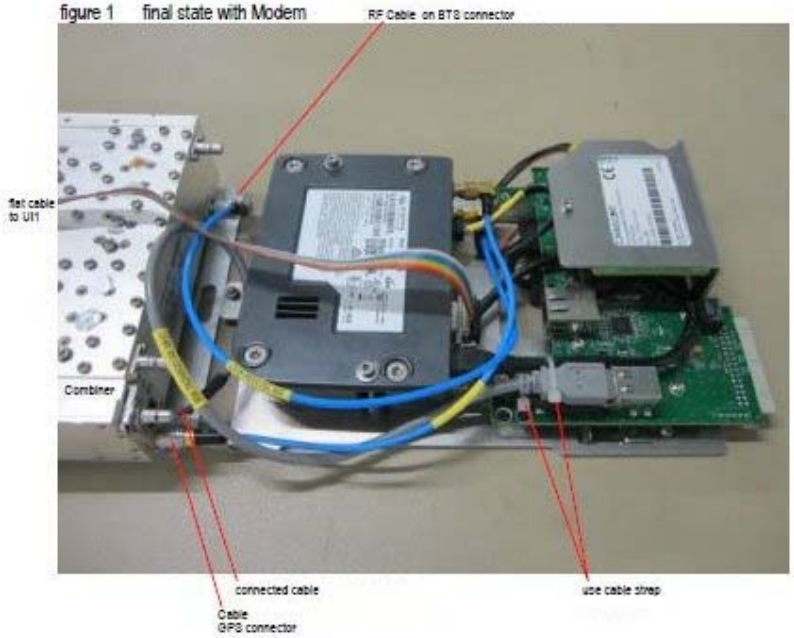


figure 4-24 Installation of modem RV50X

5. Maintenance

5.1. General

Read and observe chapter *1.2*.

Caution: The unit reaches high temperature in operation. Risk of burns by hot surface. Do not touch the unit before it has sufficiently cooled down.

☞ **Notes:**

- The Node AM does not require any preventative maintenance measures apart from the Battery Backup Unit (BBU). It is recommended to replace it after 4 years of operation (see chapter *4.3.6*).
- We recommend checking the cleanliness of the unit and in particular of the fan unit at appropriate intervals depending on the degree of dust and dirt at the installation site. If necessary, any dusty or dirty areas / parts should be cleaned at regular intervals, which also depend on the degree of dust and dirt at the installation site.

  For cleaning, the following procedure is recommended: use an industrial vacuum cleaner and, first, vacuum the outside of the unit. For inside cleaning, remove all plug-in units (as well as the fan unit) according to the instructions in the following chapter, and then, vacuum the fan unit, the cooling fins of the plug-in units as well as the complete interior of the Node AM.
- In the event of a malfunction, the user should check the status of the antennas, feeder cables, connectors, and mains power before replacing any components.
- When sending back the unit, use an appropriate packaging; see chapter *7.3*. We strongly recommend using the original packaging. The transport protection cover (see chapter *3.1.3*) should also be installed for units with bottom type fan unit (see chapter *5.2.7.2*). For a better shock protection of the DC connectors and main board the RF cards must be packed separately.

5.2. Replacement of Components

Read and observe chapter *1.2*.

Maintenance of the Node AM should be performed on a field replaceable unit (FRU) basis only. Do not damage the warranty labels on the components as this voids the warranty.

Unless otherwise agreed to in writing by CommScope, CommScope's general limited product warranty (http://www.commscope.com/Resources/Warranties/) shall be the warranty governing the Node AMs, including the installation, maintenance, usage and operation of the Node AMs.

The spare parts list contains only units that can be replaced without tuning or soldering work. It is not recommended to replace any components inside the Node AM itself, except, RF cards, combiner, and modem. Regarding the replacement of a PSU observe the corresponding Note in chapter 5.2.5.

☞ **Note:** Defect parts should only be replaced by original parts from the supplier. All interventions inside the housing are at one's own risk.

☞ **Note:** During maintenance ensure that the unit has been disconnected from mains.

☞ **Note:** Before disconnecting any cables, label any unlabeled cables to ensure correct reconnection, and check the switch positions of the removed part to set the switches of the new part accordingly.

To replace an FRU, use the appropriate tools. The tools are provided along with the equipment. Replacement tools may be ordered from the supplier.

SMA connectors have a specified torque of 60 N-cm. All screws have a right-hand thread, turn the tool clockwise for tightening and counter-clockwise for loosening. Use an appropriate tool to fasten and unfasten connectors and screws. Do NOT overtighten the connectors or screws!

The tables below show various screws with their respective torques.

Locking Torques for Stainless Steel Screws

Thread Ø	*Nominal torque*
M 2.0	0.40 N-m
M 2.5	0.82 N-m
M 3.0	1.45 N-m
M 4.0	3.30 N-m
M 5.0	6.50 N-m
M 6.0	11.00 N-m
M 8.0	27.00 N-m

table 5-1 Specified torques for stainless steel screws

Standard Torques for Neck-collar Screws

Thread Ø	*Nominal torque*
M 3.0	1 N-m
M 4.0	3.3 N-m
M 5.0	6.05 N-m

table 5-2 Standard torques for neck-collar screws

Standard Torques for Metal Cable Glands

Thread Ø	*Nominal torque to housing or nut*	*Nominal torque sleeve nut*
M 16 x 1.5	20.00 N-m	15.00 N-m
M 20 x 1.5	30.00 N-m	20.00 N-m
PG 7	6.50 N-m	0.42 N-m

table 5-3 Standard torques for metal cable glands

Specified Standard Tolerances

Nominal torque range	*Prescriptive limits*
≤ 0.5 N-m	± 0.05 N-m
≤ 1.0 N-m	± 0.10 N-m
≤ 1.5 N-m	± 0.15 N-m
≤ 2.0 N-m	± 0.20 N-m
≤ 3.0 N-m	± 0.30 N-m
≤ 4.0 N-m	± 0.40 N-m
≤ 5.0 N-m	± 0.50 N-m

Nominal torque range	*Prescriptive limits*
≤ 6.0 N-m	± 0.60 N-m
≤ 8.0 N-m	± 0.70 N-m
≤ 11.0 N-m	± 0.90 N-m
≤ 20.0 N-m	± 1.50 N-m
≤ 35.0 N-m	± 2.00 N-m
≤ 50.0 N-m	± 3.50 N-m

table 5-4 Specified standard tolerances

☞ **Note:** Terminate each open RF connector by 50 ohms, to avoid internal oscillation.

☞ **Note:** Observe that all components have watertight sealings.
After replacement of components all screws have to be fastened tight to ensure watertightness.

☞ **Note:** After the replacement of a component, check whether the system has to be levelled anew.

☞ **Note:** Do not forget to reinstall the splash water shield and vandalism cover (if this option is installed) after the replacement procedure to ensure safe operation.

☞ **Note:** It is recommended to disconnect the Node AM from mains (power-supply line) before an RF card is mounted or dismounted. In case the Node AM is not allowed to be disconnected from mains, the RF card which needs to be replaced must be disabled via software in the Technician page before removing it. This is to avoid possible damage when inserting the new RF card.

If any FRU not contained in the following chapter needs to be replaced, please contact customer service for additional instructions.

5.2.1. Multiband Combiner

Danger: Electrical hazard. Danger of death or fatal injury from electrical current inside the unit in operation. Before opening the unit, disconnect mains power.

Danger: Electrical hazard. Danger of death or fatal injury from electrical current due to a possible short-circuit caused by incorrect handling. Make sure the system has been correctly grounded (earthed) as described in chapter *3.2.3* and connected via external circuit breaker (see chapter *3.2.8*).

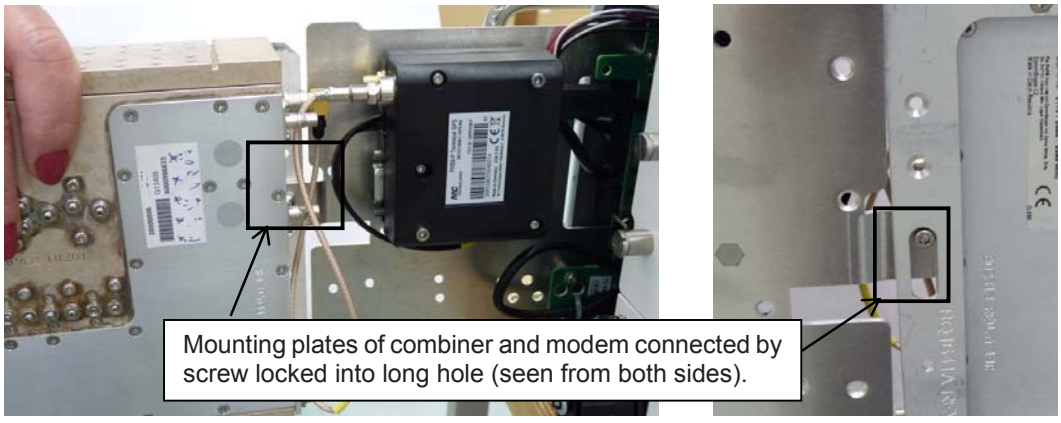
Caution: Rotating fans. Risk of injury in operation. Wear tight-fitting clothes and disconnect mains before working inside the unit.

☞ **Note:** Removal and installation of a combiner on-site must only be done by a service technician of CommScope or by a qualified person authorized and trained for this procedure who is observing the corresponding safety procedures required by local, regional and country-specific regulations which have to be observed during all times of this procedure.

Notes:
The figures in this chapter show the combiner type with three pairs of band ports. The procedure is exactly the same for combiners with two band port pairs.

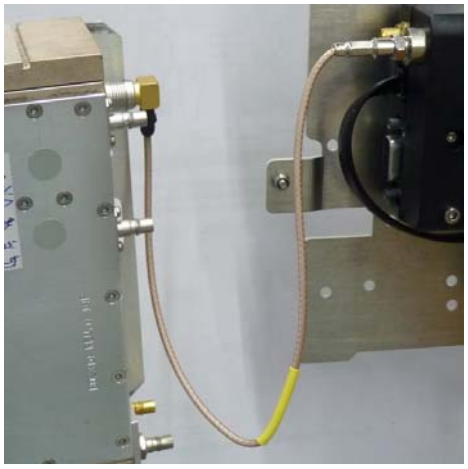
Unscrew the combiner and pull it out **carefully** with your hands.

As the long hole of the combiner's carrier plate is hooked into a screw of the modem mounting plate, this is pulled out to a certain degree, as well:



Unhook the plates and disconnect **all** cables from the combiner. Remember their positions for later reconnection. (For replacement of components on the carrier plate, now refer to the corresponding chapter.)

At four band combiners, the combiner is tied to the carrier plate by a mounting plate that is fixed with screws. To avoid a collision between modem connectors and combiner (particularly with 4-way combiners), an adapter kit for modem installation is used (see figure 5 1 and chapter 8).



Exchange the combiner and re-connect all cables at the correct positions.

☞ **Note:** In case of upgrading with a different type of multiband combiner, make sure that the operating frequency band of the modem still fits to the combiner frequency bands.

Caution: Before sliding the new module in, make sure that no cables inside, e. g. from the PSU, obstruct the way and may get squeezed or damaged in the process. Make also sure that no cables get disconnected by accident. In case of obstructing cables that may get damaged, send the unit back to the supplier for repair.

Carefully slide in the modem carrier plate, using the guide rails provided at the top and bottom of the slot for positioning the module correctly.

Then, reconnect the modem and combiner plates by hooking the screw of the modem plate into the long hole of the combiner plate.

Position the combiner plate in the same guide rails as the modem plate and slide in the combiner **carefully**, also pushing the modem carrier plate back in.

Attention: Be careful with all cables connected. Do not squeeze or damage any cables, and make sure that no cables get disconnected by accident.

Fasten the screws of the combiner tight to restore watertightness (for screw positions, see illustration at the beginning of the procedure).

5.2.2. Modem / Battery

1. **Caution**: Electrolyte inside. Risk of health hazards associated with electrolyte leakage. Do not disassemble, puncture, modify, drop, throw, or cause other unnecessary shocks to batteries.

2. **Caution**: High current if shorted. Risk of injury by high current. Do not short circuit the batteries.

3. **Caution:** The batteries might be hot. Risk of burns by hot surface. Do not touch the batteries before they have sufficiently cooled down.

Do not put the batteries to the garbage but dispose of them properly according local and/or regional regulations.

Notice:

Currently, the battery condition is only detected at shutdown, by making sure the battery has enough charge to allow a complete shutdown process. If the battery is dead, missing, or not able to hold a charge lasting more than a minute or two (the time for a normal shutdown, which could be up to 10 minutes), this will be noticed by the software at the next power up and an alarm raised. However, this means a “good” battery condition can also only be detected at shutdown. If a bad battery is replaced with a good battery in the field, the alarm will not be cleared immediately at the next bootup. Instead the system will have to have a normal power shutdown and then the alarm will be cleared at the following bootup. So, the procedure for replacing a failed battery should be:

1. Shutdown the system.
2. Replace the battery.
3. Power up (alarm will still be raised).
4. Shutdown the system.
5. Power up (alarm will now be cleared).

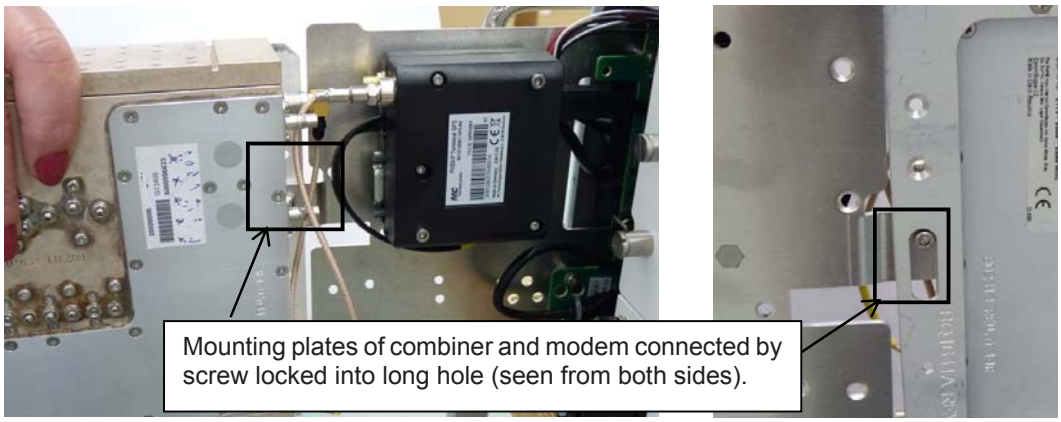
If this is not done, the alarm will be only cleared after the next shutdown and power up event of the system. Also, observe that an alarm is raised once the battery disconnect button on the UI1 board is pressed and the unit is powered up again. To delete the false alarm, the unit has to be shut down and powered up again. During the shutdown, the battery disconnect button must not be pressed.

Notice: For the replacement procedure, also observe the warnings in chapters *5.1* and *5.2.1*.

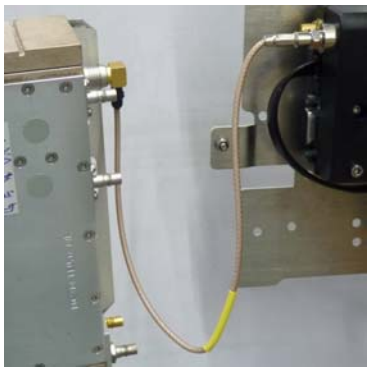
Notice: For tightening SMA connectors, always use an appropriate torque wrench:

Modem and battery are located on a carrier plate located behind the combiner carrier plate. Thus, for replacing the modem or the battery, the combiner has to be removed first. To do so refer to chapter *5.2.1*, observing the corresponding warning messages.

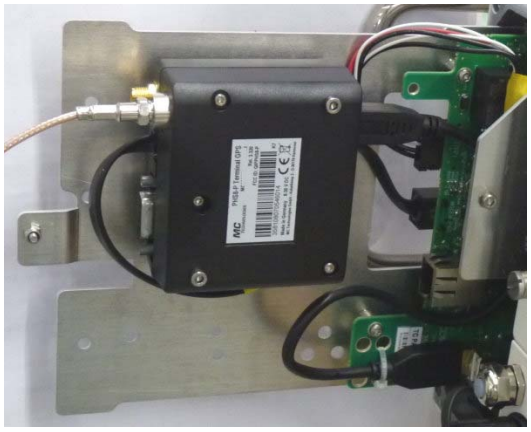
The long hole of the combiner's carrier plate is hooked into a screw of the modem mounting plate, so both plates will be pulled out together:



Unhook the plates and disconnect **all** cables from the combiner. Remember their positions for later reconnection.



Then, also carefully pull out the modem carrier plate completely, as well.

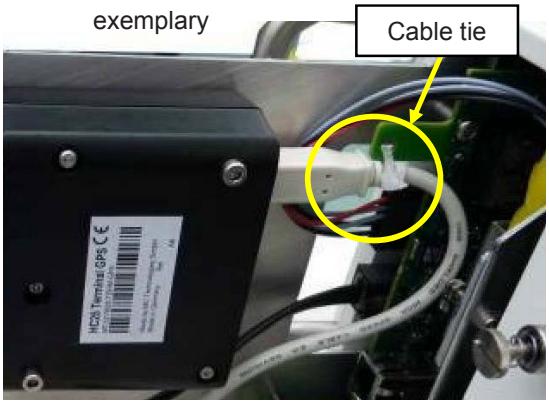


For battery replacement, please refer to chapter *4.3.6* ***Fehler! Verweisquelle konnte nicht gefunden werden.***.

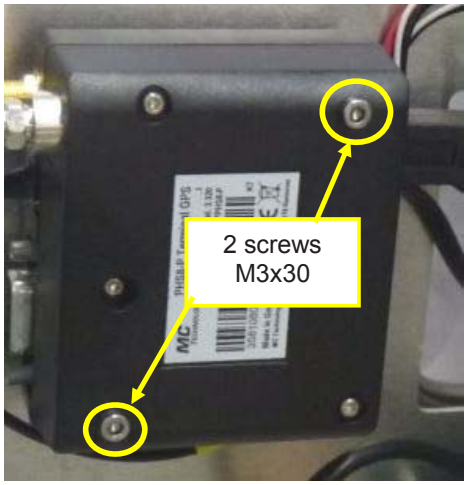
To replace the modem, proceed as follows:

Carefully disconnect all cables from the modem and remember their positions for reconnection.

☞ **Note:** In some cases, a cable tie (as illustrated to the right) might be used. Cutting this cable tie is not necessary if you proceed exactly in the order as described in the following



Unscrew the two hexagon socket-head-cap screws M3x30 of the modem (circle-marked in picture to the right).



Then, re-connect all cables at the new modem (see also schematic wiring illustrations in ***Fehler! Verweisquelle konnte nicht gefunden werden.*** and ***Fehler! Verweisquelle konnte nicht gefunden werden.***) *.

☞ **Note:** When replacing a HC25 modem with the PHS8 type, observe that the RS232 connector must not be used with the PHS8.

* In case of an upgrade with the new adapter kit (see also chapter 8), mount the new modem onto the adapter kit as illustrated in the following figure:

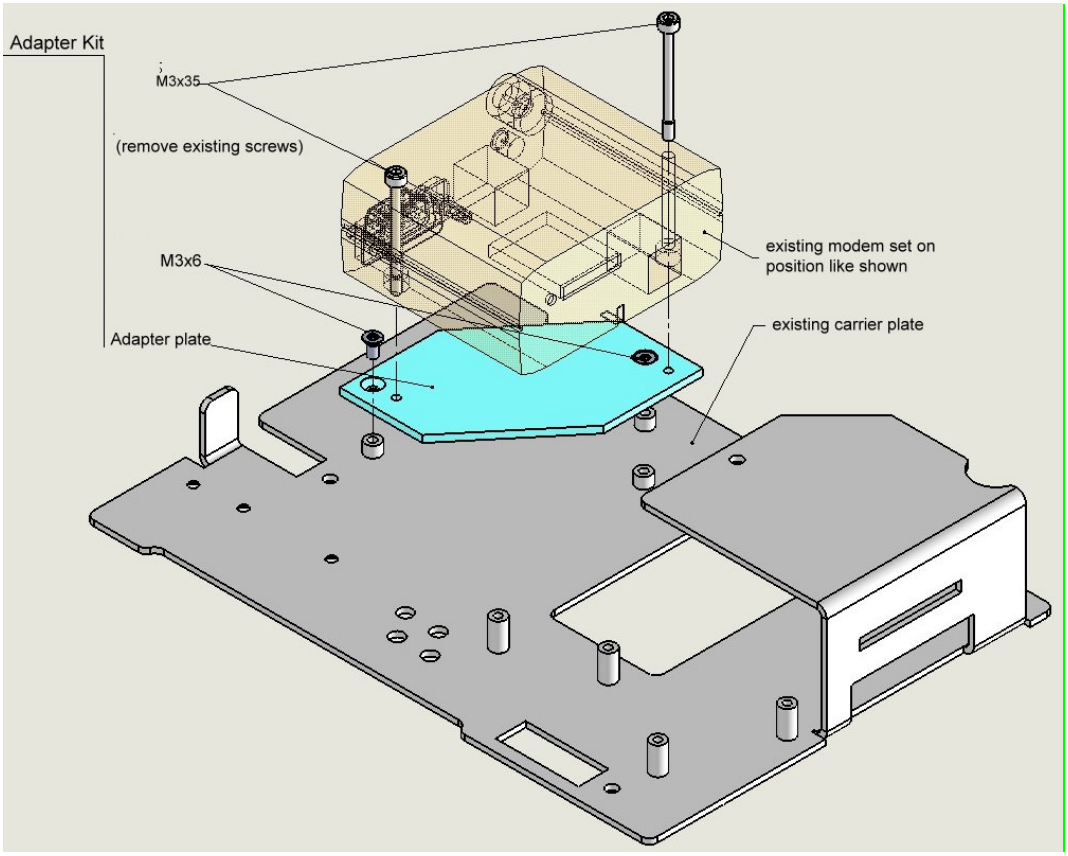
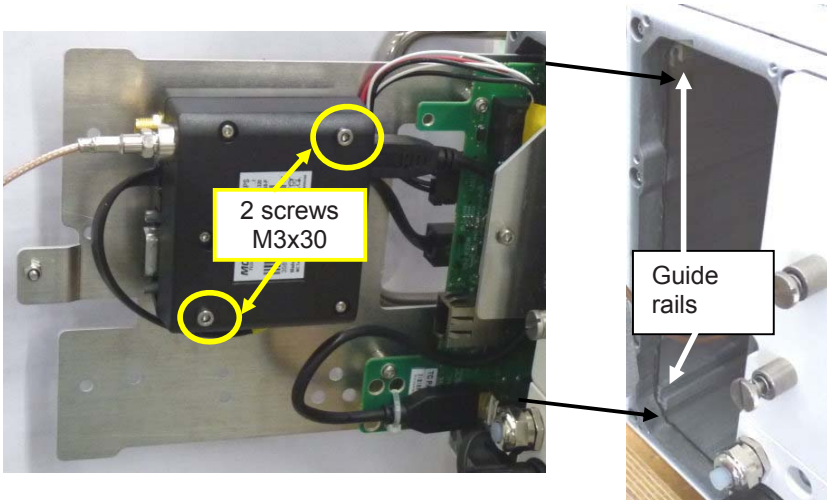


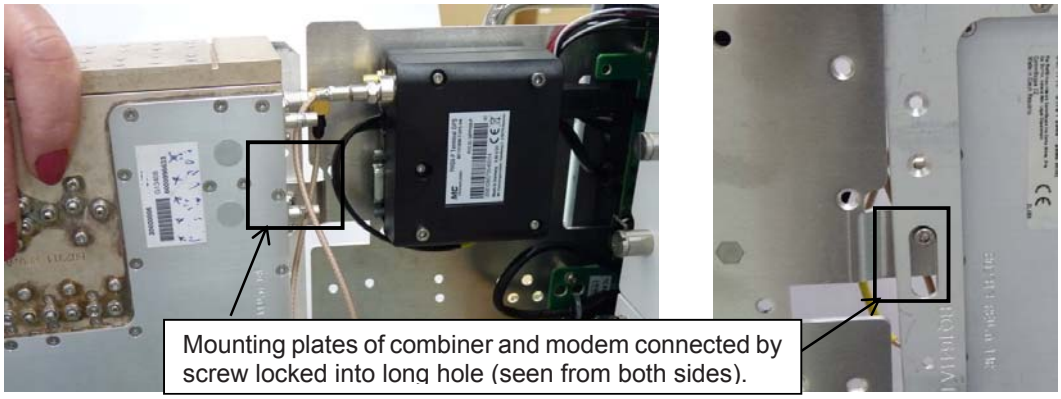
figure 5-1 Installation of modem onto adapter kit

Screw the new modem to the carrier plate with the two hexagon socket-head-cap screws M3x30.

Insert the carrier plate of the modem into the guide rails and carefully push it in, however not completely.



First, reconnect all cables between combiner and modem. Then, reconnect the combiner and modem carrier plates by hooking the screw of the modem mounting plate into the long hole of the combiner plate:



For the final installation of both, refer to the explanation in chapter *5.2.1*, strictly observing the corresponding warning messages.

5.2.3. VSWR Module (Optional)

The VSWR module is located on top of the modem plate. For removing and inserting the plate, refer to chapter *5.2.2*.

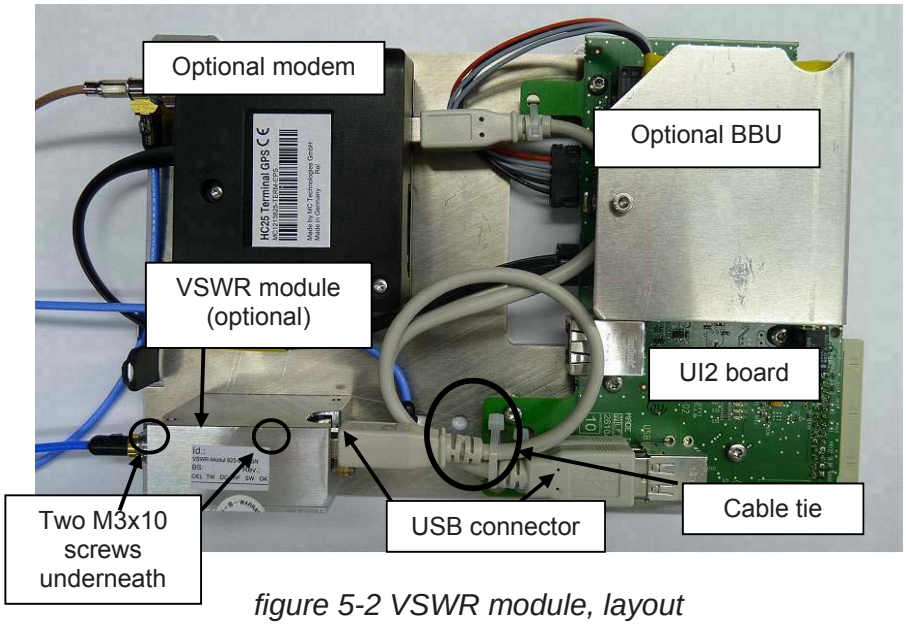


figure 5-2 VSWR module, layout

To replace the optional VSWR module, proceed in the following order:

- Unscrew the two M3x10 counter-sunk head screws underneath the rear side of the modem plate.
- Cutting the cable tie is not necessary if you carefully disconnect the USB connectors and RF cables before taking out the module.

☞ **Note: Make sure to remember their correct positions according to the RF connectors labeled with FWD** (Abbrev. for FORWARD - left) **and REV** (Abbrev. for REVERSE - right), see following illustrations:

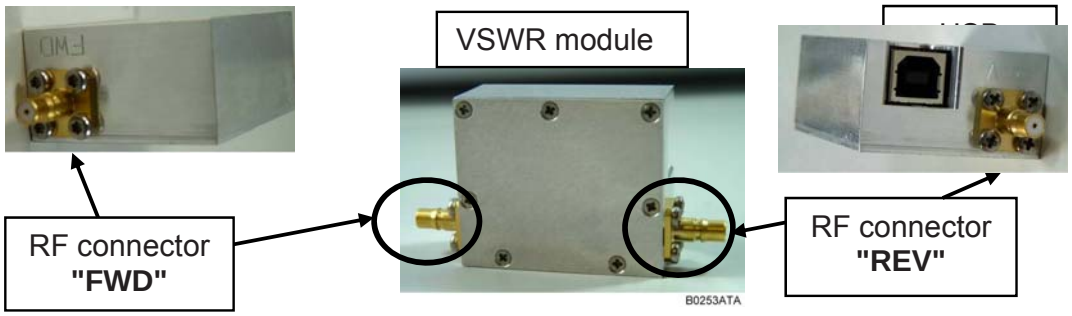


figure 5-3 VSWR module, position of RF connectors

- Insert the new VSWR module and proceed in reverse order, i.e. fasten the two screws again from below and reconnect the USB and RF cables.

☞ **Note: Be careful with the RF connectors! Do not confuse REV and FWD connectors! Ensure to re-connect the FWD-RF connector and cable to their correct positions before the replacement,** (as illustrated in *figure 5-3 VSWR module, position of RF connectors*)**.**

5.2.4. Status LED

For local supervision, a status LED located at the front at the sealed cover of the Node AM UI1 board gives an indication of the summary alarm.

This three-color LED provides visual equipment status information:

Green	Normal operation condition
Red	Summary alarm, critical
Yellow	Summary alarm, uncritical
Status LED off	Check the cables to the external alarm connector. Check mains cabling. Check mains power.

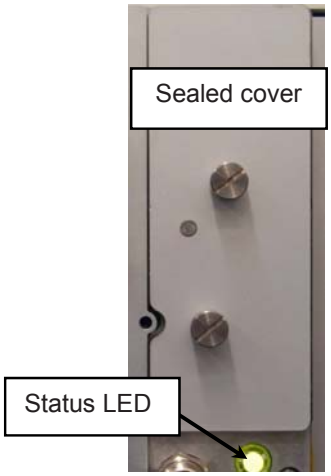


figure 5-4 Cover of UI-card with status LED

If the status LED is not required,

first unscrew the sealed cover and then

disconnect the three connection cables (indicated in the figure above) from the (external alarm) terminal block.

After replacing the cover, fasten the screws tight to restore watertightness.

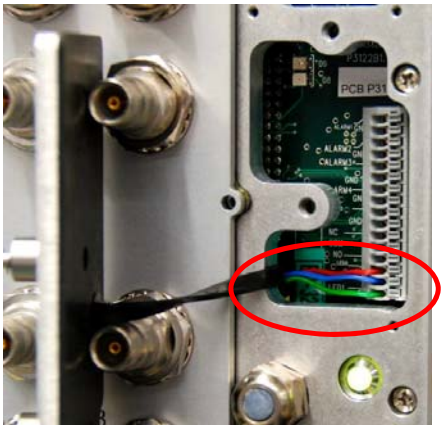


figure 5-5 Status LED and connection cables

5.2.5. Power Supply

Danger: Electrical hazard. Danger of death or fatal injury from electrical current inside the unit in operation. Before opening the unit, disconnect mains power.

Caution: Rotating fans. Risk of injury in operation. Wear tight-fitting clothes and disconnect mains before working inside the unit.

☞ **Note:** We strongly recommend not to replace a defect PSU on-site but to send the Node AM to CommScope for repair. A replacement on-site must only be done by a service technician of CommScope or by an equally trained person who has the necessary qualifications to carry out such a replacement as well as the corresponding safety tests demanded by local, regional and country-specific regulations.

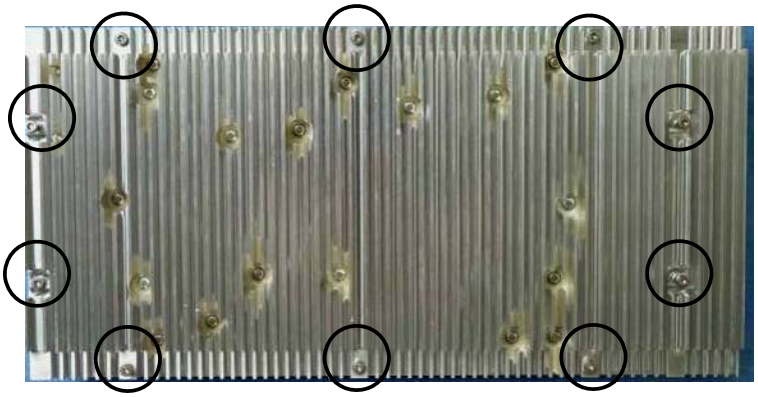
☞ **Note:** Replacing a PSU with another type (e.g. 680 W with 780 W type) is not possible on site.

To remove the original power supply (AC/DC and DC/DC types are available), proceed as follows:

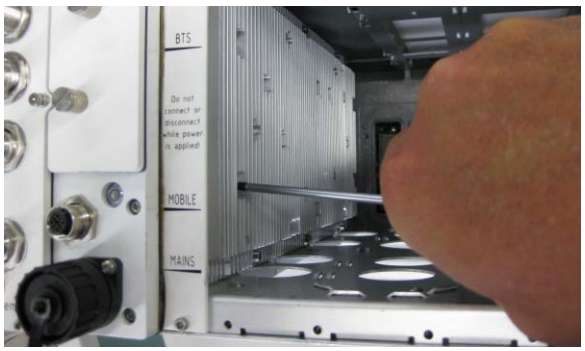
Remove RF and dummy cards as described in the next chapter *5.2.6*.

We strongly recommend, to remove the combiner as well (see chapter *5.2.1*).

Positions of the ten hexagon socket head cap screws of the power supply.



Unscrew the ten hexagon socket head cap screws of the power supply (positions as shown above).

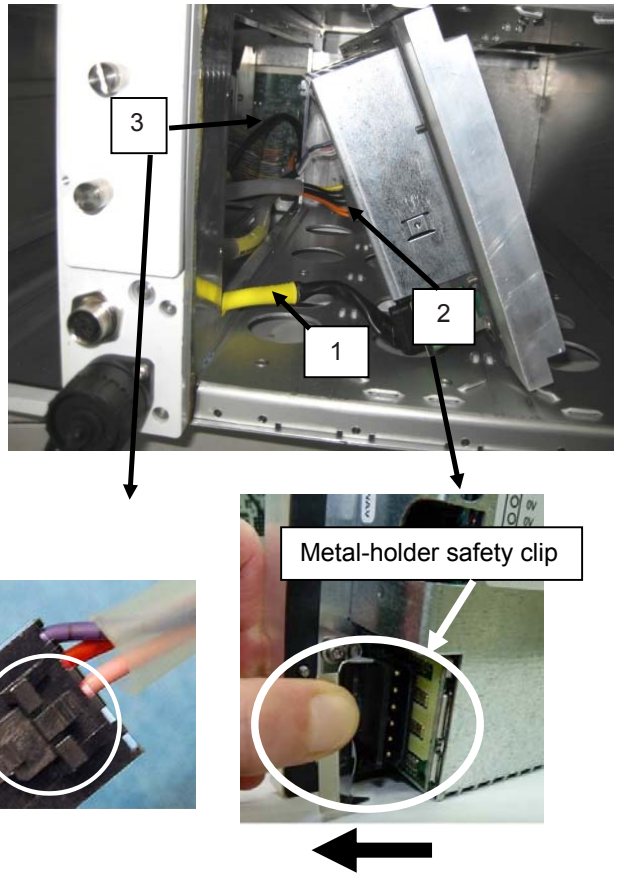


☞ **Note:**
Do not unscrew any Torx screw.

Lift out the power supply carefully with the lower part first.

Disconnect the cables and carefully lift the safety clips for the disconnection.

1 mains cable (AC – or DC) [1)]
2 secondary cable (DC) [2)]
→ with safety clip
3 I²C bus cable [3)]
→ snap-in clip / no safety clip



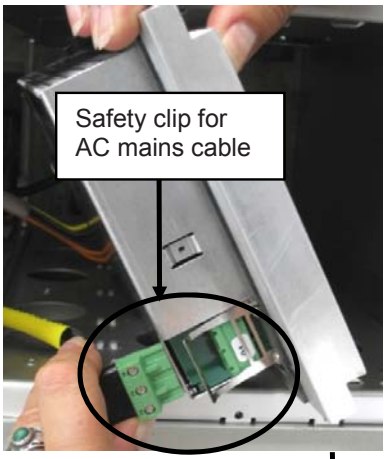
[1)] To disconnect the mains cable, observe the precautions illustrated on the next page.

[2)] To disconnect cable, press metal-holder safety clip to the rear!

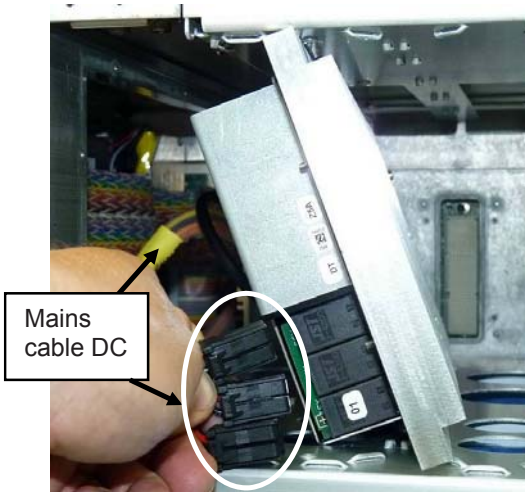
[3)] Observe that the snap-in clip of I²C bus cable has to be pressed while loosening the cable.

When **disconnecting the mains cable** from the power supply, observe the following:

In case of an **AC/DC type**, carefully lift the safety clip for the disconnection of the mains cable:



In case of a **DC/DC type**, press the snap-in clip for disconnection.



When reconnecting the cables to the new power supply, observe the same precautions as explained for the disconnection.

Observe that the cables have to be positioned as illustrated above to avoid damage by squeezing, and make sure that no cables get disconnected by accident. Also, make sure that no cables get in contact with the combiner and might be damaged or get disconnected when the combiner is removed. After the procedure, carry out the corresponding safety tests demanded by local, regional, and country-specific regulations before mains is reconnected.

Then, fasten the power supply with the ten hexagon socket head cap screws.

Reinstall the RF and dummy cards and fasten all their screws tight to restore watertightness.

5.2.6. RF Card Exchange / Upgrade with Additional RF Cards

Caution: Rotating fans. Risk of injury in operation. Wear tight-fitting clothes and disconnect mains before working inside the unit.

☞ **Notes:**

- → This instruction is also valid for the **slot duplexer**.
- → **It is strongly recommended to disconnect the Node AM from mains** (power-supply line) **before an RF card is mounted or dismounted**. In case the Node AM is not allowed to be disconnected from mains, the RF card which needs to be replaced must be disabled via software in the Technician page before removing it. This is to avoid possible damage when inserting the new RF card.
- → Observe that the RF cards must always be packed separately for transport
- → All unused slots need to be assembled with a dummy card for sufficient airflow and provided IP class.
- → Before upgrading or when replacing single-band with dual-band cards, observe the limitations for the number of dual-band cards that may be equipped as specified in chapter 7.1.
- → Replacing a single-band with a dual-band card impacts the share of available filters. A total of 48 (backplane-controlled) filters can be defined at freely variable proportions for all single-band cards equipped. For dual-band cards, these filters are not available but each dual-band card provides additional 32 wide-band filters, which can be variably shared among the two bands of this card only. Thus, if a single-band card for which more than 32 filters were defined is replaced, these can no longer be provided by the dual-band card.
- → This chapter shows the single-band cards but it is valid for dual-band cards as well.

To replace an RF card or to upgrade the Node AM with additional RF cards, proceed as follows:

To remove an RF card / or dummy card (in case of an upgrade):

Disconnect the cables.

Loosen the four socket head cap screws M3x16 mm) and take the RF / dummy card out.

To install the RF card:

Use the guide rails on top and bottom to fit in the RF card smoothly.

☞ **Note:** Fasten the screws of the RF card tight to restore watertightness. To do so, first, just slightly tighten the screws crosswise in order to avoid cant, and when all four screws are positioned correctly, fasten them tight.

Use the guide rails on top and bottom to fit in the RF card smoothly.
Reconnect the cables.

☞ **Note:** If an RF Card is exchanged by a card of another type, e.g. an AF2125 by an AF1825/2125, resetting this card via the Technician Setup menu of the SW (see SV manual) is recommended.

In case of an upgrade, also observe the following:

If the multiband combiner has to be upgraded as well (i.e. two-band combiner to three-band combiner), refer to the instructions in chapter *5.2.1* for the exchange.

The required RF cables are part of the delivery of the RF card.

Connect the individual BTS band ports of the combiner to the BTS ports of the according band of the RF cards.

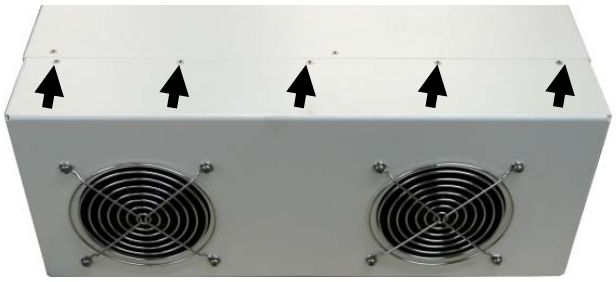
Connect the individual Mobile band ports of the combiner to the Mobile ports of the according band of the RF cards.

5.2.7. Fan Unit

5.2.7.1. Backside Type

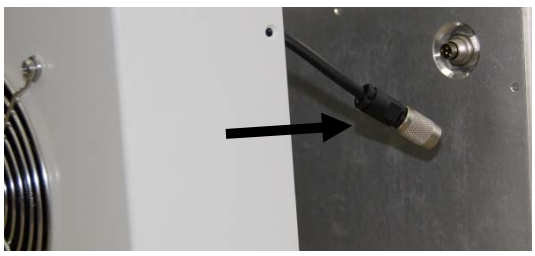
For maintaining and cleaning instructions please refer to chapter *5.1 General*.

Caution: Rotating fans. Risk of injury in operation. Wear tight-fitting clothes and disconnect mains before connecting or replacing or cleaning the fan unit.



Unscrew the 14 x M3x6 countersunk Torx screws, 5 on top, 5 at the bottom, 2 at each side.

Carefully pull the complete fan unit from the cabinet.
Unscrew the fan unit connector and disconnect it.



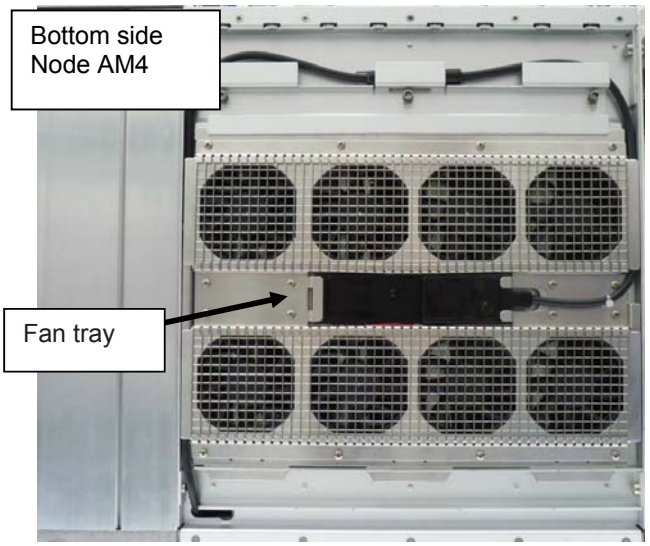
To mount the new fan unit, proceed in reverse order.

5.2.7.2. Bottom Type

For maintaining and cleaning instructions please refer to chapter *5.1 General*.

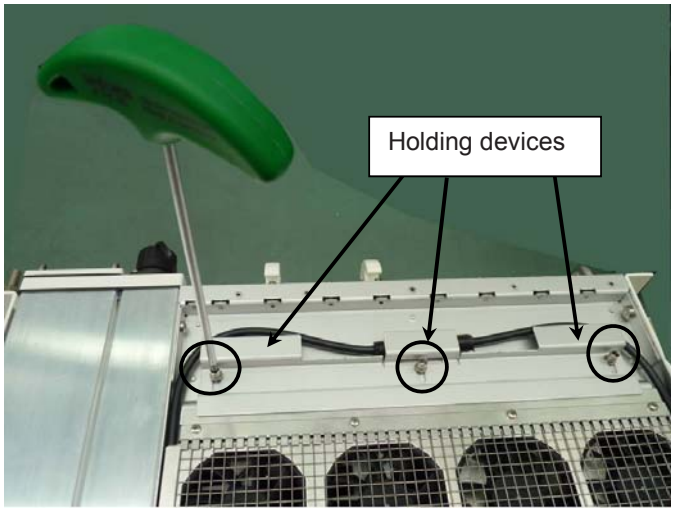
Caution: Rotating fans. Risk of injury in operation. Wear tight-fitting clothes and disconnect mains before connecting or replacing or cleaning the fan unit.

Recommendation:
To access the fan tray, carefully turn the Node AM upside down.

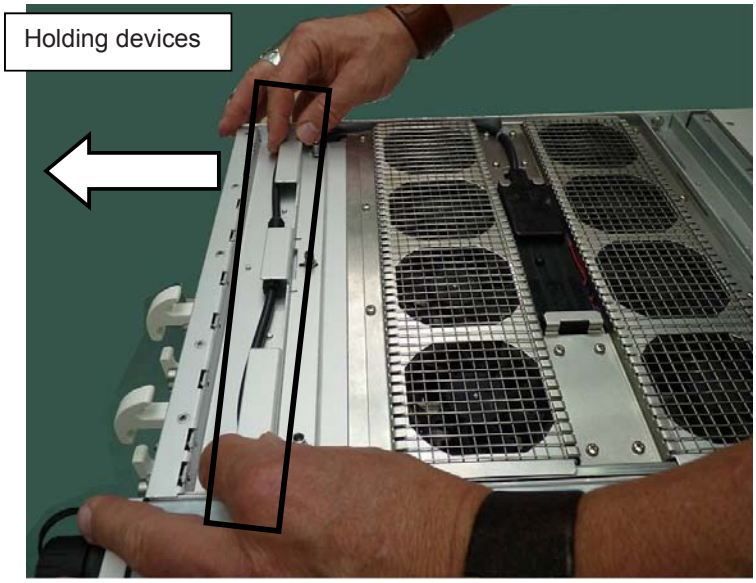


Attention:
Ensure to remember the exact position of the cables connected! Do NOT squeeze any cables.

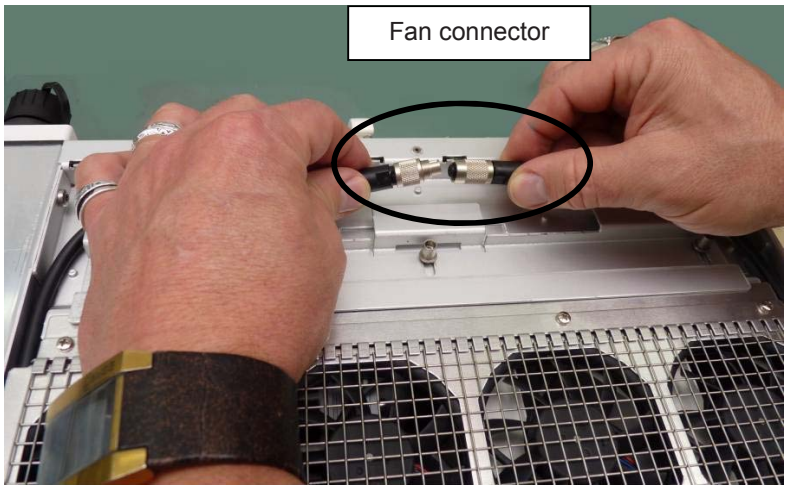
Just loosen the 3 screws (circle-marked) slightly at the holding devices for the fan tray and cable.



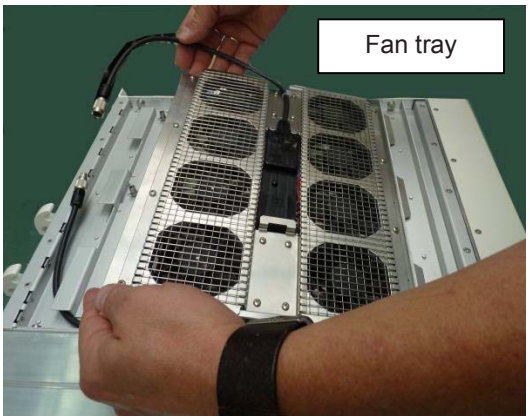
Slid the unit in the direction of the arrow shown in the picture and lift it.



Then you get access to the fan cable to be disconnected.



Carefully lift the fan tray to be replaced.



To mount the new fan unit, proceed as follows:

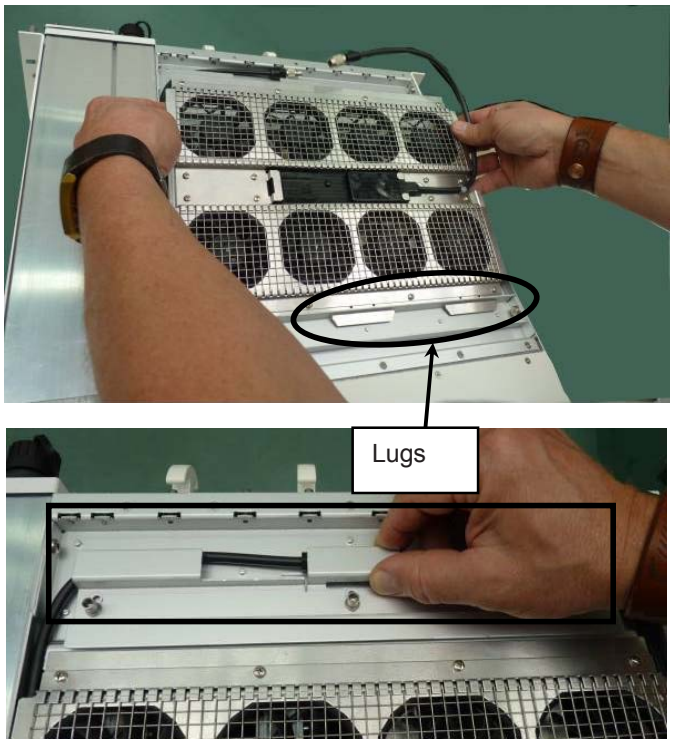
Bring in the new fan tray with the lugs along the guides.

Insert it into the grooves provided while moving back the holding devices.

Attention:
Take care to properly place the fan cables again as before the replacement. Do not squeeze them.

Reconnect the fan cable connectors and bring the fan cable into position.

Tighten the holding devices for fan tray and cable again.



Installation finished:

6. Illustrations

6.1. Cabinet Drawings Node AM

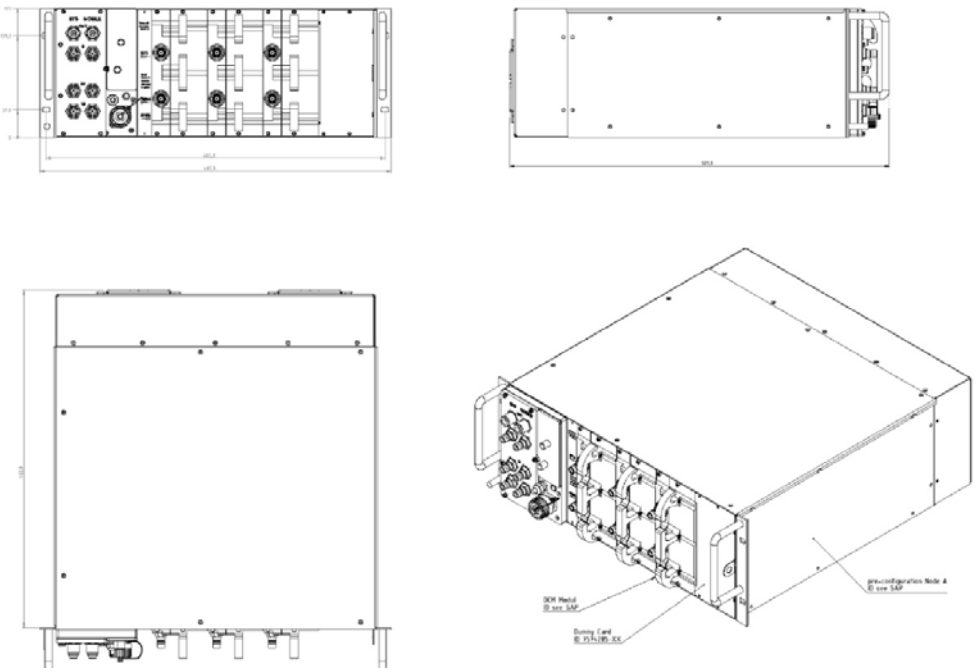


figure 6-1 Cabinet of a Node AM4 (fan unit backside type)

6.2. Layout

figure 6-2 Layout of the Node AM4, example

7. Specifications

7.1. Electrical Specifications

7.1.1. RF Card Options

Modulation Scheme	RF Card	UL Frequency, MHz	DL Frequency, MHz	Max. Gain, dB	Uplink Composite Output Power, dBm*	Downlink Composite Output Power, dBm*
LTE 700	AF 7524	703 to 748	758to 803	80	27	24
LTE 800**	AF 824	832 to 862	791 to 821	80	27	24
	AF 835			90	27	35
LTE 850	AF 8524	824 to 849	869 to 894	80	27	24
	AF 8535			90	27	35
GSM-R 900***	AF 923 R	876 to 880	921 to 925	80	25	23
	AF 936 R			90	25	36
GSM-R 900***, EGSM 900***, UMTS 900, LTE900**	AF 923 RE	876 to 915	921 to 960	80	25 (GSM) 27 (UMTS, LTE)	23 (GSM) 25 (UMTS, LTE)
	AF 936 RE			90	25 (GSM) 27 (UMTS, LTE)	36 (GSM, UMTS, LTE)
EGSM 900***, UMTS 900, LTE 900**	AF 923	880 to 915	925 to 960	80	25 (GSM) 27 (UMTS, LTE)	23 (GSM) 25 (UMTS, LTE)
	AF 936			90	25 (GSM) 27 (UMTS, LTE)	36 (GSM, UMTS, LTE)
GSM 1800, LTE 1800**	AF 1823	1710 to 1785	1805 to 1880	80	26 (GSM) 27 (LTE)	23 (GSM) 25 (LTE)
	AF 1835			92	26 (GSM) 27 (LTE)	35 (GSM, LTE)
UMTS 2100, LTE 2100**	AF 2125	1920 to 1980	2110 to 2170	82	28 (UMTS) 27 (LTE)	25 (UMTS, LTE)
	AF 2135			92	28 (UMTS) 27 (LTE)	35 (UMTS, LTE)
LTE 2600**	AF 2625	2500 to 2570	2620 to 2690	82	27	25
	AF 2635			92	27	35

* Output power per carrier (dBm) = composite output power (dBm) - 10 ˣ log (no. of carriers)

** LTE and UMTS uplink composite output power (dBm) valid for sub-bands ≤ 10 MHz, slight reduction of output power for sub-bands > 10 MHz only"]

*** Downlink output power @ 2 carriers for AF936, AF936R, AF936RE: 30 dBm/carrier

table 7-1 RF card options, EMEA, single band cards

Modulation Scheme	RF Card	UL Frequency, MHz	DL Frequency, MHz	Max. Gain, dB	Uplink Composite Output Power, dBm [1]		Downlink Composite Output Power, dBm [1]		
CELL 700, UMTS 700, LTE 700	AF 727	698 to 716 and 776 to 787	728 to 757	84	30 (GSM, CDMA, IDEN, LTE)	28 (UMTS)	27 (GSM, CDMA, IDEN, LTE)	25 (UMTS)	
	AF 737			94	30 (GSM, CDMA, IDEN, LTE)	28 (UMTS)	37 (GSM, CDMA, IDEN, LTE)	35 (UMTS)	
CELL 850, UMTS 850, LTE 850	AF 8527	824 to 849	869 to 894	84	30 (GSM, CDMA, IDEN, LTE	28 (UMTS)	27 (GSM, CDMA, IDEN, LTE)	25 (UMTS)	
	AF 8537			94	30 (GSM, CDMA, IDEN, LTE)	28 UMTS	37 (GSM, CDMA, IDEN, LTE)	35 (UMTS)	
CELL 900	AF 9037	896 to 902	935 to 941	94	30 (GSM, CDMA, IDEN)		37 (GSM, CDMA, IDEN)		
CDMA 1700 [3], UMTS 1700 [3], LTE 1700 [3]	AF 1727	1710 to 1755	2110 to 2155	84	30 (CDMA, LTE)	28 (UMTS)	27 (CDMA, LTE)	25 (UMTS)	
	AF 1737			94	30 (CDMA, LTE)	28 (UMTS)	37 (CDMA)	35 (UMTS)	36 (LTE)
LTE 1700 [3]	AF1727E	1710 to 1780	2110 to 2180	84	30 (CDMA, LTE)	28 (UMTS)	27 (CDMA, LTE)	25 (UMTS)	
GSM 1900 CDMA 1900, LTE 1900	AF 1927	1850 to 1915	1930 to 1995	84	30 (GSM, CDMA, LTE)		27 (GSM, CDMA, LTE)		
	AF 1937			94	30 (GSM, CDMA, LTE)		37 (GSM, CDMA, LTE)		
LTE 2600 [2]	AF 2625	2500 to 2570	2620 to 2690	82	27		25		
	AF 2635			92	27		35		

1) Output power per carrier (dBm) = composite output power (dBm) - 10 x log (no. of carriers)
2) LTE uplink composite output power (dBm) valid for sub-bands ≤ 10 MHz
3) To fulfill the FCC the UL requirement of 1 Watt EIRP max. for the AWS uplink band, the type of donor antenna must be selected in a way not to exceed the 1 Watt. EIRP. Antenna type selection and execution of installation has to be done in accordance to the relevant FCC part and is in responsibility of the installer.

table 7-2 RF card options for USA, single band cards

RF Card	Modulation Scheme	UL Frequency, MHz	DL Frequency, MHz	Max. Gain, dB	Uplink Composite Output Power, dBm*	Downlink Composite Output Power, dBm*
AF824/923 (combined antenna ports)	LTE 800	832 to 862	791 to 821	70	27	25
	EGSM 900, UMTS 900, LTE 900	880 to 915	925 to 960		24 (GSM) 27 (UMTS, LTE)	22 (GSM) 25 (UMTS, LTE)
AF 1823/2125 (combined antenna ports)	GSM 1800, LTE 1800	1710 to 1785	1805 to 1880	72	26 (GSM) 27 (LTE)	23 (GSM) 25 (LTE)
	UMTS 2100, LTE 2100	1920 to 1980	2110 to 2170		27 (UMTS, LTE)	25 (UMTS, LTE)

* Output power per carrier (dBm) = composite output power (dBm) - 10 x log (no. of carriers)

table 7-3 RF card options, dual band cards

7.1.2. Bandwidths available in UL and DL per rack (single-band cards)

Sub-Band Bandwidth [MHz]	Filter Resources	Sub-Band Bandwidth [MHz]	Filter Resources
0.01 to 5.00	1	40.01 to 45.00	9
5.01 to 10.00	2	45.01 to 50.00	10
10.01 to 15.00	3	50.01 to 55.00	11
15.01 to 20.00	4	55.01 to 60.00	12
20.01 to 25.00	5	60.01 to 65.00	13
25.01 to 30.00	6	65.01 to 70.00	14
30.01 to 35.00	7	70.01 to 75.00	15
35.01 to 40.00	8		

table 7-4 Bandwidths available in UL and DL per rack, single-band cards

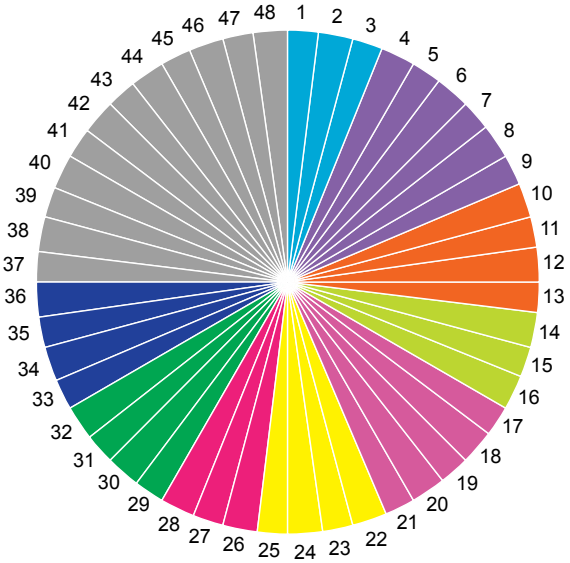
All data is subject to change without notice.

Detailed System Description – Single-Band Cards

Node AM RF cards convert the RF into digital signals and transfer them to the Node AM rack for digital filtering. The digital architecture allows sub-band filtering and is shared between all RF Cards inserted into the Node AM rack. The Node AM4 can provide up to 48 filter resources (up to 5 MHz each). Additional filtering capability is provided by on-card digital signal processing at dual-band RF cards to satisfy increasing demand of sub-bands for further RF-bands or MIMO deployments. When the sub-band bandwidths are greater than 5 MHz, the filter resources are grouped together, without phase or amplitude ripple, where the sub-band is defined by a start and stop frequency. The total number of used filter resources is determined by adding the number of filter resources required for each sub-band.

For example, if there are three sub-bands with 4 MHz for the first sub-band, 11 MHz for the second sub-band, and 20 MHz for the third sub-band, then 1 filter resource is required for the first sub-band, 3 filter resources are required for the second sub-band and 4 filter resources are required for the third sub-band. The total number of used filter resources in this example is 8. However, the maximum available bandwidth (240 MHz) will only be achieved with sub-band bandwidths of integer multiple of 5 MHz.
The following diagram shows examples for filter resources allocation:

Example of filter resources allocation (up to 5 MHz wide) of Node AM4 rack (single-band cards):



Δ	Operator A	GSM 900	1 Band	6 MHz
Δ	Operator A	GSM 1800	1 Band	32 MHz
Δ	Operator A	UMTS 2100	1 Band	20 MHz
Δ	Operator B	GSM 900	1 Band	14 MHz
Δ	Operator B	GSM 1800	1 Band	23 MHz
Δ	Operator B	UMTS 2100	1 Band	20 MHz
Δ	Operator C	GSM 900	1 Band	15 MHz
Δ	Operator C	GSM 1800	1 Band	20 MHz
Δ	Operator C	UMTS 2100	1 Band	20 MHz
Δ	Unused filter resources: 12			

table 7-5 Filter resources allocation (up to 5 MHz wide), example

All data is subject to change without notice.

7.1.3. Bandwidths available in UL and DL per dual-band card

Sub-Band Bandwidth [MHz]	*Filter Resources*
0.01 to 5.00	1
5.01 to 10.00	2
10.01 to 15.00	3
15.01 to 20.00	4
20.01 to 25.00	5
25.01 to 30.00	6
30.01 to 35.00	7
35.01 to 40.00	8

Sub-Band Bandwidth [MHz]	*Filter Resources*
40.01 to 45.00	9
45.01 to 50.00	10
50.01 to 55.00	11
55.01 to 60.00	12
60.01 to 65.00	13
65.01 to 70.00	14
70.01 to 75.00	15

table 7-6 Bandwidths available in UL and DL per dual-band card

All data is subject to change without notice.

Detailed System Description – Dual-Band Cards

With the increasing demand for mobile communication, additional radio frequency (RF) bands are globally assigned to meet that demand. In addition, better utilization of the radio spectrum is being addressed by Multiple-In Multiple-Out (MIMO) antenna technology and techniques. However, basically all measures to increase the communication link capacity result in an increased number of parallel operated radio front ends. In response to this trend, CommScope has enhanced the radio band capacity of its existing Node AM platform by providing Dual Band RF cards. Following a software upgrade, two medium power RF front ends can be operated in the same space of a legacy single band plug-in module.

Thanks to the on-card digital signal processing functionality, up to 32 filter resources (0.2 … 5 MHz each) are available per dual card. Depending on the upgrade goal, i.e. increasing the number of RF bands or MIMO performance, dual band RF cards for inter-band, e.g. 8/9 or 18/21, combination are available.

When using CommScope's Node AM chassis in situations where the sub-band bandwidths are greater than 5 MHz and where the sub-bands are defined by a start and stop frequency, the filter resources are grouped together, without phase or amplitude ripple. The total number of used filter resources per dual band card is determined by adding the number of filter resources required for each sub-band in both RF bands together. For example, if there are three sub-bands with 200 kHz for the first sub-band and 10 MHz for the second sub-band in the 1800 MHz band and 20 MHz for the third sub-band in the 2100 MHz band then one filter resource is needed in the first, two in the second, and four in the third sub-band. The total number of filter resources used is seven.

Example of filter resources allocation (up to 5 MHz wide):

Node AM/A+ Dual-Band RF Card

Com Standard	Carrier width	Filter resources
Δ GSM 1800	200 kHz	1 filter
Δ LTE 1800	10 MHz	2 filters
Δ UMTS 2100	20 MHz	4 filters
Δ Unused filter resources: 25		

table 7-7 Filter resources allocation (up to 5 MHz wide), example

7.2. Mechanical Specifications

Height, width, depth	Node AM4 chassis (with fan at backside)	177.0 x 482.3 x 462.8 mm (7 x 19 x 18.2 in)
	Node AM4 chassis (with fan at bottom)	177.0 x 482.3 x 436.3 mm (7 x 19 x 17.2 in)
Weight	Node AM4 chassis	14 kg (30.8 lb)
	RF card AX23 - AX25	3 kg (6.5 lb)
	RF card AX35 - AX36	4.5 kg (10 lb)
	Dual band RF card	6 kg (13.2 lb)

All data is subject to change without notice.

7.3. Environmental and Safety Specification

Operating temperature range	RF card Ax23 - Ax25 RF card Ax35 - Ax36	-33°C to +55°C -33°C to +50°C
Ingress protection		IP65 (Fans: IP55)
Acoustic noise (fan unit backside type)		47 dB(A) @ 25°C 55 dB(A) @ 50°C

All data is subject to change without notice.

7.4. Features

Features	
Statistic collection	Collecting data (min., max., average, standard deviation) of items measured in a 15 minutes interval.
Gain trailing	Gain adjustment based on DL RSSI. UL gain is automatically set corresponding to DL gain.
Access	Web browser based local access and remote access. Packet data and circuit switched data options. OMC connectivity via SNMP.
External alarms	Up to 5 alarms, active high or low configurable via software.
GPS functionality	Modem with a built-in GPS receiver for fast and easy location detection available as an option. Based on received GPS position the Node AM automatically changes the RF alarm and/or connectivity configuration.
Battery Backup	Battery backup to supply modem and controller for alarming of mains power failure.

All data is subject to change without notice.

For detailed description of the features above, please refer to the software manual which is part of the Node AM4 delivery.

7.5. Modems

7.5.1. HC25 / PHS8 / PLS8 / MC88 / TRM-5

MC Technologies MC88 / TRM-5	
Service	GSM/GPRS
Service connection	Circuit switch Packet switch
Physical connection	RS232, 6PG Molex, FME
Power consumption	4 W
Connectors	Data, power, RF

MC Technologies HC25[1] / PHS8[1] / PLS8-EU / PLS8-US	
Service HC25 / PHS8	GSM/GPRS/EDGE/UMTS HSPA[2] GPS
Service PLS8EU	LTE: 800/900/1800/2600 MHz, FDD-Band (20,8,3,7) UMTS (WCDMA): 900/1800/2100 MHz, FDD-Band (8,3,1) GSM/GPRS/EDGE: 900/1800 MHz GPS
Service PLS8US	LTE: 700/850/AWS(1700/2100)/1900 MHz, FDD-Band (17,5,4,2) UMTS (WCDMA): 850/AWS(1700/2100)/1900 MHz, FDD-Band (5,4,2) GSM/GRPS/EDGE: 850/900/1800/1900 MHz GPS
Service connection	Circuit switched data (not available for PLS8) Packet switched data
Physical connection	USB, RS232[3], 6PG Molex, FME
Power consumption	4 W
Connectors	Data, power, RF

1) Modem PHS8 is replacing Modem HC25, which is discontinued (both are identical except the fact that the RS232 connector must not be used with the PHS8 type).

2) HSPA is for PHS8 only

3) The RS232 connector must not be used with the PHS8 and PLS8 types.

☞ **Note:** The HC25 / PHS8 and MC88 modems are similar. **For TRM-5 and MC88 modems, please make sure that the serial port baud rate is set to the appropriate value.** Please refer to the Node AM/ Node A+ Software Manual for more details.

7.5.2. Wireless Router M!DGE (Racom)

M!DGE *	
Service	LTE/HSPA/UMTS/EDGE/GPRS
Service connection	Circuit switch Packet switch
Physical connection	RS232, 2x Ethernet, USB, SMA
Power consumption	5 W
Connectors	Data, power, RF

* M!DGE Wireless Router supported by software, mounting kit incl. cables available; M!DGE router must be purchased directly at Racom or any distributors.

8. Spare Parts List

The following list contains all FRUs available for the Node AM4. The Node AM4 configuration is available in the web interface.

Designation		ID No
Node AM4		**7613589**
Adapter Kit Modem Node AM [1)]		7817687
Combiner Kit 8-9/18/21 GPS, VSWR		7617865
Combiner Kit 8/9/18/21 GPS, VSWR [1)]		7635384
Combiner Kit 8/9/18-21/26 GPS, VSWR [1)]		7697443
Combiner Kit 8-9/18/21/26 GPS, VSWR [1)]		7697689
Combiner Kit 7/8-9/18-21/26 GPS, VSWR [1)]		7703442
Combiner Kit 7/85/17E/19		7817692
Cover (for transport protection)		7703683-00
DCM Com-mercial Applica-tions (EMEA)	DCM AF 7524 (703-748 / 758-803 MHz)	7761303-00
	DCM AF 7524L (703-733 / 758-788 MHz)	7761306-00
	DCM AF 824 (832 – 862 / 791 – 821 MHz) [2)]	7661357-01
	DCM AF 824 (832 – 862 / 791 – 821 MHz)	7621773-01
	DCM AF 824/923 combined ports (832 to 862/791 to 821 MHz & 880 to 915/925 to 960 MHz)	7693191-00
	DCM AF 835 (832 – 862 / 791 – 821 MHz)	7621771-01
	DCM AF 923 R (876 - 880 / 921 - 925 MHz)	7606744-01
	DCM AF 936 R (876 - 880 / 921 - 925 MHz)	7606746-01
	DCM AF 923 RE [2)] (876 to 915/921 to 960 MHz) (requires Slot Duplexer 7621867-00)	7621746-01
	DCM AF 936 RE (876 to 915/921 to 960 MHz) (requires Slot Duplexer 7621867-00)	7625530-01
	DCM AF 923 (880 - 915 / 925 - 960 MHz)	7562492-01
	DCM AF 923 (880 - 915 / 925 - 960 MHz) [2)]	7630563-01
	DCM AF 936 (880 - 915 / 925 - 960 MHz)	7562493-01
	DCM AF 1823 (1710 - 1725 / 1805 - 1880 MHz)	7562494-01
	DCM AF 1823 (1710 - 1725 / 1805 - 1880 MHz) [2)]	7630565-01
	DCM AF 1823/2125 combined ports (1710 to 1785/1805 to 1880 MHz)	7700741-00
	DCM AF 1835 (1710 - 1725 / 1805 - 1880 MHz)	7562495-01
	DCM AF 2125 (1920 - 1980 / 2110 - 2170 MHz)	7562496-01
	DCM AF 2125 (1920 - 1980 / 2110 - 2170 MHz) [2)]	7626358-01
	DCM AF 2135 (1920 - 1980 / 2110 - 2170 MHz)	7562497-01
	DCM AF 2625 (2500 - 2570 / 2620 - 2690 MHz)	7621749-01
	DCM AF 2635 (2500 - 2570 / 2620 - 2690 MHz)	7621747-01

1) To avoid a collision between modem connectors and combiner, the adapter kit 7817687 for modem installation (see *figure 5-1*) is used. If it is not yet installed, order it together with the new combiner.

2) Railway approved cables

Designation		ID No
Node AM4		**7613589**
DCM Commercial Applications (US)	DCM AF 727 (698 to 716 & 776 to 787 / 728 to 757 MHz)	7577532-01
	DCM AF 737 (698 to 716 & 776 to 787 / 728 to 757 MHz)	7598983-01
	DCM AF 8527 (824 - 849 / 869 - 894 MHz)	7577540-01
	DCM AF 8537 (824 - 849 / 869 - 894 MHz)	7577542-01
	DCM AF 1727 (1710 - 1755 / 2110 - 2155 MHz)	7577548-01
	DCM AF 1727E (1710 to 1780 / 2110 to 2180 MHz)	7817693-00
	DCM AF 1737 (1710 - 1755 / 2110 - 2155 MHz)	7577550-01
	DCM AF 1927 (1850 - 1915 / 1930 - 1995 MHz)	7577552-01
	DCM AF 1937 (1850 - 1915 / 1930 - 1995 MHz)	7577554-01
	DCM AF 9037 (UL 896 - 902 MHz / DL 935 - 941 MHz)	7577546-01
	DCM AF 8524 (AUS)	7801322-00
Dummy card		7574285-00
Dummy card T5		7643315-00
Fan Unit Backside Type (Kit)		7574286
Fain Unit Bottom		7644217-00
GPS Bias-T cable (AC/DC Cable USB 0.4 M Molex. 3 pol)		7626927-00
Modem-Kit PHS8 Node AM [3)]		7679538
Modem-Kit PLS-8 Node AM EU		7724196-00
Power Supply Unit DC IN 24-110 V 680 W		7609268-00
Power Supply Unit DC IN 24-110V 780W		7711908-xx
Power Supply Unit AC IN 100-240 V 680 W		7605769-00
Rechargeable battery pack 6 V		7613775-00
Slot Duplexer passive (876-915/921-960 MHz)		7621867-00
User Interface 2 - Kit > V2.0.6 [4)]		7814162
User's Manuals for Node AM4		7617868-00
VSWR Kit 925-960 MHz		7622883
VSWR-Module 925-960 MHz		7614218-00

3) Modem-Kit PHS8 is the successor of Modem-Kit HC25 which has been discontinued

4) Due to a PCB update on the UI2 Board (see also chapter *4.3.6*), SW version V2.0.6 is mandatory for this kit (containing UI2 Board 7613646-05). The former User Interface 2 – Kit 7622884 (containing UI2 Board 7613646-03) is no longer available. The UI2 Board cannot be ordered separately

The manufacturer reserves the right to replace the parts listed above by equivalent substitutes.

☞ **Note:** To ensure compatibility with your system, do not order any individual components (e.g. modems) of the kits available. Make sure to always order the complete kit (ID must be listed above) as spare part.

9. Index

10. List of Changes

Version	***Changes***	***Release Date***
M0121ACN		18-April-2018
M0121ACP	- Chapters *1.1* and *1.4* updated (AWS, WEEE) - Chapters *4.3.6*, *5.2.1*, and *5.2.2* updated due to new modem mounting plate - RF card options for US added (*table 7-2*) - Chapter *8* updated.	30-August-2018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