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Digital Indoor Base Station
Installation, Operation and Service Manual
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ROHDE&SCHWARZ

Secure Communications

Installation, Operation and Service Manual

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1 Notes on the document

This chapter provides information on using the document. In addition, it names the requirements for using the product/system.

1.1 Objectives of the document

The present document from Rohde & Schwarz Professional Mobile Radio GmbH describes the procedures that are required for the activities on and with the DIB-500 R4.1 product:

- Transport and storage
- Setup and commissioning
- Configuration
- Function tests
- Service interruption
- Maintenance
- Component replacement

In this context, it describes the relevant safety regulations as well as the components and operation of the product that is used in the ACCESSNET®-T IP mobile radio system.

1.2 Intended audience of the document

The present document is intended for all persons who

- operate an ACCESSNET®-T IP network,
- install the product on site
- connect the electrical system of the product on site
- commission and decommission the product,
- maintain the product,
- replace product components,
- transport and store the product.

Each person commissioned with performing the tasks mentioned above with or on the system must have read and understood the present document and the associated accompanying documentation.

1.3 Qualification of the personnel

Only specialised personnel is permitted to perform the tasks described in the present document. The specialised personnel must be trained and authorised to perform these tasks.

Specialists are persons, who:

- are trained and experienced in the corresponding field.
- are familiar with the applicable standards, regulations and provisions associated with the corresponding task.

1.4 Validity of the document

The validity of the present document is indicated on the title page by the PV information (Package Version).

By default, the feature release is always indicated on the title page so that the present document is also valid for the following maintenance releases. Maintenance releases are not specified since they do not result in any functional expansions/changes.

Table 1.1 describes the meaning of the PV information.

Table 1.1 Meaning of PV information

PV information	Description	Description
PV **xx**.yy.zz	Main release	Identifies the main release. This information remains unchanged during the life cycle of a PV.
PV xx.**yy**.zz	Feature release	Identifies functional expansions/changes within the main release.
PV xx.yy.**zz**	Maintenance release	Identifies maintenance activities within the main release/feature release.

1.5 Reading and navigation aids in the document

As reading and navigation aids, overview tables have been provided at the beginning of the respective chapters in the present document, for example Table 5.1 on page 89. These are to provide the reader with an overview of the tasks to be performed. In addition, they indicate the order in which the tasks are to be performed. When you have completed a work step, always navigate to the next work step via the overview table to ensure that the tasks are performed in the correct order. The overview tables are useful for readers of the printed document (indication of the corresponding sections) as well as for readers of a PDF document at the PC (via active cross-references to the corresponding sections).

1.6 Figures and special notations used

Figures and symbols are used in the present document. They serve for presenting the product and for emphasizing particular pieces of information.

1.6.1 Figures used

The figures used in this document show the product in a simplified form where necessary for clarity (e. g. technical drawings). They refer to different product designs. If not described otherwise, the respective figure relates to the standard product design.

1.6.2 Special notations

The special notations described in the following serve for the enhanced comprehensibility of information. They emphasize specific pieces of information, help you to recognize this information fast and take corresponding measures.

1.6.2.1 Designations of TIB transceiver module and equipment racks

The base station DIB-500 R4.1 provides a maximum of two TIB transceiver modules (TETRA Indoor Base Transceiver) which, in turn, can provide up to two carriers. For variants of the DIB-500 R4.1 with more than four carriers, they are provided in two equipment racks.

For this reason, the documentation of the DIB-500 R4.1 requires a unique naming of the equipment racks and the TIB transceiver modules.

Table 1.2 shows the naming scheme used of the equipment racks and the TIB transceiver modules in this document.

Table 1.2 Naming scheme of the equipment racks and the TIB transceiver modules

Name	Description
Equipment rack A	the first equipment rack for a DIB-500 R4.1 with more than four carriers
Equipment rack B	the second equipment rack for a DIB-500 R4.1 with more than four carriers
TIB A	the first TIB transceiver module. For a DIB-500 R4.1 with more than four carriers in the first equipment rack
TIB B	the second TIB transceiver module. For a DIB-500 R4.1 with more than four carriers in the first equipment rack
TIB C	the first TIB transceiver module in the second equipment rack of a DIB-500 R4.1 with more than four carriers
TIB D	the second TIB transceiver module in the second equipment rack of a DIB-500 R4.1 with more than four carriers
Carrier A	the first carrier of a TIB transceiver module
Carrier B	the second carrier of a TIB transceiver module
TIB carrier A_1	the first carrier of the first TIB transceiver module
TIB carrier A_2	the second carrier of the first TIB transceiver module

1.6.2.2 Sequence of actions

Standard operation procedures guide you step by step through a sequence of actions until you have reached the desired goal.

Example of a sequence of actions:

Goal of the actions

Preparation:
✓ List of the prerequisite(s) for an action
✓ ...

Carry out the following steps:
➔ Description of an individual work step.
➥ A possible result of the work step just performed.
1. Description of the first of multiple work steps.
➥ A possible result of the work step just performed.
2. Description of the second work step.

✓ Confirmation: Results of the entire sequence of actions.

1.6.2.3 Safety instructions used

Safety instructions in this document point to a hazard that may put persons or the product/system at risk.

Safety instructions will point out:

| the nature of the hazard,
| the source of the hazard,
| measures to be taken to avert the specified hazard.

Shown below are four safety advice symbols which indicate the severity of the danger by means of different keywords (danger, warning, caution, attention). The symbols shown may vary depending on the nature and source of the danger.

⚠ DANGER

This symbol identifies safety instructions

You are warned of an imminent danger for the life or health of persons.

➔ The arrow identifies a precautionary measure designed to avert this danger.

⚠ WARNING

This symbol identifies safety instructions

You are warned of a potential hazard for the life or health of persons.

➔ The arrow identifies a precautionary measure designed to avert this danger.

CAUTION

This symbol identifies safety instructions

You are warned of a potentially hazardous situation for the life or health of persons.

➔ The arrow identifies a precautionary measure designed to avert this danger.

NOTICE

This symbol identifies safety instructions

You are alerted of a hazard for the product/system.

➔ The arrow identifies a precautionary measure designed to avert this danger.

1.6.2.4 General instructions used

General instructions provide supplementary and useful information.

Important Information

This symbol identifies information that may assist in handling and using the product/system. This includes references to further information.

1.6.2.5 Text formatting used

Table 1.3 provides an overview of text formats used and describes the significance of these formats.

Table 1.3 Text formatting used

Text formatting	Description	Example
Example	Identifies components of the user interface of software components such as network management clients (NMC).	Buttons, dialogues etc.
`Example`	Identifies required inputs.	Passwords, IP addresses etc.
`Example`	Identifies outputs.	Panel outputs etc.

1.7 Further applicable documents

Apart from the present documentation, the scope of delivery of the product includes additional documents. In addition to the contents of the present documentation, all the other documents associated with the product must always be taken into consideration. They are mandatory for the use of the product.

These are:

- Technical data,
  describe the technical properties of the product
- Site Requirements,
  describe the requirements for the site where the product is used.
- NMC-511 FaultManager User Manual
  contains information required for the proper operation of the product.
- NMC-515 ConfigurationManager User Manual
  contains information required for the proper operation of the product.
- NMC-522 DownloadManager User Manual
  contains information required for the proper operation of the product.
- "Service Computer for ACCESSNET®-T IP" configuration manual
  describes the configuration of the service computer that is used for the installation and commissioning of network constituents of an ACCESSNET®-T IP as well as for service and maintenance purposes.
- SMT-500 Operating Manual
  describes the commissioning, operation and decommissioning of the product.
- Open Source Acknowledgement
  contains information on the respective Open Source software the product comprises, including the information on the license(s) used and the related license agreements.
- GPS Protector Technical Data
  describe the technical properties of the GPS Protector.
- project-specific document such as the "Base Design" document, where applicable:
  describes the implemented network and the associated properties and requirements.

Further applicable documents

Please also heed the documentation of the third-party devices connected to the product to prevent negative effects or problems with product.

1.8 Support information

If you have any questions or suggestions regarding Rohde & Schwarz Professional Mobile Radio GmbH products, please contact your local service partner responsible or the Rohde & Schwarz Professional Mobile Radio GmbH Support Team directly.

For a fast and cost-efficient solution of technical problems during the operation of your ACCESSNET®-T IP network, Rohde & Schwarz Professional Mobile Radio GmbH offers support contracts upon request. For information on this topic, please also revert to our responsible service partner or directly to Rohde & Schwarz Professional Mobile Radio GmbH.

Product training courses assist you in making use of the full scope of features and capabilities of your ACCESSNET®-T IP network. For information on the training program of Rohde & Schwarz Professional Mobile Radio GmbH, please revert to our responsible service partner, to Rohde & Schwarz Professional Mobile Radio GmbH or directly to Rohde & Schwarz.

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2 Safety regulations

This chapter describes the safety regulations relevant for using the product.

2.1 Safety instructions and declaration of conformity

The operation of the product is subject to the statutory provisions of the respective country, in which the product is used. For the operation, the required operating licences must be requested from the responsible local authorities. Particularly the frequency range used must be reserved for the respective purpose in the country, in which the product is used. The user of the product is responsible for observing the legal regulations and intended use.

2.1.1 Safety instructions and declaration of conformity for Europe

The product conforms with the general requirements of the responsible European Directives. This is confirmed by the marking (CE) of the installed components. The Declarations of Conformity of the installed components may be viewed upon request.

The directive on radio equipment and telecommunications terminal equipment (Gesetz über Funkanlagen und Telekommunikationsendeinrichtungen (FTEG)) implemented by the European Directive 99/5/EC (R&TTE) is applicable in Germany. The product complies with the fundamental requirements and the other relevant provisions of this directive.

The product is assigned the equipment class code for radio equipment of class 2 (2.12) and is marked as follows.

CE0408①

Figure 2.1 Conformity: CE marking

Within the scope of the European Directive 99/5/EC, the network operator must ensure that the health and safety of the product user and other persons, (Article 3 (1)a of 99/5/EC and 1999/519/EC) is warranted. With regard to the exposure of persons to electromagnetic fields (110 MHz to 40 GHz), product standard EN 50385 must be applied.

Within the EU, the product is intended for use in the following member states: Austria (AT), Belgium (BE), Bulgaria (BG), Switzerland/Liechtenstein (CH), Cyprus (CY), Czech Republic (CZ), Germany (DE), Denmark (DK), Estonia (EE), Spain (ES), Finland (FI), France (FR), Greece (GR), Hungary (HU), Ireland (IE), Iceland (IS), Italy (IT), Lithuania (LT), Latvia (LV), Netherlands (NL), Norway (NO), Romania (RO), Sweden (SE), Slovenia (SI), Slovakia (SK), Turkey (TR), England (UK).

The use of the respective frequency ranges may vary depending on the country of use. If you have any questions, please contact Rohde & Schwarz Professional Mobile Radio GmbH.

The general instructions on safety and accident prevention are documented in the Accident Prevention Guideline "General Regulations" (BGV A1)[1]. For work performed on electrical installations, the Accident Prevention Regulations (BGV A3) "Electrical Installations" must be heeded.

The product complies with the safety requirements of the European Low Voltage Directive (2006/95/EC [73/23/EEC]) due to the application of the standard EN 60950-1. The requirements of this standard must not be violated when using the product.

The operator is responsible for ensuring that:

- the product is used exclusively within the scope of the intended use.
- work on the electrical installation is performed only by experts that have been trained accordingly
- special legal requirements that govern the operation of the product are complied with
- product modifications or expansions:
  - are performed only after having consulted Rohde & Schwarz Professional Mobile Radio GmbH.
  - comply with the state of the art
  - take into consideration the applicable national and international provisions
  - are performed exclusively by trained specialists, who have been authorized accordingly.
- damage to the product and product defects are immediately remedied by specialists that have been trained and authorized accordingly.
- appropriate measures are taken against radio interference.
- any defects in the service room that come up later on are eliminated immediately.
- for subsequent modifications of the service room, the requirements described in the present document are always taken into consideration.
- appropriate fire precautions are taken as required (e.g. the use of appropriate fire extinguishers).
- special legal requirements that control the operation and handling of batteries and battery systems, if used, are complied with and that appropriate safety devices and measures are provided and taken as required.

Country-specific laws and provisions

All the stipulated laws and provisions of the respective country of use shall always apply. The operator is responsible for the adherence to these laws and provisions.

1) HVBG: Federation of German Industrial Trade Associations, Sankt Augustin, publisher of the Accident Prevention Guidelines. For sources of supply, please revert to the responsible Accident Prevention and Insurance Association office.

2.1.2 Safety instructions and declaration of conformity for North America

The product complies with the requirements of the Federal Communications Commission (FCC).

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

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

The product complies with the requirements of Industry Canada (IC).

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- l'appareil ne doit pas produire de brouillage, et
- l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- this device may not cause interference, and
- this device must accept any interference, including interference that may cause undesired operation of the device.

2.2 Intended use

The product is exclusively designed for being used as a professional TETRA communication system. In this application it is used for the wireless communication between subscribers equipped with the corresponding mobile stations as well as for switching calls and transferring data between subscribers of TETRA (Terrestrial Trunked Radio) networks.

Intended use also includes that:

- all the safety instructions set forth in the product documents are always heeded.
- all the maintenance tasks described are performed in the interval specified.
- the general, national and in-house safety regulations are heeded.

Any other use is impermissible.

The product is not used as intended, for example, if:

- the requirements described in the product documents haven not been met and instructions are disregarded.
- the structural design of the product is modified without the consent of the Rohde & Schwarz Professional Mobile Radio GmbH.
- replacement parts are used that differ from the components installed by default.

The operator of the product is responsible for damage to the product or damage caused by the product if the product was used beyond the intended application range and/or was not used as intended.

2.3 Safety measures

All the regulations listed in the following must be adhered to without fail:

- If extension cables or multiple socket outlets are used, make sure that they are inspected for proper condition periodically.
- After any safety-related parts have been replaced (e.g. power switch or circuit breakers) a safety check must be performed (visual inspection, protective earthing conductor load, leakage resistance, leakage current measurement, function test).
- Heed all the other job-specific safety measures and requirements listed in the sequences of actions.

Heed the security labelling!

In addition to the safety instructions set forth in the product documentation for the , all the safety markings in the equipment rack must be observed. They point out potential hazardous areas and must neither be removed nor changed.

2.3.1 Authorised personnel

The product may be transported, set up, connected, commissioned, operated and serviced only by specialists who are familiar with and comply with the applicable safety regulations and setup instructions.

The specialists must be authorized to perform the required tasks by the person responsible for the safety in the enterprise of the operator.

Specialists are persons, who:

- are trained and experienced in the corresponding field
- are familiar with the relevant standards, regulations, provisions and safety codes, and
- have been instructed in the mode of operation and the operating conditions of the equipment components
- can identify and avert hazards

Depending on the tasks to be performed, the following user groups are distinguished:

- operators, who
  - operate the product.
  - monitor, interrupt, terminate and restore the operation of the product.
- Service personnel: persons, who perform the following additional tasks as compared to operators
  - Set up the product.
  - Prepare and restore the operational state.
  - Adjust and/or parameterize the product.
  - Maintain, look after and repair the product.

2.3.2 Electromagnetic compatibility

With specific products, e.g. HF radio equipment, increased electromagnetic radiation may occur as a consequence of operation. Taking into consideration that unborn life is increasingly worthy of being protected, pregnant women should be protected through appropriate measures. People with personal medical devices such as cardiac pacemakers and hearing aids can also be endangered by electromagnetic radiation. The operator is obliged to assess workplaces with a considerable risk of exposure to radiation and to avert any hazards.

2.3.2.1 Electromagnetic compatibility for Europe

In proper state and when operated properly, the product complies with all the requirements in respect of interference radiation according to ETSI EN 301 489-18. The connections conducting HF signals must neither be manipulated nor damaged.

When using the product with active typical transmitters, the requirements of EN 50385 in respect of the health and safety of a user or any other person in high-frequency fields are met. Compliance with EN 50385 is achieved as of a minimum distance of 1.5 m to the transmitting antenna. A typical transmitter is made up of an omni-directional transmitting antenna with an antenna gain of 7.5 dBi installed on a mast with a height of 30 m and connected to the base station through a 40-m cable.

2.3.2.2 Electromagnetic compatibility for North America

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.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

This Class A digital apparatus complies with Canadian ICES-003.

For compliance with the electromagnetic radiation and the limit values with regard to the safety of the general population in high-frequency fields, the document "RF Exposure" must always be observed. For the proper operation of the product, the limit values specified in the document "RF Exposure" must always be complied with. For this purpose, site-specific calculations by the network operator may be required.

2.3.3 Notes on the electrical system

The product may be operated only in the operational states specified by the manufacturer without impairment of the ventilation.

Make sure that all the safety measures on the equipment, on the connecting cables and on the load have been taken. Electrical connections may be made/disconnected only when neither voltage nor current is applied to the equipment. Voltage may still be present on the outputs of the equipment after the equipment has been switched off.

Only perform those tasks described in the documents included in the scope of delivery of the product.

2.3.4 Hazardous substances

The following sections contain information on hazardous substances.

2.3.4.1 Hazardous substances in Europe

The product does not contain any substances specified in the Ordinance on Hazardous Substances, published in BGBL.I p. 1782 (Gefahrstoffverordnung [Ordinance on Hazardous Substances], abbr. GefStoffV).

2.3.4.2 Hazardous substances outside Europe

All the stipulated laws and provisions of the respective country of use shall always apply. The operator is responsible for the adherence to these laws and provisions.

2.3.5 Product disposal

The following sections contain information on product disposal.

2.3.5.1 Product disposal in Europe

The equipment rack as well as all therein installed and, if applicable, marked with the symbol (refer to Figure 2.2) components fall within the scope of the Electrical and Electronic Device Act (ElektroG).

The ElektroG Act combines the requirements of the following EC directives:

- 2002/96/EC (WEEE) for electric and electronic equipment wastes
- 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS directive).

The respective products are marked with the attached symbol according to EN 50419, refer to Figure 2.2.

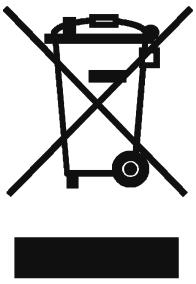

Figure 2.2 Marking the components according to EN 50419

Once the service life of a product has ended, the product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for electric and electronic wastes is not permitted.

In favour of an environmentally-friendly disposal or recycling of matters, Rohde & Schwarz Professional Mobile Radio GmbH has developed a disposal concept and fully assumes the duty of taking back and disposing of electric and electronic wastes according to the ElektroG Act on behalf of the manufacturer.

Please revert to your local service representative or directly to Rohde & Schwarz Professional Mobile Radio GmbH to dispose of the product.

2.3.5.2 Product disposal outside Europe

All the stipulated laws and provisions of the respective country of use shall always apply. The operator is responsible for the adherence to these laws and provisions.

2.4 Safety Markings

The following sections describe safety markings on the product and its packaging.

2.4.1 Safety markings on transport boxes

To protect against improper handling of the product during a transport, the transport boxes and the product itself are fitted with corresponding safety markings to call attention to proper handling.

Transport inspection using impact indicators

To check whether a product was properly transported, the transport boxes are fitted with impact indicators. The impact indicator shows strong impacts or shocks that occurred due to an improper transport.

The following safety markings indicate that the corresponding instructions must be followed:

- Safety marking "Fragile"

  The safety marking "Fragile" points to the necessary protection of the product against shock. Transport boxes with this marking must absolutely be protected against shock.

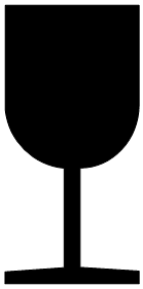

Figure 2.3 Safety marking "Fragile"

- Safety marking "Transport Upright"

The safety marking "Transport Upright" points to the cover of the transport box. Transport boxes with this marking must always be transported with the cover at the top.

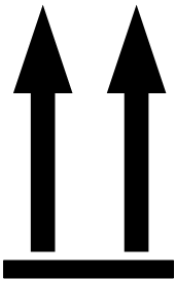

Figure 2.4 Safety marking "Transport Upright"

| Safety marking "Keep dry"

The safety marking "Keep dry" points to the necessary protection of the product against wetness (e.g. rain, high humidity during the transport in closed vehicles/containers and/or formation of condensate when covered with a tarpaulin). Transport boxes with this marking must absolutely be protected against any wet influences.

Figure 2.5 Safety marking "Keep dry"

2.4.2 Safety markings on the product

The product is equipped with safety markings. They serve as an indication to possible hazards and may not be removed or modified (if necessary, marking in accordance with DIN 4844 BGV A8 (VBG 125).

3 Product description

The Digital Indoor Base Station (DIB-500 R4.1) is used as a base station in ACCESSNET®-T IP networks. The base station is responsible for radio coverage in a defined radio coverage area. For this purpose, up to eight carriers are available depending on the antenna coupling variant. It can thus provide as many as 32 radio channels (four radio channels per carrier) for the communication of the mobile terminal equipment, via which voice and data is/are transmitted in accordance with the TETRA standard (Terrestrial Trunked Radio).

In addition, in networks with a distributed switching architecture, the DIB-500 R4.1 can take on the routing function and thus act as a full system controller node. Moreover, further functions are available; applications, for example, can be connected directly to the ACCESSNET®-T IP by means of an IP connection.

The carriers are provided via the transceiver module TETRA Indoor Base Transceiver (TIB) that can accommodate up to two carriers. Two TIB transceiver modules may be incorporated in the equipment rack of the DIB-500 R4.1, thus providing four carriers. From five carriers, a second equipment rack is used, which can also provide up to four carriers.

Two TETRA antenna connections and one GPS antenna connection (Global Positioning System, GPS) are available for connecting antennas. Internally, the antennas are coupled via the antenna coupling system. In the FlexibleTx variant, project-specific external antenna coupling systems can be used. Antenna diversity is available for optimal reception properties.

Depending on the requirement, the ACS can provide the following antenna connection variants:

- Hybrid
- Cavity
- High Power or
- FlexibleTx

For communicating with other base stations and with the IP Node (IPN) network element, the DIB-500 R4.1 features Ethernet interfaces for linking to the IP transport network.

If all the connections to the other network constituents break down during operation, the DIB-500 R4.1 ensures radio operation within its own radio cell. If the DIB-500 R4.1 is operated with a separate routing function in networks with a distributed switching architecture, the base station additionally collects call detail records (CDR).

Figure 3.1 shows the front view of the DIB-500 R4.1 with four carriers. The following table describes the components in greater detail.

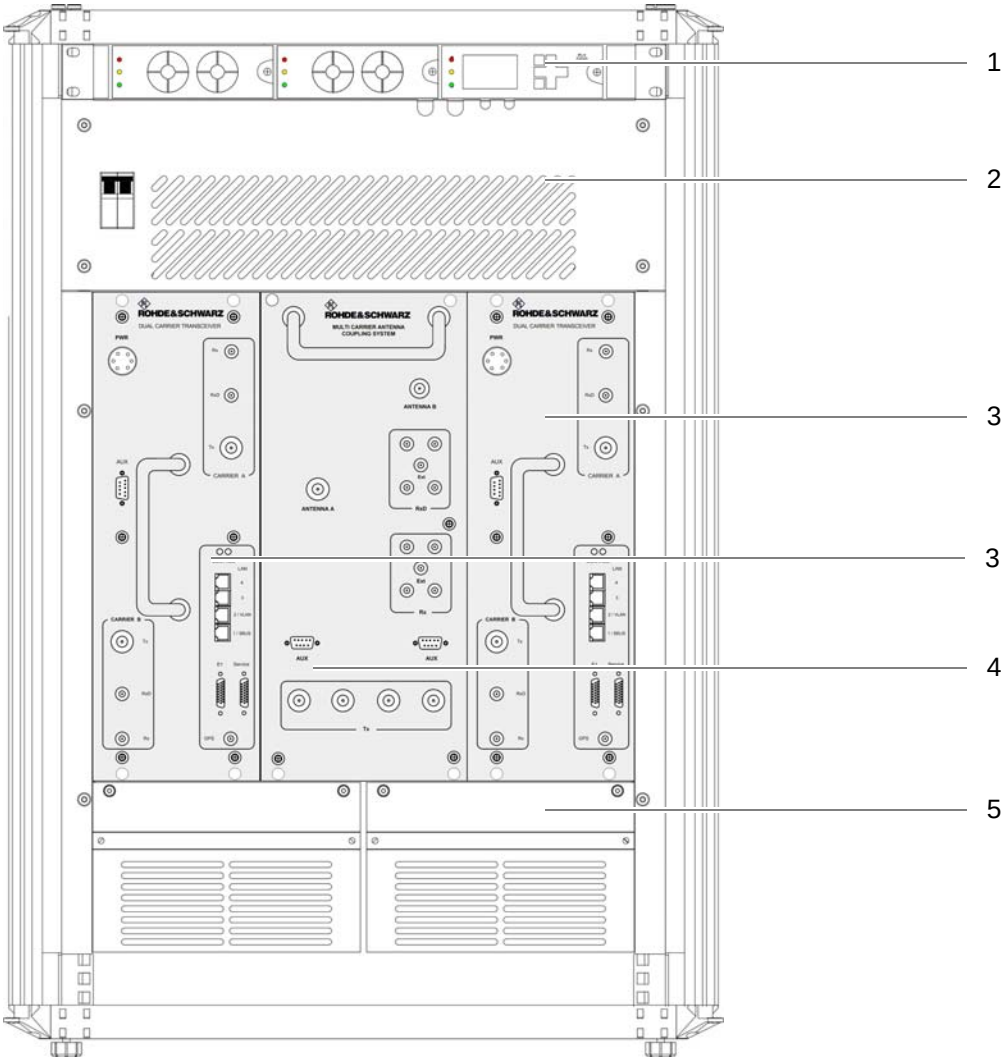

Figure 3.1 DIB-500 R4.1 (front view)

Table 3.1 Legend: DIB-500 R4.1 (front view)

No.	Component	Number	Described in
1	Voltage supply and alarming system (optional), consisting of | SC200 – optional (VAC or alarm system expansion) | Alarm input/output module – optional (VAC or alarm system expansion) | Rectifier module – optional (VAC expansion)	1	refer to section 3.1.1 on page 34
2	Cover including On/off switch	1	refer to section 3.1.4 on page 43

Table 3.1 Legend: DIB-500 R4.1 (front view)

No.	Component	Number	Described in
3	TIB transceiver module (TETRA Indoor Base)	1 - 2	refer to section 3.1.5 on page 34
4	Antenna Coupling System (ACS)	1	refer to section 3.1.6 on page 54
5	Fan unit	1 - 2	refer to section 3.1.7 on page 57

Figure 3.2 shows the top view of DIB-500 R4.1. The following table describes the components in greater detail.

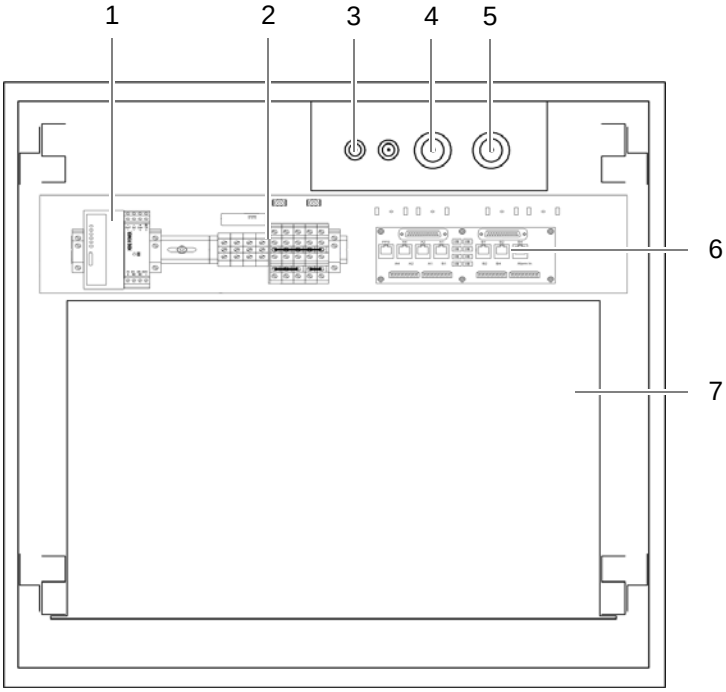

Figure 3.2 DIB-500 R4.1 without top cover (top view)

Table 3.2 Legend: DIB-500 R4.1 without top cover (top view)

No.	Component
1	LAN Routing Unit (LRU) with top hat rail power supply unit – optional (redundancy package)
2	Terminal block
3	GPS antenna connector
4	TETRA antenna connection A
5	TETRA antenna connection B
6	E1 connection board
7	Mounting frame – optional (with V_{AC} or alarm notification expansion)

The following sections describe the functions, components, interfaces, wiring and scope of supply of the DIB-500 R4.1.

3.1 Constituents

The DIB-500 R4.1 consists of the following hardware components:

- Voltage supply and alarming system
- E1 connection board
- Redundancy package with LAN Routing Unit (LRU)
- On/off switch
- TIB transceiver module (TETRA Indoor Base)
- Antenna Coupling System (ACS)
- Fan unit
- Cavity coupler (only for the Cavity variant)

3.1.1 Voltage supply and alarming system

The DIB-500 R4.1 is operated with 48 V_{DC} in the standard version. Optionally, operation with 100 V_{AC} to 240 V_{AC} is possible. Inside the equipment rack, the voltage supply is distributed via the terminal block. For a description of the terminal block, please refer to section 3.1.1.1 on page 35.

An alarm system expansion can optionally be used for the standard version of the DIB-500 R4.1 with V_{DC} voltage supply, see section 3.1.1.3 on page 37. For the V_{AC} expansion as well as the alarm system expansion, a mounting frame with corresponding hardware components is installed in the equipment rack of the DIB-500 R4.1.

Table 3.3 provides an overview of the components for the voltage supply and alarm system of the individual versions of the DIB-500 R4.1.

Table 3.3 Components for voltage supply and alarm system

Version	Terminal block	SC200	Alarm input/ output module	Rectifier module
V_{DC} voltage supply (standard)	x	---	---	---
Alarm system expansion	x	x	x	---
V_{AC} expansion	x	x	x	x

The following sections describe the components of the voltage supply and alarm system of the DIB-500 R4.1.

3.1.1.1 Terminal block

The terminal block provides terminals for connecting the V_{DC} voltage supply and distributes the internal V_{DC} supply in the equipment rack. Each equipment rack (except for the Cavity variant of the Cavity equipment rack) features a separate terminal block.

Voltage supply connector for VAC voltage supply

For the V_{AC} voltage supply, the voltage supply connector is implemented via the optional V_{AC} voltage supply unit, see section 3.1.1.2 on page 36.

The terminal block can be accessed from above after the upper equipment rack cover has been removed. Figure 3.3 shows a section of the top view of the DIB-500 R4.1 and the position of the terminal block.

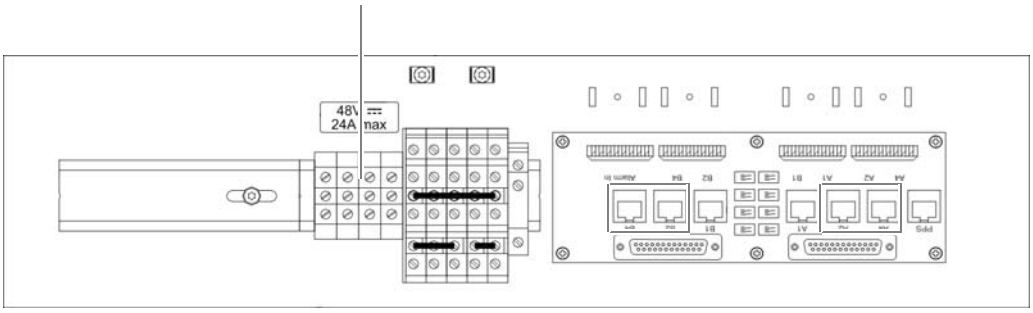

Figure 3.3 Position of the terminal block (top view)

Earthing connection (commissioning)

The earthing connection must be established via a threaded bolt on the frame of the equipment rack, see section 5.6.1 on page 107.

Figure 3.4 shows the top view of the terminal block in a simplified representation. The following table describes the terminals in more detail that are required for connecting a V_{DC} voltage supply and top hat rail power supply unit of the redundancy package.

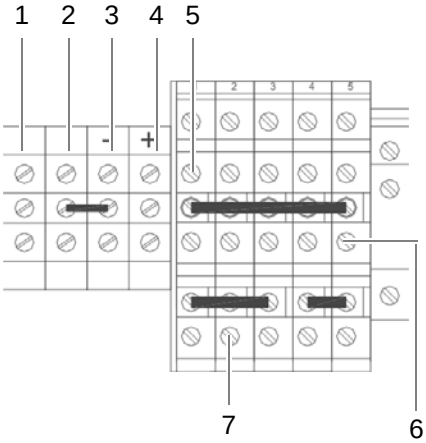

Figure 3.4 Terminal block

Table 3.4 Legend: Terminal block

No.	Wire colour
1	Terminal with earthing cable for potential equalisation
2	Terminal for connecting a negative terminal earthing
3	"-" terminal for the negative voltage supply cable
4	"+" terminal for the positive voltage supply cable
5	Terminal for connecting a positive terminal earthing
6	"+" terminal for the top hat rail power supply unit of the redundancy package
7	"-" terminal for the top hat rail power supply unit of the redundancy package

3.1.1.2 Expansion for V_{AC} voltage supply (V_{AC} voltage supply unit)

The V_{AC} voltage supply unit is a hardware component and consists of different components, see Table 3.6 on page 37. For variants of the DIB-500 R4.1 with more than four carriers, one V_{AC} voltage supply unit is installed for each equipment rack.

Voltage supply connector for VDC voltage supply

For a V_{DC} voltage supply, the voltage supply connection is implemented via the terminal block, refer to section 3.1.1.1 on page 35.

Table 3.5 describes the number of rectifier modules as a factor of the voltage supply.

Table 3.5 Number of rectifier modules

Voltage supply	Number of transceiver modules	Number of rectifier modules
100 V_{AC} - 170 V_{AC} (nominal)	1	1
	2	2
170 V_{AC} - 240 V_{AC} (nominal)	2	1

Figure 3.5 shows the front view of a V_{AC} voltage supply unit, which provides two rectifier modules, as an example. The following table describes the components in greater detail.

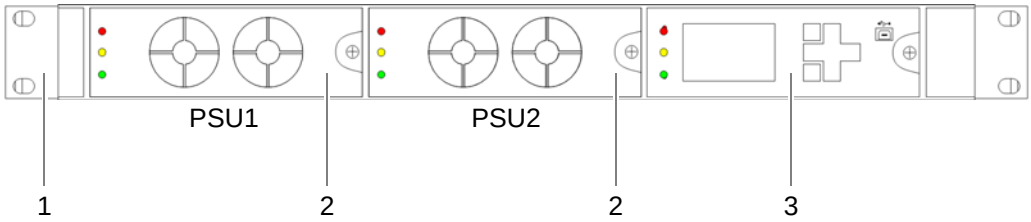

Figure 3.5 V_{AC} voltage supply unit (front view)

Table 3.6 Legend: V_{AC} voltage supply unit (front view)

No.	Constituent
1	Mounting frame
2	Rectifier module(s), the number depends on the V_{AC} voltage on site and on the number of installed transceiver modules, see Table 3.5 on page 36
3	SC200
	Alarm input/output module (installed behind the SC200 in the mounting frame)

3.1.1.3 Alarm system expansion

With V_{DC} voltage supply, the DIB-500 R4.1 can be equipped with an alarm system expansion. With the alarm system expansion, the DIB-500 R4.1 can be expanded with additional digital alarm inputs and outputs for external alarms. The alarm system expansion is also part of the V_{AC} expansion, see section 3.1.1.2 on page 36.

Figure 3.6 shows the front view of the alarm system expansion as an example. The following table describes these indicators in detail.

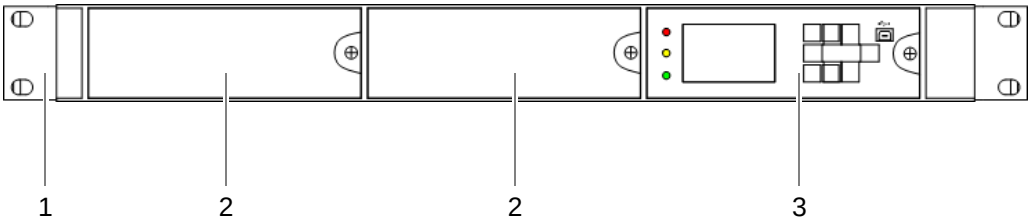

Figure 3.6 Alarm system expansion (front view)

Table 3.7 Legend: Alarm system expansion (front view)

No.	Component
1	Mounting frame
2	not used for the time being
3	SC200
	Alarm input/output module (installed behind the SC200 in the mounting frame)

3.1.1.4 SC200 – optional (V_{AC} or alarm system expansion)

The SC200 is a hardware component and used for monitoring the voltage supply and for alarm signalling and is installed in the mounting frame.

Through the SC200, external alarms can be collected via the freely-configurable, digital, alarm inputs of the alarm input / output module and reported via the Network Management System. In addition, product alarms can be signalled via the digital alarm outputs of the alarm input/output module.

Figure 3.7 shows the front view of the system controller. The following table describes these indicators in detail.

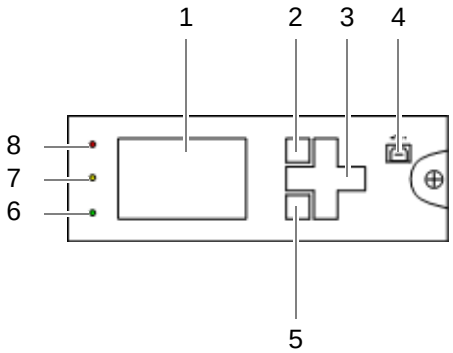

Figure 3.7 Front view of system controller

Table 3.8 Legend: front view of system controller

No.	Constituent	Colour	Description
1	Display window	---	Display window for visualization.
2	Softkey		Softkey. The respective function depends on the display in the display window.
3	Navigation keys		Keys for navigation and menu inputs.
4	USB		USB interface
5	Softkey		Softkey. The respective function depends on the display in the display window.
6	LED "Power"	green	LED for signalling of the voltage supply.
7	"Minor Alarm" LED	yellow	LED for signalling "minor" alarms.
8	"Critical/Major Alarm" LED	red	LED for signalling "major" and "critical" alarms.

Figure 3.8 shows the display window of the system controller. The following table describes these in detail.

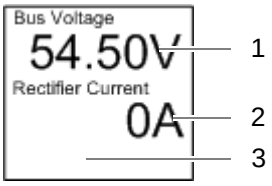

Figure 3.8 System controller display window

Table 3.9 Legend: System controller display window

No.	Constituent	Description
1	Bus voltage	The voltage of the equipment rack
2	Rectifier Current	Output current of the rectifier module (with V_{AC}-voltage supply only)
3	Alarms	Area for displaying alarms

Table 3.10 provides an overview of the possible alarm states and the corresponding alarm indicators. The visual indicators are shown on the display window of the system controller.

Table 3.10 Alarm states and alarm indicators (system controller)

Alarm state	Visual indicator	Acoustic indicator
A state cannot be displayed	???	---
MINOR	⚠	Acoustic signal every two seconds.
CRITICAL/MAJOR	⊗	Continuous acoustic signal

Figure 3.9 shows the rear view of the system controller. The following table describes these in detail.

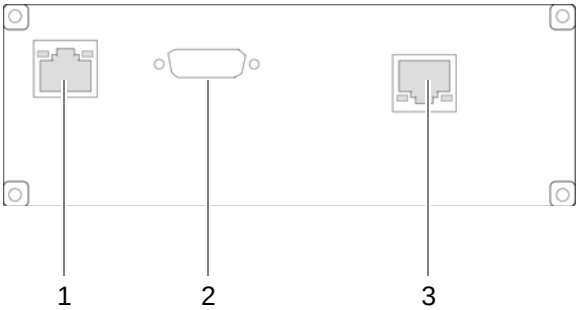

Figure 3.9 Rear view of system controller

Table 3.11 Legend: rear view of system controller

No.	Constituent	Description
1	Ethernet interface	Ethernet interface to the first TIB of the equipment rack (TIB A, LAN 1).
2	Serial interface	not used for the time being
3	Supply voltage connection	Supply voltage connection of the system controller

3.1.1.5 Alarm input/output module – optional (V_{AC} or alarm system expansion)

The alarm input/output module is a hardware component that provides the alarm contacts for the digital alarm inputs/outputs. The alarm input/output module also features alarm contacts for connecting external hardware components.

Figure 3.10 shows the alarm input/output module. The following table describes the components in greater detail.

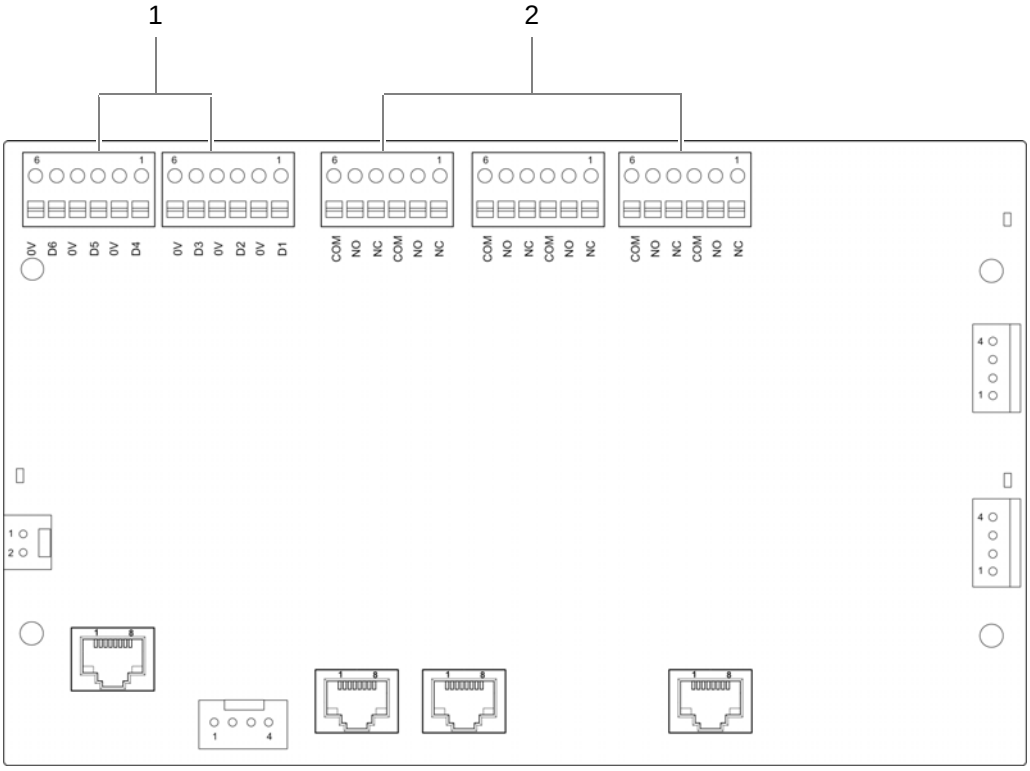

Figure 3.10 Alarm input/output module

Table 3.12 Legend: alarm input/output module

No.	Component
1	Digital external alarm inputs
2	Digital external alarm outputs

3.1.1.6 Rectifier module – optional (V_{AC} expansion)

The rectifier modules are used to supply the mounting frame and the SC200 with voltage.

The rectifier module is a hardware subcomponent of the power supply unit and used for converting alternating-current voltage (V_{AC}) into direct-current voltage (V_{DC}).

Figure 3.11 shows the front view of a rectifier module. The following table describes these indicators in detail.

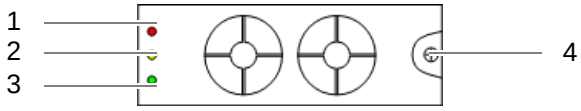

Figure 3.11 Rectifier module (front view)

Table 3.13 Legend: front view of rectifier module

No.	Constituent	Description
1	"Major Alarm" LED	LED for signalling major alarms.
2	"Minor Alarm" LED	LED for signalling "minor" alarms.
3	LED "Power"	LED for signalling of the voltage supply.
4	Mounting screw	---

3.1.2 E1 connection board

The E1 connection board provides connections for the internal and external E1 wiring and for alarms.

The external E1 interfaces A1 and B1 (refer to Figure 3.12, are routed via an E1 relay and serve to connect further network elements connected in the form of a ring. If a TIB transceiver module fails, the E1 relay is disabled and the incoming E1 connection is directly looped on to the next network element.

Figure 3.12 shows the top view of the E1 connection board. The following table describes these indicators in detail.

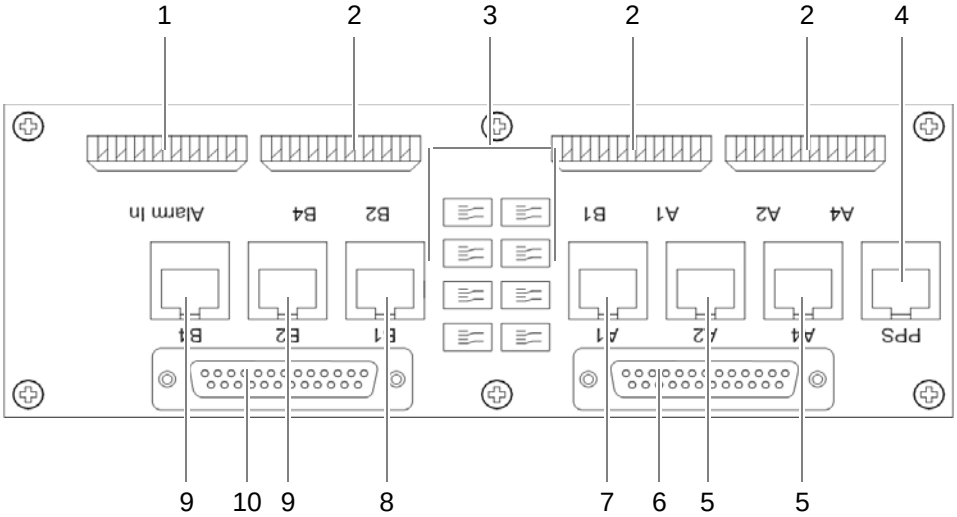

Figure 3.12 E1 connection board (top view)

Table 3.14 Legend: E1 connection board (top view)

No.	Description
1	External alarm inputs (LSA+)
2	External E1 connections (LSA+)
3	E1 relay for looping through connected E1 connections

Table 3.14 Legend: E1 connection board (top view)

No.	Description
4	"PPS" connection (pulses per second) for clock synchronisation of DIB-500 R4.1-equipment racks (RJ-45)
5	External E1 connections to TIB A (RJ-45)
6	Port for connecting the E1 connecting cables from the E1 connection panel to TIB A (D-sub)
7	External E1 port with connection to E1 relay (RJ-45)
8	External E1 port with connection to E1 relay (RJ-45)
9	External E1 connections to TIB B (RJ-45)
10	Port for connecting the E1 connecting cables from the E1 connection panel to TIB B (D-sub)

3.1.3 Redundancy package with LAN Routing Unit (LRU)

The redundancy package with LAN Routing Unit (LRU), which is available as an option, serves the base station DIB-500 R4.1 starting with five carriers for the redundant connection of the TIB transceiver modules. If the redundancy package is used, all TIB transceiver modules in both equipment racks are connected with the LAN Routing Unit (LRU) via Ethernet. In this case, the LRU takes on the routing between the TIB transceiver modules.

With the ring-shaped connection of all transceiver modules in both equipment racks, TIBs are connected with each other. If a TIP should fail, this guarantees that the connection between the remaining TIBs continuous to be ensured. This also guarantees the radio coverage of DIB-500 R4.1 even if the second, third or fourth TIB transceiver module should fail.

The redundancy package consists of the LAN Routing Unit (LRU), a top hat rail power supply unit as well as the voltage supply and Ethernet cables required for the installation. For operation, the LRU must be installed on the top hat rail on the first equipment rack of the DIB-500 R4.1, see section 5.5.1 on page 96.

Figure 3.13 shows the position of the redundancy package in the top view.

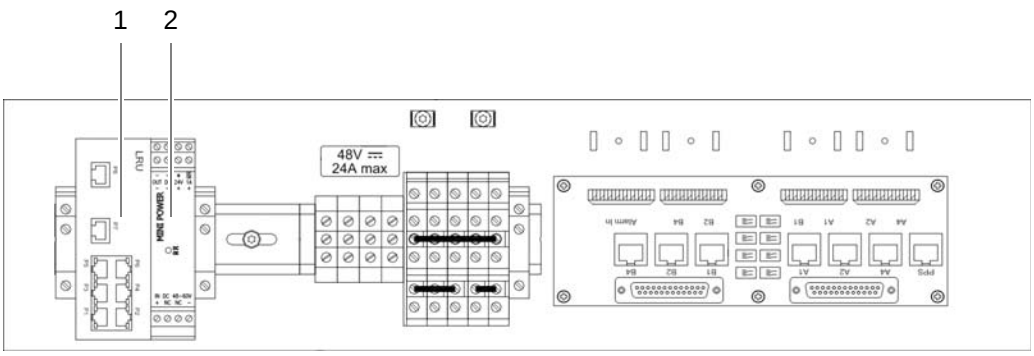

Figure 3.13 Position of the redundancy package (top view)

Table 3.15 Legend: Position of the redundancy package (top view)

No.	Component
1	LRU
2	Top hat rail power supply unit

Figure 3.14 shows the front view of the LRU, including top hat rail power supply unit. The following table describes these indicators in detail.

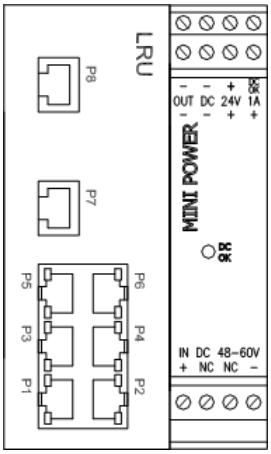

Figure 3.14 LRU, including top hat rail power supply unit (top view)

Table 3.16 Legend: LRU, including top hat rail power supply unit (top view)

Supply	Component
P1 to P4	not used for the time being
P5	TIB A (LAN 3)
P6	Connection to: | TIB C (LAN 3) – up to six carriers | TIB D (LAN 3) – starting with seven carriers
P7 and P8	not used for the time being

3.1.4 On/off switch

Every TIB transceiver module features a separate on-off switch in the respective equipment rack. The other components in the equipment cabinet are supplied with voltage via internal connections to the terminal block.

Figure 3.15 shows the On/Off switches of the TIB transceiver modules.

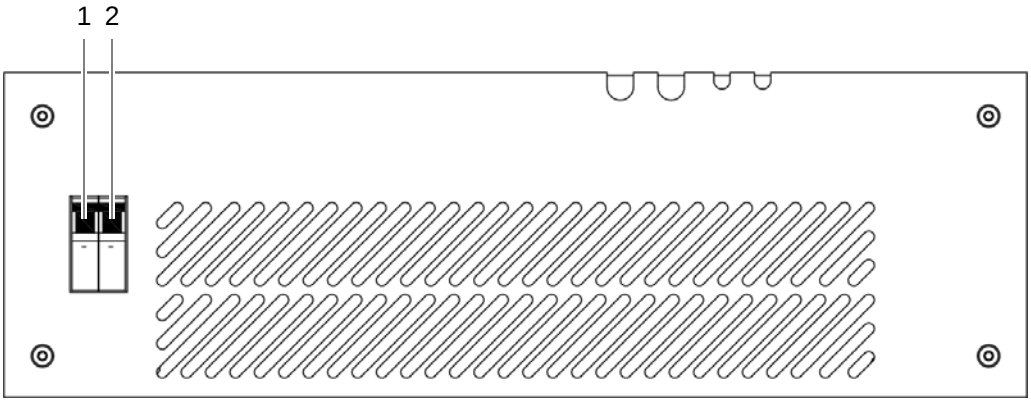

Figure 3.15 On/off switch

Table 3.17 Legend: On/Off switches

No.	Description
1	On/Off switches for the first TIB transceiver module and the corresponding fan
2	On/Off switches for the second TIB transceiver module and the corresponding fan

Voltage supply of the ACS

The antenna coupling system (ACS) is supplied with voltage via the installed TIB transceiver modules. Correspondingly, the ACS is de-energised only if the On/Off switches of all installed TIB transceiver modules have been switched off.

The following table describes the switch setting of the on/off switch.

Table 3.18 Settings of the On/Off switch

Switch setting	Description
Top	Switched on
Bottom	Switched off

3.1.5 TIB transceiver module (TETRA Indoor Base)

The TETRA Indoor Base transceiver module (TIB) is a hardware component. The TIB has been implemented in the form of a subrack for the equipment rack and provides a maximum of two carriers for the radio coverage to and from the mobile stations within an ACCESSNET®-T IP network.

Figure 3.16 shows the front view of the TIB. The following table describes these indicators in detail.

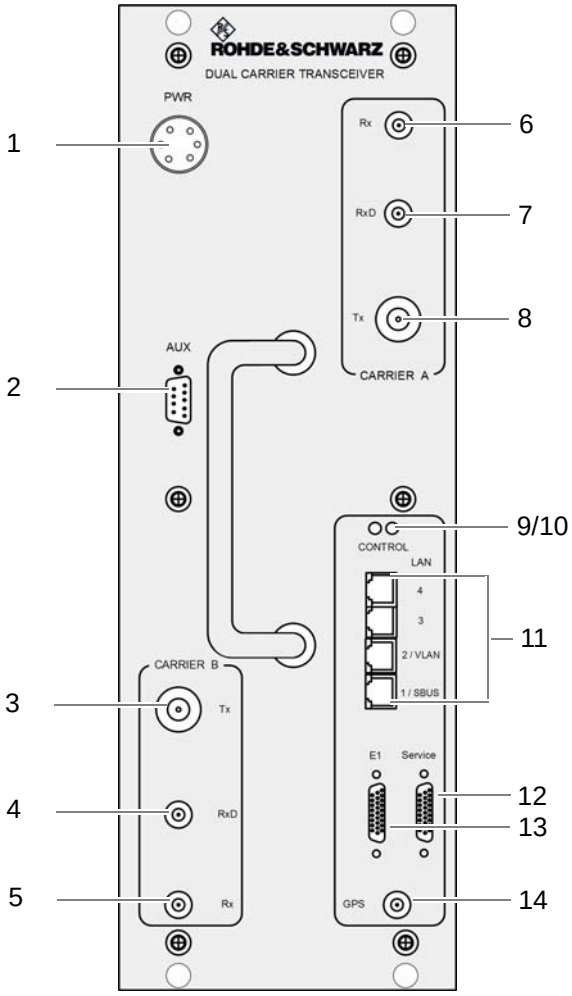

Figure 3.16 TIB (front view)

Table 3.19 Legend: TIB (front view)

No.	Supply	Description
1	PWR	48 VDC voltage supply connection
2	AUX	Interface to the antenna coupling system including voltage supply and VSWR (Voltage Standing Wave Ratio) evaluation.
3	Tx (Carrier B)	Tx transmitter output carrier B
4	RxD (Carrier B)	Rx receiver input carrier B (Diversity)
5	Rx (Carrier B)	Rx receiver input carrier B
6	Rx (Carrier A)	Rx receiver input carrier A

Table 3.19 Legend: TIB (front view)

No.	Supply	Description
7	RxD (Carrier A)	Rx receiver input carrier A (Diversity)
8	Tx (Carrier A)	Tx transmitter output carrier A
9/10	Power LED (LH side)	Voltage supply status indicator
	Alive LED (RH side)	Operation status indicator
11	Ethernet ports	Described in Table 3.20 on page 46
12	Service	Serial service interface
13	E1	E1 interface to E1 connection board of the DIB-500 R4.1
14	GPS	GPS antenna connector

Figure 3.17 shows the Ethernet port of the TIB. The following table describes these indicators in detail.

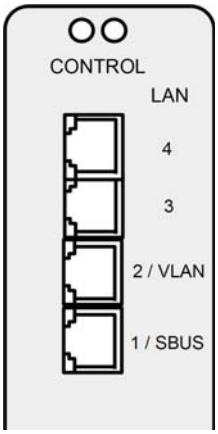

Figure 3.17 TIB Ethernet ports

Table 3.20 Legend: TIB Ethernet ports

Name of connection	Description	
	TIB A	TIB B
LAN (4)	Connection with TIB B	Connection with TIB A
LAN (3)	Connection with an additional equipment rack[1)] Connection with the LRU[2)]	Connection with the LRU[2)]
LAN (2/VLAN)	Connection of the service computer (local) Connection to an IP transport network or a layer-3 switch	Connection of the service computer (local) Connection to an IP transport network or a layer-3 switch[3)]
LAN (1/SBUS)	Connection to the SC200[4)]	not used for the time being

1) in variants starting at five carriers
2) if installed in the second equipment rack, in variants starting at five carriers
3) with controller redundancy (optional) in variants with two TIB transceiver modules with two carriers each
4) only for V_{AC} or alarm system expansion

Figure 3.18 shows the indicators of the TIB. The following table describes these indicators in detail.

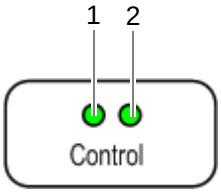

Figure 3.18 TIB indicators

Table 3.21 Legend: Indicators (LEDs) of the TIB

No.	LED	Colour	Description
1	Power- LED	green	lights up during operation
2	Alive-LED	green	flashes rapidly (100/100 ms) when the voltage supply fails
			flashes every half second (500/500 ms) when PowerPC and IntelPC are in operation (standard operation)
			flashes every second (1000/1000 ms) when PowerPC and IntelPC are shut down (Shutdown initiated)
			flashes every 2 seconds (2000/2000 ms) when the operating temperature is too high or too low
			flashes every 3 seconds (3000/3000 ms) when PowerPC and IntelPC have been shut down (Shutdown completed)

3.1.5.1 Overview of possible functions and corresponding software components on the TIB transceiver module

Besides the provisioning of the base station function (BSF), the DIB-500 R4.1 can take on the switching controller function (SCF) in ACCESSNET®-T IP networks with distributed switching architecture. In addition, the DIB-500 R4.1 is participating in the implementation of additional functions in the ACCESSNET®-T IP depending on the network configuration.

Table 3.22 provides an overview of the functions that can be provided via the DIB-500 R4.1. In addition, the software components required for providing the respective function and the corresponding hardware component are listed within the transceiver module on which the respective software component is installed. The distribution of the software components onto the hardware components is represented in Figure 3.19 on page 48.

Table 3.22 Functions and corresponding software components on the TIB transceiver module

Function	Software component	Hardware component	Described on
Base Station Function (BSF)	Coder/decoder software	Receiver/transmitter unit (transceiver)	Page 49
	TETRA Operation Server (TOS)	IntelPC	
	Processing Unit Controller (PUC)	Multi Processor Server Unit (MSU)	
Switching Controller Function (SCF)	Core Operation Server (COS)	IntelPC	Page 49
	IP Switch (IPS)	IntelPC	
Telephony Gateway (TGW)	SIP Media Gateway (SMG)	IntelPC	Page 50

Table 3.22 Functions and corresponding software components on the TIB transceiver module

Function	Software component	Hardware component	Described on
Application Gateway (AGW)	TETRA Application Platform (TAP)	IntelPC	Page 50
TETRA Vocoder Function (TVF)	SIP Media Gateway (SMG)	IntelPC	Page 49
Packet Data Gateway (PGW)	Packet Data Server (PDS)	IntelPC	Page 50
Configuration management[1)]	Network Element Manager (NEM-523)	IntelPC	Page 52
Hardware monitoring	Processing Unit Controller (PUC)	Multi Processor Server Unit (MSU)	Page 51
	Hardware Guard (HWG)	IntelPC	Page 53

1) The Configuration Management is provided as administrative function via the network management system NMS-500.

Figure 3.19 shows the block diagram of the TIB in simplified representation in a variant with two carriers and with all available functions or software components.

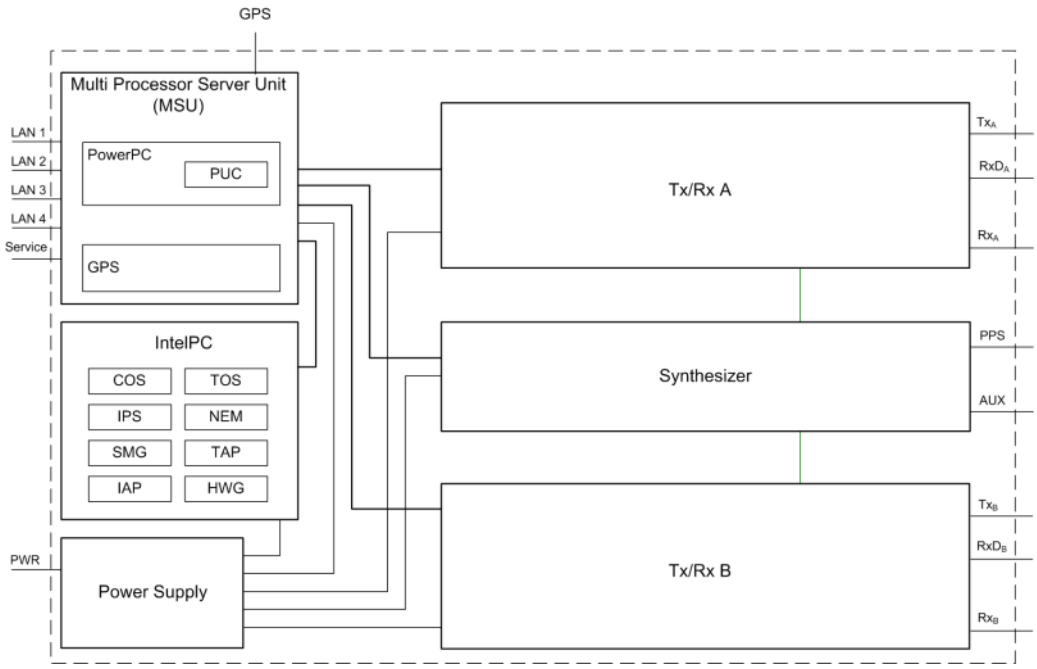

Figure 3.19 TIB block diagram

3.1.5.2 Overview of possible functions

In the ACCESSNET®-T IP, the available services and performance features are combined in form of so-called functional units. These functional units available for the present product are described in the following sections.

Depending on the respective network configuration, the DIB-500 R4.1 can provide the following functional units:

- Base Station Function (BSF)
- Switching Controller Function (SCF)
- TETRA Vocoder Function (TVF)
- Application Gateway (AGW)
- Packet Data Gateway (PGW)
- Telephony Gateway (TGW)

Base Station Function (BSF)

The Base Station Function (BSF) is a functional unit of the ACCESSNET®-T IP and provides the air interface in compliance with the TETRA standard (Terrestrial Trunked Radio, TETRA).

The air interface facilitates the communication (voice and data) between mobile stations such as hand-held mobile radios, data radios (Remote Terminal Unit, RTU) and radio dispatcher workstations. The radio channels for this purpose are generated via transceivers of the base stations that are available in various frequency ranges. The traffic and packet data channels are dynamically occupied. Signalling and short messages (SDS) are transmitted via statically configured control channels (MCCH and, if necessary, SCCH).

Switching Controller Function (SCF)

The Switching Controller Function (SCF) is a centralised function block of the ACCESSNET®-T IP and ensures the IP-based routing function between the network constituents of an ACCESSNET®-T IP network and the gateways (telephone network, application and packet data).

The SCF can be used flexibly on different network elements/platforms and combined with other functional units. If a distributed switching architecture is used in an ACCESSNET®-T IP network, gateways to applications could be implemented locally at any network constituents. Depending on the requirements of the ACCESSNET®-T IP network, the routing functions are also available to application and telephone gateways.

TETRA Vocoder Function (TVF)

The TETRA Vocoder Function (TVF) serves as a converter (encoder/decoder) for voice streams between the TETRA system and an external system such as a telephone network. With the aid of the TVF, the voice between the TETRA format used (ACELP, Algebraic Code Excited Linear Prediction) and the G.711 format (A-Law or µ-Law) is recoded. The TVF is required for the Telephone Gateway (TGW) functional unit. The TVF is also required for the Application Gateway (AGW) functional unit if the voice connection of the application is to be implemented via G.711 instead of via the TETRA codecs.

Application Gateway (AGW)

The Application Gateway (AGW) facilitates the communication between the ACCESSNET®-T IP network and applications that use the services of the TETRA system such as dispatchers, positioning systems (AVL, GIS), voice and data recording as well as SCADA or SMART-Metering applications.

Packet Data Gateway (PGW)

The packet data service facilitates the efficient transmission of packet data between mobile stations within a ACCESSNET®-T IP network and to connected IP networks. Possible application scenarios are e.g. database queries or the transmission of data to control systems (SCADA, Supervisory Control and Data Acquisition).

The Packet Data Gateway (PGW) provides the packet data gateways for mobile stations. This packet data gateway provides access points for accessing connected IP networks of various user organizations.

Telephony Gateway (TGW)

The TGW provides an IP-based telephone gateway between the ACCESSNET®-T IP network and an appropriate VoIP private automatic branch exchange.

Within the ACCESSNET®-T IP network, the TGW is logically connected to the Switching Controller Function (SCF). The signalling of the TGW for the registration and call control with the telephone system is performed according to the SIP standard (Session Initiation Protocol). The Real-time Transport Protocol (RTP) is used as the transmission protocol for the voice. The voice itself is encoded in the G.711 format (A-law or µ-law).

3.1.5.3 Multi Processor Server Unit (MSU)

The MSU is a hardware component. It serves as a hardware platform for the Processing Unit Controller (PUC) software component. It provides four Ethernet interfaces.

In addition, a GPS module is installed in the MSU that is responsible for providing the clock and time reference signals (synchronization) required for switching connections.

The MSU components are described in detail in the following sections.

PowerPC

The PowerPC is a hardware component and distributes the GPS reference signal, which it receives from the GPS module, to the IntelPC with the help of the Network Time Protocol (NTP). If connected network elements, such as an IP node (IPN), do not feature their own GPS reference signal, they can be supplied with the GPS time via the PowerPC of the DIB-500 R4.1. In addition, the PowerPC serves as hardware platform for the software component Processing Unit Controller (PUC).

Processing Unit Controller (PUC)

The Processing Unit Controller (PUC) is a software component and serves for commissioning, configuring, controlling and monitoring the integrated hardware components of the TIB. The PUC makes the resulting data available to the Network Management System via an SNMP agent.

The PUC is also responsible for the signalling between the transceivers and the TETRA Operation Server (TOS). The PUC forwards the signalling from the transceivers to the TOS or, the signalling from the TOS via the air interface back to the transceivers.

GPS module

The GPS module (Global Positioning System, GPS) is a hardware component within the MSU and ensures the provisioning of the reference signals for clock and time that are required for the synchronisation of the components within the network element. For this purpose, the time signal received from the PUC software component is processed and forwarded to the PowerPC as a reference signal. From there, the reference signal is distributed with the aid of the Network Time Protocol (NTP).

3.1.5.4 IntelPC

The IntelPC is a hardware component and, depending on the network configuration, serves as hardware platform for the following software components:

- Core Operation Server (COS)
- TETRA Operation Server (TOS)
- IP Switch (IPS)
- Network Element Manager (NEM-523)
- Packet Data Server (PDS)
- TETRA Application Platform (TAP)
- SIP Media Gateway (SMG)
- Hardware Guard (HWG)

Core Operation Server (COS)

The Core Operating Server (COS) is a software component which performs all calculations and control for exchange processes of higher protocol layers. Apart from the switching process, this includes the call administration, the authorisation validation and - if applicable - the resources management for the communication with other network elements within an ACCESSNET®-T IP network. In addition the COS assumes the control of the software component IP switch.

TETRA Operation Server (TOS)

The TETRA Operation Server (TOS) is responsible for the mobility management (registration, group handling, authentication and call management with speaker monitoring, etc.). In addition, the TOS is responsible for the resource management for the radio channels and manages the TETRA radio cell including control of the broadcast data.

IP Switch (IPS)

The IP Switch (IPS) is a software component. It serves for distributing TETRA voice data between software components and to external applications (optional) and is thus a central control component of the network element.

The TETRA voice data are received in the form of IP data packages. The received IP data packages information facilitating the routing of the IP data packages in addition to the TETRA voice data. The IPS is controlled by the Core Operation Server (COS) software component via the PUC Switch (Processing Unit Controller, PUC) protocol. The IP data packages are transferred by the IPS via point-to-point connections ("Unicast").

Network Element Manager (NEM-523)

The Network Element Manager (NEM-523) is a software component and part of the Network Management System of ACCESSNET®-T IP. It administers the network elements and enables access to the network components of the TETRA infrastructure installed in it.

In addition, the NEM-523 performs operative functions such as the redundancy management: if specific network resources are temporarily unavailable, the application will control the software component by switchover to standby resources.

The NEM-523 is responsible for management functions, and controls downloads as well as the distribution of network resources. The NEM-523 is the remote station via which the NMC-522 DownloadManager communicates while downloading software or a configuration. It is responsible for properly enabling a configuration or software and for a fallback to the previous configuration or software version in the case of faults.

Packet Data Server (PDS)

The Packet Data Server (PDS) is a software component and provides the packet data service. The packet data service enables an efficient transmission of packet data between mobile stations within an ACCESSNET®-T IP network and to externally connected IP networks. In this case, the PDS is the access point to one or several networks of user organisations for mobile stations in the ACCESSNET®-T IP. For this purpose, the PDS provides an IP gateway (Access Point Gateway, APG) for each user network, whereby a user network is always mapped by an APG and identified by a unique Access Point Name Index (APNI).

Due to the use of virtual networks (Virtual Private Network, VPN), the operation of multiple user organisations is possible in one mobile network independently of one another. Via IP gateways (Access Point Gateways [APG]), access to IP networks can be administered subscriber-specifically with the aid of the network management client NMC-512 SubscriberManager to configure the use of Internet and Intranet.

The packet data service can coexist with existing calls and Short Data Services (SDS) of the ACCESSNET®-T IP. Depending on the mobile station used in each case and the configured call priorities, the packet data transmission is not interrupted by calls.

The Packet Data Gateway (PGW) or the PDS can be operated redundantly to increase the availability. With this type of characteristic, the ACCESSNET®-T IP network generally contains two PDS on different network elements. Up to three PDS are currently being supported for each ACCESSNET®-T IP network.

TETRA Application Platform (TAP)

The TETRA Application Platform (TAP) is a software component and acts as the gateway between applications and the ACCESSNET®-T IP. The TAP is responsible for logging in/authenticating the relevant applications and connecting them to the wireless network.

Applications can be integrated into the TAP via the ACCESSNET®T Common Application Programming Interface (A-CAPI). The TAP forwards the data, processed, to the core operation server (COS), for example, and thereby establishes the connection between applications and the radio network. Via the connection with the TAP, the respective application can be integrated into the ACCESSNET®-T IP like a radio subscriber and, e.g., send short message (SDS), establishing and answering calls, etc.

A-CAPI applications connected via the TAP have a larger scope of functions than radio subscribers such as:

- combining dynamic groups,
- administering dynamic object addresses (OOCA),
- administering dynamic call lines
- monitoring stations
- recording extended time calls (voice recorder).

Examples of A-CAPI applications:

- dispatcher,
- Voice recorder,
- SDS recorder,
- Control workstation
- Object call server.

SIP Media Gateway (SMG)

The SIP Media Gateway (SMG) is a software component and used for connecting SIP-based private automatic branch exchange (PABX). The SMG converts TETRA-coded voice data to G.711 and back to facilitate the communication between TETRA subscribers and private branch exchange subscribers. For the communication with PABX, the SMG uses the standardised Session Initiation Protocol (SIP). In this function, the SMG is used as an SIP client.

Hardware Guard (HWG)

The Hardware Guard (HWG) is a software component and is used for monitoring the IntelPC.

3.1.5.5 Synthesiser

The synthesiser is a hardware component and provides all the required clock pulses and frequencies. These are based on the standard clock pulse (GPS) provided by the GPS module of the Multi Server Processor Unit (MSU). The synthesiser is used to generate and analyse the 1PPS signal (pulses per second, PPS). The synchronisation of additional TIB transceiver modules of a DIB-500 R4.1 is performed in this way.

3.1.5.6 Power supply

The voltage supply (Power Supply) is a hardware component and provides the voltage supply for the TIB.

3.1.5.7 Receiver/transmitter unit (transceiver)

A carrier is a hardware component consisting of a transmitter, a receiver and a TETRA protocol coder/decoder. Carriers are available in different frequency ranges as required. Up to two carriers can be installed in one TIB. One carrier generates the radio channel, via which the base station and the mobile terminal equipment exchange user data and signalling data.

3.1.6 Antenna Coupling System (ACS)

The antenna coupling system (ACS) is a hardware component for the DIB-500 R4.1 base station. The ACS has been implemented in the form of a subrack for the equipment rack and enables different antenna coupling variants.

In the hybrid variant, an ACS allows operating two or four carriers using one Tx/Rx antenna. In the high power variant, one or two carriers are optionally available. In case of two carriers, the operation utilises two Tx/Rx antennas. For operating more than four carriers, two ACS (integrated in two equipment carriers) can be connected with one another so that up to eight carriers on two Tx/Rx antennas are possible.

In the FlexibleTx variant, antenna coupling was performed project-specifically according to the desires and requirements of the network operator via external antenna coupling systems. In this way, the DIB-500 R4.1, e.g. can be connected to existing antenna coupling systems.

Requirements for external antenna coupling systems.

The requirements on external antenna coupling systems are described in the site requirements.

The DIB-500 R4.1 is available with different antenna coupling systems. The selection of the corresponding antenna coupling system depends on the network requirements.

The following antenna interfaces are available for different network requirements:

- Hybrid variant
  - Compact design
  - As many as eight carriers per network element (two equipment racks with four carriers each)
  - Highly flexible in the frequency selection
  - flexible frequency change
- Cavity variant
  - As many as eight carriers per network element (two equipment racks with four carriers each)
  - higher transmitting power than hybrid variant

- High power variant
  - up to two carriers per network element,
  - Higher transmitting power than hybrid and cavity variants
- FlexibleTx variant
  - only equipped with Rx path
  - up to four carriers per network element,
  - high flexibility due to the use of project-specific antenna coupling systems
  - site-specific provision by the network operator

Antenna diversity is available for optimal reception properties.

Additional Information

For more information on the technical characteristics and performance features of the different versions, please refer to the Technical data. The requirements on external project-specific antenna coupling systems are available in the site requirements.

Table 3.23 lists the antenna coupling variants, the number of carriers each variant provides and the resulting number of supported Tx/Rx antennas. For the diversity variants, the diversity reception is facilitated by means of another Rx antenna.

Table 3.23 Variants of the ACS

Variant	1 carrier	2 carriers	3/4 carriers	5/6 carriers	7/8 carriers
Hybrid	1 Tx/Rx antenna (antenna A)[1)] 1 Rx antenna (antenna B)[2)]			1 Tx-/Rx antenna (antenna A)[1)] 1 Rx antenna (antenna B)[2)]	
Cavity	like the hybrid variants but a single-carrier variant is not available				
High Power (without transmitter coupling system)	1 Tx/Rx antenna (antenna A) 1 Rx antenna (antenna B)[2)]	1 Tx/Rx antenna (antenna A) 1 Tx/Rx antenna (antenna B)	---	---	---
FlexibleTx	depending on the antenna coupling system used			---	---

1) per equipment rack
2) with diversity

Figure 3.20 shows the front view of the ACS. The following table describes the components in greater detail.

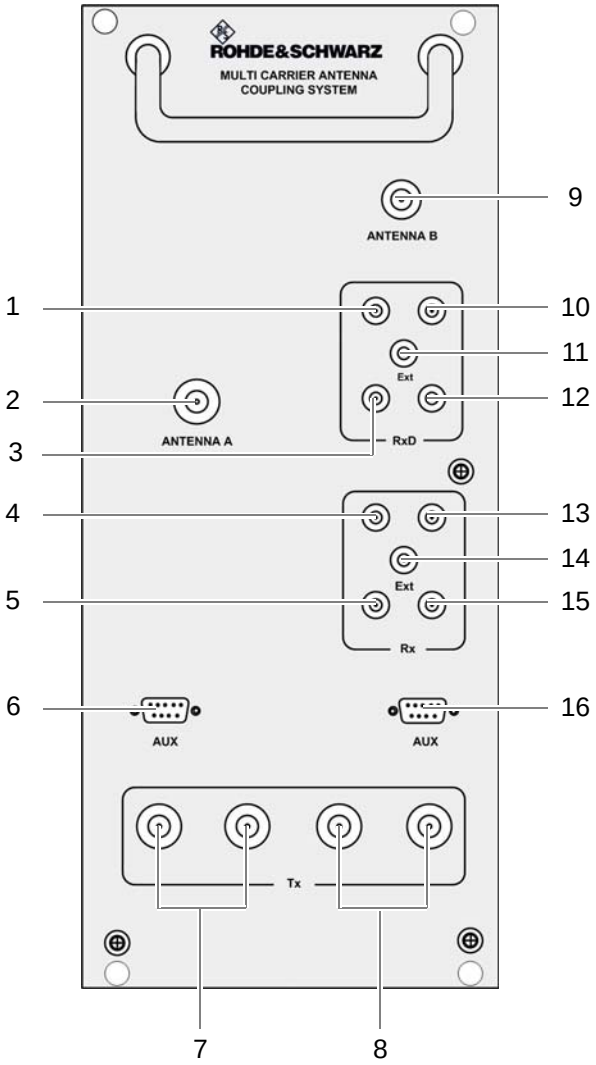

Figure 3.20 ACS (front view)

Table 3.24 Legend: ACS (front view)

No.	Supply	Description
1	RxD (TIB A_1)	Antenna B Rx output carrier TIB A_1 (only in the case of diversity)
2	Antenna A	Antenna A Tx/Rx antenna connection
3	RxD (TIB A_2)	Antenna B Rx output carrier TIB A_2 (only in the case of diversity)
4	Rx (TIB A_1)	Antenna A Rx output carrier TIB A_1
5	Rx (TIB A_2)	Antenna A Rx output carrier TIB A_2
6	AUX (TIB A)	Interface to the TIB A transceiver module (including voltage supply)
7	Tx (TIB $A_{1/2}$)	Antenna A[1)] Tx inputs carrier TIB $A_{1/2}$
8	Tx (TIB $B_{1/2}$)	Antenna A[1)] Tx inputs carrier TIB $B_{1/2}$

Table 3.24 Legend: ACS (front view)

No.	Supply	Description
9	Antenna B	Antenna B (Tx)/Rx antenna connection
10	RxD (TIB B_1)	Antenna B Rx output carrier TIB B_1 (only in the case of diversity)
11	RxD Ext	Interface (input) for connecting the reception paths of another ACS for diversity reception (with > 4 carriers)
12	RxD (TIB B_2)	Antenna B Rx output carrier TIB B_2 (only in the case of diversity)
13	Rx (TIB B_1)	Antenna A Rx output carrier TIB B_1
14	Rx Ext	Antenna A interface (output) for connecting another ACS (with > 4 carriers)
15	Rx (TIB B_2)	Antenna A Rx output carrier TIB B_2
16	AUX (TIB B)	Interface to the TIB B transceiver module (including voltage supply)

1) depending on the ACS variant

3.1.7 Fan unit

The fan unit is a hardware component and consists of one fan subrack per TIB transceiver module. The fan unit serves for optimum vertical venting of the constituents installed inside the equipment cabinet and for filtering the dirt and dust particles contained in the air. A fan subrack is made up of a fan and an air filter pad.

Figure 3.21 shows the front view of the fan subrack. The following table describes these indicators in detail.

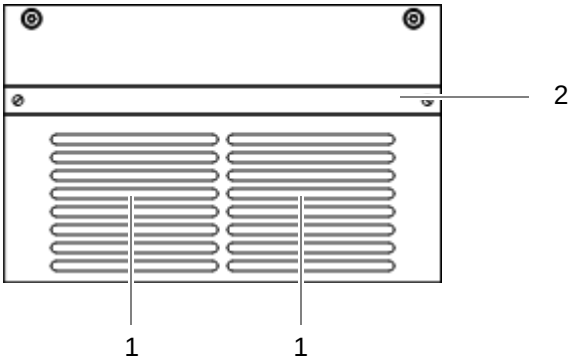

Figure 3.21 Front view of fan subrack

Table 3.25 Legend: front view of fan subrack

No.	Constituent
1	Air intake
2	Air filter pad holder including air filter pad

3.1.8 Cavity coupler (only for the Cavity variant)

The cavity coupler is a hardware component and used for lossless coupling of two to four radio channels on one transmitting antenna. Cavity couplers are available in the cavity variant of the DIB-500 R4.1 in a separate equipment rack which can accommodate up to four cavity couplers. One cavity coupler is available for each carrier.

The size of the cavity couplers depends on the frequency used, e.g. smaller cavity couplers are used for frequencies > 806 MHz that for frequencies < 486 MHz. Accordingly, the DIB-500 R4.1 employs different cavity couplers, which vary in size, depending on the frequencies used.

Figure 3.22 shows the DIB-500 R4.1 in the cavity variant for frequencies < 486 MHz. The four cavity couplers are installed in a separate equipment rack. Both equipment racks are already stacked and wired upon delivery.

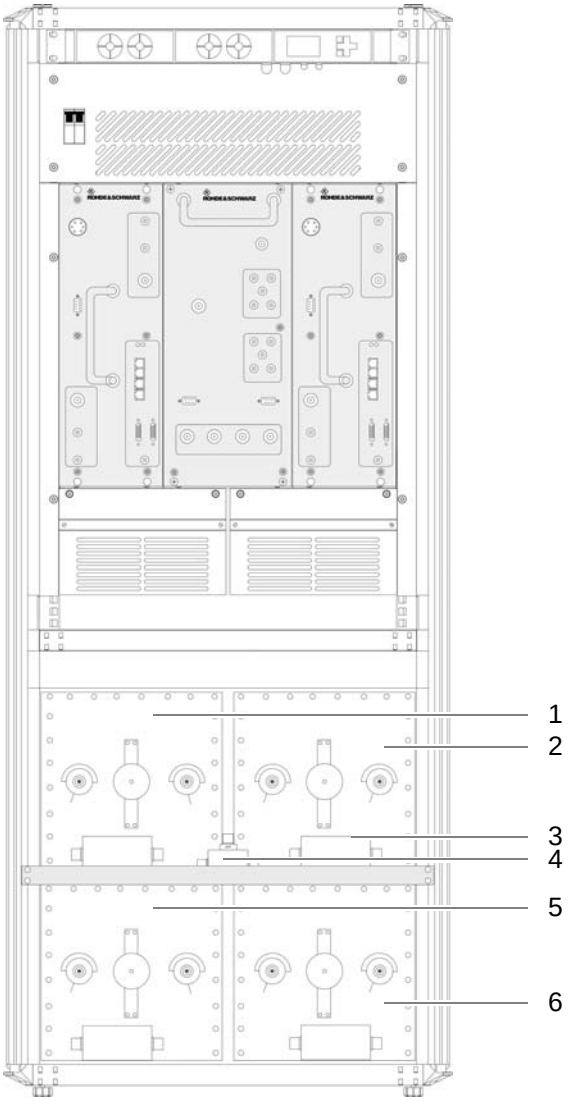

Figure 3.22 DIB-500 R4.1 cavity variant with four cavity couplers for frequencies < 486 MHz (front view)

Table 3.26 Legend: DIB-500 R4.1 cavity variant with four cavity couplers for frequencies < 486 MHz (front view)

No.	Designation
1	Cavity coupler A
2	Cavity coupler B
3	Insulator for cavity coupler B
4	Star distributor
5	Cavity coupler C
6	Cavity coupler D

Figure 3.23 shows the DIB-500 R4.1 in the cavity variant for frequencies > 806 MHz. The four cavity couplers are installed in a separate equipment rack. Both equipment racks are already stacked and wired upon delivery.

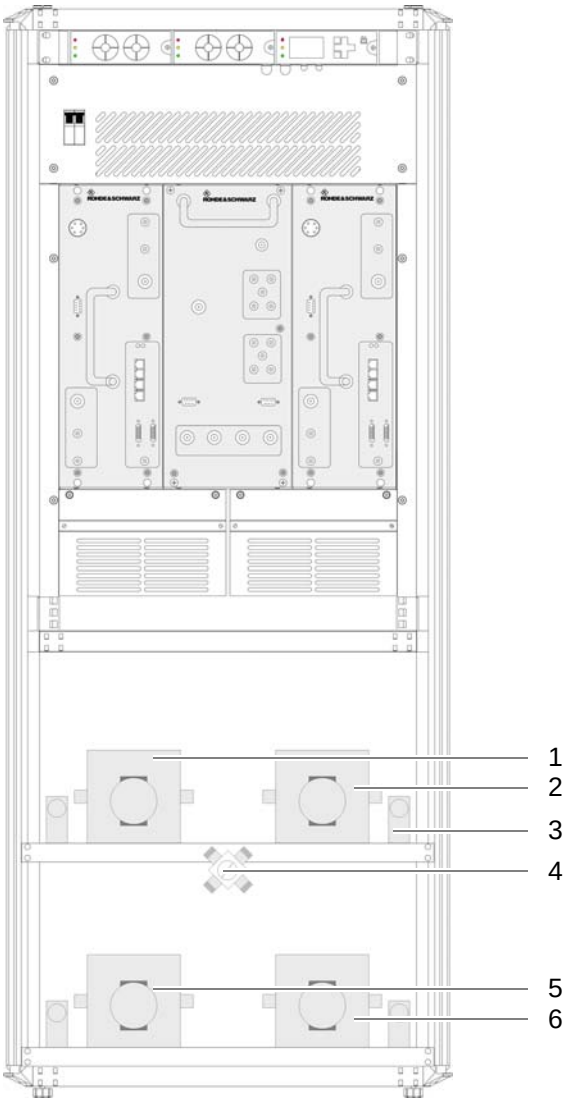

Figure 3.23 DIB-500 R4.1 cavity variant with four cavity couplers for frequencies > 806 MHz (front view)

Table 3.27 Legend: DIB-500 R4.1 cavity variant with four cavity couplers for frequencies > 806 MHz (front view)

No.	Designation
1	Cavity coupler A
2	Cavity coupler B
3	Insulator for cavity coupler B
4	Star distributor
5	Cavity coupler C
6	Cavity coupler D

3.1.9 Redundancy options for the DIB-500 R4.1 or the Base Station Function (BSF)

The ACCESSNET®-T IP provides numerous redundancy concepts to ensure the availability of services and performance features reliably even in exceptional situations. The concept of designing system functions, network elements and connection routes redundantly, may be required to ensure location reliability and system reliability. Location and system reliability refers to the capability of the network to perpetuate the operation of the overall system even if one location or route drops out completely or partially (due to technical failure, natural phenomena, acts of terrorism etc.).

In combination with the flexible network architecture, the design of the engineered system permits scalable redundancy solutions that take into account the different requirements for availability and capacity within an overall network.

The following sections describe the available redundancy options in conjunction with the DIB-500 R4.1.

3.1.9.1 Redundant Main Control Channel (MCCH)

Irrespective of the number of carriers assigned to a radio cell of a base station, a radio cell has only one main control channel (MCCH), via which the mobile stations receive information on adjacent radio cells, for example.

Generally, the main control channel is sent via the first carrier of a base station. The three remaining channels of this carrier and all the channels of all the other carriers are used as voice channels. Up to three of the remaining channels on the first carrier can be configured as secondary control channels (SCCH), which reduces the number of voice channels accordingly.

Multiple radio cells per base station

If a base station has been assigned multiple radio cells, it is also possible to configure secondary control channels on the first carriers of these radio cells. A base station can be assigned a maximum of four radio cells, i.e. for base station with eight carriers, a max. of 16 control channels are possible.

The main control channel can be configured redundantly on any available carrier. If the carrier that provided the main control channel last drops out, an alternative carrier will take on this task. In this case, the replacement carrier will continue to send on its original frequency, not on that of the failed carrier.

To ensure that the replacement carrier sends on the frequency of the failed carrier, the following optional performance features can be used:

- "n+1 Carrier redundancy"
- "n+2 Carrier redundancy"

3.1.9.2 Transceiver redundancy

To increase the system stability of carriers or to ensure the Base Station Function (BSF), as many as two redundant transceivers can be used in one base station. These spare transceivers ensure the radio coverage on the frequency of the failed transceiver if a transceiver drops out. Transceiver redundancy is mostly used in cased, in which only a few frequencies are available.

3.1.9.3 Controller redundancy

When using base stations with at least two TIB transceiver modules (TETRA Indoor Base Transceiver), the controller required for the Base Station Function (BSF) can be designed redundantly. During the operation of the base station, both TIB transceiver modules are active, whereby the controller of the first TIB controls regular base station operation and the controller of another TIB is maintained in standby.

If one of the TIB transceiver modules or an Ethernet connection fails, the operationally ready controller of the standby transceiver module is switched to active. In this way, the operation of the Base Station Function (BSF) is continually ensured.

In base stations with at least two TIB transceiver modules, this performance feature can also be combined with the optional performance features "n+1 carrier redundancy ("standby carrier")" or "n+2 carrier redundancy ("standby carrier")" and further increase the fault tolerance.

The controller redundancy affects the Gradual reduction of the carrier capacity, refer to section 3.1.9.4 on page 61.

3.1.9.4 Gradual reduction of the carrier capacity

ACCESSNET®-T IP provides the gradual reduction of the carrier capacity, which results in low traffic capacity when the controller redundancy option for base stations without carrier redundancy is selected. The operation of the base station is maintained while air interface resources (carriers) are available with reduced capacity.

3.1.9.5 Fallback operation

The radio coverage of base stations is also ensured if the base station loses the connection to an IP node (IPN) with Switching Controller Function (SCF). In this case, the base station changes to fallback operation. In fallback operation, the base station in its radio cell still maintains the Base Station Function (BSF). Even in fallback operation, authentication and authorisation are ensured since the corresponding subscriber data are stored in the base station.

The connection to other network constituents is not possible in fallback operation, the following services and performance features, however, are available locally:

- Group calls
- Individual calls (semi-duplex and duplex calls)
- Transmission of SDS and status messages
- Class 2 and class 3 air interface encryption (encrypted voice and data communication)
- Authentication (with respect to the base station)
- Priority calls, emergency calls, pre-emptive priority calls
- Queue, depending on the priority level of the call
- Rejection of a call from/to an unknown subscriber
- Rejection with the reason "Busy" if the subscriber is already making a call or the priority of the incoming call is too low
- Configurable call time limit
- Inactivity timer (ending half-duplex calls after the configured inactivity time has expired)

The fallback operation is signalled to the mobile stations, which take this information into account when selecting radio cells. Fallback operation is the emergency operating mode of base stations in ACCESSNET®-T IP networks with centralised switching architecture.

3.1.9.6 Stand-alone operation

The radio coverage of base stations with Switching Controller Function (SCF) in networks with distributed switching architecture continues to be ensured if they lose the connection to all other network constituents with SCF. In this case the base station switches to stand-alone operation.

In stand-alone operation, the base station in its radio cell will perpetuate the Base Station Function (BSF) as well as all the other local services and gateways (Application Gateway (AGW) and/or Packet Data Gateway (PGW)). As opposed to fallback operation, in stand-alone operation call detail records (CDR) will still be generated.

The stand-alone operation is signalled to the mobile stations, which take this information into account when selecting radio cells. Stand-alone operation is the emergency operating mode of base stations in ACCESSNET®-T IP networks with distributed switching architecture.

3.1.9.7 Redundancy by means of overlapping radio coverage

Especially in critical radio coverage zones, radio coverage can be ensured by employing two redundant base stations to compensate for the failure of one base station in exceptional circumstances. In this case, the entire traffic load handled by only one base station; for this reason, the base stations must be dimensioned appropriately.

If overlapping radio coverage is selected as a redundancy option, this must be taken into account when planning the radio network, assigning the frequencies in the system and when dimensioning the base stations.

3.2 Interfaces

Table 3.28 provides an overview of the interfaces of the DIB-500 R4.1. The use of interfaces is described in the corresponding sections on the components of the DIB-500 R4.1. Required connections are described in the procedures for the commissioning in chapter 5 on page 89 or for the component replacement in chapter 11 on page 171.

Table 3.28 Interfaces DIB-500 R4.1

Number of carriers		1/2	3/4	5/6	7/8
Number of E1 interfaces Impedance 120 Ω, LSA+ connection (cutting clamp connector) and RJ-45		4	6	8	10
Number of external alarm inputs (open/close) Connector LSA+ (cut-and-snap-in connector)		2			
Number of digital external alarm inputs (active/open) Screwless clamps for 0.5 to 2 mm² [20 to 14 AWG]		6 – optional[1)]			
Number of digital external alarm outputs Relay contact switch (load capacity: 0.1 A at 60 V) Screwless clamps for 0.5 to 2 mm² [20 to 14 AWG]		6 – optional[1)]			
Number of ethernet interfaces[2)] Specification Ethernet, 10/100BaseT, Connector RJ 45		4	8	12	16
Antenna connector	Hybrid	7/16 socket			
	Cavity				
	High Power				
Tx transmitter output	FlexibleTx	N-socket			
Rx receiver input		N-socket			
GPS antenna connector		N-socket			

Table 3.28 Interfaces DIB-500 R4.1

Specification for air interface in compliance with:	EN 300 392-2 (TETRA V+D) V2.5.1
Test of the air interface in compliance with:	EN 300 394-1 (TETRA Conformance testing specification) V2.3.1
Electromagnetic compatibility	ETSI EN 301 489-1 V 1.8.1 Approval corresponding to the Federal Communications Commission (FCC) and Industry Canada (IC)

1) via the alarm input/output module (optional)
2) The number of unused Ethernet interfaces per network element depends on the number of installed transceiver modules TETRA Indoor Base Transceiver (TIB), the connection to the transport network and connected accessories as needed.

3.3 Wiring diagrams

The internal wiring is already in place in the condition as supplied to the customer and prepared for commissioning. Inside the equipment cabinet, all the connecting cables are marked with the corresponding part number and port designation of the corresponding hardware component, e.g. for Port 1 = P1.

The cables that still need to be connected for commissioning the product such as cables for connecting the voltage supply and the existing grounding system on site must be connected when the product is installed, see chapter 5 on page 89.

Table 3.29 provides an overview of the internal wiring diagrams that are described in the following sections.

Wiring of variants without diversity

The wiring diagrams of the DIB-500 R4.1 described in the following sections refer to antenna connections with diversity. For variants without diversity, the internal wiring does not change. In addition, only one antenna connection is available.

Table 3.29 Internal wiring diagrams DIB-500 R4.1

Wiring diagram		Described in
Internal wiring of the hybrid variant	Internal wiring of the hybrid variant – two carriers	Section 3.3.1.1 on page 66
	Internal wiring of the hybrid variant – four carriers	Section 3.3.1.2 on page 67
	Hybrid variant – eight carriers	Section 3.3.1.3 on page 68
	Hybrid variant – Eight carriers with LRU (redundancy package)	Section 3.3.1.4 on page 70

Table 3.29 Internal wiring diagrams DIB-500 R4.1

Wiring diagram		Described in
Internal wiring of the cavity variant	Internal wiring of the cavity variant – two carriers	Section 3.3.2.1 on page 73
	Internal wiring of the cavity variant – four carriers	Section 3.3.2.2 on page 74
	Internal wiring of the cavity variant – eight carriers	Section 3.3.2.3 on page 75
	Wiring of cavity equipment rack	Section 3.3.2.4 on page 76
Internal wiring of the high power variant	Internal wiring of the high power variant – one carrier	Section 3.3.3.1 on page 78
	Internal wiring of high power variant – two carriers	Section 3.3.3.2 on page 79
Internal wiring for FlexibleTx variant	Internal wiring of FlexibleTx variant – two carriers	Section 3.3.4.1 on page 81
	Internal wiring for FlexibleTx variant – Four carriers	Section 3.3.4.2 on page 82

3.3.1 Internal wiring of the hybrid variant

For the hybrid variant of the DIB-500 R4.1 up to two equipment cabinets are used depending on the number of carriers (four carriers per equipment cabinet). Starting with five carriers, the equipment cabinets are positioned next to each other on site and connected with each other, see section 3.3.1.3 on page 68.

Wiring of variants with two carriers

The wiring is identical for the hybrid and high power variants with two carriers.

Table 3.30 provides an overview of the internal wiring diagrams of the hybrid variant that are described in the following sections.

Table 3.30 Internal wiring diagrams of the hybrid variant

Wiring diagram	Described in
Internal wiring of the hybrid variant – two carriers	Section 3.3.1.1 on page 66
Internal wiring of the hybrid variant – four carriers	Section 3.3.1.2 on page 67
Hybrid variant – eight carriers	Section 3.3.1.3 on page 68
Hybrid variant – Eight carriers with LRU (redundancy package)	Section 3.3.1.4 on page 70

3.3.1.1 Internal wiring of the hybrid variant – two carriers

Figure 3.24 shows the internal wiring of the DIB-500 R4.1 in the hybrid variant with two carriers. Upon delivery, the connections have already been wired ex works.

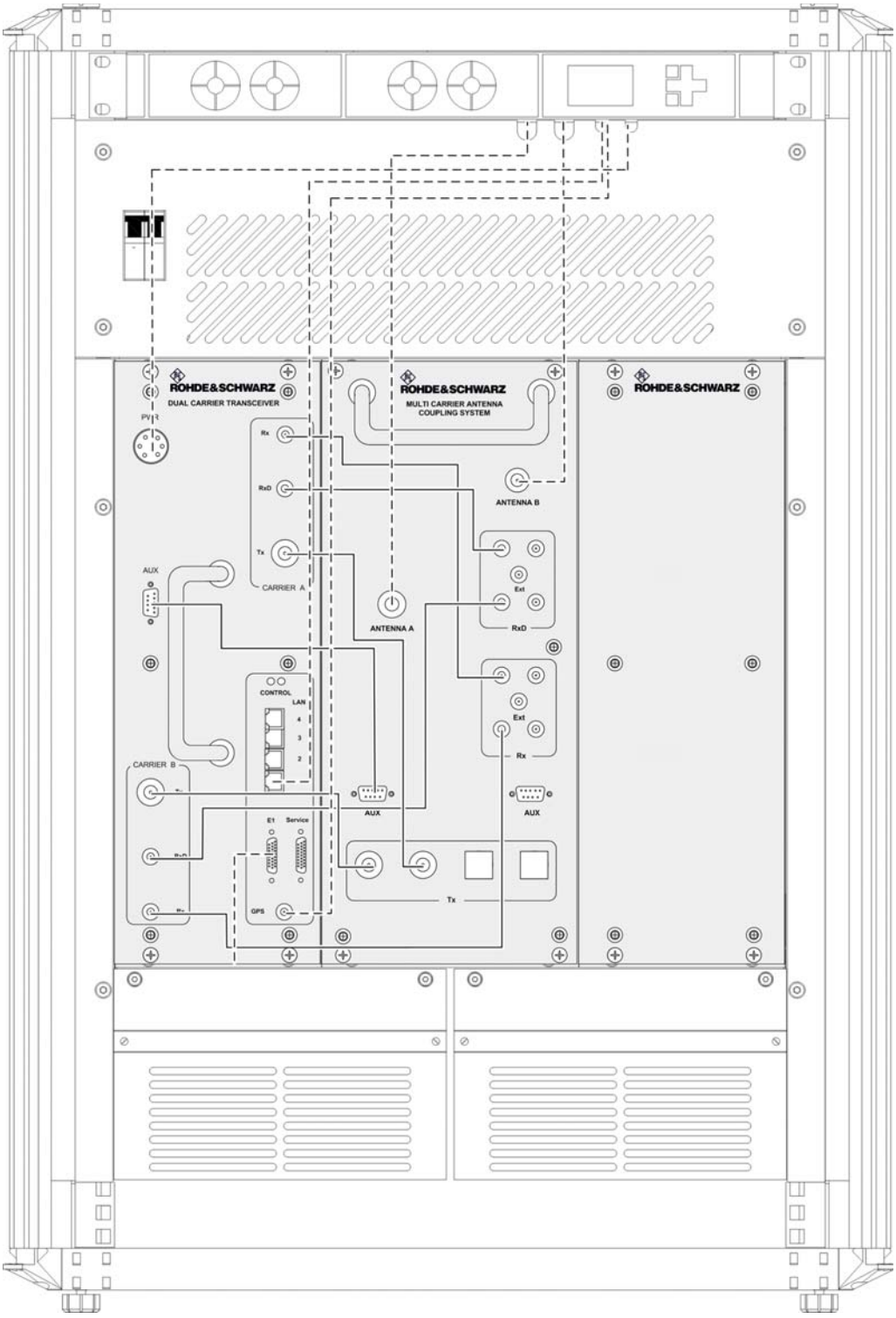

Figure 3.24 Wiring diagram of DIB-500 R4.1 – hybrid-variant with two carriers (diversity)

3.3.1.2 Internal wiring of the hybrid variant – four carriers

Figure 3.25 shows the internal wiring of the DIB-500 R4.1 in the hybrid variant with four carriers. Upon delivery, the connections have already been wired ex works.

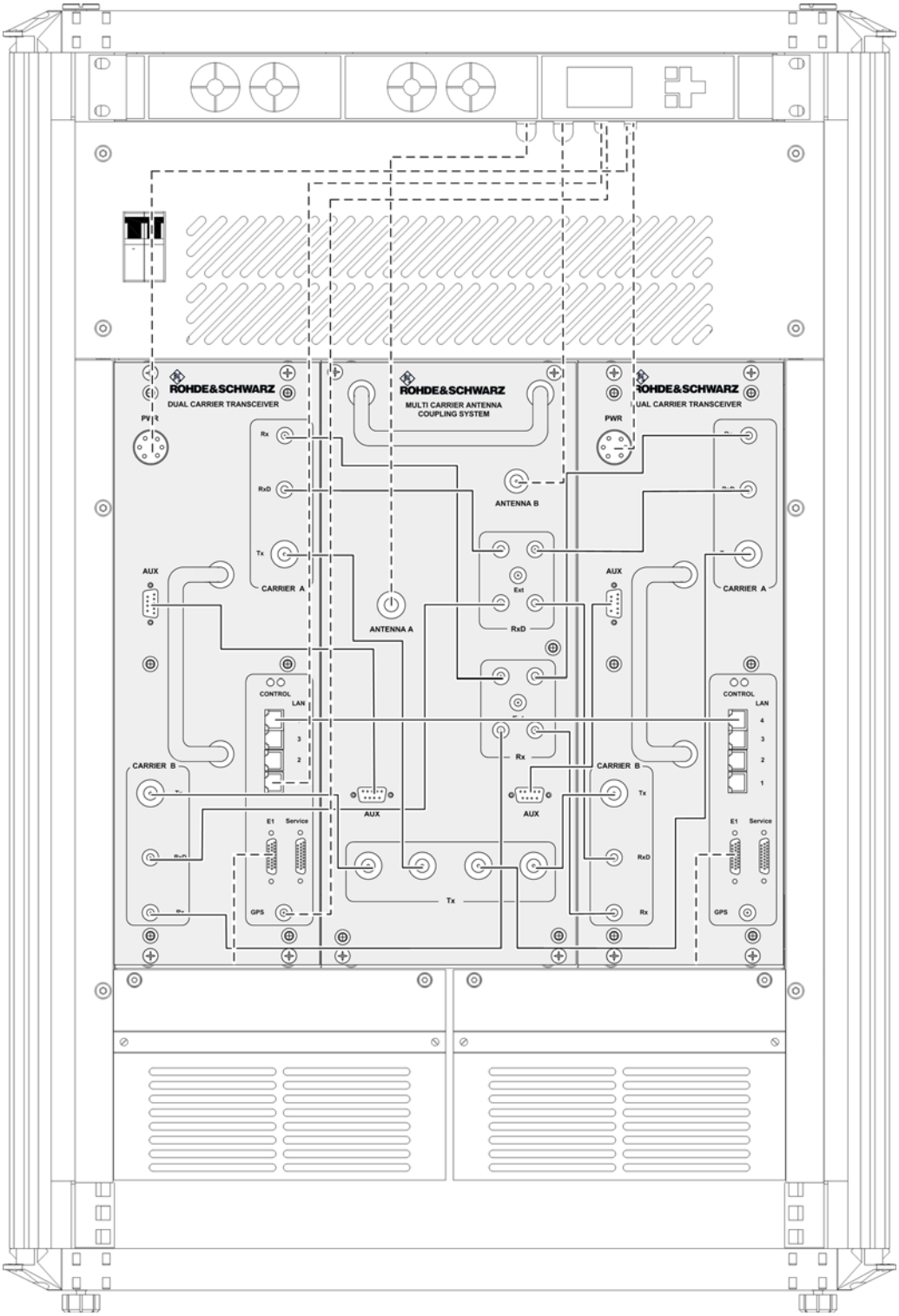

Figure 3.25 Wiring diagram DIB-500 R4.1 – hybrid variant with four carriers (diversity)

3.3.1.3 Hybrid variant – eight carriers

Two equipment racks installed next to each other are used for the hybrid variant as of five carriers. The internal wiring within an equipment rack corresponds to the wiring of the hybrid variant with four carriers, see section 3.3.1.2 on page 67.

Cable labeling for the connection of two equipment racks

For variants with more than four carriers, the corresponding connecting cables are supplied. They are identified according to their intended purpose, see Table 3.31 on page 70.

Figure 3.26 shows the connection between the equipment racks of the DIB-500 R4.1 in the hybrid variant with eight carriers. The connections are described in detail in the associated table.

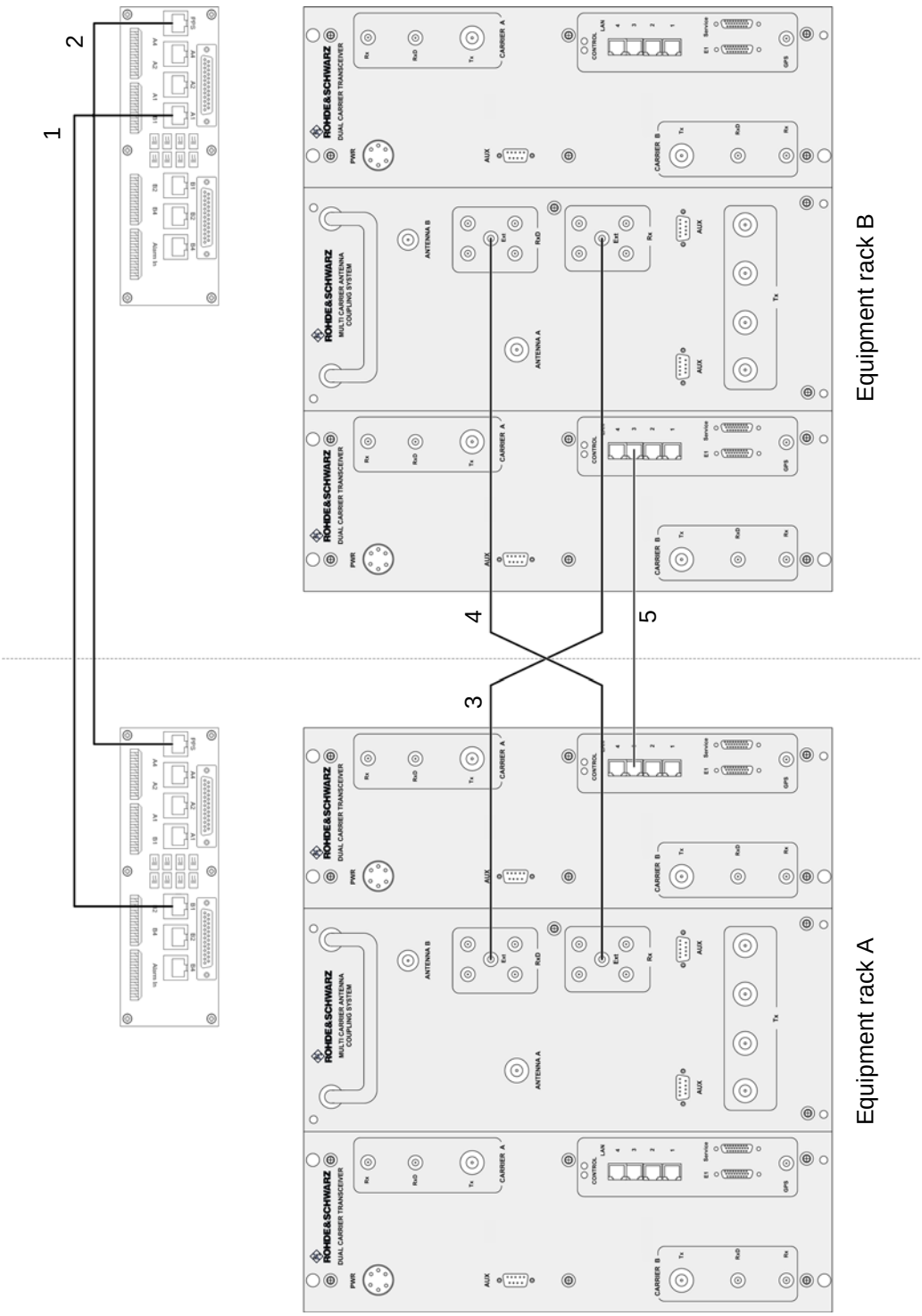

Figure 3.26 Wiring diagram DIB-500 R4.1 – hybrid variant with eight carriers (diversity)

Table 3.31 Legend: Wiring diagram DIB-500 R4.1 – hybrid variant with eight carriers (diversity)

No.	Connection from	To hardware component	Cable labeling
1	E1 connection board A (B1)	E1 connection board B (A1) for connecting a second equipment rack	E1
2	E1 connection board A (PPS)	E1 connection board B (PPS) for transmitting the PPS synchronisation clock from TIB A	PPS
3	ACS A (RxD Ext)	ACS B (Rx Ext) for connecting the reception paths for diversity reception	DIV
4	ACS A (Rx Ext)	ACS B (RxD Ext) for connecting the reception paths for diversity reception	DIV
5	TIB B (LAN 3)	TIB C (LAN 3) for connecting the TIB	LAN

3.3.1.4 Hybrid variant – Eight carriers with LRU (redundancy package)

Two equipment racks installed next to each other are used for the hybrid variant as of five carriers. The internal wiring within an equipment rack corresponds to the wiring of the hybrid variant with four carriers, see section 3.3.1.2 on page 67.

Figure 3.27 shows the connection between the equipment racks of the DIB-500 R4.1 in the hybrid variant with eight carriers. The connections are described in detail in the associated table.

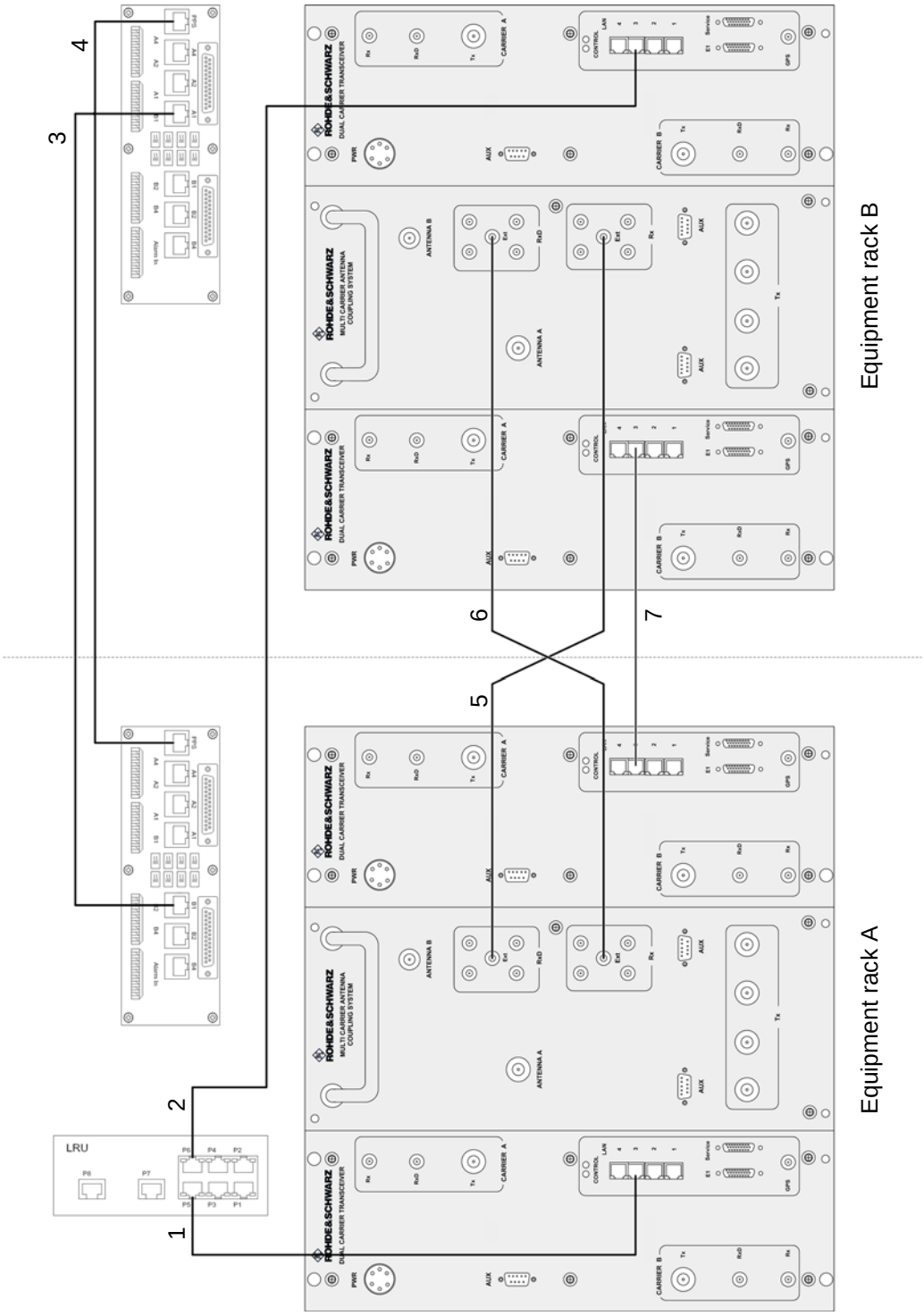

Figure 3.27 Wiring diagram DIB-500 R4.1 – Hybrid variant with eight carriers and redundancy package (diversity)

Table 3.32 Legend: Wiring diagram DIB-500 R4.1 – Hybrid variant with eight carriers and redundancy package (diversity)

No.	Connection from	To hardware component	Cable labeling
1	TIB A (LAN 3)	LRU (P5) for connecting the TIB D (ring connection) installed in a second equipment racks. Alternatively, TIB A and TIB D can be directly connected (series connection).	LAN[1)]
2	LRU (P6)	Connection for ring connection to: | TIB C (LAN3) – up to six carriers | TIB D (LAN3) – starting with seven carriers	LAN[1)]
3	E1 connection board A (B1)	E1 connection board B (A1) for connecting a second equipment rack	E1
4	E1 connection board A (PPS)	E1 connection board B (PPS) for transmitting the PPS synchronisation clock from TIB A	PPS
5	ACS A (RxD Ext)	ACS B (Rx Ext) for connecting the reception paths for diversity reception	DIV
6	ACS A (Rx Ext)	ACS B (RxD Ext) for connecting the reception paths for diversity reception	DIV
7	TIB B (LAN 3)	TIB C (LAN 3) for connecting the TIB	LAN

1) Ethernet cable from the redundancy package

3.3.2 Internal wiring of the cavity variant

In the cavity variant, the cavity couplers are installed in an additional cavity equipment rack. Both equipment racks are already stacked and wired upon delivery. For the cavity variant starting with five carriers, two equipment racks positioned next to each other are being used which are stacked on a cavity equipment rack.

Table 3.33 provides an overview of the internal wiring diagrams of the cavity variants that are described in the following sections.

Table 3.33 Internal wiring diagrams of cavity variants

Wiring diagram	Described in
Internal wiring of the cavity variant – two carriers	Section 3.3.2.1 on page 73
Internal wiring of the cavity variant – four carriers	Section 3.3.2.2 on page 74
Internal wiring of the cavity variant – eight carriers	Section 3.3.2.3 on page 75
Wiring of cavity equipment rack	Section 3.3.2.4 on page 76

3.3.2.1 Internal wiring of the cavity variant – two carriers

Figure 3.28 shows the wiring of the equipment rack of the DIB-500 R4.1 to the cavity equipment rack with two carriers. The following table describes these indicators in detail. Upon delivery, the connections have already been wired ex works.

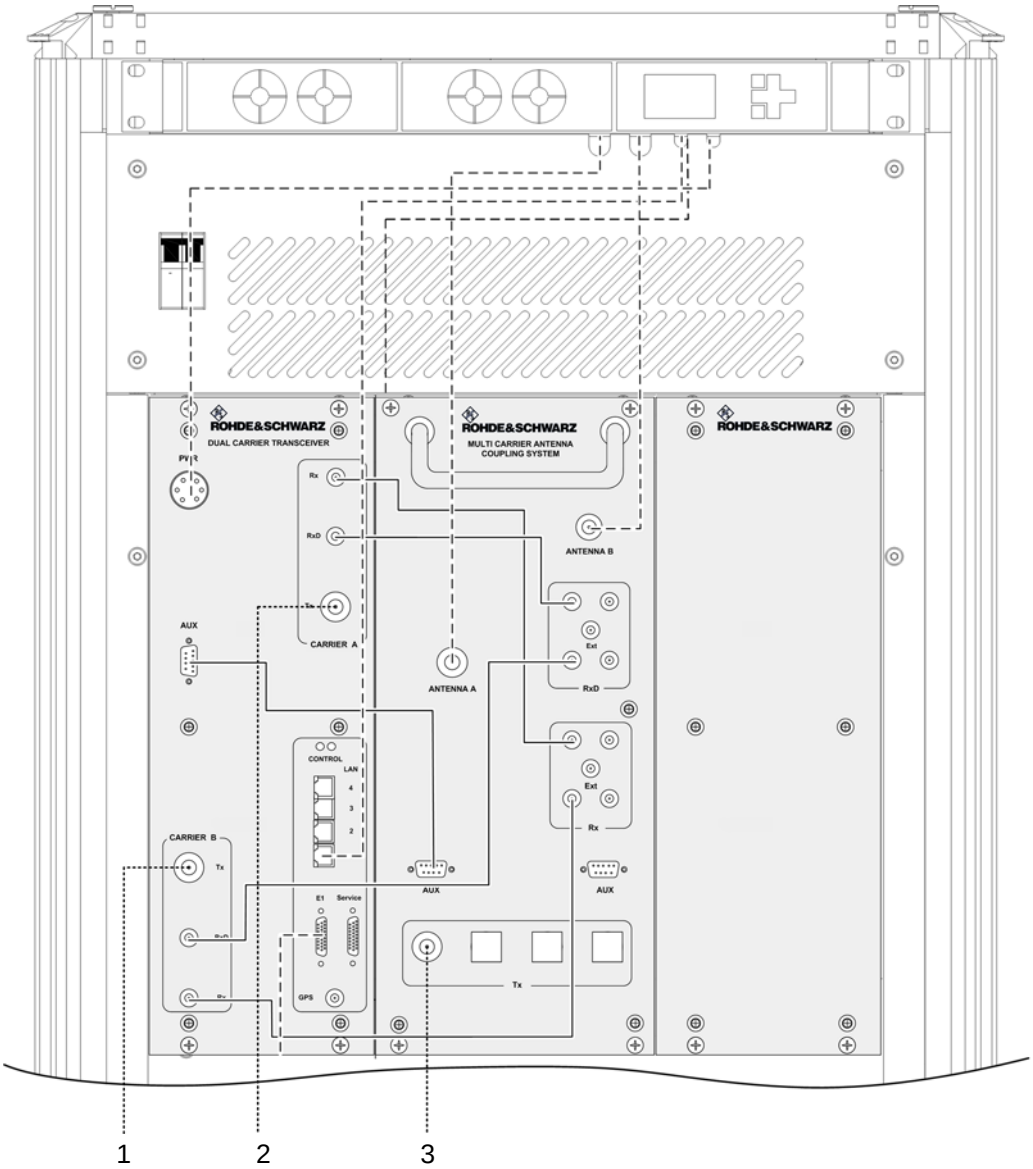

Figure 3.28 Wiring diagram of DIB-500 R4.1 – cavity variant with two carriers (diversity)

Table 3.34 Legend: Wiring diagram DIB-500 R4.1 – cavity variant with two carriers (diversity)

No.	Connection from	To hardware component
1	Carrier B Tx	Insulator cavity coupler B
2	Carrier A Tx	Insulator cavity coupler A
3	Cavity antenna connection at star distributor	Tx input antenna A (ACS)

3.3.2.2 Internal wiring of the cavity variant – four carriers

Figure 3.29 shows the wiring of the equipment rack of the DIB-500 R4.1 to the cavity equipment rack with four carriers. The following table describes these indicators in detail. Upon delivery, the connections have already been wired ex works.

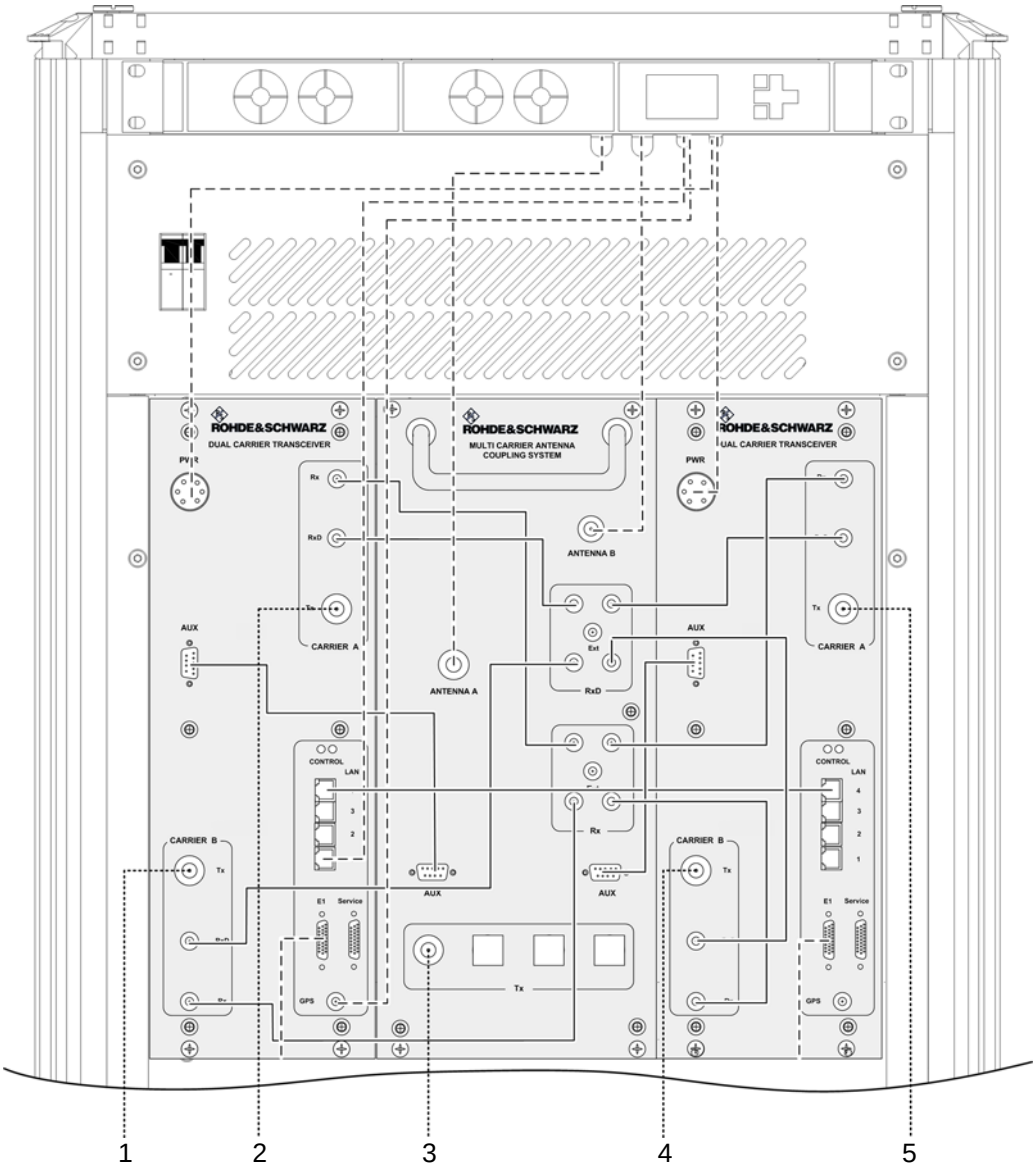

Figure 3.29 Wiring diagram of DIB-500 R4.1 – cavity variant with four carriers (diversity)

Table 3.35 Legend: Wiring diagram DIB-500 R4.1 – cavity variant with four carriers (diversity)

No.	Connection from	To hardware component
1	Carrier B Tx (TIB A)	Insulator cavity coupler B
2	Carrier A Tx (TIB A)	Insulator cavity coupler A
3	Cavity antenna connection at star distributor	Tx input antenna A (ACS)
4	Carrier B Tx (TIB B)	Insulator cavity coupler D
5	Carrier A Tx (TIB B)	Insulator cavity coupler C

3.3.2.3 Internal wiring of the cavity variant – eight carriers

Two equipment cabinets installed next to each other are used for the cavity variant as of five carriers. Apart from the wiring between the equipment cabinets A and B, the wiring in each case corresponds to that of the cavity variant with four carriers, refer to section 3.3.2.2 on page 74.

Connection between equipment cabinets identical to hybrid variant (eight carriers)

The connection between the equipment cabinets A and B is identical for the hybrid variant and cavity variant with eight carriers. The connection between the equipment cabinets A and B is described with the example of the hybrid variant in section 3.3.1.3 on page 68 or in section 3.3.1.4 on page 70.

3.3.2.4 Wiring of cavity equipment rack

The wiring between the cavity equipment rack and the equipment rack of the DIB-500 R4.1 is identical in all variants and, for this reason, is done independently of the installed cavity couplers and the frequency used.

Figure 3.30 shows the wiring of the cavity equipment rack to the equipment rack of the DIB-500 R4.1 with four carriers in a schematic representation. The following table describes these indicators in detail. Upon delivery, the connections have already been wired ex works.

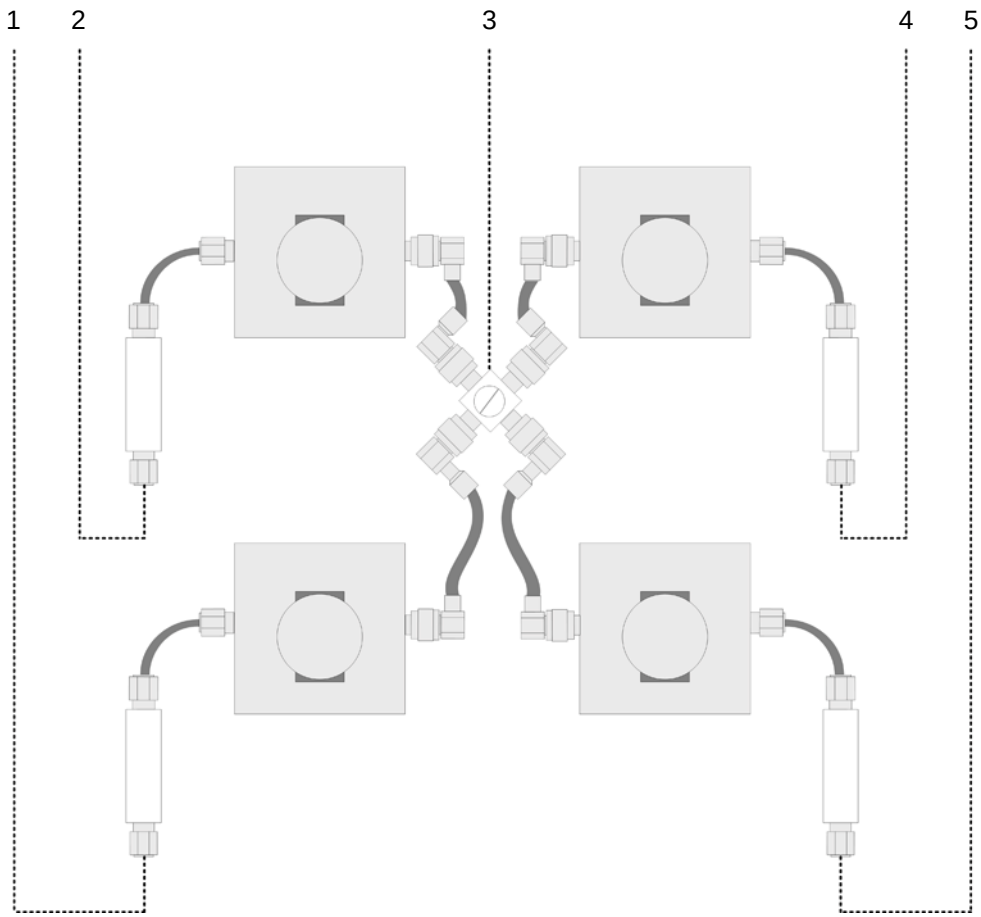

Figure 3.30 Wiring diagram of cavity equipment rack for four carriers (schematic representation)

Table 3.36 Legend: Wiring diagram of cavity equipment rack for four carriers (schematic representation)

No.	Connection from	To hardware component
1	Insulator cavity coupler C	Carrier A Tx (TIB B)
2	Insulator cavity coupler A	Carrier A Tx (TIB A)
3	Tx input antenna A (ACS)	Cavity antenna connection at star distributor
4	Insulator cavity coupler B	Carrier B Tx (TIB A)
5	Insulator cavity coupler D	Carrier B Tx (TIB B)

3.3.3 Internal wiring of the high power variant

The following sections describe the wiring diagrams of the high power variant.

Wiring of variants with two carriers

The wiring is identical for the hybrid and high power variants with two carriers.

3.3.3.1 Internal wiring of the high power variant – one carrier

Figure 3.31 shows the internal wiring of the DIB-500 R4.1 in the high power variant with one carrier. Upon delivery, the connections have already been wired ex works.

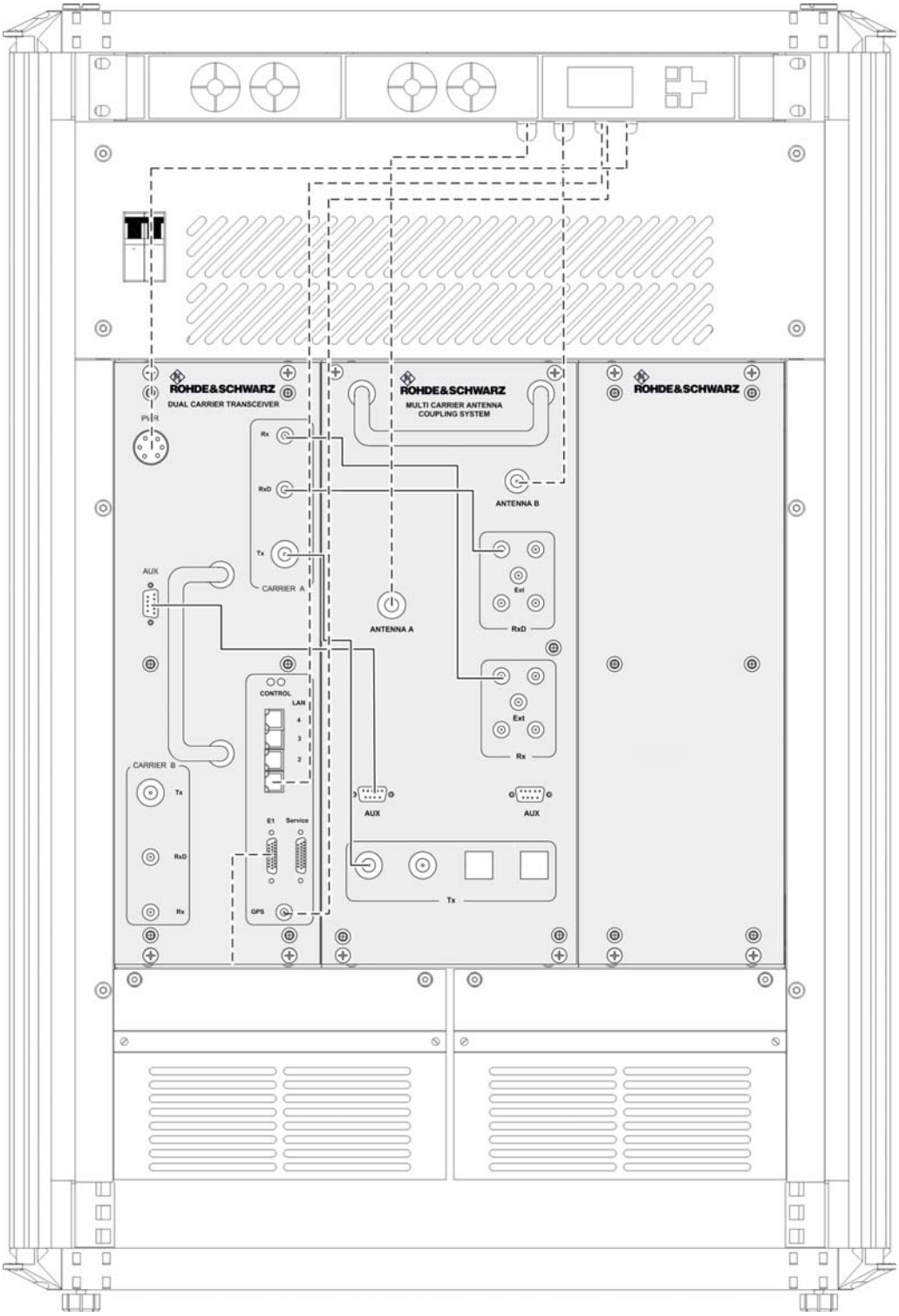

Figure 3.31 Wiring diagram DIB-500 R4.1 – High power variant with one carrier (diversity)

3.3.3.2 Internal wiring of high power variant – two carriers

Figure 3.32 shows the internal wiring of the DIB-500 R4.1 in the high power variant with two carriers. Upon delivery, the connections have already been wired ex works.

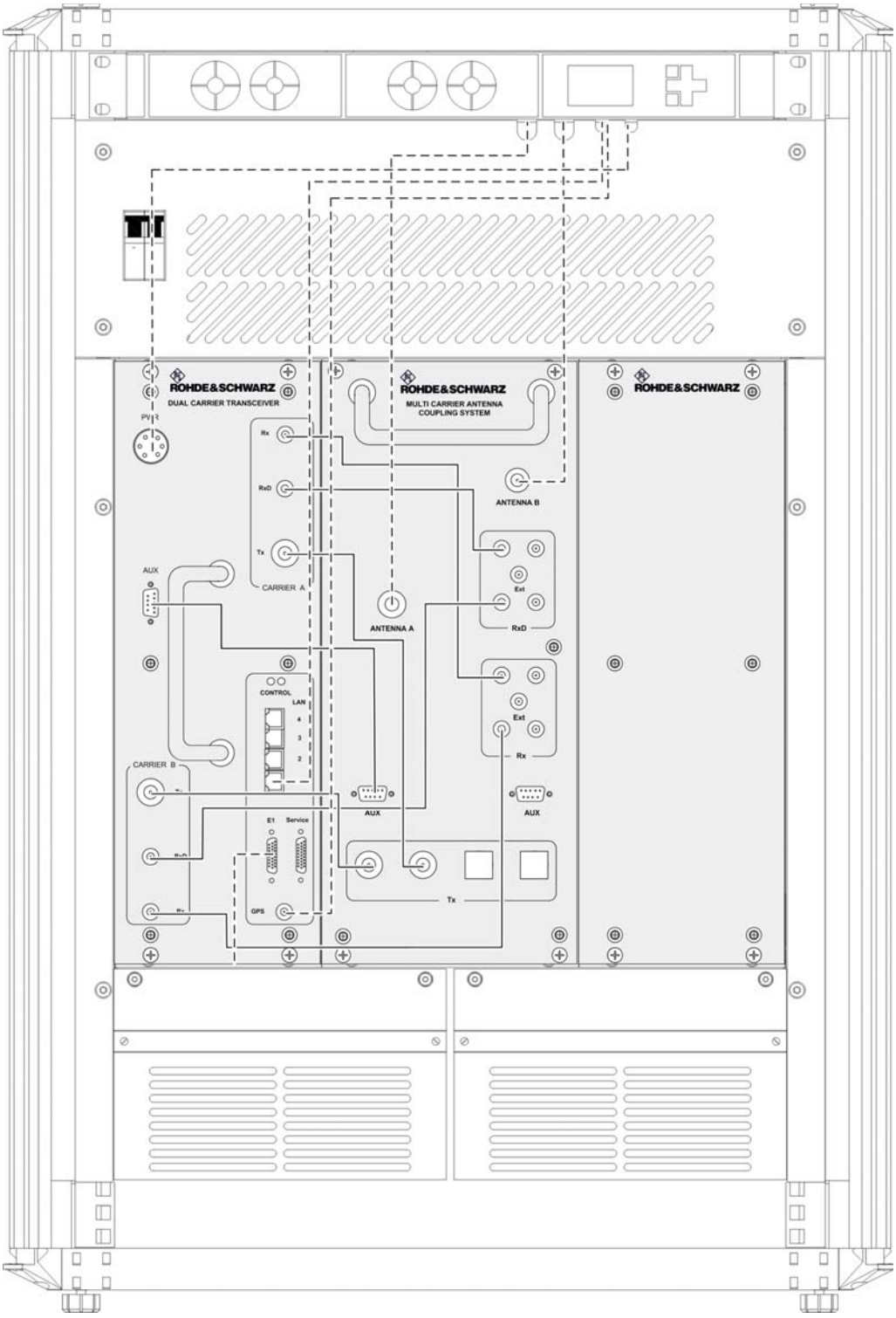

Figure 3.32 Wiring diagram of DIB-500 R4.1 – high power variant with two carriers (diversity)

3.3.4 Internal wiring for FlexibleTx variant

The following sections contains a description of the wiring diagrams for the FlexibleTx variant.

Wiring diagram for external antenna coupling system

The wiring diagram for the connection of external antenna coupling systems is available in the section 5.10.2 on page 121.

3.3.4.1 Internal wiring of FlexibleTx variant – two carriers

Figure 3.32 shows the internal wiring of the DIB-500 R4.1 in the FlexibleTx variant with two carriers. Upon delivery, the connections have already been wired ex works.

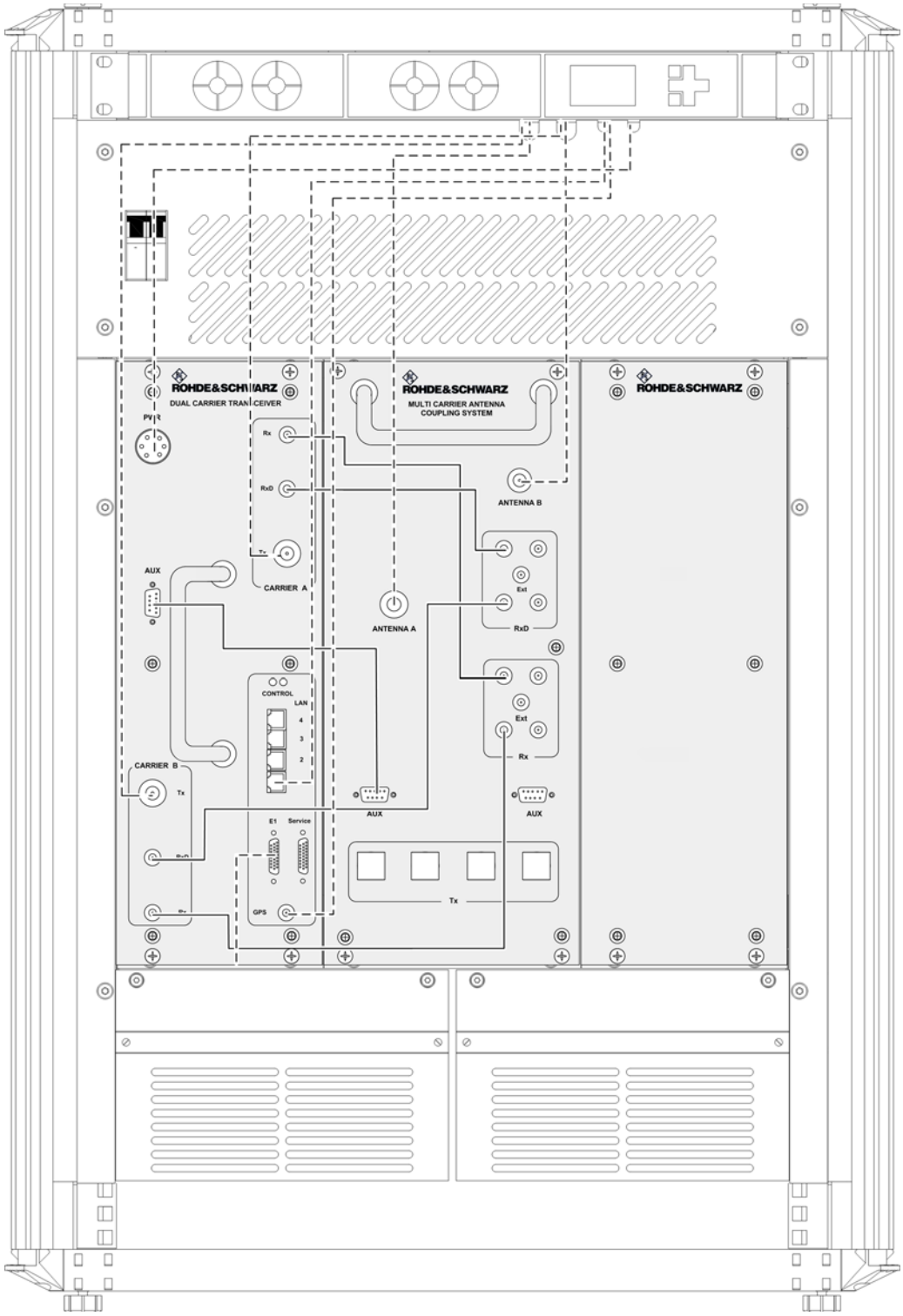

Figure 3.33 Wiring diagram DIB-500 R4.1 – FlexibleTx variant with two carriers (Diversity)

3.3.4.2 Internal wiring for FlexibleTx variant – Four carriers

Figure 3.34 shows the internal wiring of the DIB-500 R4.1 in the FlexibleTx variant with two carriers. Upon delivery, the connections have already been wired ex works.

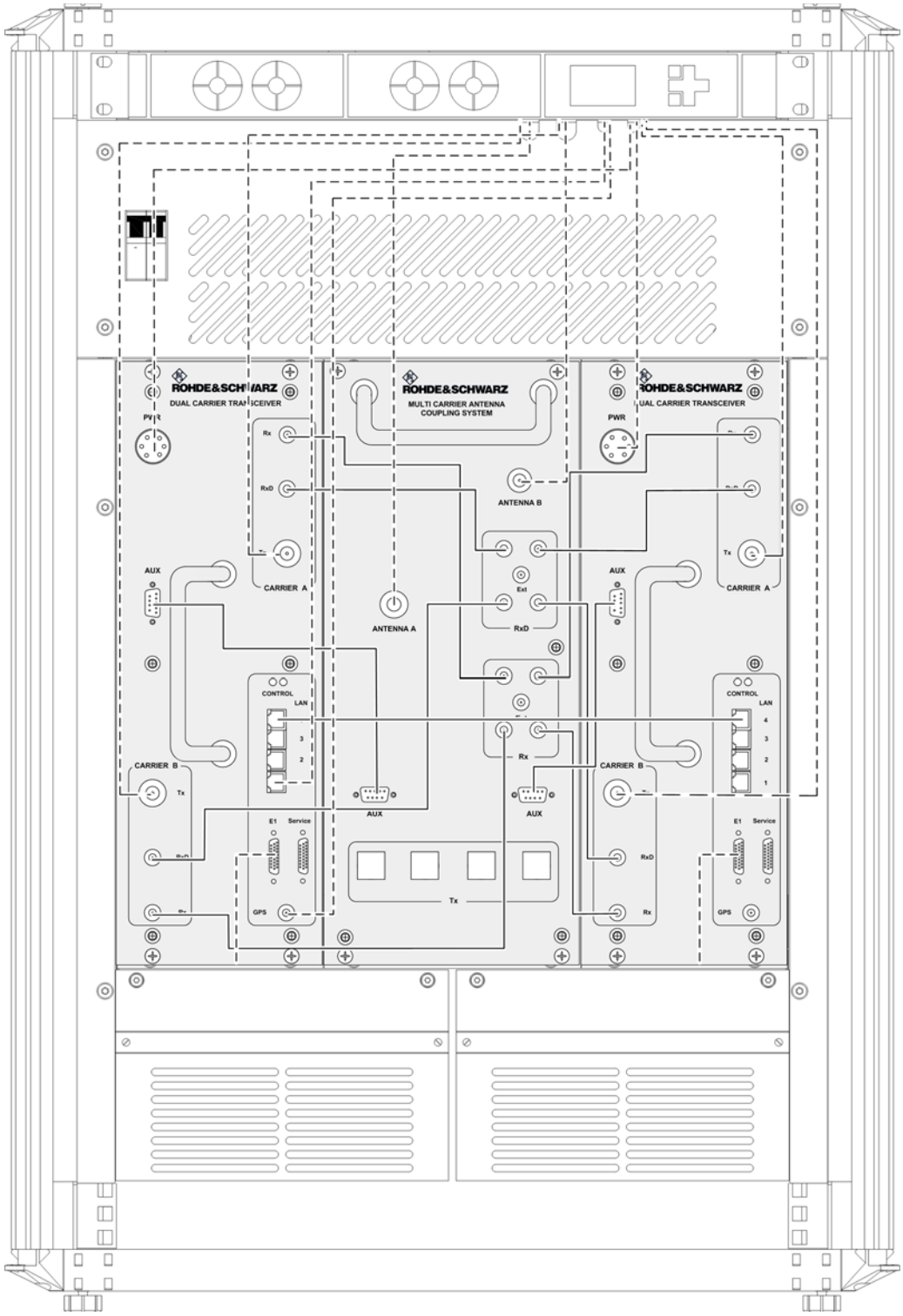

Figure 3.34 Wiring diagram DIB-500 R4.1 – FlexibleTx variant with four carriers (Diversity)

3.4 Scope of delivery

The scope of delivery of the DIB-500 R4.1 depends on the respective variant. In the Hybrid and high power variants, the base stations are delivered in a 19" equipment racks. If there are more than four carriers, they are delivered in two 19" equipment racks. The height of the equipment rack(s) will increase by 12 rack units each for the cavity variants.

The variants of the DIB-500 R4.1 depend on the following characteristics:

- Voltage supply
- Antenna connection
- Number of carriers
- Frequency range
- Cavity option
- Redundancy package

Table 3.37 Scope of delivery of the DIB-500 R4.1

Designation	Part number	Number
Network element DIB-500 R4.1 (V_{DC} voltage supply), made up of the constituents listed in section 3.1 as on page 34	5501.xxxx.xx[1)] (xx depends on the selected antenna connection, the number of carriers and the frequency range)	1
V_{AC} voltage supply consisting of: - Mounting frame - SC200 - Alarm input/output module - Rectifier module	5500.9991.00	1
Alarm system expansion[1)] - Mounting frame - SC200 - Alarm input/output module	5500.9979.00	1
Antenna mounting kit, including the GPS antenna	5500.8672.00	1
GPS protector (optional)	5500.3070.00	1
Expansion package for variants starting with five carriers, consisting of connecting cables[2)]	5500.6186.00	1
Redundancy package[3)] (optional) for variants starting with five carriers: - LAN Routing Unit (LRU) - Top hat rail power supply unit - Connecting cables (Ethernet and voltage supply)	5500.6192.00	1
Rectifier module (optional)	5500.8950.00	1

1) already included in the V_{AC} voltage supply by default
2) the cable lengths refer to the standard upright versions.
3) Alternative to the standard expansion package

4 Transport and storage

This chapter describes the transport and storage of the DIB-500 R4.1 product. The safety measures to be followed and prerequisites for the corresponding activities are described in section 4.1 on page 85. The required tools, auxiliaries and materials are described in section 4.2 on page 86.

4.1 Safety measures and prerequisites

The following safety measures and prerequisites must be followed for all tasks described in this chapter:

- The safety regulations must be considered at all times, see chapter 2 on page 21.
- Observe all other activity-based safety measures and prerequisites in the activity descriptions in this chapter.
- The transport and storage of the product must always be performed in accordance with the regulations and temperature ranges, see Table 4.1 on page 85.
- Equipment racks may be transported only in upright position on shock-absorbing pallets.
- Equipment racks may not be carried due to their weight. For this reason, use only means of lifting and/or transportation, see Table 4.2 on page 86.
- If it is a single equipment rack, it may be lifted briefly by two persons to lift it onto or from a shock-absorbing pallet.
- The transport lock installed in the condition as supplied to the customer must be installed again before the product is transported to protect the mounting frame. The transportation lock is fixed through the top cover of the equipment rack and is contained only in variants with V_{AC} or alarm system expansion, see section 3.1.1 on page 34.
- The required tools, auxiliary means and materials specified must be available, refer to section 4.2 on page 86.

Table 4.1 provides an overview of the ambient data, for which the product has been designed. These ambient data must be taken into consideration when transporting and storing the product.

Table 4.1 Ambient data

Operation	Appropriate for ambient conditions in compliance with	ETSI EN 300 019-1-3 class 3.1
	Temperature range	+5 °C to +45 °C
	Relative humidity	5 % to 85 % (non-condensing)
	Protection class(es)	IP40
Transport[1)]	Appropriate for ambient conditions in compliance with	ETSI EN 300 019-1-2 class 2.2
	Temperature range	-40 °C to +70 °C
Storage[1)]	Appropriate for ambient conditions in compliance with	ETSI EN 300 019-1-1 class 1.2
	Temperature range	-40 °C to +70 °C

1) in original packaging

4.2 Tools, aids and materials

Table 4.2 provides an overview of the tools, auxiliaries and materials required for the steps in this chapter.

Table 4.2 Overview of tools, auxiliaries and materials (Transport and storage)

Tools, aids	Materials
| Transport/lifting devices, e.g. lift truck | In addition, at least three persons are needed | Coin to unscrew/tighten the mounting screws of the equipment rack top cover	| Shock-absorbing pallet measuring at least 70 cm x 70 cm (e.g. for transport with a lift truck) | Packaging material

4.3 Transporting the equipment rack

This section describes the transport of the DIB-500 R4.1 product for all transports to and from the operation room.

Use of transport devices

If a means of transportation is used, ensure that lateral tensioners or lateral safeguards of the equipment rack connections are firmly secured during transport and cannot shift. Loosen any tensioners and safeguards used after the transport.

The equipment rack may be transported only in upright position on shock-absorbing pallets. The following procedure describes the transport on a shock-absorbing pallet with a lift truck.

Transporting equipment racks on a pallet using a lift truck

Preparation:

✓ The wall panels and the top cover of the equipment rack must be securely installed.
✓ Equipment rack doors must be locked.
✓ The operation must have been shut down permanently, refer to section 8.2 on page 164.
✓ Appropriate means of transportation must be available, e.g. a lift truck.
✓ The transport must be performed by at least three persons.
✓ The equipment rack must be secured against overturning, e.g. with a suitable packaging.
✓ The equipment rack must be packaged accordingly.
✓ Ensure that no slinging devices are resting on the equipment rack. They could damage the equipment rack, e.g. by exerting pressure.

Carry out the following steps:

WARNING

Risk of injury

Injuries could occur due to the heavy weight of the equipment rack during lifting. In addition, it could fall down during lifting.

➔ Lift the equipment rack evenly.

➔ If necessary, ask an additional person to assist during lifting.

1. Lift the equipment rack evenly with two persons so that a third person can position the pallet centered under the equipment rack.

NOTICE

Risk of damage

The equipment rack could be damaged while setting it down.

➔ Set the equipment rack evenly onto the levelling feet.

2. Set the equipment rack evenly onto the levelling feet and centered on the pallet.

NOTICE

Risk of damage from tipping over

The equipment rack may tip over during transportation, resulting in damage.

➔ When transporting on a lift truck ensure that the ground is suitable for transportation.

➔ Avoid any vibrations due to unevenness or inclination.

➔ When transporting, ensure that no lateral tilt of the equipment rack will occur.

NOTICE

Risk of damage due to vibrations

The equipment rack could be damaged from vibrations.

➔ Always use a shock-absorbing pallet for the transport.

3. Use the means of transportation to transport the equipment rack to the intended installation site/operating room.
4. Set the equipment rack down at the location or in the operation room.

✓ You have successfully transported the equipment rack.

4.4 Storage

The product must be stored in closed rooms that are dry and weatherproof. In addition, this room must meet the required ambient conditions, refer to Table 4.1 on page 85.

5 Setup and commissioning

This chapter describes the setup and commissioning of the DIB-500 R4.1 product. The safety measures to be followed and prerequisites for the corresponding tasks are described in section 5.1 on page 90. The required tools, auxiliaries and materials are described in section 5.2 on page 90.

The tasks listed in the following table must be performed for setting up the DIB-500 R4.1.

Table 5.1 Overview of the tasks to be performed (Setup and commissioning)

Tasks/work steps			Described in
Installing equipment racks			Section 5.3 on page 92
Removing the top cover of the mounting frame			Section 5.4 on page 94
Connecting equipment racks (as of 5 carriers)	Assembly of the redundancy package – optional		Section 5.5.1 on page 96
		Installing the left top hat rail end bracket	Section 5.5.1.1 on page 97
		Establishing the voltage supply of the LRU	Section 5.5.1.2 on page 98
		Inserting the LRU	Section 5.5.1.3 on page 102
		Installing the top hat rail power supply unit	Section 5.5.1.4 on page 103
		Installing the right top hat rail end bracket	Section 5.5.1.5 on page 105
	Connecting the equipment racks A and B		Section 5.5.2 on page 105
Connection to the electrical system	Connection with the grounding system		Section 5.6.1 on page 107
	Defining the reference potential		Section 5.6.2 on page 108
	Connecting the voltage supply		Section 5.6.3 on page 110
		Connecting the VDC voltage supply	Section 5.6.3.1 on page 110
		Connecting the VAC voltage supply – optional	Section 5.6.3.2 on page 112
Connecting Ethernet cables			Section 5.7 on page 113
Installing the GPS antenna			Section 5.8 on page 114
Installing the GPS protector - optional			Section 5.9 on page 117
Connecting antennas	Connecting antennas (GPS and TETRA)		Section 5.10.1 on page 119
	Connection of external antenna coupling systems – Optionally, only FlexibleTx variant		Section 5.10.2 on page 121
Connecting external alarm sensors (LSA+)			Section 5.11 on page 123

Table 5.1 Overview of the tasks to be performed (Setup and commissioning)

Tasks/work steps		Described in
Connecting external alarms – optional, with VAC or alerting expansion	Removing the top cover of the equipment rack	Section 5.12.1 on page 124
	Connecting external alarms	Section 5.12.2 on page 126
	Mounting the top cover of the mounting frame	Section 5.12.3 on page 128
Mounting the top cover of the equipment rack		Section 5.13 on page 129
Switching on the voltage source		Section 5.14 on page 129
Switching on the DIB-500 R4.1		Section 5.15 on page 129

5.1 Safety measures and prerequisites

For the setup and commissioning, the following safety measures and prerequisites must be observed:

- All the supply lines/cables must be passed or suspended in a way ensuring that
  - the operation of the device is not impaired,
  - there are no trip hazards for the operator or any other persons,
  - the required minimum distances and cable lengths are complied with.
- The site must be prepared in compliance with the document "Site Requirements".
- The DIB-500 R4.1 may be set up and commissioned only of the required ambient conditions are met at all times, see Table 4.1 on page 85.
- The safety regulations must be considered at all times, see chapter 2 on page 21.
- Observe all other activity-based safety measures and prerequisites in the activity descriptions in this chapter.
- The required tools and materials must be available, see section 5.2 on page 90.

5.2 Tools, aids and materials

Table 5.2 provides an overview of the tools, auxiliaries and materials required for the steps in this chapter.

Dimensioning cable lengths

For the dimensioning of cables, consider that the equipment rack may have to be moved for maintenance work.

Table 5.2 Overview of tools, aids and materials (setup and commissioning)

Work step	Tools, aids	Materials
Installing equipment racks		Transport/lifting devices, e.g. lift truck or crane hook at least two persons	suitable slinging devices (e.g. ropes, chains or lifting straps) Pallet
Removing the top cover of the mounting frame	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover	---
Assembly of the redundancy package – optional	Flat-bladed screwdriver size 0.9 x5.4 Flat-bladed screwdriver size 0.8 x2.5 Flat-bladed screwdriver size 0.6 x4.5 Flat-bladed screwdriver size 0.5 x3	Redundancy package[1)] (optional), consisting of – 2 top hat rail end brackets – 2 power supply cables – LAN Routing Unit (LRU) – Top hat rail power supply unit
Connecting the equipment racks A and B	---	Connecting cable from the scope of supply for variants from carriers
Connection to the electrical system	M13 ring spanner Size 4 Allen wrench Flat-bladed screwdriver size 0.6 x4.5 Cable end sleeve calliper	Earthing cable connected with the earthing system at the location with eye size 13 mm according to the document "Site Requirements" Power supply cable with a wire cross section of 4 mm^2 according to the document "Site Requirements" Cable end sleeves
Connecting Ethernet cables	Side cutting pliers Cable stripper Crimping tool for RJ-45 connector	Ethernet cables according to the document "Site Requirements" RJ-45 connector (unless already fastened on the Ethernet cable) Fastening material (cable tie)
Installing the GPS protector - optional	Size 18 dynamometric key with a torque of 100 Ncm	GPS protector (optional)
Installing the GPS antenna	Size 4 Allen wrench No. 1 Phillips head screwdriver Size 8 dynamometric key with a torque of 0.6 Nm Ladder	GPS antennas incl. accessories from the scope of supply, such as textile tape[2)] Fastening material (cable tie)
Connecting antennas (GPS and TETRA)	The required tools depend on the antenna cable used and the related connector.	Antenna cable
Connecting external alarms – optional, with V_{AC} or alerting expansion	No. 1 Phillips head screwdriver	Cable tie against tensile stress
Mounting the top cover of the equipment rack	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover	Fastening screws previously loosened The upper cover previously removed together with the related grommet

1) Refer to the price list of Rohde & Schwarz Professional Mobile Radio GmbH
2) For DIB-500 R4.1 with more than two transceiver modules TIB and controller redundancy, the use of an additional GPS antenna is recommended.

5.3 Installing equipment racks

Depending on the variant, the DIB-500 R4.1 consists of several equipment racks upon delivery. Upon delivery, equipment racks have already been wired ex works.

The equipment racks may be freestanding or they may be placed against the wall with the rear or with either side. If multiple equipment racks of the same type are used in the operation room, these may also be positioned next to each other. It is not possible to stack equipment racks.

The following requirements must be met for being able to operate the network element as intended:

- Free space of at least 700 mm for service purposes:
  - on the front of the equipment rack
  - on the top of the equipment rack
- Maximum distance between the equipment racks (from five carriers) of 50 mm.
- The space above the equipment rack (no superstructures) depends on the bending radius of the antenna cable used.

Required cable lengths

The cable sets for the Ethernet and E wiring refer to the standard variants. The cable sets are designed for a max. spacing of 50 mm between the equipment racks. Longer cables may be required for the respective application.

Figure 5.1 shows the space required when setting up the DIB-500 R4.1.

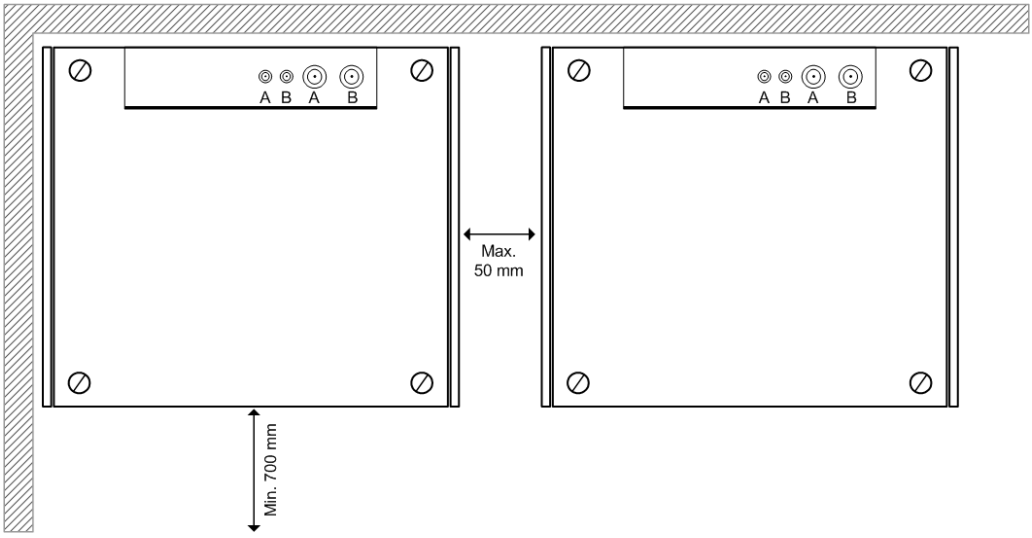

Figure 5.1 Space required for setting up the DIB-500 R4.1

Setting up the equipment rack

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The location intended for operation must have a solid and plane underground.

✓ At least two people are required to set up the equipment rack.
✓ You need suitable means of transportation, e.g. a lift truck.
✓ During transport, observe the notes and procedures in chapter 4 on page 85.
✓ The equipment rack must have been unpacked.
✓ The equipment rack must be bolted to the pallet.

Carry out the following steps:

NOTICE

Risk of damage from tipping over

The equipment rack may tip over during transportation, resulting in damage.

➔ When transporting on a lift truck ensure that the ground is suitable for transportation.

➔ Avoid any vibrations due to unevenness or inclination.

➔ When transporting, ensure that no lateral tilt of the equipment rack will occur.

1. Place the pallet with the equipment rack in the operation room.
2. Unscrew the equipment rack from the pallet and position it at the intended location with two people.
3. Slide the two claws for floor anchorage underneath the levelling feet up to the stop with the edges facing down.

Aligning the floor anchorage claws

Attach the floor anchorage claws diagonally (e.g. front LH side and rear RH side) to the bottom of the equipment rack to ensure utmost protection against tilting.

4. Fasten the claws to the floor, if necessary.
5. If required, secure the equipment cabinets against tilting through additional means, e.g. by screwing them to a wall.
6. For variants with several equipment racks, proceed as described in the previous process steps.

✓ You have successfully completed the setup.

5.4 Removing the top cover of the mounting frame

To perform work in the equipment rack, the top cover of the equipment rack has to be removed.

Removing the transportation lock – optional, only for VAC or alarm system expansion

Upon delivery, a transportation lock is installed between the mounting frame and the upper cover of the equipment rack, retained by the upper cover of the equipment rack. This transportation lock must be removed prior to/while commissioning the product.

The transport lock can be removed after the upper cover of the equipment rack has been removed. Keep the transport lock in a safe place, you may need it again for transports later on.

Proceed as follows to remove the top cover:

Preparation:

✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.

Carry out the following steps:

Keeping materials

Keep all the materials such as fastening screws in a safe place. You will need them again.

1. Loosen the mounting screws of the grommet using a size 2 cross-head screwdriver, refer to Figure 5.2.

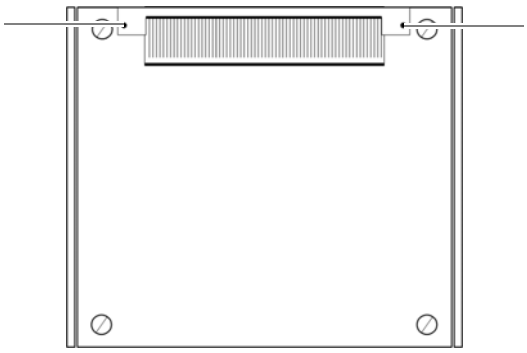

Figure 5.2 Top equipment rack cover – grommet mounting screws

2. Loosen the mounting screws of the equipment rack top cover using a coin, refer to Figure 5.3.

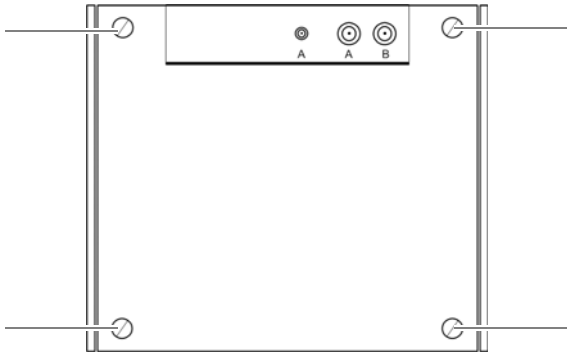

Figure 5.3 Equipment rack top cover - mounting screws

NOTICE

Damage of the earthing connection

The grounding connection may be damaged if you remove the equipment rack top cover without removing the grounding cable connected on the inside of the cover.

➔ Cautiously lift the top cover of the equipment rack. When doing so, the grounding cable must not be subject to tensile stress.

3. Loosen the grounding cable by pressing the catch of the blade connector and pushing the blade connector out of the catch..
4. Remove the top cover of the equipment rack.
5. Remove the transportation lock, if necessary.

✓ You have successfully removed the top cover.

5.5 Connecting equipment racks (as of 5 carriers)

For variants with five or more carriers (hybrid and cavity), two equipment racks are used equipped with a total of three or four TIB transceiver modules and two antenna coupling systems (ACS). Upon delivery, no connection exists between the equipment racks. This connection must first be established. The procedure for connecting the two equipment racks (A and B) is identical for the hybrid and cavity variant.

For connecting equipment racks (starting with five carriers), the tasks listed in the following table must be performed.

Table 5.3 Overview of the tasks to be performed (Connecting equipment racks (as of 5 carriers))

Tasks/work steps	Described in
Assembly of the redundancy package – optional	Section 5.5.1 on page 96
Connecting the equipment racks A and B	Section 5.5.2 on page 105

5.5.1 Assembly of the redundancy package – optional

The redundancy package is not installed upon delivery in order to avoid transport damages. The DIB-500 R4.1 features a top hat rail so that the LRU and the corresponding top hat rail power supply unit can be installed by snapping it in with a click mechanism on this top hat rail in the first equipment rack (A).

Figure 5.4 shows the top hat rail of the installed components of the redundancy package. The following table describes the components in greater detail.

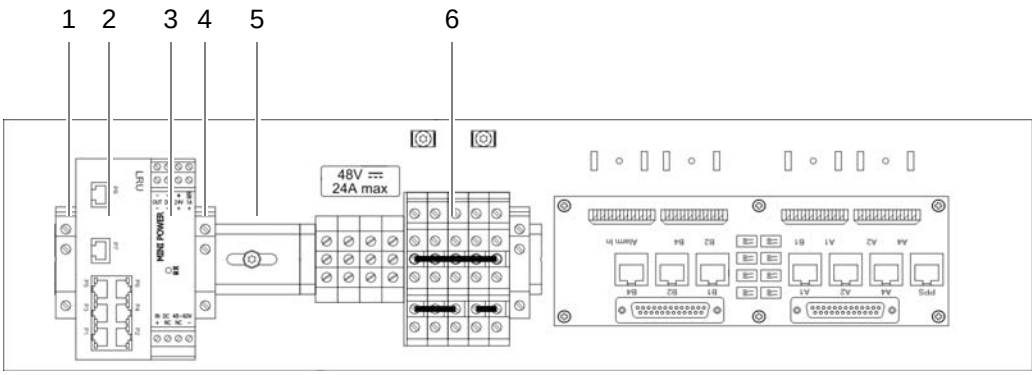

Figure 5.4 Redundancy package (installed)

Table 5.4 Legend: Redundancy package (installed)

No.	Designation
1	top hat rail end bracket (left-hand side)
2	LRU
3	Top hat rail power supply unit
4	top hat rail end bracket (right-hand side)
5	Top hat rail
6	Terminal block

The tasks listed in the following table must be performed for the installation of the redundancy package.

Table 5.5 Overview of the tasks to be performed (Assembly of the redundancy package – optional)

Tasks/work steps	Described in
Installing the left top hat rail end bracket	Section 5.5.1.1 on page 97
Establishing the voltage supply of the LRU	Section 5.5.1.2 on page 98
Inserting the LRU	Section 5.5.1.3 on page 102
Installing the top hat rail power supply unit	Section 5.5.1.4 on page 103
Installing the right top hat rail end bracket	Section 5.5.1.5 on page 105

5.5.1.1 Installing the left top hat rail end bracket

To prevent components on the top-hat rail from shifting, top-hat rail end brackets must be installed.

Before the components are mounted on the top hat rail, a top hat rail end bracket must be installed on the left-hand end of the top hat rail, refer to Figure 5.5.

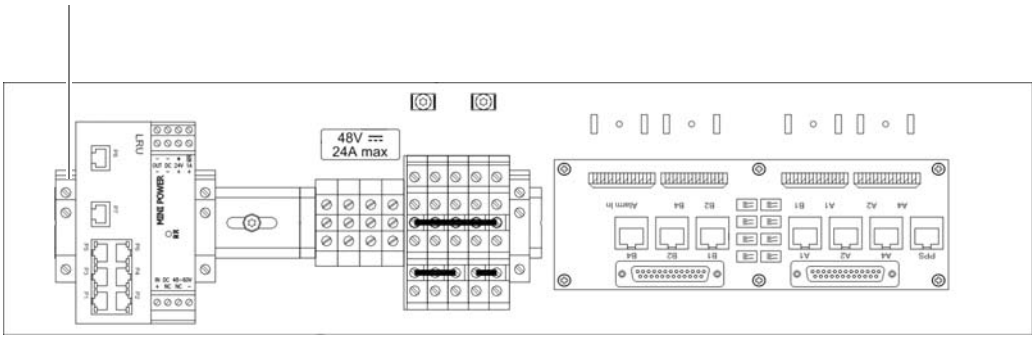

Figure 5.5 top hat rail end bracket (left-hand side)

Proceed as follows to install top hat rail end brackets:

Preparation:
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.

Carry out the following steps:

⚠ WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

⚠ DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Clamp the top hat rail end holder onto the top hat rail in the appropriate position, refer to Figure 5.5.
2. Tighten the screws using a flat-bladed screwdriver size 0.9 x 5.4.

✓ You have successfully installed the top hat rail end bracket.

5.5.1.2 Establishing the voltage supply of the LRU

The tasks listed in the following table must be performed for establishing the voltage supply of the LRU.

Table 5.6 Overview of the tasks to be performed (Establishing the voltage supply of the LRU)

Tasks/work steps	Described on
Connecting the voltage supply of the top hat rail power supply unit	Page99
Connecting voltage supply cables to the top hat rail power supply unit	Page100

Figure 5.6 shows an overview of the established voltage supply. The following table describes these indicators in detail.

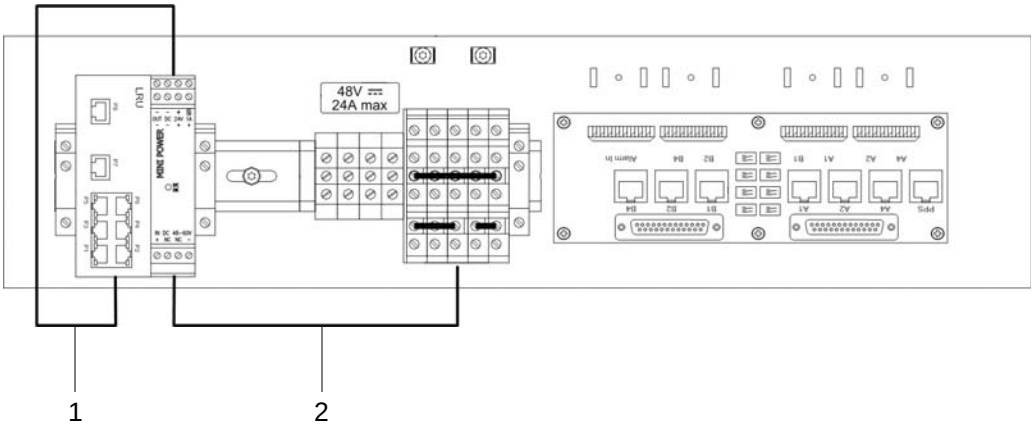

Figure 5.6 Overview of the voltage supply of the LRU

Table 5.7 Legend: Overview of the voltage supply of the LRU

No.	Connection between
1	LRU and top hat rail power supply unit
2	Top hat rail power supply unit and terminals of the terminal block

Connecting the voltage supply of the top hat rail power supply unit

Connecting the voltage supply of the top hat rail power supply unit is done directly via the terminal block.

Figure 5.7 shows the terminal block to which the wires of one of the power supply cables must be connected. The following table describes these indicators in detail.

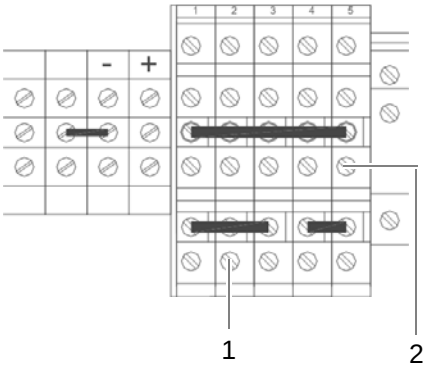

Figure 5.7 Terminals of the terminal block

Table 5.8 Legend: Terminals of the terminal block

No.	Wire colour
1	white
2	brown

Proceed as follows to connect the voltage supply cable of the top hat rail power supply unit:

Preparation:
- ✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
- ✓ The voltage source on site must be de-energised.
- ✓ The toggle switches must be set to the "Off" position ("downward" switch position).
- ✓ The top cover of the equipment rack must have been removed.

Carry out the following steps:
- ➔ Connect the two wires of the voltage supply cable appropriately to the terminals of the terminal block, see Figure 5.7 on page 99.

✓ You have successfully connected the voltage supply cable of the top hat rail power supply unit.

Connecting voltage supply cables to the top hat rail power supply unit

The voltage supply cables must be connected to the top hat rail power supply unit before the power supply unit is installed.

Figure 5.8 shows the terminals of the top hat rail power supply unit to which the power supply cables must be connected. The following table describes these indicators in detail.

Figure 5.8 Connectors for the voltage supply cable on the top hat rail power supply unit

Table 5.9 Legend: Connectors for the voltage supply cable on the top hat rail power supply unit

No.	Designation	Input/output	Wire colour	Connection between
1	- (DC)	Output: 24 V_{DC}	white	LRU and top hat rail power supply unit
2	+ (1A)		brown	
3	-	Input: 48 V_{DC}	white	top hat rail power supply unit and voltage supply connector
4	+		brown	

Proceed as follows to connect the voltage supply cable to the top hat rail power supply unit:

Preparation:

✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.
✓ The power supply cable of the top hat rail power supply unit must have been connected to the terminals of the terminal block.

Carry out the following steps:

1. Connect the voltage supply cable for the connection between the LRU and the top hat rail power supply unit with the corresponding terminals of the top hat rail power supply unit, refer to Figure 5.8 on page 100. Use a size 0.8 x 2.5 flat-bladed screwdriver for this purpose.

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

2. Connect the voltage supply cable for the connection between the top hat rail power supply unit and the voltage supply connector to the appropriate terminals of the top hat rail power supply unit, refer to Figure 5.8 on page 100. Use a size 0.8 x 2.5 flat-bladed screwdriver for this purpose.
3. Place the top hat rail power supply unit onto the upper side of the mounting frame.

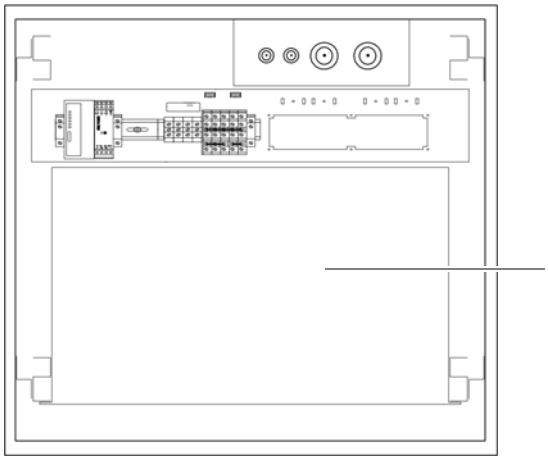

Figure 5.9 Upper side of the mounting frame

✓ You have successfully connected voltage supply cables to the top hat rail power supply unit.

5.5.1.3 Inserting the LRU

The LRU must be connected to the top hat rail. First, the power supply cable to the top hat rail power supply unit must be connected.

Figure 5.10 shows the voltage supply connection of the LRU. The following table describes it in detail.

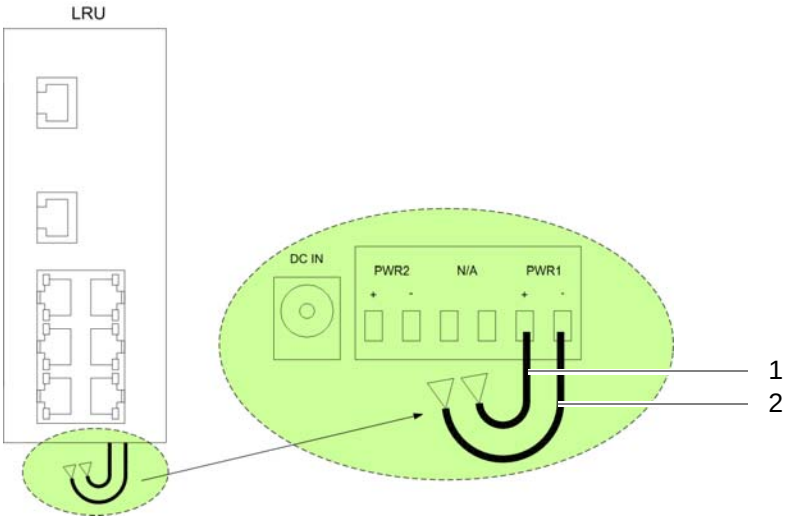

Figure 5.10 Voltage supply connection of the LRU

Table 5.10 Legend: Voltage supply connection of the LRU

No.	Designation	Wire colour	Connection between
1	PWR1 +	brown	LRU and top hat rail power supply unit
2	PWR2 -	white	

Figure 5.11 shows the position of the LRU on the top hat rail .

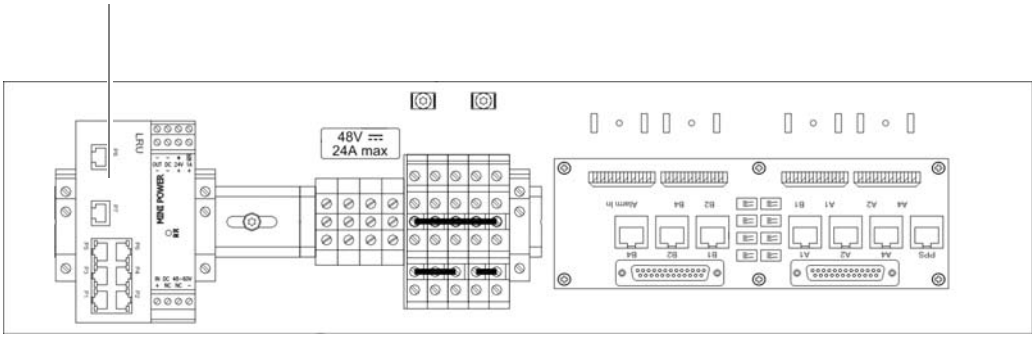

Figure 5.11 LRU on the top hat rail

Inserting the LRU

Preparation:

✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.
✓ The power supply cables must have been connected to the top hat rail power supply unit.

Carry out the following steps:

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Connect the voltage supply cable to the LRU according to the labeling, refer to Figure 5.10 on page 102.
2. Plug the LRU onto the top hat rail from above, refer to Figure 5.11 on page 102. The catch must snap in audibly.

✓ The installation of the LRU has thus been completed.

5.5.1.4 Installing the top hat rail power supply unit

The top hat rail power supply unit must be connected to the top hat rail.

Figure 5.12 shows the position of the top hat rail power supply unit on the top hat rail.

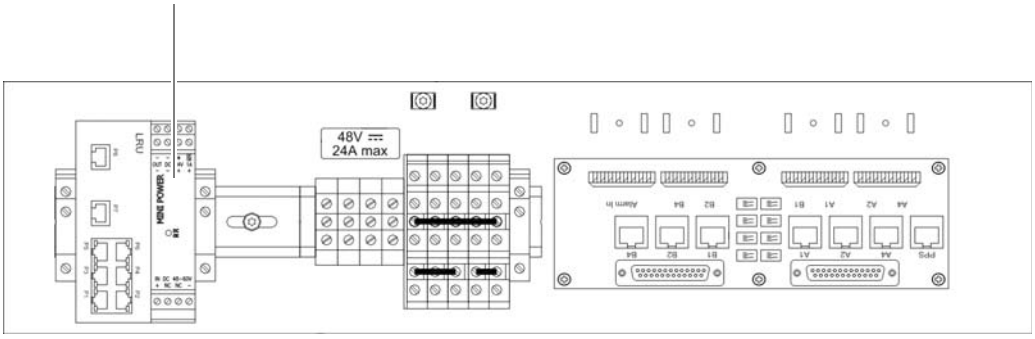

Figure 5.12 Top hat rail power supply unit on the top hat rail

Proceed as follows to install the top hat rail power supply unit:

Preparation:

✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.

✓ The power supply cables must have been connected to the top hat rail power supply unit.
✓ The LRU must be installed.

Carry out the following steps:

NOTICE

Risk of damage

The connected wires of the voltage supply cables connected to the top hat rail power supply unit may be torn out of the terminals.

➔ Proceed with caution when installing the top hat rail power supply unit.

➔ Ensure that the voltage supply cables do not get caught on any projecting parts during installation.

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

➔ Plug the top hat rail power supply unit onto the top hat rail from above, refer to Figure 5.12 on page 103. The catch must snap in audibly.

✓ You have successfully installed the top hat rail power supply unit.

5.5.1.5 Installing the right top hat rail end bracket

To prevent components on the top-hat rail from shifting, top-hat rail end brackets must be installed.

To secure the components reliably, a top hat rail end bracket must be installed to the right of the top hat rail power supply unit, refer to Figure 5.13.

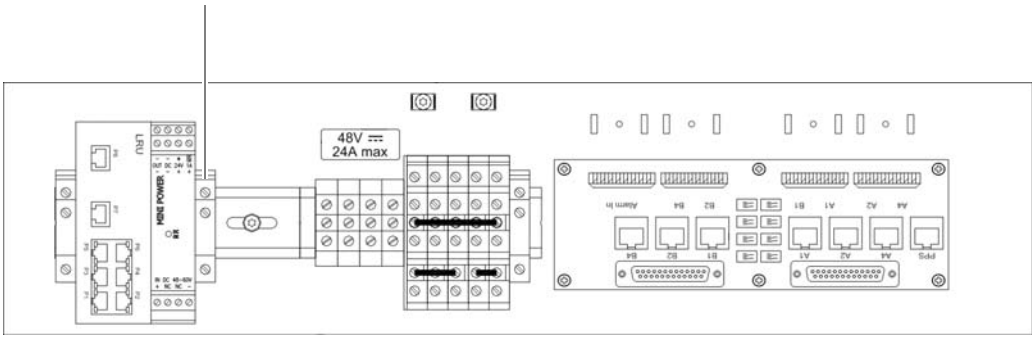

Figure 5.13 top hat rail end bracket (right-hand side)

The following conditions must be met to install the right-hand top hat rail end bracket:

- The LRU must be installed.
- The top hat rail power supply unit must have been installed.

The procedure for installing top hat rail end brackets is described in section 5.5.1.1 on page 97.

5.5.2 Connecting the equipment racks A and B

To be able to operate variants with more than four carriers (hybrid and cavity), the two equipment racks (A and B) must be connected with each other on site.

Table 5.11 describes the connections that must be made when connecting the equipment racks.

Table 5.11 Connecting equipment racks – required connections

Connection	Description
TIB transceiver modules (cabinet A and B) – via the E1 connection board	The TIB transceiver modules are connected with each other in a chain via the E1 connection board. The connection is made via the corresponding connectors on the E1 connection board so that the first TIB transceiver module is connected with the second one, the second one with the third one, etc.

Table 5.11 Connecting equipment racks – required connections

Connection		Description
TIB transceiver modules (cabinet A and B) – via Ethernet	via TIB	The TIB transceiver modules are chained via Ethernet. The connection is made from the first to the second and from the second to the third TIB transceiver module, etc.
	via TIB and LRU (optional, redundancy package)	The TIB transceiver modules are connected with each other via Ethernet in the "shape of a ring," see section 3.1.3 on page 42.
GPS synchronisation – via PPS		Each TIB transceiver module is equipped with a GPS receiver for this purpose. For operating both the equipment racks on one GPS antenna only (mounted to equipment rack A), a PPS (Pulse per Second) connection has been provided. The two equipment racks are connected with each other through the PPS port on the respective E1 connection boards. The PPS signals from TIB transceiver module A and B within an equipment rack are connected with each other and to the E1 connection board.
Rx antennas (with diversity)		If diversity reception is required, the corresponding connectors of the two equipment racks must be connected with each other.

Connecting the equipment racks

Preparation:

✓ The two equipment racks must already be installed in the location provided for this purpose, refer to section 5.3 on page 92.

✓ The redundancy package must have been installed in equipment rack A (optional), see section 5.5.1 on page 96.

Carry out the following steps:

Wiring diagrams for connecting the equipment racks A and B

The required wiring diagrams are described in the following sections:

| Without redundancy package, see section 3.3.1.3 on page 68,

| With redundancy package, see section 3.3.1.4 on page 70.

➔ Connect the cables from the scope of supply with the corresponding connections between the two equipment racks.

✓ The equipment racks have thus been connected with each other.

5.6 Connection to the electrical system

The following section describes the procedure for performing the electrical connection of the product properly.

Defining the reference potential

For the electrical connection of the DIB-500 R4.1, it is necessary to define the reference potential and connect an earthing cable accordingly, see section 5.6.2 on page 108.

The tasks listed in the following table must be performed for the electrical connection.

Table 5.12 Overview of the tasks to be performed (Connection to the electrical system)

Tasks/work steps	Described in
Connection with the grounding system	Section 5.6.1 on page 99
Defining the reference potential	Section 5.6.2 on page 108
Connecting the voltage supply	Section 5.6.3 on page 110

5.6.1 Connection with the grounding system

Before you can connect and switch on the voltage supply, the equipment rack must be connected with the earthing system at the location.

For connection with the grounding system, a grounding connector for the grounding cable (green-yellow) has been provided below the top cover of the equipment cabinet.

Figure 5.14 shows the position of the grounding connector in the equipment rack.

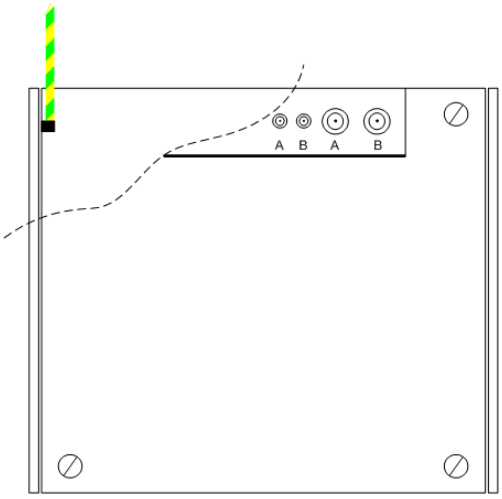

Figure 5.14 Equipment rack grounding connector

Proceed as follows to connect the equipment rack to the grounding system:

Preparation:

✓ An appropriate grounding system (earth circuit connector, etc.) must already be installed.

✓ You need a green-yellow earthing cable that is already connected to the earthing system.
✓ The equipment rack must be accessible from above.
✓ The upper cover of the equipment rack must have been removed, refer to section 5.4 on page 94.

Carry out the following steps:
1. Loosen the outer nut of the earth connection on the equipment rack using the 13-mm ring spanner.
2. Remove the spring washer and the plain washer.

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

3. Slide the eye of the grounding cable onto the threaded bolt of the grounding connector.
4. Slide the washer and then the spring washer onto the threaded pin of the grounding connector.
5. Retighten the outer nut of the earth connection using the 13-mm ring spanner.

✓ The equipment rack is connected to the grounding system.

5.6.2 Defining the reference potential

The reference potential must be defined at the terminal block of the DIB-500 R4.1 depending on the earthing (reference potential) on site (negative terminal earthing or positive terminal earthing). To do so, you have to connect an earthing cable preinstalled at the terminal block corresponding to the reference potential at the location to a specific terminal of the terminal block.

The reference potential must be defined for V_{DC} as well as V_{AC} voltage supply.

Defining the reference potential

Preparation:
✓ The voltage source on site must be switched off.
✓ The equipment rack must be connected to the grounding system.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The top cover of the equipment rack must have been removed.
✓ The reference potential on site must be known.

Carry out the following steps:

NOTICE

Risk of short circuit.

The product may be damaged if the live wires of the voltage supply cable are connected without grounding. In addition, an incorrectly connected earthing cable can cause a short circuit, e.g. if the voltage source requires grounding on the positive terminal, the earthing cable, however, is connected to the terminal marked with "-".

➔ As an overvoltage protection and lightning arrester, it is mandatory that one terminal of the supply circuit be earthed.

➔ Connect the preinstalled earthing cable corresponding to the earthing at the location as described below.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

➔ Connect the preinstalled yellow-green grounding cable (1) according to the earthing at the location

➔ in the case of positive terminal earthing with the terminal identified by "+" (3), or

➔ in the case of a negative terminal earthing with the terminal identified by "-" (2), see Figure 5.15.

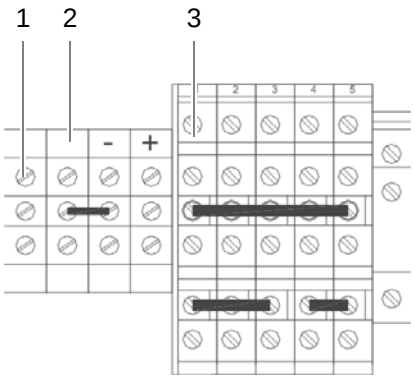

Figure 5.15 Terminals for defining the reference potential

✓ You have successfully defined the reference potential.

5.6.3 Connecting the voltage supply

The procedure for connecting the voltage supply cable differs depending on the type of voltage supply (V_{DC}, optional V_{AC}).

NOTICE

Risk of damage

Connecting V_{AC} and V_{DC} power supply cables at the same time can damage the DIB-500 R4.1.

➔ Never connect the V_{AC} and V_{DC} voltage supply cables at the same time.

➔ The connection must be made by an electrician.

The procedures for connecting the V_{DC} and V_{AC} voltage supply are described in the following sections.

5.6.3.1 Connecting the V_{DC} voltage supply

In the case of a DIB-500 R4.1 with V_{DC} voltage supply, the voltage supply is connected directly via the corresponding terminals of the terminal block, see 3.1.5 on page 45.

Clamp specification

The terminals are dimensioned for cable cross sections of up to 4 mm^2.

Proceed as follows to connect the voltage supply cable:

Preparation:

✓ The voltage source on site must be switched off.
✓ The equipment rack must be connected to the grounding system.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The top cover of the equipment rack must have been removed.
✓ The reference potential must have been defined.

Carry out the following steps:

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

NOTICE

Risk of short circuit.

The product may be damaged if the live wires of the voltage supply cable are connected without grounding. In addition, an incorrectly connected earthing cable can cause a short circuit, e.g. if the voltage source requires grounding on the positive terminal, the earthing cable, however, is connected to the terminal marked with "-".

➔ Ensure that the reference potential has already been defined or that this process step is performed first, see section 5.6.2 on page 108.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Connect the positive voltage supply cable with the terminal (2) identified by "+", refer to Figure 5.16.

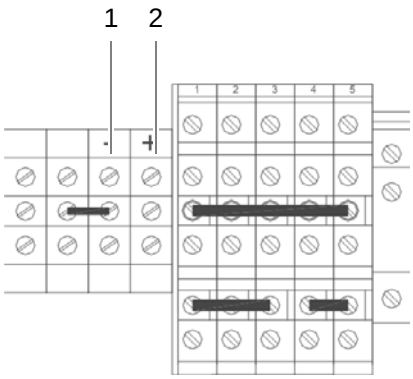

Figure 5.16 Voltage supply connector

2. Connect the negative voltage supply cable with the terminal (1) identified by "-", refer to Figure 5.16.

✓ You have successfully connected the power supply cables.

Switching on the Voltage Source Later on

Since the commissioning of the network requires additional work steps that need to be performed in the equipment rack, the voltage source must stay switched off for the time being. Switching on the voltage source is required only later on for the configuration.

5.6.3.2 Connecting the V_{AC} voltage supply – optional

The DIB-500 R4.1 with V_{AC} expansion (optional) provides a power supply cable via the equipment rack for each rectifier module. Rectifier modules are already connected to the mounting frame and can be connected to the voltage source on site.

With a V_{AC} voltage supply (optional), the DIB-500 R4.1 can be connected to the voltage source on site in the following connection variants:

- to a fixed connection (e. g. distributor box),

  with this connection variant, an easily accessible separator must be available in the voltage supply circuit of the voltage source, such as a fuse in the sub-distribution
- or with a plug with earthing contact to a mains socket.

  with this connection variant, the mains socket must be easily accessible and located as close to the product as possible. The length of the voltage supply cable limits the possible distance. The length of the voltage supply cable is 2.5 m.

One plug with earthing contact in compliance with CEE 7/VII for each integrated rectifier module is included in the scope of delivery and already installed upon delivery. The voltage supply cable(s) are identified according to the related rectifier module, e.g. "PSU1".

Removing plugs with earthing contact

The plug with earthing contact can be removed when the DIB-500 R4.1 is to be connected to a fixed connection (e.g. distributor box). In this case, the strand ends of the voltage supply cable/s must be fitted with end sleeves for strands.

Figure 5.17 shows the possible connection variants for the V_{AC}- voltage supply

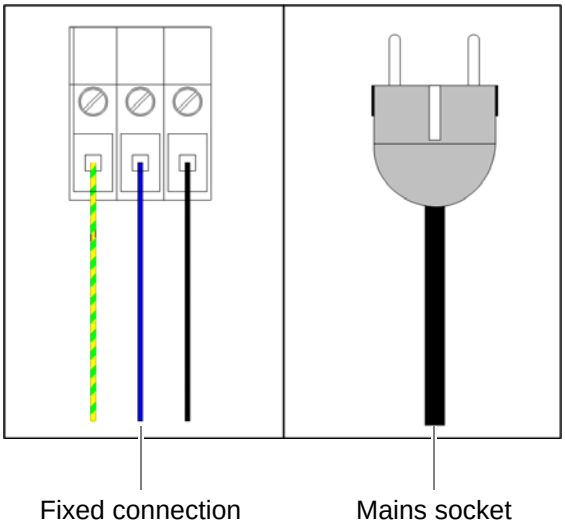

Figure 5.17 V_{AC} voltage supply – connection variants

Proceed as follows to connect the voltage supply cable:

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".

✓ The equipment rack must be connected to the grounding system.

✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.
✓ Depending on the connection variant, the plug with earthing contact may have to be removed already.
✓ The reference potential must have been defined.

Carry out the following steps:

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

NOTICE

Risk of damage

The product may be damaged if the live wires of the voltage supply cable are connected without grounding.

➔ Connect the green-yellow grounding cable of the grounding conductor first.

➔ Connect the power supply cable(s) at installed rectifier modules – depending on the connection variant – with the voltage source, see Figure 5.17 on page 112.

✓ The voltage supply cable has been connected.

Switching on the Voltage Source Later on

Since the commissioning of the network requires additional work steps that need to be performed in the equipment rack, the voltage source must stay switched off for the time being. Switching on the voltage source is required only later on for the configuration.

5.7 Connecting Ethernet cables

All network elements of the ACCESSNET®-T IP network are connected to an IP transport network using an external layer-3 switch. For this reason, operating the DIB-500 R4.1 requires that Ethernet cables are connected according to the overview in section Figure 3.17 on page 46 to the DIB-500 R4.1. In addition, the Ethernet cables must be fastened with cable ties in the equipment rack.

As a router, the layer-3 switch ensures the communication between the individual network constituents that each form a separate subnetwork. In addition, the layer-3 switch facilitates the integration into existing IP transport networks.

Requirements for the layer-3 switch for controller redundancy

For controller redundancy (see section 3.1.9.3 on page 61), it is required that the layer-3 switch supports the Multiple Spanning Tree Protocol (MSTP) in accordance with IEEE 802.1Q2.

If network elements must be connected to a layer-3 switch, it is required that the configuration of the layer-3 switch has been completed.

Connecting network elements with the layer-3 switch

Preparation:

✓ The initial download must have been completed on the corresponding network element.

✓ The layer-3 switch must have been configured project-specific.

Carry out the following steps:

Routing of the Ethernet Cable

When connecting the Ethernet cable, ensure that cables are not routed in front of the fan unit so they do not impair the replacement of fan unit components.

➔ Connect the Ethernet cable to the Ethernet port of the layer-3 switch and to the corresponding Ethernet port of the network element, refer to section 3.1.5 on page 45.

✓ You have successfully connected the network element to the layer-3 switch.

5.8 Installing the GPS antenna

The scope of delivery of the product comprises an antenna mounting kit including the GPS antenna. A third-party GPS antenna may be used instead. In this case, heed the documentation of the third-party devices to prevent adverse effects and malfunctions of the product and other products connected to it.

The GPS antenna included in the scope of delivery is appropriate for the following installation sites:

| on the roof of a building
| at the wall of a building
| on an antenna mast

Figure 5.18 shows an example of installing the GPS antenna supplied.

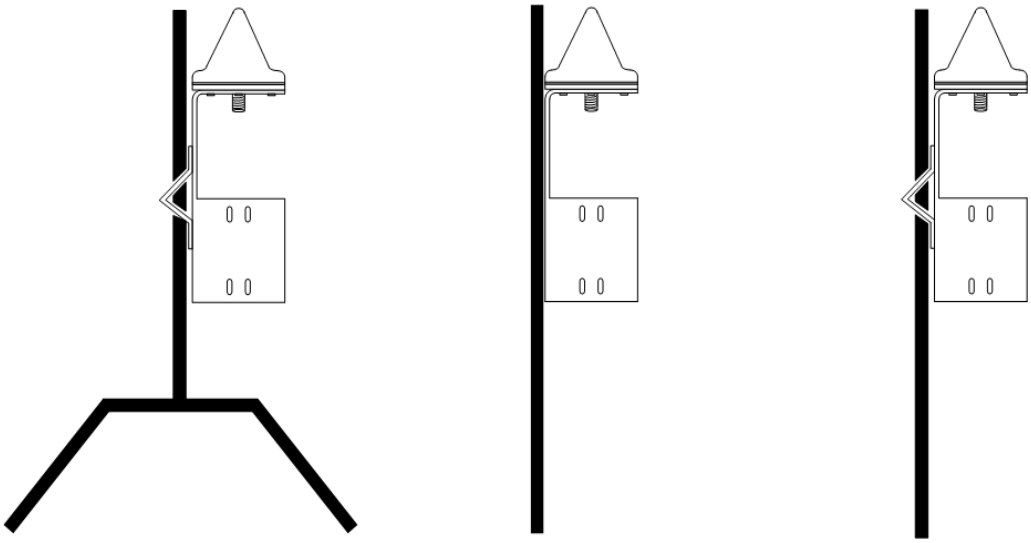

Figure 5.18 Example: installation of the GP antenna supplied (roof, wall, mast installation)

Responsibility for the installation, commissioning and maintenance of the GPS antenna

The operating company is responsible for the proper installation, commissioning and maintenance of the GPS antenna unless this is an integral part of the contract concluded with Rohde & Schwarz Professional Mobile Radio GmbH.

The operator is responsible for ensuring that:

- the installation location of the GPS antenna is appropriate for installing an antenna, e.g. the roof or wall of a building or an antenna mast.
- an antenna mast, if used, including any required retaining elements are installed in such a way that they are protected against outside influences, e.g. a storm.
- equipment for overload protection and lightning protection of the GPS antenna has been provided at the installation site. In this case, ensure that the amplifier integrated into the GPS antenna is supplied V_{DC} voltage via the antenna cable.

Additional GPS antenna recommended

For DIB-500 R4.1 with more than two TIB transceiver modules and controller redundancy, the use of an additional GPS antenna is recommended to ensure the GPS synchronicity of the entire base station in case the active controller fails.

Without GPS satellite reception the proper operation of the DIB-500 R4.1 is ensured for one year (depending on the ambient conditions) if a GPS signal was received before at least once.

Proceed as follows to install the GPS antenna:

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
✓ The antenna mounting kit including the GPS antenna supplied must be available.

Carry out the following steps:

1. If you are installing the antenna on a mast, fasten the fibre ribbon on the antenna mast as an additional means of securing the GPS antenna against slipping.

NOTICE

The GPS antenna must not be installed on the antenna mast of the TX antenna of a base station. Otherwise reliable decoupling cannot be guaranteed.

➔ Exclusively install the GPS antenna in appropriate locations such as on building roofs.

2. Position the GPS antenna at the installation site.
3. When installing the antenna on a mast, use a size 1 cross-head screwdriver to fasten the mounting clamp on the holder of the GPS antenna with the cross-head screws, refer to Figure 5.19. The mounting clamp can be installed on the holder of the GPS antenna either horizontally or vertically.

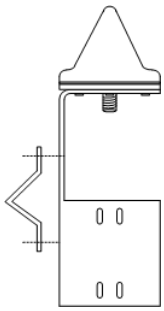

Figure 5.19 GPS antenna – installing the mounting clamp

4. Tighten the corresponding fastening screws to install the GPS antenna at the installation site. Use a size 4 Allen wrench for this purpose.

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

5. Connect the cable of the GPS antenna to the corresponding connector on the bottom of the GPS antenna, refer to Figure 5.20.

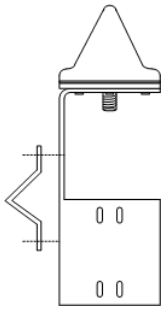

Figure 5.20 Connecting the cable of the GPS antenna

Additional protection against tensile stress

If required, use appropriate mechanisms as an additional means of protecting long GPS antenna cables against tensile stress.

6. Protect the GPS antenna cable against tensile stress by securing it to the holder of the GPS antenna with cable ties.
7. After the installation of the GPS antenna, it is recommended to check the installation site of the GPS antenna, see section 7.6.1 on page 159.

✓ You have successfully installed the GPS antenna.

5.9 Installing the GPS protector - optional

To protect the GPS antenna input against overvoltage (caused by lightning, for example), a GPS protector is optionally available that should be used in combination with a lightning surge protector to provide for optimum overvoltage protection. The GPS protector can be ordered separately.

GPS overvoltage concept

When using the GPS protector, the GPS supply lines at the entry into the building should be safeguarded against high overvoltages by a grounded lightning surge protector.

The GPS protector is a passive and thus maintenance-free hardware component mounted on the GPS antenna connection of the equipment rack.

Installing the GPS protector

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The equipment rack must be connected to the grounding system.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).

Carry out the following steps:

NOTICE

Risk of damage from electrostatic discharge (ESD)

The base station can be damaged if antennas are connected or disconnected during the switched-on state. The GPS antenna connection is particularly sensitive to electrostatic discharge (ESD).

➔ Ensure that the base station is switched off before connecting or disconnecting antennas.

➔ Install the GPS protector on the GPS antenna connection applying a tightening torque of 100 Ncm using a size 18 dynamometric key.

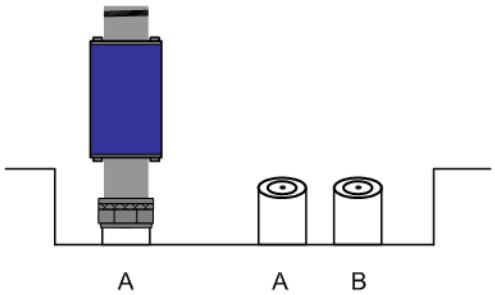

Figure 5.21 GPS antenna connection with GPS protector

✓ You have successfully installed the GPS protector.

5.10 Connecting antennas

The following sections contains a description of the wiring diagrams for the FlexibleTx variant.

- Connecting antennas (GPS and TETRA)
- Connection of external antenna coupling systems – Optionally, only FlexibleTx variant

5.10.1 Connecting antennas (GPS and TETRA)

Each equipment cabinet features three antenna connectors – two for TETRA antennas (A and B) and one GPS antenna connector. All the antenna connectors are routed from the front of the respective TIB transceiver module or ACS to the top of the respective equipment cabinet.

To ensure proper operation of the antenna system, you have to connect the TETRA antennas (antenna A and B (optional for diversity)) as well as the GPS antenna.

Figure 5.22 shows the antenna connections on the upper side of the equipment rack. The following table describes it in detail.

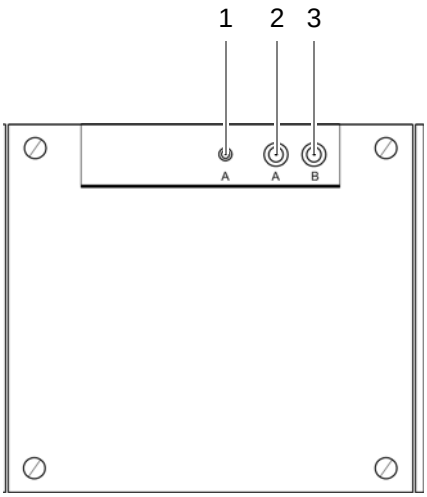

Figure 5.22 Antenna connectors – equipment cabinet top view

Table 5.13 Legend: Antenna connections – top view of equipment rack

No.	Description
1	GPS antenna connector
2	TETRA antenna connection A
3	TETRA antenna connection B – optional, for diversity

The procedure for connecting the antenna(s) to one equipment rack is described in the following.

Proceed as follows to connect an antenna / antennas:

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".

✓ The equipment rack must be connected to the grounding system.
✓ Appropriate antenna cables of the required lengths must be available.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).

Carry out the following steps:

Cable-specific tools and process steps

The required tools and process steps depend on the antenna cable used and the related connector.

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

NOTICE

Risk of damage from electrostatic discharge (ESD)

The base station can be damaged if antennas are connected or disconnected during the switched-on state. The GPS antenna connection is particularly sensitive to electrostatic discharge (ESD).

➔ Ensure that the base station is switched off before connecting or disconnecting antennas.

➔ Connect the required antennas on the upper side of the equipment rack, refer to Figure 5.22 on page 119.

The following options are available:

| Connect the GPS antenna:
  – to the optional GPS protector (recommended),
  – directly to the corresponding connector.
| TETRA antenna(s): Directly connected to corresponding connector/connectors.

✓ The antennas have thus been connected.

5.10.2 Connection of external antenna coupling systems – Optionally, only FlexibleTx variant

In the FlexibleTx variant, antenna coupling was performed project-specifically according to the desires and requirements of the network operator via external antenna coupling systems. In this way, the DIB-500 R4.1, e.g. can be connected to existing antenna coupling systems.

Requirements for external antenna coupling systems.

The requirements on external antenna coupling systems are described in the site requirements.

Figure 5.23 shows by way of an example the connection of an external antenna coupling system to the FlexibleTx variant of the DIB-500 R4.1. The connections of external antenna coupling systems to the DIB-500 R4.1 and to the antenna(s) are to be defined to match the project.

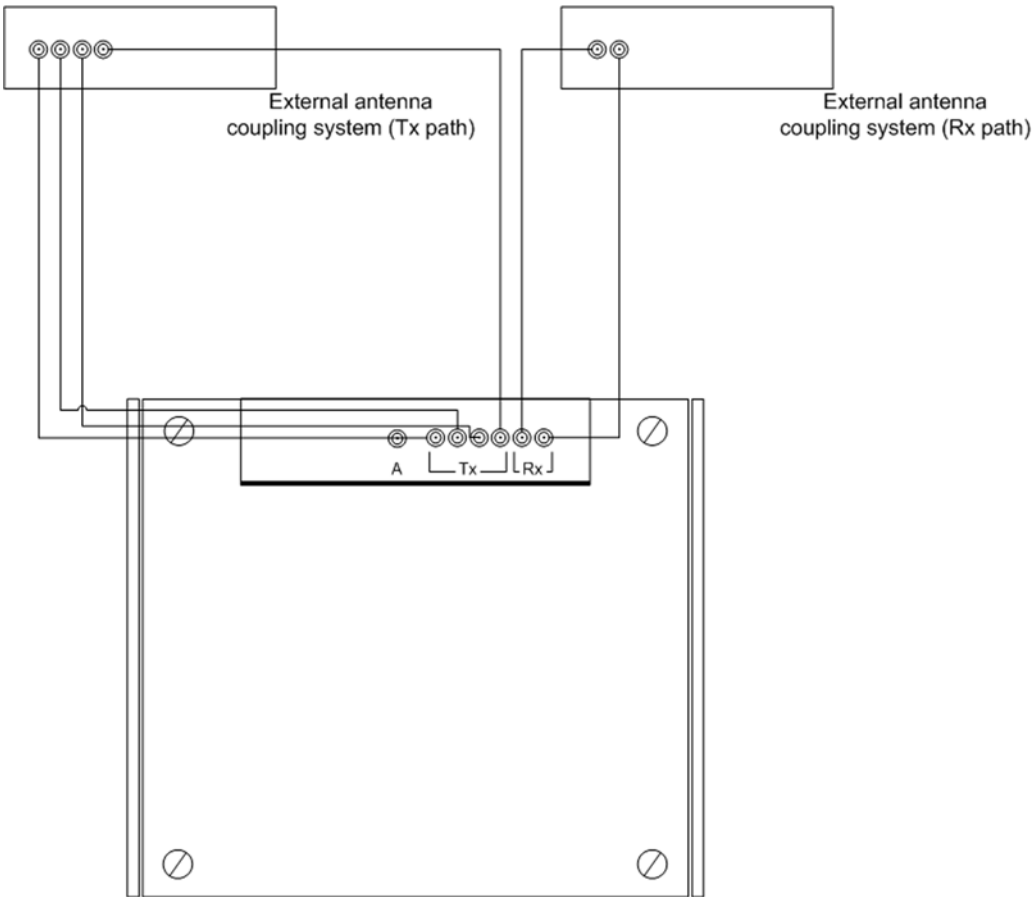

Figure 5.23 Connection of an external antenna coupling system

Connect external antenna coupling system

Preparation:

✓ The site must be prepared in compliance with the document "Site Requirements".
✓ The equipment rack must be connected to the grounding system.
✓ Appropriate antenna cables of the required lengths must be available.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).

Carry out the following steps:

Cable-specific tools and process steps

The required tools and process steps depend on the antenna cable used and the related connector.

NOTICE

Cable damage

If cables are routed over sharp edges or in bending radiuses too small for the cables, the cables may be damaged.

➔ Never route cables over sharp edges and always maintain to the bending radius.

NOTICE

Risk of damage from electrostatic discharge (ESD)

The base station can be damaged if antennas are connected or disconnected during the switched-on state.

➔ Ensure that the base station is switched off before connecting or disconnecting antennas.

➔ Connect the external antenna coupling system to the upper side of the equipment rack, see Figure 5.23 on page 121.

✓ The external antenna coupling system is connected.

5.11 Connecting external alarm sensors (LSA+)

The DIB-500 R4.1 features two alarm inputs that are connected via the "Alarm in" LSA+ strip on the E1 connection board. The assignment of the alarm inputs is controlled project-specifically.

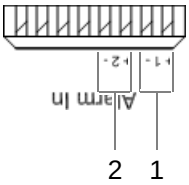

Figure 5.24 Alarm inputs (LSA+)

Proceed as follows to connect external alarm sensors:

Preparation:

✓ The connecting cables provided must comply with the "Site requirements" document.

Carry out the following steps:

➔ Connect the corresponding wires of the external alarm sensors to the terminals on the LSA+ strip, refer to Figure 5.24 on page 123.

✓ You have successfully connected external alarm sensors.

5.12 Connecting external alarms – optional, with V_{AC} or alerting expansion

If the DIB-500 R4.1 is equipped with a V_{AC} or alarm system expansion, it features six digital alarm inputs and six digital alarm outputs that are connected with the alarm input/output module, see Figure 5.25 on page 124.

The alarm inputs/outputs can be configured as required. The alarm inputs/outputs to be used can be defined through connection to the corresponding terminals. The alarms are signalled with the corresponding severity via the alarm outputs.

The tasks listed in the following table must be performed for the connection of external alarms.

Table 5.14 Overview of the tasks to be performed (connecting external alarms)

Tasks/work steps	Described in
Removing the top cover of the equipment rack	Section 5.12.1 on page 124
Connecting external alarms	Section 5.12.2 on page 126
Mounting the top cover of the mounting frame	Section 5.12.3 on page 128

Figure 5.25 shows the alarm inputs/outputs of the alarm input/outputs of the alarm input/output module. The following table describes these indicators in detail.

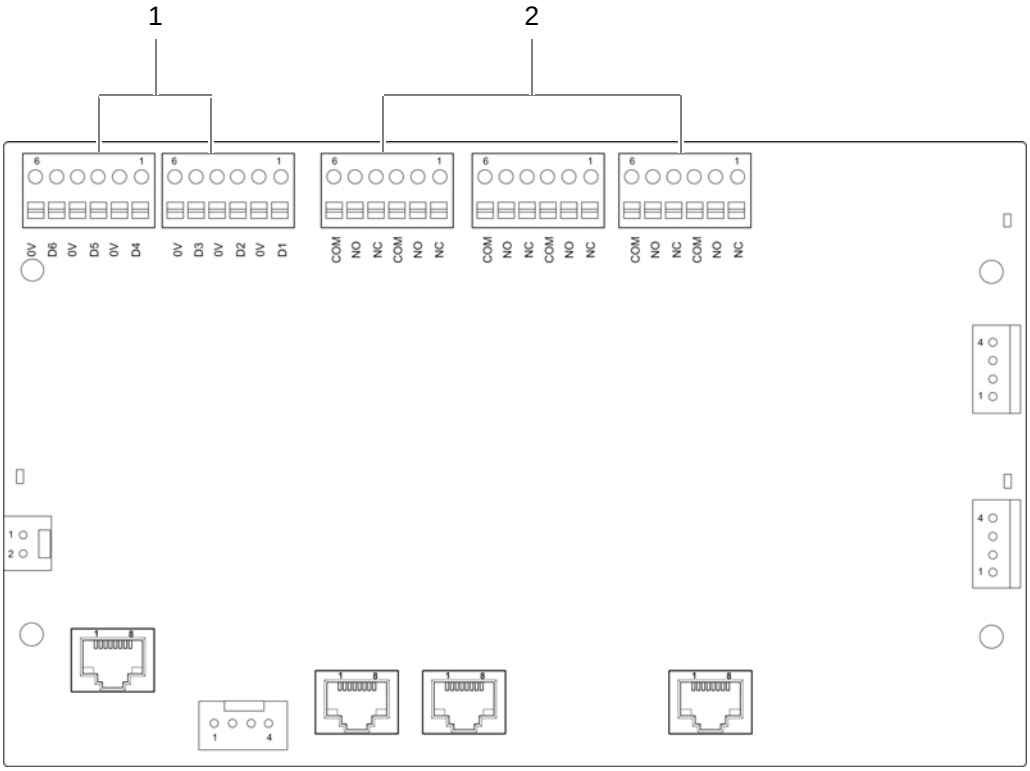

Figure 5.25 Alarm input/output module – alarm inputs/outputs

Table 5.15 Legend: Alarm input/output module – alarm inputs/outputs

No.	Description	Alarm input/output
1	Alarm inputs (I)	I1
		I2
		I3
		I4
		I5
		I6
2	Alarm outputs (O)	O1
		O2
		O3
		O4
		O5
		O6

5.12.1 Removing the top cover of the equipment rack

The alarm input/output module is installed in the mounting frame, refer to 3.1.1.5 on page 40. The top cover of the mounting frame must be opened to be able to access the alarm input/output module. The top cover of the equipment rack must be removed to be able to access the mounting frame.

The top cover of the mounting frame is secured with five mounting screws.

Proceed as follows to remove the top cover of the mounting frame:

Preparation:
✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The top cover of the equipment rack must have been removed.
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.

Carry out the following steps:

Keeping materials

Keep all the materials such as fastening screws in a safe place. You will need them again.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Loosen the mounting screws of the top cover of the mounting frame using a size 1 cross-head screwdriver, refer to Figure 5.26.

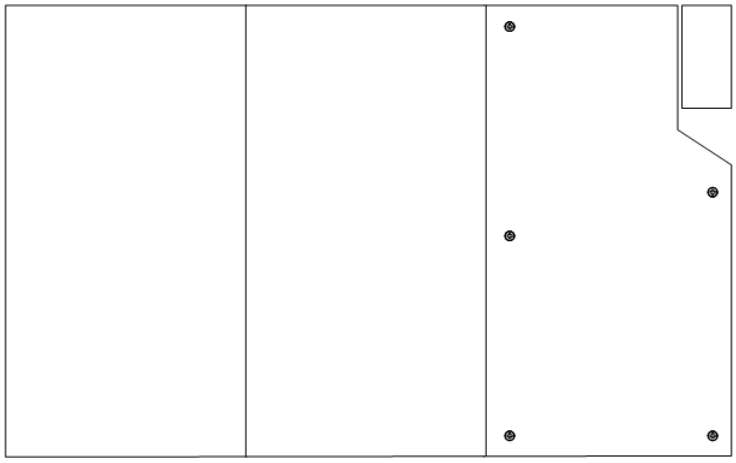

Figure 5.26 Mounting frame mounting screws

2. Remove the top cover of the mounting frame.

✓ You have successfully removed the top cover of the mounting frame.

5.12.2 Connecting external alarms

Depending on the desired alarm signalling, external alarms can be connected to the terminals of the alarm inputs/outputs. For the alarm outputs you can influence, in which cases alarms are to be signalled. This is determined via the corresponding connection combinations of the terminals, refer to Figure 5.27.

Figure 5.27 shows examples of the clamps for connecting external alarms. The following table describes these indicators in detail.

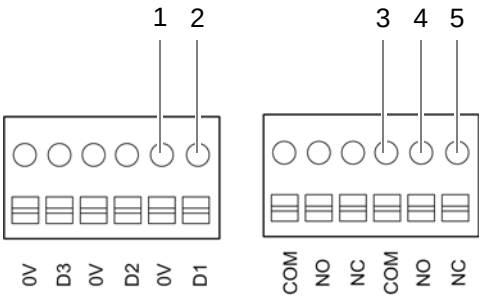

Figure 5.27 Terminals for connecting external alarms (example)

Table 5.16 Legend: terminals for connecting external alarms (example)

No.	Alarm input/output	Terminal	Description
1	Alarm input	0V	Grounding (digital input 1)
2		D1	Digital input 1
3	Alarm output	COM	Common – centre contact
4		NO	normally open – switch open if an alarm is not signalled e.g. a connected line will light up if an alarm occurs
5		NC	normally closed – switch closed if an alarm is signalled e.g. a connected lamp will go out if an alarm occurs

Alarm jumper

If an external alarm is not connected, one alarm jumper must be mounted per alarm input to short-circuit the contacts. When external alarms are connected, the jumper must be removed from the corresponding terminal.

Proceed as follows to connect external alarms:

Preparation:
✓ The voltage source on site must be de-energised.
✓ The toggle switches must be set to the "Off" position ("downward" switch position).
✓ The connecting cables must be available.
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.

✓ The top cover of the mounting frame must have been removed.
✓ The top cover of the equipment rack must have been removed.

Carry out the following steps:

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Route the cables of the external alarms through the corresponding grommet.

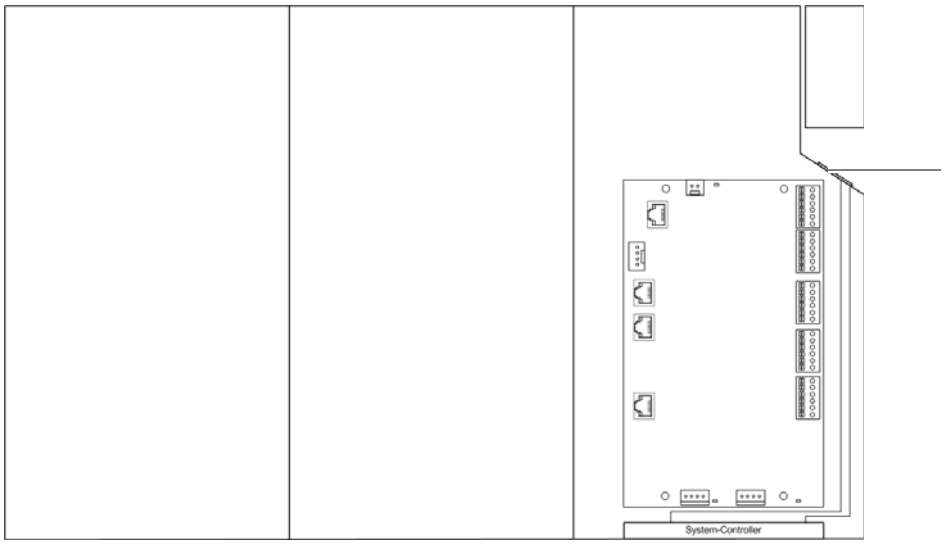

Figure 5.28 Mounting frame grommet (top view)

2. Cautiously press the lever (1) downward to open the clamps of the connectors (2).

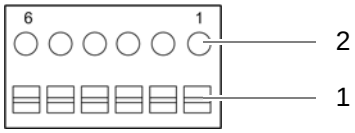

Figure 5.29 Alarm input/output module - connection

Clamp specification

The terminals of the alarm input/output module are designed for cable cross sections of 0.5 - 2.0 mm^2 (20 - 14 AWG).

3. Connect the wires of the external alarms to the corresponding clamps of the alarm input/output module, refer to Figure 5.25 on page 124.

4. Ensure that all the terminals of vacant alarm inputs are connected through alarm jumpers.

Strain relief of connected cables / connecting lines

When connecting cables and connecting lines, you must ensure that they are protected against tensile strain.

5. Fasten the connected cables in the equipment rack in such a way that they are protected against tensile strain, e. g. by using cable ties.

✓ You have successfully connected external alarms.

5.12.3 Mounting the top cover of the mounting frame

The top cover of the mounting frame must be mounted again for normal operation.

Proceed as follows to mount the top cover of the mounting frame:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
✓ You need the mounting screws you removed before.

Carry out the following steps:

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Position the top cover of the mounting frame.
2. Tighten the mounting screws of the upper cover of the mounting frame. Use a size 1 cross-head screwdriver for this purpose, refer to Figure 5.26.

✓ You have successfully mounted the top cover of the mounting frame.

5.13 Mounting the top cover of the equipment rack

The top cover of the equipment rack must be mounted again for normal operation.

Proceed as follows to mount the top cover of the equipment rack:

Preparation:
✓ The tools, auxiliary means and materials specified must be available, refer to section 5.2 on page 90.
✓ You need the mounting screws you removed before.

Carry out the following steps:
1. Position the equipment rack top cover.
2. Tighten the mounting screws of the equipment rack top cover. Use a coin to do so, refer to Figure 5.3.
3. Fasten the mounting screws of the equipment rack grommet again. Use the size 2 cross-head screwdriver for this purpose, refer to Figure 5.2.

✓ You have successfully mounted the equipment rack top cover.

5.14 Switching on the voltage source

Before the product can be switched on, the voltage source must be switched on. The procedure for switching on the voltage source depends on the circumstances at the respective installation site.

Proceed as follows to switch on the voltage source:

Preparation:
✓ The equipment rack must be connected with the grounding system of the voltage source at the installation site.
✓ The antennas must be connected.
✓ The external alarms must be connected.

Carry out the following steps:
➔ Switch on the voltage source via the corresponding equipment at the installation site.
  ➥ The equipment rack is energised. TIB, ACS and fans continue to be switched off.
  ➥ If installed, the SC200 is switched on. The display window of the SC200 lights up.

✓ The procedure for switching on the voltage source has been completed.

5.15 Switching on the DIB-500 R4.1

If the voltage source at the location is switched on, the equipment rack is already energised even though TIB, ACS and fans continue to be switched off. For this reason, the DIB-500 R4.1 is not yet switched on and operational.

The product is switched on via an on/off switch in the upper part of the equipment cabinet. After the voltage supply has been switched on, all the connected hardware components will automatically start. Connections will be enabled. After about three to five minutes, all hardware components have started up and are ready for operation.

To switch on the product, the connections must have been made properly and the voltage source at the installation site must have been switched on already.

Switching on DIB-500 R4.1

Preparation:

✓ The equipment rack must be connected with the earthing system, see section 5.6.1 on page 107.
✓ The equipment rack must be connected to the voltage source at the location, see section 5.6.3 on page 110.
✓ The voltage source at the location must be switched on, see section 5.14 on page 129.
✓ All required connecting cables and antennas must be connected, see chapter 5 on page 89.

Carry out the following steps:

➔ Switch the on/off switch upward to switch on the DIB-500 R4.1, see Figure 5.30.

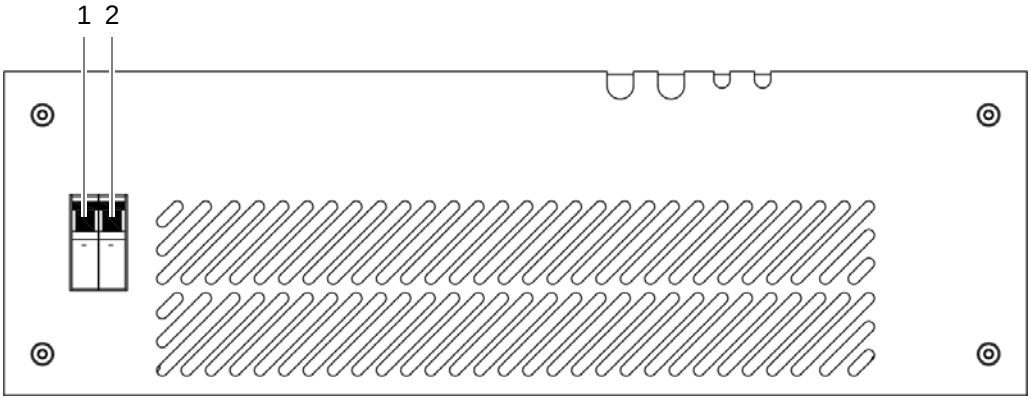

Figure 5.30 On/off switch

➥ The TIB transceiver module starts up.
➥ The fans are switched on.
➥ The antenna coupling system (ACS) is supplied with voltage via the TIB transceiver modules.

✓ You have successfully switched on the DIB-500 R4.1.

Performing function tests

After performing the described procedure/s, the described function tests should be performed to ensure the proper operation of the product, refer to chapter 7 on page 151.

6 Configuration

The following chapter describes the procedure for the proper configuration of the product. The product is already configured upon delivery. After a component replacement or due to project-specific circumstances, it may still be necessary to perform configuration steps.

The tasks listed in the following table must be performed for the configuration of the DIB-500 R4.1.

Table 6.1 Overview of the tasks to be performed

Tasks/work steps			Described in
Configuring the software	Preparatory measures	Switching on the voltage source	Section 6.1.2 on page 132
		Switching on the DIB-500 R4.1	
		Connecting the service computer to the TIB transceiver module	
	Deleting the ARP buffer		Section 6.1.3 on page 134
	Configuring and generating network configurations via the NMC-515 ConfigurationManager		Section 6.1.4 on page 134
	Creating the download repository		Section 6.1.5 on page 135
	Adapting IP addresses (with more than one transceiver module)		Section 6.1.6 on page 135
	Performing an initial download via NMC-522 DownloadManager		Section 6.1.7 on page 142
Adjusting a cavity coupler – optional (cavity variant only)	Setting the output rating		Section 6.2.2 on page 144
	Measuring and checking the carriers (impedance adjustment)		Section 6.2.3 on page 146

6.1 Configuring the software

Prerequisite for configuring the network element (as a preparatory measure for the network-specific configuration of the network with the aid of the NMC-515 ConfigurationManager network management client) is the completed commissioning of the network element, see chapter 5 on page 89.

The tasks listed in the following table must be performed for the configuration of the software.

Table 6.2 Overview of the tasks to be performed (Configuring the software)

Tasks/work steps		Described in
Preparatory measures	Switching on the voltage source	Section 6.1.2 on page 132
	Switching on the DIB-500 R4.1	
	Connecting the service computer to the TIB transceiver module	

Table 6.2 Overview of the tasks to be performed (Configuring the software)

Tasks/work steps	Described in
Deleting the ARP buffer	Section 6.1.3 on page 134
Configuring and generating network configurations via the NMC-515 ConfigurationManager	Section 6.1.4 on page 134
Creating the download repository	Section 6.1.5 on page 135
Adapting IP addresses (with more than one transceiver module)	Section 6.1.6 on page 135
Performing an initial download via NMC-522 DownloadManager	Section 6.1.7 on page 142

6.1.1 Work equipment

Table 6.3 provides an overview of the work equipment required for the steps in this chapter.

Table 6.3 Overview of work equipment (Configuration)

Work step	Work equipment
Configuring the software	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" Straight through ethernet cable

Service computers not included in the scope of delivery

Service computers are not part of the product's scope of supply and are available separately.

6.1.2 Preparatory measures

The preparatory measures listed in the following table must be performed for the configuration of the software.

Table 6.4 Overview of preparatory measures (Configuring the software)

Tasks/work steps	Described in
Switching on the voltage source	Section 5.14 on page 129
Switching on the DIB-500 R4.1	Section 5.15 on page 129
Connecting the service computer to the TIB transceiver module	Section 6.1.2.1 on page 133

6.1.2.1 Connecting the service computer to the TIB transceiver module

In principle, the service computer can be connected to any open Ethernet interface of the TIB transceiver module.

Connecting the service computer despite assigned Ethernet interfaces

If all Ethernet interfaces of the respective TIB transceiver module are assigned, you can disconnect the Ethernet cable for connection to the layer-3 switch/IP transport network, if necessary, and connect the service computer to the corresponding Ethernet interface. Note that a connection to the IP transport network no longer exists in this case.

Proceed as follows to connect the service computer:

Preparation:

✓ The working appliances must be available, refer to section 6.1.1 on page 132.
✓ The service computer must have been started already.
✓ The corresponding On/Of switch(es) must be in the "On" position (switch position: "Up").

Carry out the following steps:

➔ Connect the Ethernet cable to the service connector of the network element (refer to Figure 6.1) and to the Ethernet port of the service computer.

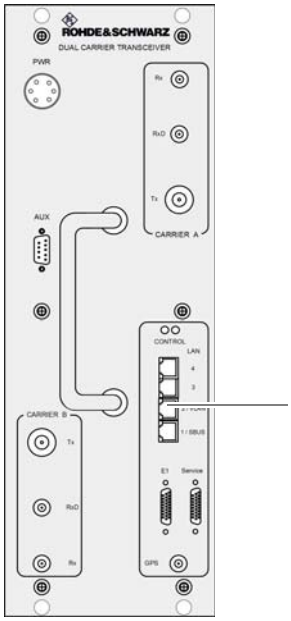

Figure 6.1 Service connector

✓ You have successfully connected the service computer.

6.1.3 Deleting the ARP buffer

The assignments of IP addresses to hardware addresses of network adapters (MAC address) are stored in the ARP (Address Resolution Protocol) buffer.

To ensure the proper execution of the initial download and to be able to directly connect with hardware components, it is necessary to delete the ARP buffer on the respective service computer after every connection.

Proceed as follows to delete the ARP buffer:

Preparation:
✓ The service computer must be connected.

Carry out the following steps:
1. Call up the command prompt via the Windows Start menu > *Programs* > *Accessories* > *Command Prompt*.
   ➥ The "command prompt" is displayed:
2. Enter the command below to delete the ARP buffer:

   `arp -d`

3. If necessary, you can use the following command to display entries in the ARP buffer:

   `arp -a`

✓ You have successfully deleted the ARP buffer.

6.1.4 Configuring and generating network configurations via the NMC-515 ConfigurationManager

Via the NMC-515 ConfigurationManager network management client, the network configuration for an ACCESSNET®-T IP network is created based on the defined network design. For this purpose, the NMC-515 ConfigurationManager permits the creation and adaptation of an ACCESSNET®-T IP network model. The calculations of the required configurations for the operating systems and software components used and the generation of the configuration files are based on this network model.

The procedures for generating network configurations via the NMC-515 Configuation-Manager network management client are described in the related product documents, refer to Table 6.5.

Table 6.5 Required product documents

Product	Document type	Described in
NMC-515 ConfigurationManager	User Manual	Chapter 4

6.1.5 Creating the download repository

For commissioning network elements locally via the NMC-522 DownloadManager, the Download Repository must be created on the service computer. For this purpose, the required directory structures must be stored on the service computer.

The procedures for this purpose are described in corresponding documents, refer to Table 6.6.

Table 6.6 Required product documents

Product	Document type
Service computer	Configuration Manual

6.1.6 Adapting IP addresses (with more than one transceiver module)

If a base station with multiple transceiver modules is used, the IP addresses of these hardware components must be adapted.

The following work steps are required for this purpose:

- Adapting the IP addresses (IntelPC)
- Adapting the IP addresses (PowerPC)

6.1.6.1 Adapting the IP addresses (IntelPC)

The IP addresses of the hardware components are identical after the respective platform image has been loaded. When hardware components are delivered, the platform images have already been loaded. For the initial download via the NMC-522 DownloadManager, however, the corresponding hardware components must feature a unique IP address.

Table 6.7 describes the standard IP address that is assigned while loading the platform image of a transceiver module.

Table 6.7 Standard IP addresses of the transceiver modules

Standard IP address
10.255.255.1

If a base station with multiple transceiver modules is used, the IP addresses of all additional transceiver modules must be adapted. Otherwise it will not be possible to access the respective transceiver module(s).

Table 6.8 describes the IP scheme by which the IP addresses of the transceiver modules must be assigned.

Table 6.8 Transceiver module IP addressing scheme (IntelPC)

First transceiver module	Second transceiver module	Third transceiver module	Fourth transceiver module
10.255.255.1	10.255.255.2	10.255.255.3	10.255.255.4

Adapting the IP address

Preparation:

✓ According to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP"

✓ The service computer must be connected to the corresponding component, see section 6.1.2.1 on page 133.

Carry out the following steps:

1. Start "PuTTY" by double-clicking the executable file.
   ➥ The user interface of "PuTTY" will be displayed:

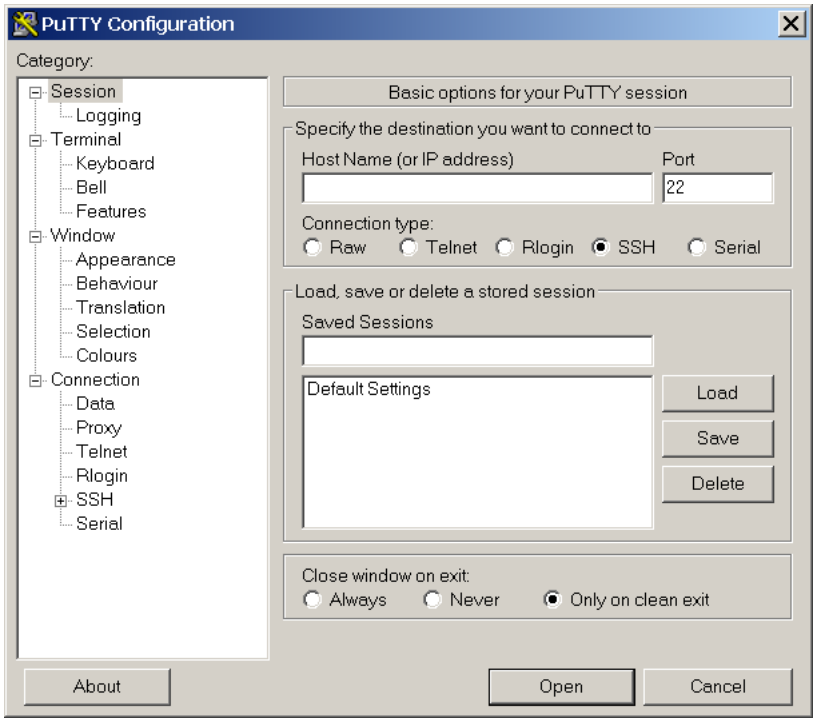

Figure 6.2 "PuTTY" user interface

2. Enter the corresponding standard IP address in the *Host Name (or IP address)* field, see Table 6.7 on page 135.
3. Click *Open*.
   ➥ The SSH connection will be established.
   ➥ The following output is displayed:
   `login as:`
4. Enter the following as the user name:

   `root`

5. Press the ENTER key to confirm your input.
6. Enter the following as the password:

   `accessnet`

7. Press the ENTER key to confirm your input.
   ➥ The connection to the component has been set up.

Command "ifconfig.xxx"

The "ifconfig.xxx" command opens the corresponding "ethX/Y" configuration file. "xxx" corresponds to the respective configuration file. The "ethX/Y" configuration files depend on the component. Thus, the commands listed below are possible:

- MPU-550 and TIB/TOB (DIB-500 R3.2 and DIB-500 R4)
  - eth1/1 contains the IP address for the initial download. This file must be configured accordingly.
  - eth1/0 receives the customer-specific IP address for operation with the initial download.
- GPP-100 and TIB (DIB-500 R4.1)
  - eth0/0 receives the customer-specific IP address for operation with the initial download.
  - eth0/1 contains the IP address for the initial download. This file must be configured accordingly.

8. Enter the following command to open the corresponding configuration file:

   `vi /etc/sysconfig/network/devices/ifconfig.xxx`

   "xxx" corresponds to the command for the corresponding component.

   ➥ The "ethX/Y" configuration file will open. The following output is an example:

```
# ====================================================
# ACCESSNET-T Configuration File
#
# Network : cta
# Description : CTA_CFG_TL47_5_v04
# Config. Int. Version : 1.3
# Network Element : bs02-001
# Network Component : IntelPC_1
# Configuration version : 0.0
# Generated by : NMC-515 ConfigurationManager 2.32.7
# Date/Time : 2008-02-22 16:45:19
# ====================================================
ONBOOT=YES
SERVICE=ipv4-static
IP=10.255.25x.xxx
PREFIX=27
```

NOTICE

Different configuration files

Depending on the component/s, multiple "ethX/Y" configuration files may be available. The configuration file must match the corresponding component.

➔ Check the contents of the open configuration file. The "IP" entry must match the corresponding component, refer to 6.1.4 on page 134.

9. In the "IP“ entry, navigate to the passage to be adapted with the arrow keys.

10. Enter the following command to delete the corresponding line:

    `x`

11. Enter the following command to insert a corresponding figure:

    `I`

12. Navigate to the end of the line with the arrow keys and enter the corresponding figure, see 135.
13. Enter the following command to change to the main menu:

    `Esc`

14. Enter the following command and confirm your entry with the Enter key:

    `:wq`

    ➥ The changes will be saved and the configuration file closed.
15. Enter the following command to restart the network service of the component:

    `/etc/init.d/network restart`

    ➥ The changed IP address will take effect.
    ➥ The SSH connection via "PuTTY" will be changed because the IP address has changed.

Checking the IP address – (optionally)

If required, check the IP address by establishing an SSH connection via PuTTY. You can also check whether the IP address can be reached by entering the command **`ping 10.255.25x.xxx`**. 255.25x.xxx corresponds to the respective IP address.

16. If required, proceed analogously for any further IP addresses.

✓ The procedure for adapting the IP address has been completed.

6.1.6.2 Adapting the IP addresses (PowerPC)

For the proper operation of the PowerPC, the IP address/es of the PowerPC must be adapted after the IP address of the IntelPC (refer to section 6.1.6.1 on page 135) has been adapted.

Table 6.9 describes the IP addressing scheme, according to which the IP addresses of the PowerPCs of the transceiver modules of base stations are to be assigned.

Table 6.9 Transceiver module IP addressing scheme (PowerPC)

First transceiver module	Second transceiver module	Third transceiver module	Fourth transceiver module
10.255.255.17	10.255.255.18	10.255.255.19	10.255.255.20

The procedure for adapting the IP address is described in the following.

Adapting the IP address

Preparation:

✓ According to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP"
✓ The service computer must be connected to the corresponding component, see section 6.1.2.1 on page 133.
✓ The IP address of the IntelPC must have been adapted already.
✓ The ARP buffer of the service computer must be deleted again, see section 6.1.3 on page 134.

Carry out the following steps:

1. Start "PuTTY" by double-clicking the executable file.
   ➥ The user interface of "PuTTY" will be displayed:

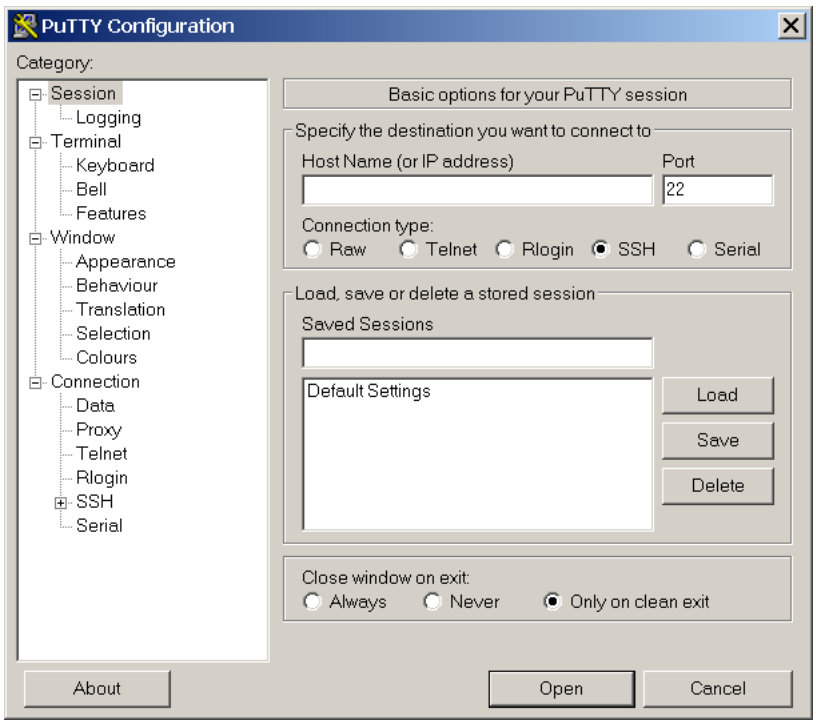

Figure 6.3 "PuTTY" user interface

2. Enter the corresponding IP address in the "Host Name (or IP address)" field, refer to Table 6.8 on page 135.
3. Click "Open".
   ➥ The SSH connection will be established.
   ➥ The following output is displayed:
   `login as:`
4. Enter the following as the user name:

   `root`

5. Press the ENTER key to confirm your input.
6. Enter the following as the password:

   `accessnet`

7. Press the ENTER key to confirm your input.
   ➥ The connection to the component has been set up.

8. Enter the following command to open the corresponding configuration file:

   vi /etc/udhcpd.conf

   ➥ The "udhcpd.conf" configuration file is opened. The following output is an example:

```
# ================================================================
# ACCESSNET-T Configuration File
#
# Network : cta
# Description : cta
# Package Version : 7.0
# Network Element : bs01-002 (DIB1_12)
# Software Component : aeos-intel_1 (AEOS Intel)
# Software Version :
# Configuration Version : 1001281502
# Generated by : NMC-515 ConfigurationManager 03.01.00
# Date/Time : 28.01.2010 15:02:32 CET
# ================================================================
start 10.101.101.49
end 10.101.101.49
interface eth1
siaddr 10.101.101.33
option lease 864000
option subnet 255.255.255.224
max_leases 1
dhcp_magkey 0x13242c8
opt bootfile autoscript.img
```

9. Navigate to the IP address of the "start" entry with the arrow keys.
10. Enter the following command to delete the corresponding line:

    x

11. Enter the following command to insert a corresponding figure:

    I

12. Enter the corresponding IP address of the PowerPC, refer to Table 6.9 on page 138.

NOTICE

The IP addresses in the "start" and "end" entries must be identical. Otherwise the proper operation of the PowerPC is not ensured.

➔ Ensure that the IP addresses in the "start" and "end" entries are identical.

13. Proceed analogously for the IP address of the "end" entry.
14. Navigate to the IP address of the "siaddr" entry with the arrow keys.
15. Enter the following command to delete the corresponding line:

    x

16. Enter the following command to insert a corresponding figure:

    I

17. Enter the corresponding IP address of the IntelPC, refer to Table 6.8 on page 135.
18. Enter the following command to change to the main menu:

    Esc

19. Enter the following command and confirm your entry with the Enter key:

    :wq

    ➥ The changes will be saved and the configuration file closed.
20. Enter the following command to open the corresponding configuration file:

    vi /etc/exports

    ➥ The "exports" configuration file is opened. The following output is an example:

```
# ================================================================
# ACCESSNET-T Configuration File
#
# Network : cta
# Description : cta
# Package Version : 7.0
# Network Element : bs01-002 (DIB1_12)
# Software Component : aeos-intel_1 (AEOS Intel)
# Software Version :
# Configuration Version : 1001281502
# Generated by : NMC-515 ConfigurationManager 03.01.00
# Date/Time : 28.01.2010 15:02:32 CET
# ================================================================
/ 10.101.101.49/
255.255.255.224(rw,no_root_squash,no_subtree_check)
/linuxppc 10.101.101.49/
255.255.255.224(rw,no_root_squash,no_subtree_check)
intelpc-1-1-1-1-bs01-002:~ #
```

Adaptation of the network mask not required

The network mask need not be adapted (here "255.255.255.224").

21. Navigate to the IP address of the "/" (here: "10.101.101.49") entry with the arrow keys.
22. Enter the following command to delete the corresponding line:

    x

23. Enter the following command to insert a corresponding figure:

    I

24. Enter the corresponding IP address of the PowerPC, refer to Table 6.9 on page 138.
25. Proceed analogously for the IP address of the "/linuxppc" entry.
26. Enter the following command to change to the main menu:

    Esc (Escape)

27. Type in the following command:

```
:wq
```

28. Press the ENTER key to confirm your input.
    ➥ The changes will be saved and the configuration file closed.
29. Enter the following command to restart the hardware component:

    ```
    reboot
    ```

    ➥ The hardware component is restarted.

Checking the IP addresses (optionally)

If required, check the IP address by establishing an SSH connection via PuTTY. Alternatively you can check the availability of the IP addresses of the IntelPC and PowerPC via the command **`ping 10.255.25x.xxx`**. 255.25x.xxx corresponds to the respective IP address, refer to Table 6.8 and Table 6.9.

✓ The procedure for adapting the IP address has been completed.

6.1.7 Performing an initial download via NMC-522 DownloadManager

The NMC-522 DownloadManager network management client transmits the required data from the download repository to the network elements via an initial download. The initial download can only be performed on site via the service computer. For the initial download, a direct Ethernet connection between service computer and the first TIB transceiver module is required.

Deleting the ARP buffer

To ensure that the initial download is performed properly, the ARP buffer must be deleted after the service computer has been connected, refer to section 6.1.3 on page 134.

The procedures for operating the NMC-522 DownloadManager network management client are described in the related product documents, refer to Table 6.10.

Table 6.10 Required product documents

Product	Document type	Described in
NMC-522 DownloadManager	User Manual	Chapter 4

6.2 Adjusting a cavity coupler – optional (cavity variant only)

The cavity coupler must be matched to the set Tx frequency of the connected carrier. To be able to perform this setting, only the carrier to be measured in each case is activated to exclusively measure its power at the antenna output. The Tx frequency is adjusted with the handwheel of the corresponding cavity coupler so that the maximum transmitting power is present at the antenna connection.

NOTICE

Damage to circulators

When new frequencies are configured via the NMC-515 network management client, the circulators may be damaged if the cavity coupler(s) is/are not adjusted to these frequencies.

➔ Configure a maximum transmitter output of 1,000 mW via the NMC-515 ConfigurationManager for the corresponding carrier(s) using the *carrier* item. This corresponds to a value of 30 dBm.

➔ Adjust the cavity coupler(s) as soon as possible to the corresponding frequencies. The cavity coupler(s) must be adjusted manually.

Procedure described refers to one cavity coupler

The procedure described in the following refers to one cavity coupler. Depending on the DIB-500 R4.1 variant, the work steps may have to be repeated for further cavity couplers.

The tasks listed in the following table must be performed for the adjustment of a cavity coupler.

Table 6.11 Overview of the tasks to be performed (Adjusting a cavity coupler – optional (cavity variant only))

Tasks/work steps	Described in
Connecting the service computer to the TIB transceiver module	Section 6.1.2.1 on page 133
Setting the output rating	Section 6.2.2 on page 144
Measuring and checking the carriers (impedance adjustment)	Section 6.2.3 on page 146

6.2.1 Tools and aids

Table 6.12 provides an overview of tools and aids that are required for adjusting a cavity coupler.

Table 6.12 Overview of tools and aids (Adjusting a cavity coupler – optional (cavity variant only))

Work step	Tools, aids
Setting a cavity coupler to the TX frequency		A service computer that is configured accordingly[1)] | Straight through ethernet cable | VSWR measuring instrument, recommended: – R&S NRT measuring device and the appropriate adapter – NRT-Z44 measuring head and the appropriate adapter | RF connecting cable for connection with the VSWR measuring instrument | Dummy load (50 Ω) | Screwdriver/wrench to loosen the fastening screw of the cavity coupler (for frequencies ≥ 800 MHz)

1) see the "Service computers for ACCESSNET®-T IP" configuration manual

6.2.2 Setting the output rating

To adjust the cavity coupler to a new Tx frequency, a sufficiently high output power must be set so that changes at the handwheel of the cavity coupler are detectable at the measuring device.

Proceed as follows to set the output power to a standard value:

Preparation:
✓ The tools and aids must be available, refer to section 6.2.1 on page 144.
✓ The current transmission power and frequency must be known.
✓ The On/Off switches must be set to switch position "On" (switch position: up), see Figure 3.15 on page 43.
✓ The service computer must be connected via Ethernet cable, see section 6.1.2.1 on page 133.
✓ The service computer must have been started.

Carry out the following steps:
1. Call up the command prompts via the Windows menu *Start* > *Run*.
2. Enter the command **`cmd`** .
   ➥ The command prompt window opens.
3. Initiate a TELNET session to the BSC command shell by entering the command **`telnet 10.xxx.xxx.XX 5100`** to query the frequency of all active carriers.

   xxx corresponds to the IP address of the BSC (PUC) depending on the site, refer to the project-specific documents.

   XX corresponds to the IP address of the PowerPC of the corresponding TIB.
4. After the command prompt, enter **`u S3`** to change to user level 3.
5. Enter the command **`p 1 -A sbue sbcc 02 0x`** to check the configured output power of the corresponding carrier;

   x corresponds to carrier no.

   ➥ The power of the corresponding carrier is displayed in mW:

```
BSC Command Shell tobs-ppc (Port: 5100)
u
'puc_1'-BSC 10.32.36.17 (5100) >u **
Password OK
User Level: 3
Command is okay
p l -A sbue sbcc 02 01
'puc_1'-BSC 10.32.36.17(5100)>pl-A sbue sbcc 02 01
Appl Node No In Description          Parameter value R
-------------------------------------------------------SBUE SBCC 02
01 Transmit power of the carrier in mW 600
Command is okay
```

6. Repeat this work step for all the carriers that have to be set accordingly.
7. Enter the **`p s sbue sbcc 02 0x 25000`** command to set the output power to 25 W;

   x corresponds to the carrier number.

   ➥ The following output is displayed:
   ```
   'puc_1'-BSC 10.32.36.17 (5100) >p s sbue sbcc 02 01 25000
   SBUE SBCC 02 01 Transmit power of the carrier in mW 25000
   Command is okay
   ```
8. Repeat this work step for all the carriers that have to be set accordingly.
9. Enter the **`car hw-reset x`**,

   x corresponds to carrier no.

   ➥ The following output is displayed:
   ```
   'puc_1'-BSC 10.32.36.17 (5100) >
   car hw-reset 1
   'puc_1'-BSC 10.32.36.17 (5100) >car hw-reset 1
   Command is okay
   ```
10. Use the command **`bsca la`** to check whether the corresponding carriers have actually been reactivated.
    ➥ The following output is displayed:
    ```
    bsca la
    'puc_1'-BSC 10.32.36.17 (5100) >bsca la
    Active Alarms of component BSC:
    --------------------------------
                none

    Active Alarms of component CAR1:
    --------------------------------
                none
    Active Alarms of component CAR2:
    --------------------------------
                none

    Command is okay
    ```

Take note of the status

A carrier is enabled when the output for the corresponding carrier shows none . If the carrier has not been enabled, you have to repeat the command..

✓ You have successfully set the output power.

6.2.3 Measuring and checking the carriers (impedance adjustment)

For all the variants of the DIB-500 R4.1 the same procedure is used for measuring and checking carriers (impedance adjustment). Depending on the variant, the hand wheel of the cavity combiner is secured with a mounting screw.

NOTICE

Overheating of the Tx insulator

The Tx insulator of the respective cavity coupler can overheat during the impedance adjustment.

➔ Close the impedance adjustment within 10 minutes.

➔ As an alternative, you can interrupt the process and wait until the Tx insulator has cooled off.

Additional work steps (depending on the variant)

Depending on the variant, the mounting screw of the hand wheel may have to be loosened/tightened using a screwdriver/spanner before/after adjusting the cavity combiner.

Measuring instrument used

The procedure for impedance adjustment described below applies exclusively to the use of the recommended R&S NRT VSWR measuring equipment (incl. NRT-Z44 measuring equipment). If impedance adjustment was performed with a different measuring instrument, always proceed in keeping with the product documentation of the measuring instrument used.

Measuring and checking carriers (impedance adjustment)

Preparation:

✓ The tools and aids must be available, refer to section 6.2.1 on page 144.

Carry out the following steps:

1. Disable all the corresponding carriers with the command **`car shutdown x`**;x corresponds to carrier no.
   ➥ The following output is displayed:
   `car shutdown 1'puc_1'-BSC 10.xx.xx.XX (5100) >car shutdown 1Command is okay`
2. Use the command **`bsca la`** to verify whether the corresponding carriers are actually disabled.
   ➥ A carrier is disabled when the output for the corresponding carrier yields CAR_DOWN_EVP. If the carrier has not been disabled yet, you have to repeat the corresponding command.

NOTICE

If neither an antenna is mounted nor a dummy load is applied when the antenna cable is removed, an overload may occur due to the missing terminating resistance . The components fitted could then be damaged.

➔ Ensure that the original antenna is connected to the antenna connector above the equipment cabinet, refer to Figure 6.4.

➔ Otherwise, fit a dummy load (50 Ω) to the antenna connection.

3. Remove the antenna cable from the corresponding antenna connector, refer to Figure 6.4.

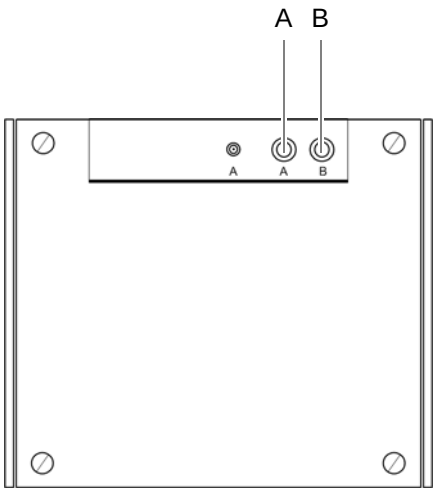

Figure 6.4 Antenna connectors

4. Plug the connecting cable of the respective measuring probe including the adapter into the free antenna connector, refer to Figure 6.5.

5. Connect the antenna cable to the adapter of the measuring probe. Alternatively, connect a dummy load (50 Ω), refer to Figure 6.5.

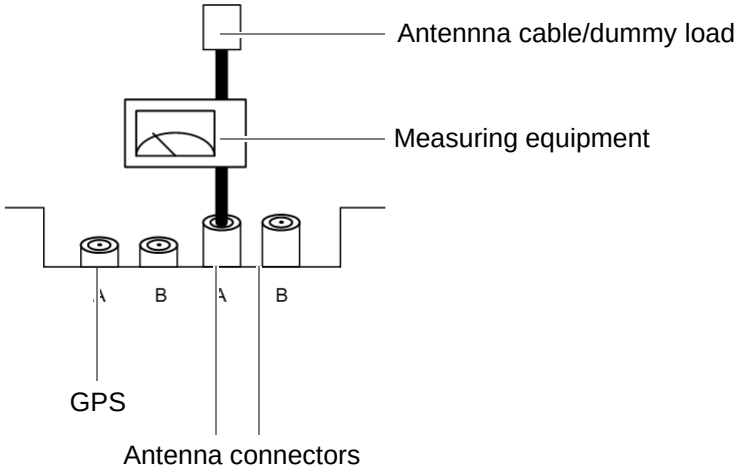

Figure 6.5 Connected measuring equipment

6. Switch on the appropriate measuring equipment and check the AVG (W) and SWR of the R&S NRT measuring equipment on the display.
7. Enable the carrier to be measured with the command **`car sw-reset x`**, x corresponds to carrier no.
   ➥ The set power is displayed:RF output power on the R&S NRT (display [AVG]).
8. Release the hand wheel on the front of the corresponding cavity coupler.

Adjusting the maximum transmitter output

The handwheel must be adjusted so that the maximum transmitting power is achieved. When turning the handwheel, the transmitting power climbs to a maximum value and then drops back down with continued turning. If this happens, turn the cavity coupler handwheel back in the opposite direction in order to reset the maximum value.

NOTICE

Damage to circulators

When new frequencies are configured via the NMC-515 network management client, the circulators may be damaged if the cavity coupler(s) is/are not adjusted to these frequencies.

➔ Configure a maximum transmitter output of 1,000 mW via the NMC-515 ConfigurationManager for the corresponding carrier(s) using the *carrier* item. This corresponds to a value of 30 dBm.

➔ Adjust the cavity coupler(s) as soon as possible to the corresponding frequencies. The cavity coupler(s) must be adjusted manually.

9. Use the cavity coupler handwheel to adjust the Tx frequency until the maximum transmitter output is present at the antenna connection.

Maximum transmitter output measurement

The maximum transmitter output measurement must always be greater than the value produced by the following formula: Maximum transmitter output configuration - 5 dBm.

10. Tighten the handwheel on the front of the corresponding cavity coupler again.
11. Disable the measured carrier again with the command **`car shutdown x`**,

    x corresponds to carrier no.

12. Repeat the previous work steps beginning with step 7. for all the carries to be measured.
13. Remove the antenna cable or the dummy load from the adapter of the measuring probe.
14. Remove the corresponding measuring equipment and reconnect the antenna cable.
15. Set the output power back to the permissible value (network-specific) with the command **`p s sbue sbcc 02 0x XXXXX`**;

    x corresponds to carrier no.;

    XXXXX corresponds to the power in W. For information on the permissible value, please refer to the project-specific documents.

16. Re-enable all the carriers with the command **`car sw-reset x`**,

    x corresponds to carrier no.

17. Use the command **`bsca la`**to check whether the corresponding carriers have actually been reactivated.
    ➥ The following output is displayed:

```
bsca la'puc_1'-BSC 10.32.35.17 (5100) >bsca laActive Alarms of
component BSC:---------------------------------
            noneActive Alarms of component CAR1:------------------
---------------             noneActive Alarms of component CAR2:--
------------------------------             noneCommand is okay
```

Take note of the status

A carrier is enabled when the output for the corresponding carrier shows none. If the carrier has not been enabled, you have to repeat the command.

✓ The impedance adjustment has been completed.

6.3 Concluding tasks

Once you have successfully completed the visual inspection via the SMT, you must restore the proper operational state of the product.

Proceed as follows to restore the operating condition

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.

✓ The tools, auxiliary means and materials specified must be available, refer to section 6.1.1 on page 132.

Carry out the following steps:

1. Reconnect the connecting cables to the RJ-45 or LSA+ terminal block on the E1 connection board.
2. If necessary, reattach the Ethernet cables that are intended for the connection to the Ethernet interfaces of the TIB transceiver module.
3. If necessary, reinstall the covers of the equipment rack.
4. Put the network element into operation again, refer to section 9.1 on page 167.

✓ You have restored the proper operating condition of the product.

7 Function tests and operating surveillance

After all the tasks have been performed on the product that have effects on the product and/or its components, the proper operation of all the integrated network and hardware components should be tested. We recommend logging the results of the test.

In addition, it is recommended to perform the tasks described in the following sections in regular intervals during the operation.

Table 7.1 provides an overview of tasks for testing the function and for operational monitoring.

Table 7.1 Overview of tasks (Function tests and operating surveillance)

Tasks/work steps		Described in
Checking operating states	Checking operating statuses via the NMC-511 FaultManager	Section 7.2.1 on page 153
	Checking operating statuses via LEDs of the TIB	Section 7.2.2 on page 153
	Checking operating statuses via LEDs of the SC200 or rectifier modules – optional (only for VAC voltage supply)	Section 7.2.3 on page 154
	Checking operating states via SMT-500	Section 7.2.4 on page 155
Checking the reachability of network elements		Section 7.3 on page 155
Checking voice channels	Checking the voice channel (two carriers)	Section 7.4.1 on page 156
	Checking the voice channel (more than two carriers)	Section 7.4.2 on page 157
Checking standby carriers – optional		Section 7.5 on page 158
Function tests and operating surveillance GPS	Checking the installation site of the GPS antenna	Section 7.6.1 on page 159
	GPS operational monitoring (via NMC-511 FaultManager)	Section 7.6.2 on page 159
	Function tests and fault analysis GPS	Section 7.6.3 on page 161
Checking external antenna coupling systems		Section 7.7 on page 162

7.1 Work equipment for function tests

Table 7.2 provides an overview of the work equipment required for the steps in this chapter.

Table 7.2 Overview of work equipment (function tests and operating surveillance)

Work step	Work equipment
Checking operating statuses via the NMC-511 FaultManager	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" Straight through ethernet cable Network management client NMC-511 FaultManager
Checking voice channels	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" min. two mobile stations
Checking the reachability of network elements	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" Straight through ethernet cable
Function tests and operating surveillance GPS	Network management client NMC-511 FaultManager GPS antenna GPS antenna cable GPS protector

7.2 Checking operating states

The proper operation of the product and the integrated hardware components can be tested manually – provided indicators are available – at the respective hardware component or via a connected NMC-511 FaultManager network management client.

In addition, the operating statuses can be checked via the SMT (Service and Maintenance Tool) hardware component.

Table 7.3 provides an overview of the procedures for checking operating states of the DIB-500 R4.1.

Table 7.3 Overview of the procedures for checking operating states

Work step	Described in
Checking operating statuses via the NMC-511 FaultManager	Section 7.2.1 on page 153
Checking operating statuses via LEDs of the TIB	Section 7.2.2 on page 153
Checking operating statuses via LEDs of the SC200 or rectifier modules – optional (only for VAC voltage supply)	Section 7.2.3 on page 154
Checking operating states via SMT-500	Section 7.2.4 on page 155

7.2.1 Checking operating statuses via the NMC-511 FaultManager

To check the operating states via the NMC-511 FaultManager, a service computer that is configured accordingly or an NMC computer with installed NMC-511 FaultManager is required which is connected via remote operation using a Remote Desktop connection with the ACCESSNET®-T IP network.

Checking the operating status (via the NMC-511 FaultManager)

Preparation:
✓ The NMC-511 FaultManager must have been started.

Carry out the following steps:
1. Use the *Equipment* view of the NMC-511 FaultManager to navigate to the corresponding network constituent (hardware or software component).
2. Ensure that the corresponding network constituent is shown in green in the *Equipment* view of the NMC-511 FaultManager.
   ➥ If the respective network constituent is shown in red, you must perform a fault analysis, see NMC-511 FaultManager User Manual.
3. Check whether a predecessor alarm status is displayed for the respective network constituent which displays a fault that may already have existed.
   ➥ If the predecessor alarm status is shown in red, it is recommended to generate a report via the *Analysis* perspective.
4. Navigate to the *Service* perspective and check whether corresponding services are shown in green.
   ➥ If services are shown in red, you must perform a fault analysis, see NMC-511 FaultManager User Manual.

✓ The function test has been completed.

7.2.2 Checking operating statuses via LEDs of the TIB

The procedure for checking operating statuses (visual inspection) of integrated network/hardware components is described in the following.

Check the operating states of installed network and hardware components

Preparation:
✓ The electrical connection must be made and commissioning completed.

Carry out the following steps:
➔ Check the operating states of installed hardware components.
   ➥ The Power LED (1) is lit and the Alive LED (2) flashes in periodical intervals, refer to Figure 7.1.

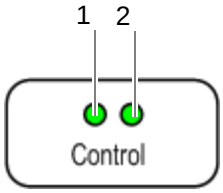

Figure 7.1 TIB indicators

✓ The function test has been completed.

7.2.3 Checking operating statuses via LEDs of the SC200 or rectifier modules – optional (only for V_{AC} voltage supply)

The proper operation of the voltage supply unit can be checked via the LEDs of the SC200 and the LEDs of the rectifier modules (if available) as well as in the display window of the SC200.

Table 7.4 provides an overview of LED colours of voltage supply unit constituents and describes them in detail.

Table 7.4 LED colours (voltage supply unit)

LED	Colour	Description
POWER	Green	LED for signalling of the voltage supply.
Minor Alarm	Yellow	LED for signalling minor alarms.
Critical/Major Alarm	Red	LED for signalling major and critical alarms.

Table 7.5 provides an overview of the possible alarm states and the corresponding alarm indicators. The visual indicators are shown on the display window of the system controller.

Table 7.5 Alarm states and alarm indicators (system controller)

Alarm state	Visual indicator	Acoustic indicator
A state cannot be displayed	???	---
MINOR	⚠	Acoustic signal every two seconds.
CRITICAL/MAJOR	⊗	Continuous acoustic signal

Proceed as follows to check operating statuses of the voltage supply unit:

Preparation:
✓ The electrical connection must be made and commissioning completed.

Carry out the following steps:
1. Check the LEDs of the SC200 and the rectifier(s). The green LEDs must light permanently.
2. Check the display window of the SC200. No alarms may be displayed.

✓ The function test has been completed.

7.2.4 Checking operating states via SMT-500

The SMT (Service and Maintenance Tool) is a hardware component for checking the operating statuses of the installed transceiver modules.

The following operating statuses can be checked through the SMT:

- Readiness for operation
- Voltage supply
- Readiness for operation of software components (n)
- Temperature
- Availability of the installed carriers

The procedures for checking operating statuses are described in the corresponding product documentation, see Table 7.6.

Table 7.6 Required product documents

Product	Document type
SMT-500	Operating Manual

7.3 Checking the reachability of network elements

Table 7.7 describes the standard IP address that is assigned while loading the platform image of a transceiver module.

Table 7.7 Standard IP addresses of the transceiver modules

Standard IP address
10.255.255.1

After network elements have been connected with the external layer-3 switch, you have to check whether the respective network element can be reached via the IP address of the first transceiver module, see Table 7.7The availability of the IP address is checked with the command **`ping`** .

Proceed as follows to check the reachability of network elements:

Preparation:

✓ The service computer must be connected to the external layer-3 switch.
✓ The service computer must have been started already.

Carry out the following steps:

1. Call up the command prompt with the Windows menu *Start* > *Programs* > *Accessories*.
   ➥ The "command prompt" is displayed.
2. Enter the following command to check the reachability of the network element:

   `ping 10.255.25X.xx`

   "10.255.25X.xx" corresponds to the IP address of the first transceiver module within the network element, see Table 7.7.

✓ You have successfully checked the reachability.

7.4 Checking voice channels

The procedure for checking voice channels depends on the available carries of the DIB-500 R4.1.

The following work steps are required for checking voice channels:

- Checking the voice channel (two carriers)
- Checking the voice channel (more than two carriers)

7.4.1 Checking the voice channel (two carriers)

To check the functionality of the voice connections between the base station and the connected exchanges, voice communication must be set up between two radio sets. Voice communication is always set up on the first free voice channel of the base station. To be able to check all the carriers on site, the voice channels of the carrier already checked must be disabled after a check to be able to use the next carrier for the voice communication. The voice channels are disabled on the command interface of the TOS component of the DIB-500 R4.1. For this purpose, a Telnet connection to the component must be established.

Checking the Voice Channel

Preparation:

✓ The working appliances must be available, refer to section 7.1 on page 152.
✓ The On/Off switches must be in switch position "On" (switch position: up).
✓ The service computer must have been connected refer to section 6.1.2.1 on page 133.

Carry out the following steps:

1. Enter the following command to initiate a TELNET session to the TOS component:

   `telnet 10.xxx.xxx.17 5000`

   xxx corresponds to the IP address of the TOS) depending on the site, refer to the project-specific documents.

2. Enter the access authorization password.
3. Establish voice communication using the two radio sets.
4. Check whether both the radio sets can send and receive voice transmissions.
5. Terminate the voice communication.
6. Enter the following commands one after the other to disable the voice channels on the second carrier of the DIB-500 R4.1:

   `p s lnsw slsw 10 08 00`

   `p s lnsw slsw 10 07 00`

   `p s lnsw slsw 10 06 00`

   `p s lnsw slsw 10 05 00`

7. Re-establish voice communication using the two radio sets.
8. Check whether both the radio sets can send and receive voice transmissions.
9. Terminate the voice communication.
10. Enter the following commands one after the other to disable the voice channels on the first carrier of the DIB-500 R4.1:

```
p s lnsw slsw 10 04 00
p s lnsw slsw 10 03 00
p s lnsw slsw 10 02 00
```

11. Re-establish voice communication using the two radio sets.
12. Check whether both the radio sets can send and receive voice transmissions.
13. Terminate the voice communication.
14. Enter the following command to enable the voice channels that you disabled before:

    ```
    p s lnsw slsw 10 xx 17
    ```

    xx corresponds to the voice channel on the respective carrier

15. Enter the following command to restart the software component:

    ```
    g quit
    ```

    ➥ The TOS component terminates the TELNET connection to the service laptop and restarts.

✓ The check of the voice channel is complete.

Variants with more than two Carriers

For a DIB-500 R4.1 with more than two carriers, the function test must be continued as described in section 7.4.2 on page 157.

7.4.2 Checking the voice channel (more than two carriers)

Checking the voice channels of a DIB-500 R4.1 with more than two carriers requires further work steps in addition to the procedure described in section 7.4.1 on page 156.

Checking the Voice Channel

Preparation:

✓ The working appliances must be available, refer to section 7.1 on page 152.
✓ The On/Off switches must be in switch position "On" (switch position: up).
✓ The SMT and the service computer must have been connected, see Operating Manual SMT-500.

Carry out the following steps:

1. Perform the work steps step 1. to step 13. in section 7.4.1 on page 156 .
2. Enter the following command to disable the fourth carrier:

   ```
   bsce  block  2
   ```

3. Establish voice communication using the two radio sets.
4. Check whether both the radio sets can send and receive voice transmissions.
5. Terminate the voice communication.
6. Enter the following command to disable the third carrier:

   ```
   bsce  block  3
   ```

7. Enter the following command to disable the fourth carrier:

   bsce block 4

8. Establish voice communication using the two radio sets.
   ➥ The voice communication setup is denied because there are no voice channels available.
   ➥ The functionality of the voice channels has thus been proven.
9. Re-enable the voice channels that you disabled before. To this end, enter the following command to restart the TOS software component:

   g quit

   ➥ The TOS software component terminates the TELNET connection to the service laptop and restarts.
10. Establish voice communication with the two radio sets once more to complete the procedure.
11. Check whether both mobile stations can send and receive voice transmissions.
12. Terminate the voice communication.
13. First, enter the following command to enable all the carriers previously disabled:

    bsce deblock x

    x corresponds to the respective carrier

✓ The check of the voice channel is complete.

7.5 Checking standby carriers – optional

ACCESSNET®-T IP optionally supports the operation of the DIB-500 R4.1 with up to two standby carriers that replace up to two carriers that have dropped out with respect to f frequency and function.

As a preventive maintenance measure, it is recommended to check the function of the standby carriers at regular intervals, see section 10.1 on page 169. This is done via the Network Management Client NMC-511 FaultManager.

Table 7.8 Required product documents

Product	Document type	Described in
NMC-511 FaultManager	User Manual	Chapter 4

Checking standby carriers

Preparation:
✓ The respective DIB-500 R4.1 must be in operation.
✓ The NMC-511 FaultManager must have been started.

Carry out the following steps:
1. Block the corresponding operational carrier with the NMC-511 FaultManager using the *System blocking* maintenance function.
   ➥ The corresponding carrier(s) are excluded from operational mode and identified in the *Equipment* view with the "Hammer" icon.
   ➥ Existing standby carriers are disabled.
2. In the NMC-511 FaultManager, check whether the standby carrier(s) are disabled in the *Equipment* view and are not reporting any alarm.

3. Unblock any blocked operational carriers after at least 5 minutes with the *System release* maintenance function.
   ➥ The system blocking of operational carriers has been revoked.
   ➥ Standby carriers are switched back to their original status.

✓ You have successfully checked the standby carriers.

7.6 Function tests and operating surveillance GPS

The following sections describe procedures for function tests and the operational monitoring concerning the GPS functionality of the DIB-500 R4.1.

7.6.1 Checking the installation site of the GPS antenna

To prevent damage caused by insufficient guarding and/or fastening, the installation site of the GPS antenna should be checked following the installation of the GPS antenna.

Proceed as follows to check the installation site of the GPS antenna

Preparation:
✓ The installation and connection of the GPS antenna must have been completed.

Carry out the following steps:
1. Check the installation site of the GPS for proper condition such as the fastening of the antenna mast.

Circumferential range of vision (angle of unobstructed visibility of the sky) of the GPS antenna.

A good circumferential range of vision (angle of unobstructed visibility of the sky according to the recommendations of the manufacturer) must be maintained to ensure proper reception of the GPS antenna. The angle of the GPS antenna supplied is 90 °. When using a third-party GPS antenna, heed the corresponding documentation supplied with the GPS antenna.

2. Check the circumferential range of vision of the GPS antenna.

✓ The visual inspection has thus been completed.

7.6.2 GPS operational monitoring (via NMC-511 FaultManager)

The PUC software component (Processing Unit Controller) monitors the operation of the GPS module. The PUC monitors the function of the GPS receiver and the visible GPS satellites based on the received GPS data.

The NMC-511 FaultManager network management client is convenient for rapidly detecting and localizing faults in an ACCESSNET®-T IP network. This facilitates prompt fault elimination.

All the network constituents of an ACCESSNET®-T IP network are monitored via the NMC-511 FaultManager. Operational states and faults are detected by the network management system and visualized via all the connected workstations with the NMC-511 FaultManager installed and enabled.

The NMC-511 FaultManager displays the operational states and faults in an alarm status list based on the corresponding network element in the respective network infrastructure. This makes permanent network monitoring possible.

The procedures for this purpose are described in corresponding documents, refer to Table 7.9.

Table 7.9 Required product documents

Product	Document type
NMC-511 FaultManager	User Manual

In the NMC-511 FaultManager the operating conditions and errors on network components are represented by so-called alarm objects.

Alarm objects furnish alarms/statuses for properties of hardware and software components. In addition, alarm objects contain information that aids in the context of fault management in the evaluation, localisation and removal of errors.

Output via command line (shell)

In addition to the NMC-511 FaultManager, the messages can also be visualised via the shell of the PUC software component. This requires especially trained technical personnel with "Service Level 3".

If you have any questions on this topic, please revert to your responsible service representative.

Table 7.10 describes the possible messages of the GPS module.

Table 7.10 GPS module – Possible messages

No.	Alarm object (NMC-511 FaultManager)	Message (PUC shell)	Description
1	*GPS module* | *Synchronisation signal*	`GPS_STATUS_1PPS_GPS_ERROR_EVP`	No or insufficient GPS satellite reception
2	*GPS antenna* | *Satellite reception*	`GPS_SATELLITE_CONTACT_ERROR_EVP`	
3	*GPS module* | *NMEA interface*	`GPS_STATUS_NMEA_ERROR_EVP`	No GPS receiver data
4	*GPS antenna* | *Voltage supply*	`GPS_STATUS_ANTENNA_ERROR_EVP`	Malfunction of the voltage supply in the TIB transceiver module
5	*GPS module* | *Voltage supply*	`GPS_STATUS_HW_MODULE_ERROR_EVP`	

Messages if the voltage supply is switched off

The voltage supply for the GPS antenna in the GPS module features a short-circuit monitoring. In case of malfunctions, the PUC switches the voltage supply for the GPS antenna and the GPS module off. All messages are subsequently visualised.

7.6.3 Function tests and fault analysis GPS

Table 7.11 describes the possible causes and required measures relative to the corresponding messages, see Table 7.10 on page 160.

Recommendation

To check the proper operation of the GPS module, the interfacing of a replacement GPS antenna is recommended. Not all damage is detectable by mere visual inspection, for example damage to the GPS protector or to the GPS antenna. For this reason, you should take the measures described in Table 7.11 on page 162 before replacing components.

NOTICE

Damage from electrostatic discharge (ESD)

Electrostatic discharges (ESD) can damage the hardware component(s).

➔ Perform the process steps described here at an ESD workstation.

➔ If no ESD workstation is available, you must wear and ESD wristband for the process steps described here which is connected with an uncoated metallic surface.

NOTICE

Risk of damage

Installed components may be damaged. All the HF connections within the network element may only be established/disconnected when the network element is disconnected from the mains.

➔ Ensure that the voltage supply of the component to be replaced is switched off before you perform any work on the component.

Table 7.11 GPS module – Fault analysis

No.	Possible cause(s)	Required measure(s)
1 2	Badly positioned GPS antenna or a GPS connecting cable that is too long and with excessive attenuation.	Perform the following measures: 1. Check whether messages 4 and 5 are visualised in addition to messages 1 and 2, see Table 7.10 on page 162. In this case, first perform the required measures for messages 4 and 5. 2. Ensure that the voltage supply is switched off. 3. Check the following properties: – Installation location of the GPS antenna – Damage of the GPS antenna and the GPS connecting cable – Length of the GPS connecting cable 4. If necessary, change the installation site of the GPS antenna and/or replace the corresponding components. 5. Restart the PUC software component. 6. Check whether messages are still being visualised. 7. Send the TIB transceiver module in for repair services if the messages 1 and 2 are still being visualised.
3	GPS module defective	Perform the following measures: 1. Check whether other messages are visualised in addition to message 3, see Table 7.10 on page 160. In this case, first perform the required measures for these messages. 2. Check whether messages are still being visualised. 3. Send the TIB transceiver module in for repair services if message 3 is still being visualised.
4 5	| Short circuit on the GPS antenna connection caused by: – damaged GPS antenna – damaged GPS antenna connecting cable – damaged GPS protector | Overvoltage at the GPS antenna connection, e.g. due to lightning strike The voltage supply for the GPS antenna in the GPS module features a short-circuit monitoring. In case of malfunctions, the PUC switches the voltage supply for the GPS antenna and the GPS module off. As a result, messages 1, 2 and 3 are also being reported. In this case, the PUC must be restarted to re-establish the voltage supply after the fault analysis has been performed.	Perform the following measures: 1. Ensure that the voltage supply is switched off. 2. Check the following properties: – Damage of the GPS antenna and the GPS connecting cable – Length of the GPS connecting cable 3. Check the optional GPS protector: – Remove the optional GPS protector, refer to section 11.10.1 on page 222. – Connect the GPS antenna cable directly to the GPS antenna connector on the equipment rack, refer to section 5.10 on page 119. – Check whether messages are still being visualised. 4. If necessary, replace the corresponding components. 5. Restart the PUC software component. 6. Check whether messages are still being visualised. 7. Send the TIB transceiver module in for repair services if the messages 4 and 5 are still being visualised.

7.7 Checking external antenna coupling systems

The operator alone is responsible for checking external antenna coupling systems, insofar as this is not a contractual component of the Rohde & Schwarz Professional Mobile Radio GmbH. An appointed installer of the antenna coupling system is responsible for conducting all the necessary measures and for compliance with the corresponding specifications.

8 Service interruption

The following chapter describes the procedure for the service interruption of the product.

The following service interruptions are distinguished:

- Temporary service interruption
- Permanent service interruption

A service interruption may be required in the following cases:

- Work on an open equipment cabinet
- The replacement of defective components.
- End of operation,
- System malfunction,
- The integration of further components,

Possible Restrictions for the Service

If a product is taken out of service, the operation of other parts in the radio network may be impaired as well. Discuss this problem with your service partner to obtain detailed information on risks and on recommended procedures.

8.1 Temporary service interruption

To interrupt service temporarily, you must turn off the power supply. In addition, depending on the connection variant on site, the equipment rack must be disconnected from the voltage source.

Table 8.1 provides an overview of possible connection types and describes required procedures for disconnection from the voltage source.

Table 8.1 Connection types and procedures for disconnection from the voltage source

Connector type	Procedure
Fixed connection (e.g. distributor box)	Set the corresponding toggle switch on site to the "Off" switch setting or de-energise the fixed connection via a fuse.
Plug with earthing contact	Pull the plug out of the mains socket.

In the version with V_{AC} voltage supply, one voltage supply cable per rectifier module is available via the mounting frame of the voltage supply unit in the equipment rack.

Turn off the power supply

Carry out the following steps:

Voltage supply of the other components

If the DIB-500 R4.1 is operated with V_{AC} voltage supply, the voltage supply unit will still be live when the on/off switches are switched to off.

1. Switch off the voltage supply by flipping down the On/Off switch; refer to Figure 8.1.

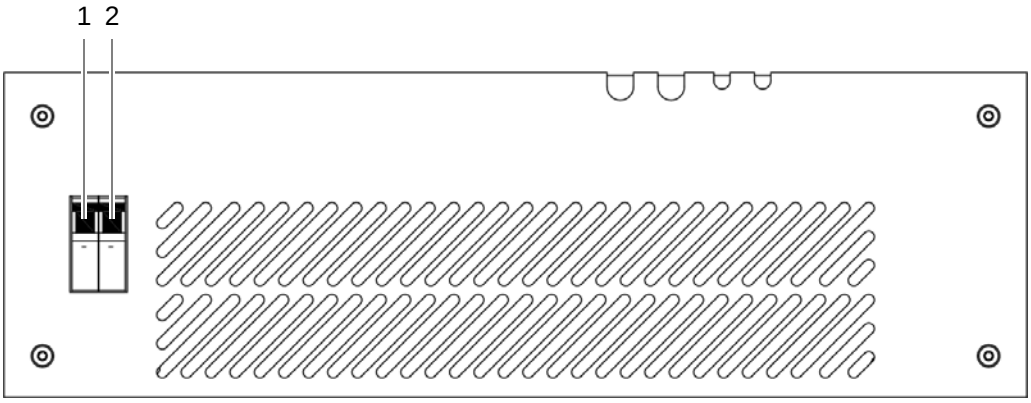

Figure 8.1 On/off switch

➥ The hardware components are switched off.

2. Switch off the voltage source at the location. Alternatively you can switch off the fuse of the sub-distribution.
3. Use a voltmeter to check whether the supply lines from the voltage source at the location are de-energised.
4. Check whether all LED displays of the hardware components and the SC200 are inactive.

✓ You have turned off the power supply.

Recommissioning

The required recommissioning will be pointed out in the corresponding sections.

8.2 Permanent service interruption

The following chapter describes the procedure for performing a permanent shutdown of the product properly.

For a permanent service interruption, all physical connections routed to the outside must be disconnected in addition to the temporary service interruption. This requires that the operation of the network element has already been interrupted temporarily.

Table 8.2 provides an overview of the order for disconnecting physical connections from network elements.

Table 8.2 Disconnecting physical connections (order)

Order	Physical connection
1.	Voltage Supply Cable
2.	Antenna cable: | GPS antenna | TETRA antenna(s) | External antenna coupling systems
3.	Ethernet cable

Permanent service interruption

Preparation:

✓ The operation of the network element must have been interrupted temporarily, refer to section 8.1 on page 163.

Carry out the following steps:

➔ Remove any physical connections from the network element accordingly Table 8.2.

✓ The equipment rack has now been shut down permanently.

Recommissioning

For recommissioning after a permanent shutdown, proceed as described in section 9.2 on page 168.

9 Recommissioning

This chapter describes the procedures for putting the product back into operation.

The following recommissioning situations are distinguished:

- Recommissioning after a temporary service interruption
- Recommissioning after a permanent service interruption

9.1 Recommissioning after a temporary service interruption

To recommission the product, you either have to connect the equipment rack to the voltage source or switch it on, depending on the connection variant.

Table 9.1 provides an overview of possible connection types and describes required procedures for connection to the voltage source.

Table 9.1 Connection types and procedures for connection with the voltage source

Connector type	Procedure
Fixed connection (e.g. distributor box)	Set the corresponding toggle switch on site to the "On" switch setting or energize the fixed connection via a fuse.
Schuko plug	Connect the plug to the mains socket.

When switching on the product, all the hardware components will automatically be started. After about three to five minutes, all hardware components have started up and are ready for operation.

Proceed as follows to recommission a network element after a temporary service interruption:

Preparation:

✓ The equipment rack must be connected to the grounding system.
✓ The voltage source on site must be switched off. This must have been checked with a voltmeter.

Carry out the following steps:

1. Connect the equipment rack to the voltage source on site depending on the connection variant, refer to Table 9.1 on page 167.
2. Switch the voltage source at the location on again, see section Recommissioning after a temporary service interruption on page 167.
3. Switch on the product, refer to section Recommissioning after a temporary service interruption on page 167.

✓ You have successfully recommissioned a network element.

9.2 Recommissioning after a permanent service interruption

The present section describes the proper procedure for recommissioning after a permanent shutdown of the product. For this purpose, the disconnected physical connections must be restored.

Proceed as follows to recommission a network element after a permanent shutdown:

Preparation:
✓ The equipment rack must be connected to the grounding system.
✓ The component rack must be connected to the voltage supply.
✓ The voltage supply must be switched off.

Carry out the following steps:
1. Connect the antennas, refer to section 5.15 on page 129.
2. Connect the required cables, refer to section 5.6 on page 107 and section 5.7 on page 113.
3. Switch on the voltage source, see section 5.14 on page 129.
4. Switch on the DIB-500 R4.1, see section 5.15 on page 129.

✓ You have successfully recommissioned a network element.

10 Maintenance

To ensure the proper operation of products, maintenance tasks and periodical visual inspections are required.

The products have been designed for permanent and unsupervised operation. For this reason, maintenance need not be performed according to a fixed schedule. Still you should make checks from time to time. While doing so, you can look out for any dirt in the vicinity of or inside equipment racks and remove it if required to insure that the air supply and heat dissipation of the product are not affected.

The topical state of the hardware components can be monitored via a connected network management client (NMC-511 FaultManager). For more information on the NMC-511 FaultManager, please refer to the product documentation of the NMC-511 FaultManager.

10.1 Maintenance tasks

Contaminations may impair the air supply and heat output and possibly affect the operation. For this reason, the activities listed below should be performed in the interval specified.

Table 10.1 Maintenance work

Task/s	Interval/s
Replace the fan	after 40,000 operating hours (corresponds to approx. five years)
Replace the air filter pad	Depends on the environmental conditions

Early fan replacement

Independent of the ambient conditions at the installation site, the fan may have to be replaced earlier. For this reason, please comply with the recommended visual inspections and intervals.

10.2 Periodical visual inspections

The table below lists the recommended tasks for maintaining the products. The visual inspections should be performed in the intervals specified to be able to respond in due time, e.g. in the case of changes at the location that may result in improper operation.

We recommend logging the results of the inspection.

Table 10.2 Tasks to be performed during visual inspections and intervals

Task/s	Interval/s[1)]
Site inspection based on the document "Site Requirements“, such as the inspection of the: | Grounding facility | Voltage supply connection | Installation location of the GPS antenna | Condition and fit of all the supply lines and replacement of supply lines as required.	| Upon location changes | Once every year
Check the condition of the product in respect of: | Readiness for operation | Dirt and dust accumulations on and in the equipment rack, clean if required | Check the degree of soiling of the contact pins, remove any dirt if required. | Proper operation of the fan unit; replace the air filter pad as required.	Once every year
Perform a function test of the external alarms – if connected	Once every year
Checking standby carriers – if available	Once every year
Checking external antenna coupling systems	Project specific[2)]

1) depending on the respective environmental conditions at the site of the product, shorter intervals may be required

2) The use of external antenna coupling systems is project specific and dependent on the antenna coupling systems used. The operator alone is responsible for properly checking external antenna coupling systems.

Replacing components

If faults of or damage to components occur, the component affected including the installed software component(s) may have to be replaced.

11 Component replacement

This chapter describes the component replacement of hardware components and, if necessary, the configuration or the software update of installed software components. The safety measures to be followed and prerequisites for the corresponding tasks are described in section 11.1 on page 171. The hardware components that can be replaced are described in section 11.2 on page 172. Tools, aids and materials required for the replacement are described in section 11.2 on page 172.

The product has been designed for continuous operation. In a few cases, however, it may be required to replace installed hardware components and/or update software components installed on the hardware components.

Possible reasons:

- Replacement due to network optimisation
- Replacement due to disruption in operation

11.1 Safety measures and prerequisites

For the component replacement, the following safety measures and prerequisites must be observed:

- The safety regulations must be considered at all times, see chapter 2 on page 21.
- Observe all other activity-based safety measures and prerequisites in the activity descriptions in this chapter.
- The front of the equipment cabinet must be accessible (clearance of at least 700 mm, refer to the document "Site Requirements").
- It must be possible to completely open or remove the cabinet door(s) and the top cover.
- Required tools, aids and materials must be available, see section 11.2 on page 172.
- Note that the component replacement of individual hardware components may require preparatory and finalising tasks. The are described at the beginning of the corresponding section.
- Keep all the materials such as fastening screws in a safe place. You will need them again.
- Cables to be removed must be reconnected correctly when the component is installed. Mark the cables accordingly to ensure that they are connected properly.

11.2 Overview of replacement components and tools, aids and materials

Every replacement component can be uniquely identified via a part number. Please specify the corresponding part number when ordering. In case of questions concerning replacement components and part numbers, please contact Rohde & Schwarz Professional Mobile Radio GmbH.

Table 11.1 provides an overview of replacement components whose replacement is described in this chapter.

Table 11.1 Overview of replacement components

Replacement component		Replacement is described in	Tools, aids and materials described in
TETRA Indoor Base station transceiver (TIB)		Section 11.3 on page 175	Section 11.2.1 on page 172
Antenna Coupling System (ACS)		Section 11.4 on page 179	Section 11.2.2 on page 173
Air filter mat		Section 11.5.1 on page 184	Section 11.2.3 on page 173
Fan subrack		Section 11.5.2 on page 187	
LAN Routing Unit (LRU)		Section 11.6 on page 188	Section 11.2.4 on page 173
Top hat rail power supply unit for operating the LRU		Section 11.7 on page 190	Section 11.2.5 on page 173
Voltage supply unit	Rectifier module	Section 11.8 on page 192	Section 11.2.6 on page 174
	Mounting frame		
Cavity coupler		Section 11.9 on page 218	Section 11.2.7 on page 174
GPS protector (optional)		Section 11.10 on page 221	Section 11.2.8 on page 175

11.2.1 Replacing the TIB transceiver module (tools and aids)

Table 11.2 provides an overview of the tools and aids that are required for replacing the TIB transceiver module.

Table 11.2 Overview of tools and aids (replacing the TIB)

Work step	Tools, aids
Replacing the TIB		Torx screwdriver size TX25 | Flat-bladed screwdriver size 0.6 x 3.5 | Wrench size 8 | Wrench size 19 | Size 8 dynamometric key with a torque of 0.6 Nm | Size 19 dynamometric key with a torque of 1 Nm
Software update and configuration of the TIB		according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" | Straight through ethernet cable

11.2.2 Replacing the ACS (tools and aids)

Table 11.3 provides an overview of tools and aids that are required for replacing the ACS.

Table 11.3 Overview of tools and aids (replacing the ACS)

Work step	Tools, aids
Replacing the ACS	Torx screwdriver size TX25 Flat-bladed screwdriver size 0.6 x 3.5 Wrench size 8 Wrench size 19 Size 8 dynamometric key with a torque of 0.6 Nm Size 19 dynamometric key with a torque of 1 Nm

11.2.3 Replacing components of the fan unit (tools, aids and materials)

Table 11.4 provides an overview of tools, aids and materials that are required for replacing components of the fan unit.

Table 11.4 Overview of tools, aids and materials (replacing components of the fan unit)

Work step	Tools, auxiliaries	Materials
Replacing the air filter pad	---	new air filter pad
Replacing the fan subrack	Torx screwdriver size TX20	---

11.2.4 Replacing the LRU (tools and aids)

Table 11.5 provides an overview of tools and aids that are required for replacing the LRU.

Table 11.5 Overview of tools and aids (replacing the LRU)

Work step	Tools, auxiliaries
Removing the top cover of the equipment rack	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover

11.2.5 Replacing the top hat rail power supply unit (tools and aids)

Table 11.6 provides an overview of tools and aids that are required for replacing the top hat rail power supply unit.

Table 11.6 Overview of tools and aids (replacing the top hat rail power supply unit)

Work step	Tools, auxiliaries
Removing the top cover of the equipment rack	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover
Replacing the top hat rail power supply unit – optional, only variants with redundancy package	Flat-bladed screwdriver size 0.8 x 2.5 Flat-bladed screwdriver size 0.8 x 4

11.2.6 Replacing components of the mounting frame/the voltage supply unit (tools, aids and materials)

Table 11.7 provides an overview of tools, aids and materials that are required for replacing components of the mounting frame/the voltage supply unit.

Table 11.7 Overview of tools, aids and materials (replacing components of the mounting frame/voltage supply unit

Work step	Tools, aids	Materials
Replacing rectifier modules – optional	No. 2 Phillips head screwdriver Size 2 Torque/Phillips head screwdriver with a torque of 1.5 Nm	Material for securing empty rack openings, such as dummy plates
Removing the top cover of the equipment rack	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover	---
Removing the top cover of the equipment rack	No. 1 Phillips head screwdriver	---
Replacing the mounting frame	Torx screwdriver size TX25 Wrench size 10 No. 1 Phillips head screwdriver Wrench size 4 Combination pliers file	Cable tie
Configuring the SC200 – optional	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" Straight through ethernet cable or USB	---

11.2.7 Replacing cavity couplers (tools and aids)

Table 11.8 provides an overview of tools and aids that are required for replacing cavity couplers.

Table 11.8 Overview of tools and aids (replacing cavity couplers)

Work step	Tools, auxiliaries
Replacing a cavity coupler	Phillips head screwdriver size PH2 Coin to unscrew/tighten the mounting screws of the equipment rack top cover
Setting a cavity coupler to the TX frequency	according to the configured service computer, refer to the Configuration Manual "Service Computer for ACCESSNET®-T IP" Straight through ethernet cable VSWR measuring instrument, recommended: – R&S NRT measuring device and the appropriate adapter – NRT-Z44 measuring head and the appropriate adapter RF connecting cable for connection with the VSWR measuring instrument Dummy load (50 Ω) Screw driver/spanner for loosening the mounting screw of the cavity combiner (depending on the variant)

11.2.8 Replacing the GPS protector (tools and aids)

Table 11.9 provides an overview of the tools and aids that are required for replacing the GPS Protector.

Table 11.9 Overview of tools and aids (replacing the GPS protector)

Work step	Tools, aids
Replacing the GPS protector	Size 18 dynamometric key with a torque of 100 Ncm

11.3 Replacing the TIB

An equipment rack can hold as many as two TIB transceiver modules with up to two carriers. If it is required to replace more than one TIB at the same time, we recommend that you perform all the work steps for removing and installing one TIB before you start removing and installing another TIB.

The component is mounted on a holding plate and additionally secured to the equipment cabinet with retaining screws. All the cable connections of the component are on the front. To provide for easy removal/installation, the component features a handle.

The tasks listed in the following table must be performed for the replacement of the TIP transceiver module.

Table 11.10 Overview of the tasks to be performed (Replacing the TIB)

Tasks/work steps	Described in
Temporary service interruption	Section 8.1 on page 163
Removing the TIB	Section 11.3.1 on page 177
Installing the TIB	Section 11.3.2 on page 178
Recommissioning after a temporary service interruption	Section 9.1 on page 167
Software update and configuration of the TIB	Section 11.3.3 on page 179

Figure 11.1 shows the front view of the TIB. The following table describes these indicators in detail.

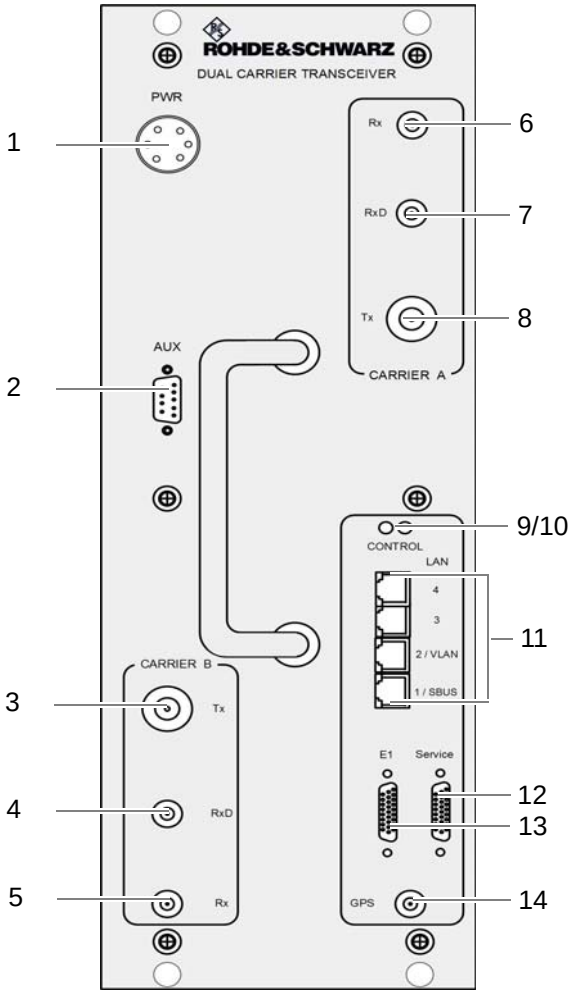

Figure 11.1 TIB (front view)

Table 11.11 Legend: TIB (front view)

No.	Name of connection	Description
1	PWR	48 VDC voltage supply connection
2	AUX	Interface to the antenna connection (Antenna Coupling System, ACS), including voltage supply
3	Tx (Carrier B)	Tx transmitter output carrier B
4	RxD (Carrier B)	Rx receiver input carrier B (Diversity)
5	Rx (Carrier B)	Rx receiver input carrier B
6	Rx (Carrier A)	Rx receiver input carrier A
7	RxD (Carrier A)	Rx receiver input carrier A (Diversity)
8	Tx (Carrier A)	Tx transmitter output carrier A
9	LAN (4)	Ethernet ports, described in Table 3.20 on page 46
10	LAN (3)	
11	LAN (1/SBUS)	
12	GPS	GPS antenna connector

11.3.1 Removing the TIB

The procedure for removing the TIB is described below.

Proceed as follows to remove the TIB:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.10 on page 175.
✓ The tools and aids must be available, refer to section 11.2.1 on page 172.

Carry out the following steps:

NOTICE

Risk of damage

Installed components may be damaged. All the HF connections within the network element may only be established/disconnected when the network element is disconnected from the mains.

➔ Ensure that the voltage supply of the component to be replaced is switched off before you perform any work on the component.

⚠ WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Disconnect all the cables connected to the component.

   Proceed as follows:

   | Remove the power supply cable, see (1) in Figure 11.1 on page 176.
   | Remove all Ethernet cables, see (9) to (11) in Figure 11.1 on page 176.
   | Remove all cables at the Rx receiver inputs and at the GPS antenna connection using a wrench size 8, see (4) to (7) and (12) in Figure 11.1 on page 176.
   | Remove all cables at the Tx transmitter outputs using a wrench size 19, see (3) and (8) in Figure 11.1 on page 176.
   | Remove the cable at the port for the "AUX" antenna connection using a flathead screwdriver size 0.6 x 3.5, see (2) in Figure 11.1 on page 176.

2. Loosen the mounting screws of the component on the front of the equipment rack using a Torx screwdriver size TX25.

NOTICE

Risk of damage

Risk of damage due to high weight (19 kg). The TIB may fall when pushing it in/pulling it out and damage other components.

➔ When pulling the TIB out, additionally support it from below with your other hand.

3. Now cautiously pull the component out along the holder.

✓ The removal of the TIB has been completed.

11.3.2 Installing the TIB

The procedure for installing the TIB is described below.

Proceed as follows to install the TIB:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.10 on page 175.
✓ The tools and aids must be available, refer to section 11.2.1 on page 172.
✓ You need the mounting screws removed with the component.

Carry out the following steps:

NOTICE

Risk of damage

Risk of damage due to high weight (19 kg). The TIB may fall when pushing it in/pulling it out and damage other components.

➔ When pulling the TIB out, additionally support it from below with your other hand.

⚠ WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Cautiously slide in the component along the holding plate from the front until the connecting pins on the rear of the component slide into the openings provided.
2. Retighten the attachment screws of the component on the front of the equipment cabinet. Use a Torx screwdriver size TX 25 for this purpose.
3. Properly reconnect all the cables to the component.

Proceed as follows:

- Connect the corresponding cable at the port for the "AUX" antenna connection using a flathead screwdriver size 0.6 x 3.5, see (2) in Figure 11.1 on page 176.
- Connect the corresponding cables at the Tx transmitter outputs with a dynamometric key size 19 using a torque of 1 Nm, see (3) and (8) in Figure 11.1 on page 176.
- Connect the corresponding cables at the Rx receiver inputs and at the GPS antenna connection with a dynamometric key size 8 using a torque of 0.6 Nm, see (4) to (7) in Figure 11.1 on page 176.
- Connect the Ethernet cables at each of the respective intended ports, see (9) to (11) in Figure 11.1 on page 176.
- Connect the power supply cable, see (1) in Figure 11.1 on page 176.

4. Perform the concluding tasks, refer to Table 11.10 on page 175.

✓ You have successfully installed the TIB.

11.3.3 Software update and configuration of the TIB

The software update and the configuration of the TIB are performed through network management clients via an Ethernet connection to the service computer.

The tasks listed in the following table must be performed for the configuration of the TIB.

Table 11.12 Overview of the tasks to be performed (Software update and configuration of the TIB)

Tasks/work steps	Described in
Connecting the service computer to the TIB transceiver module	Section 6.1.2.1 on page 133
Deleting the ARP buffer	Section 6.1.3 on page 134
Configuring and generating network configurations via the NMC-515 ConfigurationManager	Section 6.1.4 on page 134
Creating the download repository	Section 6.1.5 on page 135
Adapting IP addresses (with more than one transceiver module)	Section 6.1.6 on page 135
Performing an initial download via NMC-522 DownloadManager	Section 6.1.7 on page 142

11.4 Replacing the ACS

The component is mounted on a holding plate and additionally secured to the equipment cabinet with retaining screws. All the cable connections of the component are on the front. To provide for easy removal/installation, the component features a handle.

The tasks listed in the following table must be performed to replace the ACS.

Table 11.13 Overview of the tasks to be performed (Replacing the ACS)

Tasks/work steps	Described in
Temporary service interruption	Section 8.1 on page 163
Removing the ACS	Section 11.4.1 on page 181
Installing the ACS	Section 11.4.2 on page 183
Recommissioning after a temporary service interruption	Section 9.1 on page 167

Figure 11.2 shows the front view of the ACS. The following table describes the components in greater detail.

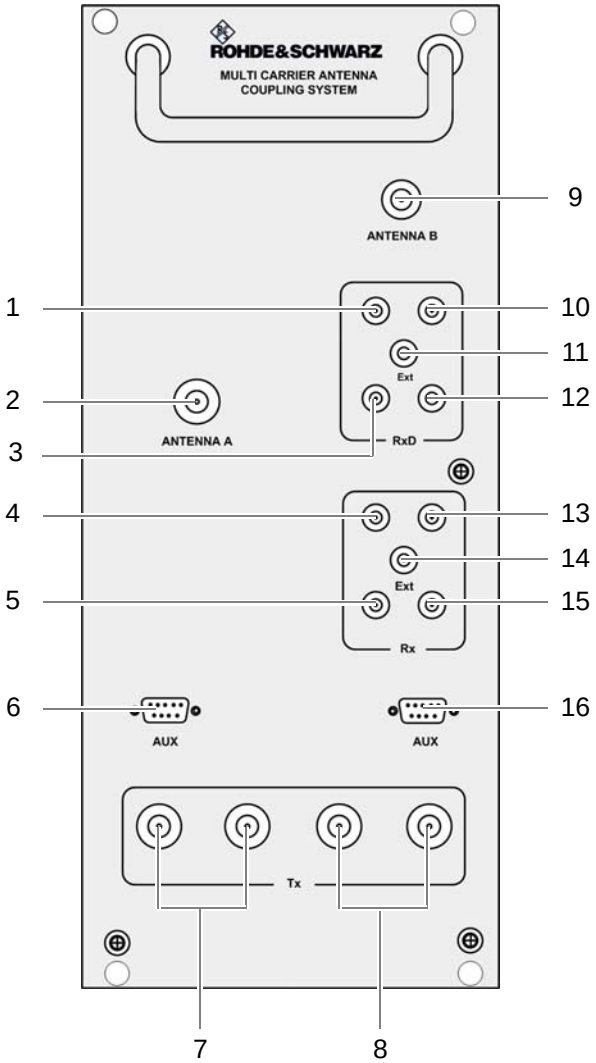

Figure 11.2 ACS (front view)

Table 11.14 Legend: ACS (front view)

No.	Supply	Description
1	RxD (TIB A_1)	Antenna B Rx output carrier TIB A_1 (only in the case of diversity)
2	Antenna A	Antenna A Tx/Rx antenna connection
3	RxD (TIB A_2)	Antenna B Rx output carrier TIB A_2 (only in the case of diversity)
4	Rx (TIB A_1)	Antenna A Rx output carrier TIB A_1
5	Rx (TIB A_2)	Antenna A Rx output carrier TIB A_2
6	AUX (TIB A)	Interface to the TIB A transceiver module (including voltage supply)
7	Tx (TIB $A_{1/2}$)	Antenna A[1)] Tx inputs carrier TIB $A_{1/2}$
8	Tx (TIB $B_{1/2}$)	Antenna A[1)] Tx inputs carrier TIB $B_{1/2}$
9	Antenna B	Antenna B (Tx)/Rx antenna connection
10	RxD (TIB B_1)	Antenna B Rx output carrier TIB B_1 (only in the case of diversity)
11	RxD Ext	Interface (input) for connecting the reception paths of another ACS for diversity reception (with > 4 carriers)
12	RxD (TIB B_2)	Antenna B Rx output carrier TIB B_2 (only in the case of diversity)
13	Rx (TIB B_1)	Antenna A Rx output carrier TIB B_1
14	Rx Ext	Antenna A interface (output) for connecting another ACS (with > 4 carriers)
15	Rx (TIB B_2)	Antenna A Rx output carrier TIB B_2
16	AUX (TIB B)	Interface to the TIB B transceiver module (including voltage supply)

1) depending on the ACS variant

11.4.1 Removing the ACS

The procedure for removing the ACS is described below.

Proceed as follows to remove the ACS:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.10 on page 175.
✓ The tools and aids must be available, refer to section 11.2.2 on page 173.

Carry out the following steps:

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Disconnect all the cables connected to the component.

Proceed as follows:

- Remove the cable at the "AUX" port using a flathead screwdriver size 0.6 x 3.5, see (6) in Figure 11.2 on page 180.
- Remove the cables at ports "Antenna A" and "Antenna B" as well as at the antenna inputs "Tx" using a wrench size 19, see (2), (7) and (8) in Figure 11.2 on page 180.
- Remove the cables at the antenna outputs "Rx" and "RxD" using a wrench size 8, see (1) and (3) to (5) in Figure 11.2 on page 180.

2. Loosen the mounting screws of the component on the front of the equipment rack using a Torx screwdriver size TX25.
3. Remove the terminating resistors (if available, variant-dependent) from the Rx multicouplers on the front cover of the ACS by screwing them off using the size 8 wrench, refer to Figure 11.3.

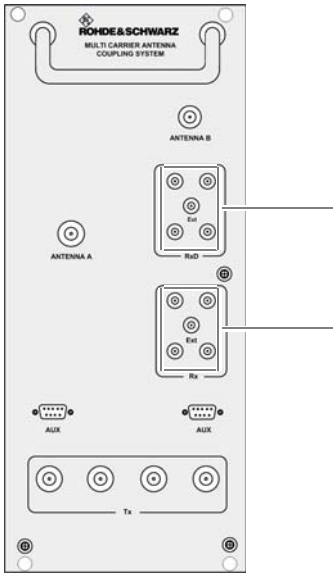

Figure 11.3 ACS front view - terminating resistors (variant-dependent)

NOTICE

Risk of damage

Risk of damage due to high weight (16 kg). The ACS may fall when pushing it in/pulling it out and damage other components.

➔ When pulling the ACS out, additionally support it from below with your other hand.

4. Now cautiously pull the component out along the holder.

✓ You have successfully removed the ACS.

11.4.2 Installing the ACS

The procedure for installing the ACS is described below.

Proceed as follows to install the ACS:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.10 on page 175.
✓ The tools and aids must be available, refer to section 11.2.2 on page 173.
✓ You need the terminating resistors and fastening screws removed with the component.

Carry out the following steps:

NOTICE

Risk of damage

Risk of damage due to high weight (16 kg). The ACS may fall when pushing it in/pulling it out and damage other components.

➔ When pulling the ACS out, additionally support it from below with your other hand.

⚠ WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Cautiously slide in the component along the slide rail holder from the front until the connecting pins on the rear of the component slide into the openings provided.
2. If available, mount the terminating resistors (variant-dependent) properly on the front cover of the ACS again applying a tightening torque of 0.6 Nm with a size 8 dynamometric key, refer to Figure 11.2 on page 180 and Figure 11.3 on page 182.
3. Retighten the attachment screws of the component on the front of the equipment cabinet. Use a Torx screwdriver size TX 25 for this purpose.
4. Properly reconnect all the cables to the component.

   Proceed as follows:

   | Connect the corresponding cables at the antenna outputs "Rx" and "RxD" with a dynamometric key size 8 using a torque of 0.6 Nm, see (1) and (3) to (5) in Figure 11.3 on page 182.

   | Connect the corresponding cables at the ports "Antenna A" and "Antenna B" as well as at the antenna inputs "Tx" with a dynamometric key size 19 using a torque of 1 Nm, see (2), (7) and (8) in Figure 11.3 on page 182.

   | Connect the corresponding cables at the "AUX" port using a flathead screwdriver size 0.6 x 3.5, see (6) in Figure 11.3 on page 182.
5. Verify that all the connections made are properly connected.
6. Perform the concluding tasks, refer to Table 11.10 on page 175.

✓ The installation of the ACS has been completed.

11.5 Replacing fan unit constituents

You can replace the air filter pad or the entire fan unit of the DIB-500 R4.1. The procedures for this are described in the following sections.

- Replacing the air filter pad
- Replacing the fan subrack

11.5.1 Replacing the air filter pad

The fan insert is equipped with an air filter pad that removes dirt and dust particles from the supply air. The air filter pad is accessible via the front side of the equipment rack.

The air filter pad can be hot-swapped. The fan subrack need not be removed for replacing the air filter pad. The air filter pad holder is made up of a plate and a fastener, between which the air filter pad is fixed.

The tasks listed in the following table must be performed for the replacement of the air filter pad.

Table 11.15 Overview of the tasks to be performed (Replacing the air filter pad)

Tasks/work steps	Described in
Removing the air filter pad	Section 11.5.1.1 on page 184
Installing the air filter pad	Section 11.5.1.2 on page 185

11.5.1.1 Removing the air filter pad

The air filter pad is fastened in an air filter pad holder that is secured to the fan insert with two mounting screws.

Table 11.16 describes the positions of the air filter pad holder mounting screws and their significance.

Table 11.16 Positions of the air filter pad holder mounting screws

Position	Description
	Locked
	Unlocked

Proceed as follows to remove the air filter pad:

Carry out the following steps:

1. Turn the air filter pad holder mounting screws by 90° to loosen them, refer to Figure 11.4.

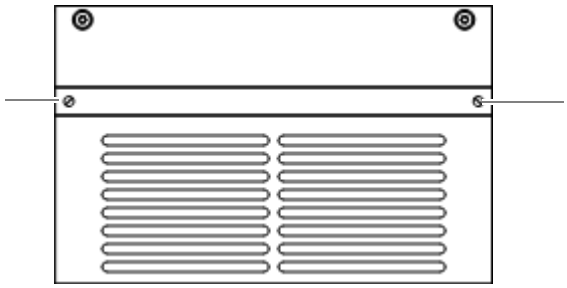

Figure 11.4 Air filter pad holder mounting screws

2. Pull the air filter pad holder out to the front.
3. Remove the fastener of the air filter pad holder by pressing the fastener together and taking it out of the holder.

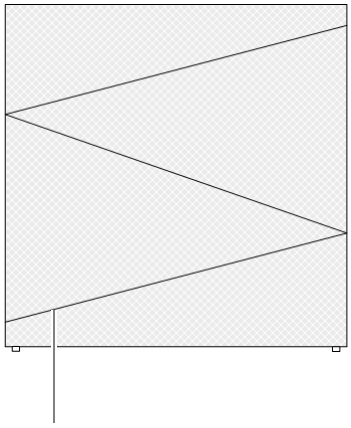

Figure 11.5 Air filter pad fastener (top view)

4. Remove the air filter pad.

✓ You have successfully removed the air filter pad.

11.5.1.2 Installing the air filter pad

To install the air filter pad, the air filter pad holder must be slid back into the fan insert and fastened.

Proceed as follows to install the air filter pad:

Preparation:

✓ You need the air filter pad and the fastener loosened during the removal.

Carry out the following steps:

Positioning the air filter pad

When positioning the air filter pad in the air filter pad holder, ensure that all the edges of the air filter pad are aligned and make firm contact so that supply air cannot flow past the air filter pad. Otherwise dirt and dust particles will not be filtered from the supply air reliably.

1. Position the air filter pad in the air filter pad holder.
2. Press the fastener of the air filter pad holder together to fasten it in the holder again, refer to Figure 11.6.

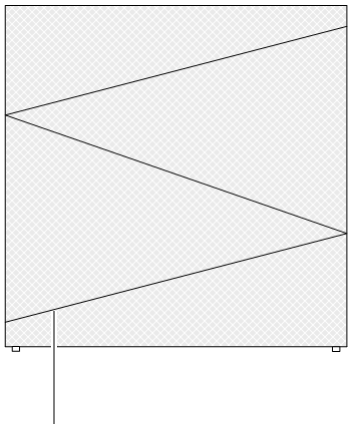

Figure 11.6 Fastener of air filter pad holder (top view)

3. Position the air filter pad holder between the two hold points on the sides of the fan insert.
4. Cautiously slide the air filter pad holder in to the rear.
5. Fit and tighten the air filter pad holder, refer to Figure 11.7.

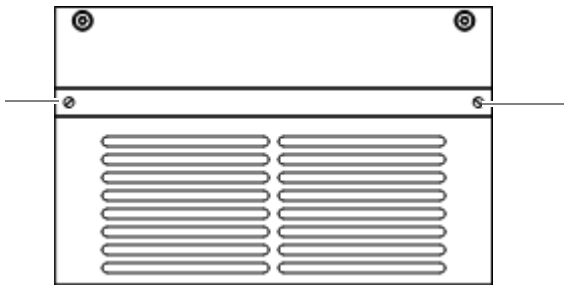

Figure 11.7 Air filter pad holder mounting screws

✓ You have successfully installed the air filter pad.

11.5.2 Replacing the fan subrack

The fan insert is suspended on a mounting rail in the equipment rack and secured to the front of the equipment rack with two mounting screws.

The fan insert can be replaced during operation. In this case, the replacement should be performed fast. Otherwise the TIB transceiver modules may switch off automatically as a factor of the ambient conditions.

NOTICE

Risk of overheating

During the operation without fan subrack, it is possible that the corresponding TIB transceiver module will overheat and be damaged.

➔ Ensure that you install the new fan subrack immediately following the removal.

The tasks listed in the following table must be performed for the replacement of the air filter pad.

Table 11.17 Overview of the tasks to be performed (Replacing the air filter pad)

Tasks/work steps	Described in
Removing the fan subrack	Section 11.5.2.1 on page 184
Installing the fan subrack	Section 11.5.2.2 on page 188

11.5.2.1 Removing the fan subrack

The fan insert is equipped with a voltage supply unit. The voltage supply connector (D-Sub) is on the rear of the fan insert.

Proceed as follows to remove the fan insert:

Preparation:
✓ Ensure that the replacement component is available in its area of use.
✓ The tools and aids must be available, refer to section 11.2.3 on page 173.

Carry out the following steps:
1. Loosen the mounting screws of the fan insert using a Torx screwdriver size TX20 x 80, refer to Figure 11.8.

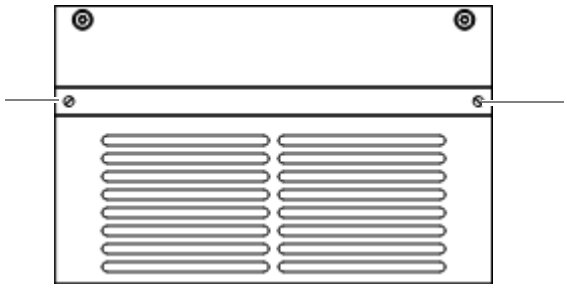

Figure 11.8 Fan insert mounting screws

Resistance when pulling out the fan insert

Slight resistance will be noticed when pulling out the fan insert. Pull the fan insert out further to disconnect the voltage supply connector.

2. Cautiously pull out the fan insert to the front along the holder.

✓ You have successfully removed the fan insert.

11.5.2.2 Installing the fan subrack

The voltage supply connector will be reconnected when the fan insert is installed. Subsequently, the fan will start automatically.

Proceed as follows to install the fan insert:

Preparation:
✓ The tools and aids must be available, refer to section 11.2.3 on page 173.
✓ You need the mounting screws removed with the component.

Carry out the following steps:
1. Slide the fan insert in from the front along the holder.
   ➥ The fan will start automatically.
2. Reattach the fan insert to the front of the equipment rack. Use a Torx screwdriver size TX20 for this purpose.

✓ You have successfully installed the fan insert.

11.6 Replacing the LRU – optional (redundancy package)

For variants with redundancy package (hybrid and cavity) a LAN switch (LAN routing unit, LRU) is additionally used optionally to connect the two equipment racks, i.e. the TIB transceiver modules installed in the racks.

The tasks listed in the following table must be performed for the replacement of the LRU.

Table 11.18 Overview of tasks to be performed (replacing the LRU)

Tasks/work steps		Described in
Preparatory measures	Temporary service interruption	Section 8.1 on page 163
	Removing the top cover of the mounting frame	Section 5.4 on page 94
Removing the LRU		Section 11.6.1 on page 189
Inserting the LRU		Section 11.6.2 on page 190
Concluding tasks	Mounting the top cover of the equipment rack	Section 5.13 on page 129
	Recommissioning after a temporary service interruption	Section 9.1 on page 167

The LRU and the top hat rail power supply unit are installed on a top hat rail and each fastened by a lock.

The LRU is supplied with voltage via a separate top hat rail power supply unit.

Figure 11.9 shows the top view of the installed redundancy package. The following table describes the additional components in detail.

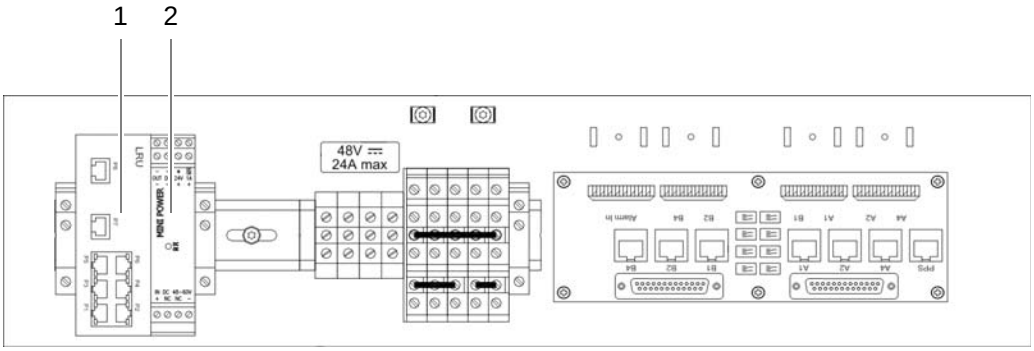

Figure 11.9 Redundancy package (top view)

Table 11.19 Legend: Redundancy package (top view)

No.	Component
1	LRU
2	Top hat rail power supply unit of the LRU

11.6.1 Removing the LRU

The LRU is fastened onto the top hat rail with a locking device, see Figure 11.9 on page 189.

Removing the LRU

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The preparatory measures must be completed, refer to Table 11.10 on page 175.
✓ The tools and aids must be available, refer to section 11.2.4 on page 173.

Carry out the following steps:

1. Secure the LRU with your one hand and pull the red locking device away from the component, refer to Figure 11.10.

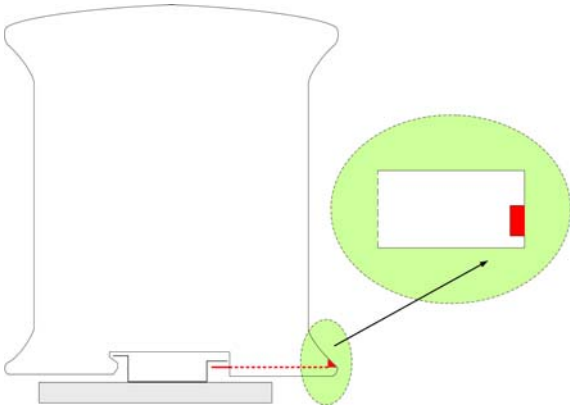

Figure 11.10 Locking device of the LRU (section)

2. Pull the component slightly forward and then upwards off the top hat rail.
3. Remove all the connected cables.

✓ The removal of the LRU has thus been completed.

11.6.2 Inserting the LRU

The procedure corresponds to the description in section 5.5.1.3 on page 102.

11.7 Replacing the top hat rail – optional (redundancy package)

The top hat rail power supply unit is used for the voltage supply of the LRU. For this purpose, the top hat rail power supply unit is connected with the LRU and the terminal block using two power supply cables.

The tasks listed in the following table must be performed to replace the top hat rail power supply unit.

Table 11.20 Overview of the tasks to be performed (Replacing the top hat rail – optional (redundancy package))

Tasks/work steps		Described in
Preparatory measures	Temporary service interruption	Section 8.1 on page 163
	Removing the top cover of the mounting frame	Section 5.4 on page 94
Removing the top hat rail power supply unit		Section 11.7.1 on page 191
Connecting voltage supply cables to the top hat rail power supply unit		on page 100
Installing the top hat rail power supply unit		Section 11.7.2 on page 192
Concluding tasks	Mounting the top cover of the equipment rack	Section 5.13 on page 129
	Recommissioning after a temporary service interruption	Section 9.1 on page 167

Figure 11.11 shows the top hat rail power supply unit on the top hat rail and additional components. The following table describes these indicators in detail.

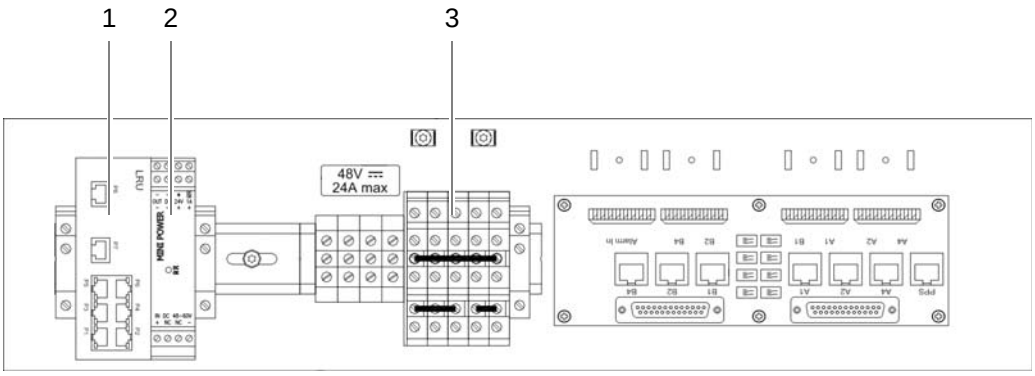

Figure 11.11 Top hat rail power supply unit on the top hat rail

Table 11.21 Legend: Top hat rail power supply unit on the top hat rail

No.	Designation
1	LRU
2	Top hat rail power supply unit of the LRU
3	Terminal block

11.7.1 Removing the top hat rail power supply unit

The top hat rail power supply unit is clamped on with a locking device, refer to Figure 11.11 on page 190.

Proceed as follows to remove the top hat rail power supply unit:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The upper cover of the equipment rack must have been removed, refer to section 5.4 on page 94.
✓ The tools and aids must be available, refer to section 11.2.5 on page 173.

Carry out the following steps:

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Disconnect the voltage supply cables from the top hat rail power supply unit. Us a size 0.8 x 2.5 flat-bladed screwdriver for this purpose.

2. Secure the top hat rail power supply unit with one hand and pull the locking device away from the component using a size 0.8 x 4 flat-bladed screwdriver, refer to Figure 11.12.

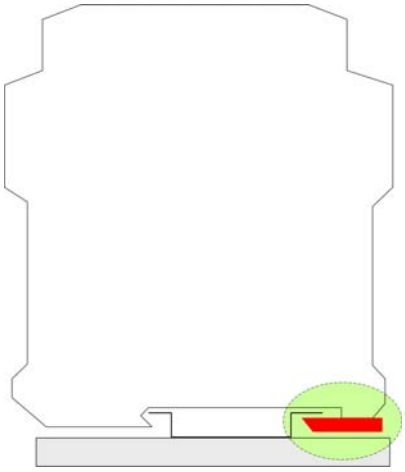

Figure 11.12 Locking device of top hat rail power supply unit

3. Pull the component slightly forward and then upwards off the top hat rail.

✓ You have successfully removed the top hat rail power supply unit.

11.7.2 Installing the top hat rail power supply unit

The procedure corresponds to the description in section 5.5.1.4 on page 103.

11.8 Replacing components of the V_{AC} and alarm system expansion – optional

The standard design of the DIB-500 R4.1 with V_{DC} voltage supply can be expanded by a V_{AC} voltage supply unit or by an alarm system expansion. Depending on the design, additional hardware components are available that can also be replaced.

Table 11.22 provides an overview of the components for the voltage supply and alarm system of the individual versions of the DIB-500 R4.1.

Table 11.22 Components for voltage supply and alarm system

Version	Terminal block	SC200	Alarm input/ output module	Rectifier module
V_{DC} voltage supply (standard)	x	---	---	---
Alarm system expansion	x	x	x	---
V_{AC} expansion	x	x	x	x

Table 11.23 provides an overview of replacement components of the V_{AC} and the alarm system expansion.

Table 11.23 Overview of replacement components (V_{AC} and alarm system expansion)

Replacement component	Replacement is described in
Rectifier module	Section 11.8.1 on page 193
SC200 (the SC200 must always be replaced together with the mounting frame)	Section 11.8.2 on page 196

11.8.1 Replacing rectifier modules

The rectifier module is a hardware subcomponent of the power supply unit and used for converting alternating-current voltage (V_{AC}) into direct-current voltage (V_{DC}).

The tasks listed in the following table must be performed to replace the rectifier modules.

Table 11.24 Overview of the tasks to be performed (Replacing rectifier modules)

Tasks/work steps		Described in
Preparatory measures	Temporary service interruption	Section 8.1 on page 163
Uninstalling rectifier modules		Section 11.8.1.1 on page 193
Installing rectifier modules		Section 11.8.1.2 on page 195
Concluding tasks	Recommissioning after a temporary service interruption	Section 9.1 on page 167

11.8.1.1 Uninstalling rectifier modules

The rectifier module is secured to the mounting frame with a fastening screw.

Remove the rectifier module as follows:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.24 on page 193.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.

Carry out the following steps:

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Loosen the fastening screw of the rectifier module using a size 2 cross-head screwdriver, refer to Figure 11.13.

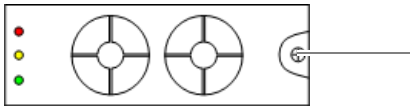

Figure 11.13 Rectifier module fastening screw

➥ When loosening the fastening screw, the rectifier module is slightly pushed out of the mounting frame.

NOTICE

Risk of damage

Damage of the component. The connector of the component is on the rear and may be damaged when stored improperly.

➔ Do not place the component on its rear side. Otherwise the connector may be damaged.

WARNING

Risk of burns

Risk of burns when touching the component. The component may become hot during operation.

➔ Always wear protective gloves when handling the component.

2. Pull the component out of the subrack cautiously.

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off.

➔ Do not reach into the empty subrack with your hand.

3. Take appropriate measures to safeguard the empty subrack, e.g. through dummy panels.

✓ You have successfully removed the rectifier module.

11.8.1.2 Installing rectifier modules

You have to install the rectifier module in the subrack provided for this purpose, refer to Figure 11.14.

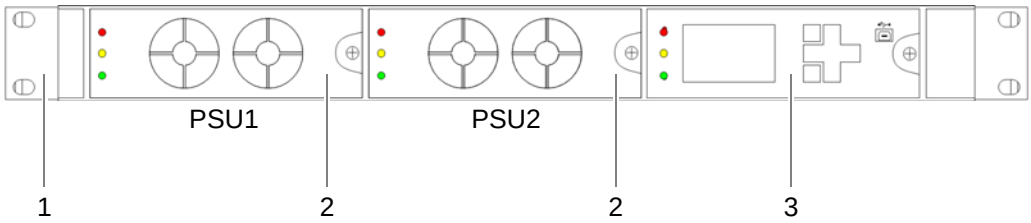

Figure 11.14 Rectifier mounting frame

Proceed as follows to install a rectifier module:

Preparation:
✓ The preparatory measures must be completed, refer to section 11.8 on page 192.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.
✓ You need the mounting screw removed with the component.

Carry out the following steps:
1. Remove the subrack safeguard such as dummy panels if installed.

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

2. Position the rectifier module.
3. Cautiously slide the component into the subrack from the front until the mounting screw touches the mounting frame.

NOTICE

Risk of damage

Damage of installed components. If you apply excessive force when tightening the mounting screw, installed components of the equipment rack may be damaged.

➔ Use a size 2 torque cross-head screwdriver for tightening the fastening screw.

➔ Ensure that the maximum torque does not exceed the following value: **1.5 Nm**.

4. Tighten the mounting screw on the mounting frame.
   ➥ The connector of the rectifier module is connected to the mounting frame.
5. Take the network element back to operation to test the function of the rectifier module, refer to section 9.1 on page 167.
   ➥ The rectifier module starts automatically.
   ➥ The SC200 detects the rectifier module and loads the required configuration parameters.

LED Indicator of the rectifier module

The status of the rectifier module is indicated via the LEDs on the front after the initialisation of the SC200. During the initialisation (approx. 90 seconds) the "Power" LED will light up and the "Minor" LED will flash.

6. Ensure that the "Power" LED (3) is lit and the "Major Alarm" (1) and "Minor Alarm" (2) LEDs are off, refer to Figure 11.15.

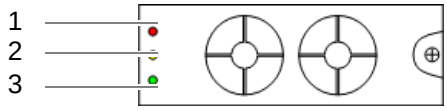

Figure 11.15 Front view of the rectifier module – indicators (LEDs)

7. Perform the concluding tasks, refer to Table 11.24 on page 193.

✓ You have successfully installed the rectifier module.

11.8.2 Replacing the mounting frame and the SC200

Depending on the voltage supply and the optional components, the mounting frame may have different constituents, refer to Table 3.7 on page 37.

The mounting frame is fastened with two retaining brackets that are secured to the equipment rack on the front with four mounting screws.

The tasks listed in the following table must be performed to replace the mounting frame.

Table 11.25 Overview of the tasks to be performed (Replacing the mounting frame and the SC200)

Tasks/work steps		Described in
Preparatory measures	Temporary service interruption	Section 8.1 on page 163
	Removing the top cover of the mounting frame	Section 5.4 on page 94
	Removing the top cover of the equipment rack	Section 5.12.1 on page 124
	Disconnecting external alarms (via alarm input/output module)	on page 198
	Removing connections of the SC200	on page 199
	Removing Plugs with Earthing Contact – optional (only for VAC expansion)	on page 200
	Uninstalling rectifier modules	Section 11.8.1.1 on page 193
Replacing the mounting frame and the SC200	Removing the mounting frame	on page 201
	Preparing the mounting frame	on page 203
	Installing the mounting frame	on page 204
	Attaching connectors of the SC200	on page 206
	Connecting external alarms	Section 5.12.2 on page 126
Concluding tasks	Installing Plugs with Earthing Contact – optional (only for VAC expansion)	on page 207
	Mounting the top cover of the mounting frame	Section 5.12.3 on page 128
	Mounting the top cover of the equipment rack	Section 5.13 on page 129
	Recommissioning after a temporary service interruption	Section 9.1 on page 167
	Configuring the SC200	Section 11.8.2.4 on page 208

11.8.2.1 Preparatory measures

Before you can start with the replacement of the mounting frame, the preparatory tasks listed in the following table must be performed.

Table 11.26 Overview of preparatory measures (Replacing the mounting frame and the SC200)

Tasks/work steps	Described in
Temporary service interruption	Section 8.1 on page 163
Removing the top cover of the mounting frame	Section 5.4 on page 94
Removing the top cover of the equipment rack	Section 5.12.1 on page 124
Disconnecting external alarms (via alarm input/output module)	on page 198
Removing connections of the SC200	on page 199
Removing Plugs with Earthing Contact – optional (only for VAC expansion)	on page 200

Disconnecting external alarms (via alarm input/output module)

Before replacing the mounting frame, the external alarms connected to the alarm input/output module must be disconnected. The alarm input/output module is installed in a mounting frame.

If an external alarm is not connected, alarm jumpers are installed between the terminals of the alarm inputs in the condition as supplied to the customer to short-circuit the contacts. If installed, these alarm jumpers must additionally be removed when external alarms are disconnected. The removed alarm jumpers will be required again when external alarms are reconnected.

Documentation of the specific pin assignment

During commissioning the external alarms were connected depending on the desired alarm signalling. Before disconnecting the external alarms, ensure that the pin assignment is documented properly to be able to restore the original state following the replacement.

Proceed as follows to disconnect external alarms:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The preparatory tasks must have been performed, refer to section 11.8.2.1 on page 197.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.
✓ The pin assignment of the external alarms must be documented for reconnection.

Carry out the following steps:

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Remove the safeguard/s that protect the connected cables in the equipment rack against tensile strain such as cable ties.
2. Cautiously press the lever (1) downward to open the clamps of the connectors (2), refer to Figure 11.16.

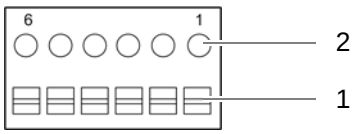

Figure 11.16 Alarm input/output module - connection

3. Remove the wires of the external alarms from the corresponding clamps of the alarm input/output module, refer to Figure 11.16 on page 198.
4. Remove any installed alarm jumpers (3), refer to Figure 11.16 on page 198. You will need them again.
5. Route the cables of the external alarms through the corresponding grommet, refer to Figure 11.17.

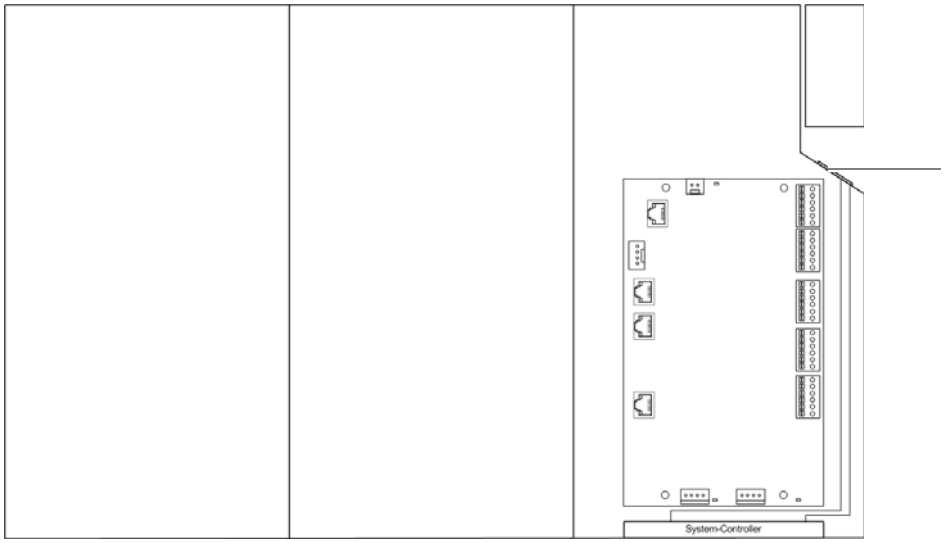

Figure 11.17 Mounting frame grommet (top view)

6. Secure the wires of the external alarms against short circuit.
7. Fasten the cables of the external alarms accordingly in/on the equipment rack.

✓ You have successfully disconnected external alarms.

Removing connections of the SC200

The connections to the SC200 must have been removed to be able to replace the mounting frame.

Figure 11.18 shows the rear view of the system controller. The following table describes these in detail.

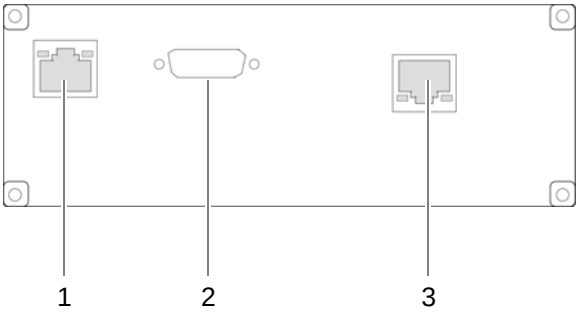

Figure 11.18 Rear view of system controller

Table 11.27 Legend: rear view of system controller

No.	Constituent	Description
1	Ethernet interface	Ethernet interface to the first TIB of the equipment rack (TIB A, LAN 1).
2	Serial interface	not used for the time being
3	Supply voltage connection	Supply voltage connection of the system controller

Proceed as follows to remove connections:

Preparation:
✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The preparatory tasks must have been performed, refer to section 11.8.2.1 on page 197.
✓ The connecting cables must be marked for reconnection.

Carry out the following steps:
1. Remove the cables (1) and (3) from the rear of the SC200, refer to Figure 11.18 on page 199.
2. Route the cables through the appropriate grommets, refer to Figure 11.19.

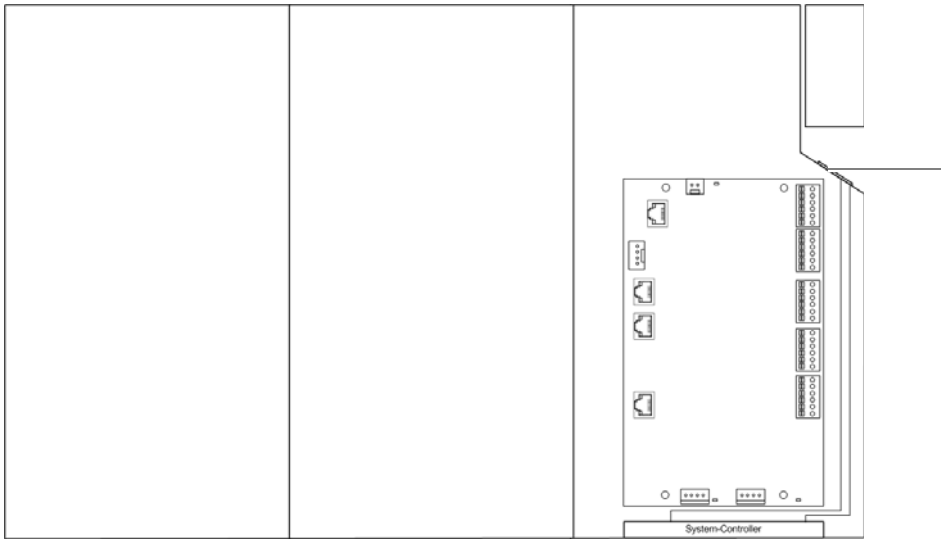

Figure 11.19 Mounting frame grommet (top view)

3. Fasten the cables appropriately in/on the equipment rack.

✓ You have successfully removed connections.

Removing Plugs with Earthing Contact – optional (only for V_{AC} expansion)

If the integrated rectifier module(s) is/are equipped with a plug/plugs with earthing contact, they must be removed before use.

Connection to a Fixed Connection

The plug with earthing contact can be removed when the DIB-500 R4.1 system is to be connected to a fixed connection (e. g. distributor box). In this case, the strand ends of the voltage supply cable/s must be fitted with end sleeves for strands.

Proceed as follows to remove a plug/plugs with earthing contact:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.

Carry out the following steps:

➔ Remove the plug(s) with earthing contact using the tool required for this purpose.

✓ You have successfully removed a plug/plugs with earthing contact.

11.8.2.2 Replacing the mounting frame and the SC200

Before replacing the mounting frame, the corresponding connections must be removed to be able to install/remove the mounting frame. The SC200 is always replaced together with the mounting frame.

Removing the mounting frame

The SC200 and the alarm input/output module are installed in the mounting frame. With V_{AC} voltage supply, additional rectifier modules have been installed that need to be removed before removing the mounting frame.

Depending on the variant (V_{DC}-/V_{AC} voltage supply, optionally additional alarming unit), a grounding cable, the DC voltage supply cable from the terminal block and the AC voltage supply cable(s) are connected to the mounting frame.

Proceed as follows to remove the mounting frame:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.
✓ The preparatory tasks must have been performed, refer to section 11.8.2.1 on page 197.
✓ The rectifier module(s) must have been removed, refer to section 11.8.1.1 on page 193.

Carry out the following steps:

1. Remove all cable ties and strain relief devices of the AC voltage supply cable/s.
2. Route the AC voltage supply cable/s appropriately through the equipment rack so that it does not/they do not get in the way when removing the mounting frame later on.

3. Loosen the mounting screws of the retaining brackets on the front of the equipment rack using a Torx screwdriver size TX 20 x 80, refer to Figure 11.20.

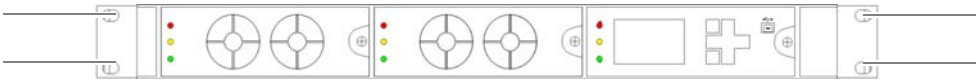

Figure 11.20 Mounting frame mounting screws

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

4. Cautiously pull the component out of the subrack until the cover of the V_{DC} voltage supply connectors on the side of the component is accessible, refer to Figure 11.21.

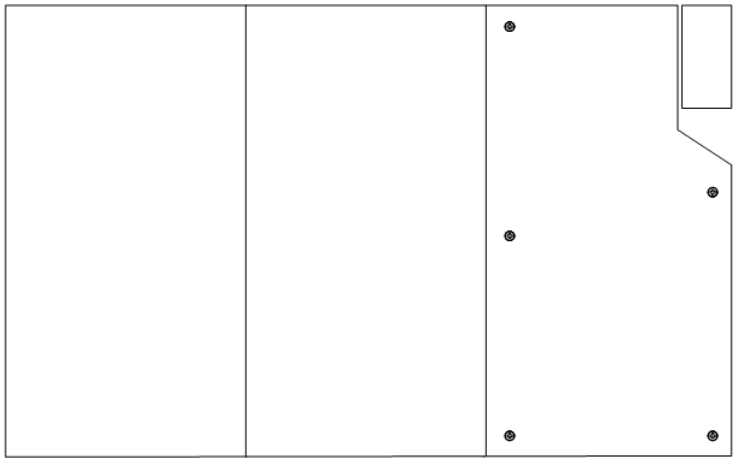

Figure 11.21 Mounting frame – cover of the DC voltage supply connectors (top view)

5. Loosen the nut of the earthing connector using a size 10 wrench.
6. Loosen the mounting screws of the DC voltage supply connector cover using a size 1 cross-head screwdriver, refer to Figure 11.22.

Figure 11.22 Mounting frame – cover of the DC voltage supply connectors (side view)

7. Loosen the nut of the DC voltage supply cables using a size 4 wrench, refer to Figure 11.23.

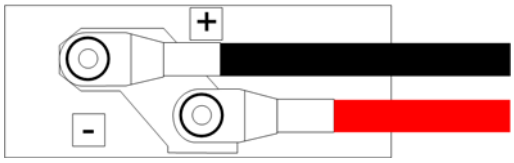

Figure 11.23 Mounting frame – DC voltage supply connectors (side view)

8. Remove the DC voltage supply cables.
9. Pull the component out of the subrack cautiously.
10. Remove the retaining brackets from the component by loosening the fastening screws using a size 1 cross-head screwdriver. The retaining brackets will be required when installing the component again.

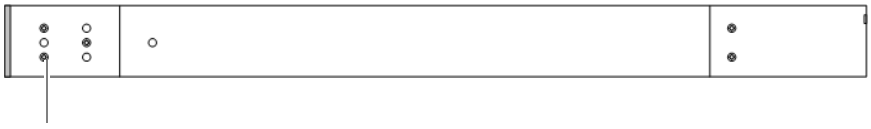

Figure 11.24 Mounting frame – retaining brackets (side view)

✓ You have successfully removed the mounting frame.

Preparing the mounting frame

Before installing the mounting frame, the frame must be prepared appropriately. For this purpose, part of the replacement cover of the DC voltage supply connectors must be broken off along the predetermined breaking pattern.

Proceed as follows to prepare the mounting frame:

Preparation:

✓ The upper cover of the mounting frame must have been removed, refer to section 5.12.1 on page 124.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.

Carry out the following steps:

1. Loosen the mounting screws of the DC voltage supply connector cover using a size 1 cross-head screwdriver..

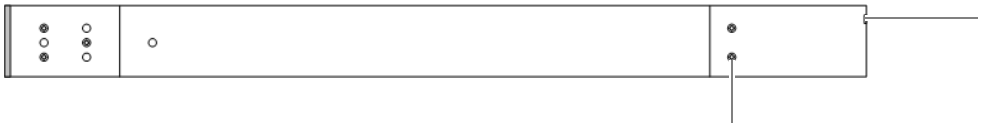

Figure 11.25 Mounting frame – cover of the DC voltage supply connectors (side view)

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

2. Brake off the rear part of the cover along the predetermined breaking pattern. Use combination pliers for this purpose.

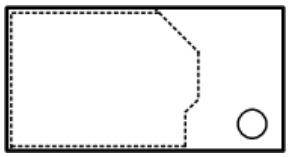

Figure 11.26 Cover of the DC voltage supply connectors - predetermined breaking pattern (rear view)

3. Deburr the edges of the predetermined breaking pattern. Use a file for this purpose.

✓ You have successfully prepared the mounting frame.

Installing the mounting frame

When installing the mounting frame, it must be reconnected to the grounding cable and the DC voltage supply cables. With V_{AC}-voltage supply, the removed rectifier modules must be installed again.

Proceed as follows to install the mounting frame:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The preparatory tasks must have been performed, refer to 11.8.2.1 on page 197.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.
✓ The mounting frame must have been prepared appropriately, refer to section on page 203.
✓ You need the mounting screws removed with the component.
✓ You need the retaining brackets removed with the component.
✓ You need the cover of the DC voltage supply connectors you dismounted when removing the component.

Carry out the following steps:

1. Install the removed retaining brackets again, refer to Figure 11.24.
2. Route the AC voltage supply cable/s appropriately through the equipment rack so that it does not/they do not get in the way when installing the mounting frame later on.

Strain relief of connected cables / connecting lines

When connecting cables and connecting lines, you must ensure that they are protected against tensile strain.

3. Fasten the connected cables in the equipment rack in such a way that they are protected against tensile strain, e. g. by using cable ties.

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

4. Position the component.
5. Cautiously slide the component into the subrack from the front until the grounding cable and the DC voltage supply cables reach up to the connectors on the side of the component.
6. Reconnect the grounding cable properly.
7. Retighten the nut of the grounding cable. Use a size 10 wrench for this purpose.
8. Route the DC voltage supply cables through the corresponding grommet of the DC voltage supply connector cover.
9. Properly reconnect all the cables to the component.
10. Retighten the nut of the DC voltage supply cable. Use a size 4 wrench for this purpose.
11. Mount the cover of the DC voltage supply connectors on the mounting frame again, refer to Figure 11.22 on page 202. Use a size 1 cross-head screwdriver for this purpose.
12. Cautiously slide in the component from the front along the holder until it has completely engaged.
13. Tighten the mounting screws of the retaining brackets again at the front side of the equipment rack. Use a Torx wrench size TX10 20 x 80 for this purpose.

Strain relief of connected cables / connecting lines

When connecting cables and connecting lines, you must ensure that they are protected against tensile strain.

14. Fasten the connected cables in the equipment rack in such a way that they are protected against tensile strain, e. g. by using cable ties.
15. Reinstall the rectifier module/s, see section 11.8.1.2 on page 195.

✓ You have successfully installed the mounting frame.

Attaching connectors of the SC200

The SC200 connections must be installed prior to connecting the external alarms.

Proceed as follows to install the connections:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.
✓ The voltage source on site must be switched off. This must have been checked with a voltmeter
✓ The preparatory tasks must have been performed, refer to section 11.8.2.1 on page 197.
✓ The tools and aids must be available, refer to section 11.2.6 on page 174.

Carry out the following steps:

DANGER

Risk of electric shock

Electric shock when touching live parts. Hardware components in the equipment cabinet are live.

➔ When performing work in the equipment cabinet, ensure that the voltage source on site is switched off. This must have been checked with a voltmeter.

1. Route the cables through the appropriate grommets, refer to Figure 11.27.

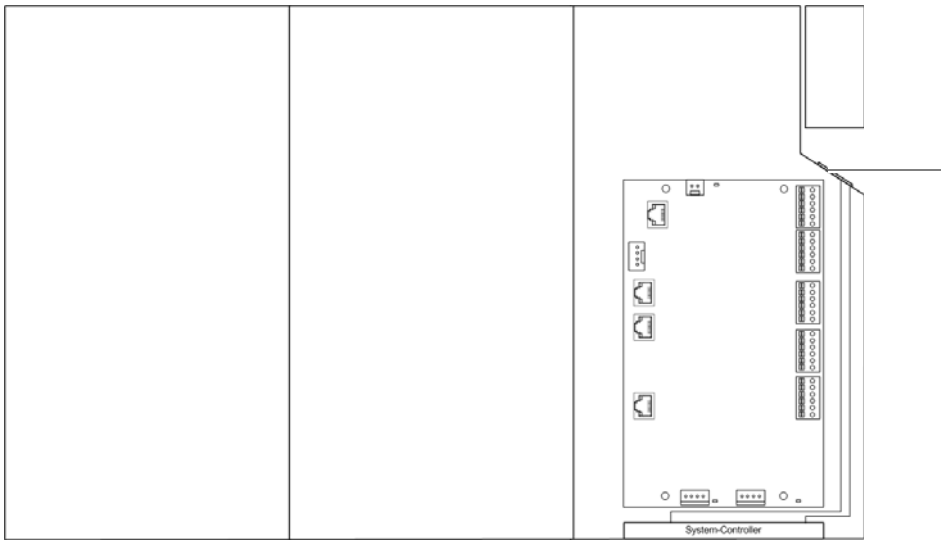

Figure 11.27 Mounting frame grommet (top view)

2. Reconnect all the cables properly to the rear of the component, refer to Figure 11.18 on page 199.

Strain relief of connected cables / connecting lines

When connecting cables and connecting lines, you must ensure that they are protected against tensile strain.

3. Fasten the connected cables in the equipment rack in such a way that they are protected against tensile strain, e. g. by using cable ties.

✓ You have successfully installed the connections.

11.8.2.3 Concluding tasks

To complete the replacement of the mounting frame, the tasks listed in the following table must be performed.

Table 11.28 Overview of finalising tasks (Replacing the mounting frame and the SC200)

Tasks/work steps	Described in
Installing Plugs with Earthing Contact – optional (only for VAC expansion)	on page 207
Mounting the top cover of the mounting frame	Section 5.12.3 on page 128
Mounting the top cover of the equipment rack	Section 5.13 on page 129
Recommissioning after a temporary service interruption	Section 9.1 on page 167
Configuring the SC200	Section 11.8.2.4 on page 208
Function tests and operating surveillance	Chapter 7 on page 151

Installing Plugs with Earthing Contact – optional (only for V_{AC} expansion)

With a V_{AC} voltage supply, the DIB-500 R4.1 system can be connected to the voltage source on site via the following connection variants:

| to a fixed connection (e. g. distributor box),

| or with a plug with earthing contact to a mains socket.

If the integrated rectifier module(s) is/are to be operated with a plug/plugs with earthing contact, the corresponding plugs with earthing contact in compliance with CEE 7/VII must be mounted on the corresponding voltage supply cables.

Mounting plugs with earthing contact

The required mounting of plugs with earthing contact- especially of the grounding cable (grounding conductor) - may vary depending on the country of use and the mains socket.

Proceed as follows to mount a plug/plugs with earthing contact:

Preparation:

✓ The network element must have been put out of operation temporarily, refer to section 8.1 on page 163.

Carry out the following steps:

➔ Mount the plug(s) with earthing contact on the corresponding voltage supply cable(s) using the tool required for this purpose.

✓ You have successfully mounted a plug/plugs with earthing contact.

11.8.2.4 Configuring the SC200

To ensure proper operation of the SC200, it must be configured accordingly. Following the configuration of the IP settings, all the other configuration parameters can be loaded via the "SC200-def_cfg_XXXX-XX-XX.dcc" (XXXX-XX-XX corresponds to the date) configuration file of the S200.

When delivered as a spare part, the SC200 will not yet be configured. In this case, you have to perform the configuration tasks described below.

Table 11.29 describes the possible states of the SC200. Depending on the configuration level, the SC200 needs to be configured following a replacement of the mounting frame.

Table 11.29 State of the replacement component

State	Configuration required
Spare part	x
Replacement part, e. g. from an already available DIB-500 R4.1 system	---

The tasks listed in the following table must be performed for the configuration of the SC200.

Table 11.30 Overview of the tasks to be performed (Configuring the SC200)

Tasks/work steps	Described in
Installing the "DCTools" application	on page 209
Configuring the orientation of the SC200 display window (local)	on page 209
Configuring IP settings of the SC200 (local)	on page 211
Loading the SC200 configuration file (via the "DCTools" application)	on page 213
Uninstalling the "DCTools" application	on page 218

Installing the "DCTools" application

The system controller is configured via the "DCTools" application on the SC200. For this purpose, the application must be installed via a setup wizard. The installation file (Setup) and the configuration file of the SC200 are available on the PV-DVD.

Table 11.31 describes the directory structure of the PV-DVD for the "DCTools" application.

Table 11.31 Directory structure of the PV-DVD – "DCTools" application

Directory	Subdirectory	Content description
software	dctools	This subdirectory holds all the data required for the "DCTools" application: | The installation file of the "DCTools application: "DCTools-X.X.X-Installer.EXE" (X.X.X corresponds to the version number) | Configuration file of the SC200: "SC200-def_cfg_XXXX-XX-XX.dcc" (XXXX-XX-XX corresponds to the date) | The Product Release Note of the "DCTools" application: "PRN0067_A DCTools Version X-X-X.pdf" (X.X.X corresponds to the version number)

Proceed as follows to install the "DCTools" application:

Preparation:
✓ The service computer must have been started.
✓ Any other applications running in the background must have been closed.
✓ The installation file must be available.

Carry out the following steps:
1. Start the Setup Wizard by double-clicking on the installation file and following the instructions during the course of the installation.
   ➥ The "DCTools" application has been installed, started and will be displayed in the Windows task bar.

✓ The installation has been completed.

Configuring the orientation of the SC200 display window (local)

When delivered as a spare part, the SC200 will not yet be configured. In the delivery status, the orientation of the display window in the mounting frame will not be configured. To be able to operate the SC200 properly, the orientation of the display window must be configured.

The orientation of the SC200 display window must be configured via the controls of the SC200.

Controls of the SC200

When delivered as a spare part, the SC200 will not yet be configured. Once the configuration file of the SC200 has been loaded, the controls of the SC200 will be disabled to prevent configuration adaptations.

Configuring the orientation of the display window of the SC200

Preparation:

✓ The voltage source on site must be switched on. This must have been checked with a voltmeter.

✓ The network element must be switched on.

Carry out the following steps:

Using softkeys

The respective function depends on the display in the display window. Softkey 1 is used to call menus and save settings. Softkey 2 is used to call superordinate menus and discard settings.

1. Press softkey 1 to open the main menu, refer to Figure 11.28 on page 210.

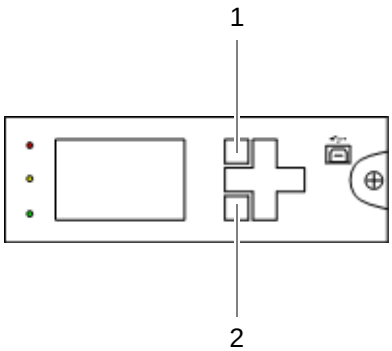

Figure 11.28 SC200 – Softkeys

➥ The main menu will be displayed.

2. Press the navigation button downward twice to navigate to the *Settings* menu.
3. Press softkey 1 to open the main menu.
   ➥ The *Settings* menu will be displayed.
4. Press the navigation button downward once to navigate to the *Setup* menu.
5. Press softkey 1 to open the main menu.
   ➥ The *Setup* menu will be displayed.
6. Press the navigation button downward four times to select the *Orientation* setting.
7. Press softkey 1 to open the main menu.
   ➥ The *Orientation* menu will be displayed.
8. Select the *Set to Horizontal* setting.
   ➥ The orientation will change.
9. Press softkey 1 to save the setting.

10. Press softkey 2 to exit the settings.
11. Press softkey 2 twice to exit the main menu.

✓ You have successfully configured the display window of the SC200.

Configuring IP settings of the SC200 (local)

For the proper operation, each SC200 should have corresponding IP settings. The IP settings will not have been configured upon delivery of the replacement component.

Table 11.32 shows the IP settings that have to be configured for the SC200.

Table 11.32 IP settings of SC200

Setting	Value
IP address – "IP Address" setting	10.255.255.30[1)]
Network mask – "Subnet Mask" setting	10.255.255.0
Gateway (default gateway) – "Gateway Address" setting	10.255.255.1

1) When using the SC200 in the second equipment rack with more than four carriers: 10.255.255.29

The IP settings must be configured via the controls of the SC200.

Controls of the SC200

When delivered as a spare part, the SC200 will not yet be configured. Once the configuration file of the SC200 has been loaded, the controls of the SC200 will be disabled to prevent configuration adaptations.

Configuring the IP settings of the SC200

Preparation:
✓ The voltage source on site must be switched on.
✓ The network element must be switched on.

Carry out the following steps:

Using softkeys

The respective function depends on the display in the display window. Softkey 1 is used to call menus and save settings. Softkey 2 is used to call superordinate menus and discard settings.

1. Press softkey 1 to open the main menu, refer to Figure 11.29 on page 212.

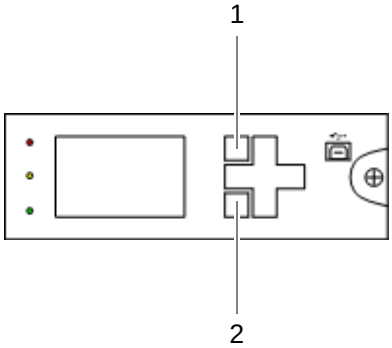

Figure 11.29 SC200 – Softkeys

➥ The main menu will be displayed.
2. Press the navigation button downward twice to navigate to the *Settings* menu.
3. Press softkey 1 to open the main menu.
➥ The *Settings* menu will be displayed.
4. Press the navigation button downward once to navigate to the *Setup* menu.
5. Press softkey 1 to open the main menu.
➥ The *Setup* menu will be displayed.
6. Press the navigation button downward once to select the *IP Address* setting.
➥ The first group of digits is marked, e.g. **10**.255.253.30.
7. Use the "up" and "down" navigation buttons to set the respective value.
8. Use the "left" and "right" navigation buttons to switch between the groups of digits.
9. Set the corresponding IP address, refer to Table 11.33 on page 213.
10. Press softkey 1 to save the settings.
11. Press softkey 2 to exit the settings.
12. Proceed analogously to configure the *Subnet Mask* settings, refer to Table 11.33 on page 213.
13. Proceed analogously to configure the *gateway Address* settings, refer to Table 11.33 on page 213.
14. Press softkey 2 twice to exit the main menu.

✓ You have completed configuring the IP settings of the SC200.

Loading the SC200 configuration file (via the "DCTools" application)

The configuration file of the SC200 contains an adapted configuration for operation in the DIB-500 R4.1. The configuration file is loaded via the application "DCTools".

Upon the first start of the "DCTools" application, a new connection must be established and configured accordingly.

Table 11.33 shows the required settings of the new connection to the SC200. For all the other properties you can accept the default values.

Table 11.33 Required settings of the new connection to the SC200

Property	Required setting
Connection Name	Any
Server IP Address	10.255.255.30

Loading the configuration file of the SC200:

Preparation:
✓ The network element must be switched on.
✓ The IP settings of the SC200 must have been configured.
✓ The IP address of the service computer must be in the same subnet as the network element to be updated, refer to Table 11.32 on page 211.
✓ The "DCTools" application must have been installed.
✓ The configuration file of the SC200 must be available.
✓ The service computer must have been connected, refer to section 6.1.2.1 on page 133.

Carry out the following steps:
1. Start the "DCTools" application via the corresponding entry on the Windows Start menu or, for example via a shortcut on the Windows desktop, if installed.
   ➥ The *Welcome to DCTools* dialogue will open.

Don't show again

Enable (check) this checkbox if you do not want this dialogue to be displayed again in future actions.

   ➥ The application has been started and will be displayed in the Windows task bar.
2. Click the corresponding icon in the Windows task bar.
3. Click the *Connection Manager* item:

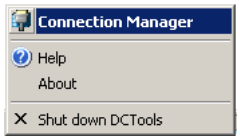

Figure 11.30 Windows task bar – Connection Manager item

   ➥ The *Connection List* window will be displayed.

4. Click the *Create a new connection (Ins)* button to create a new connection.

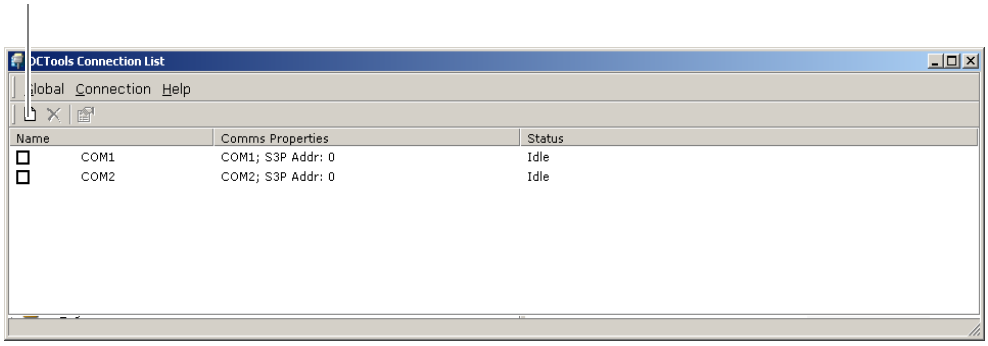

Figure 11.31 "DCTools" application – "Create a new connection (Ins)" button

➥ The *Comms Properties* dialogue box will be displayed.

5. Enter the required settings, refer to Table 11.33 on page 213.

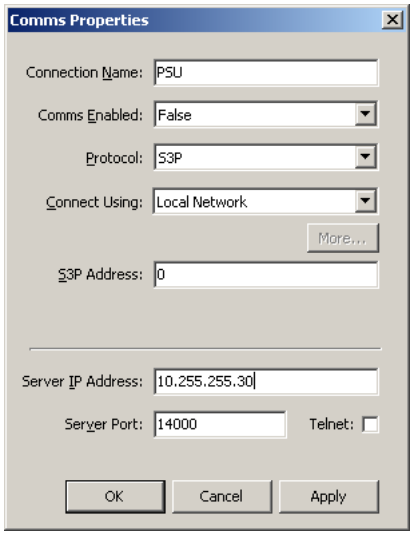

Figure 11.32 "DCTools" application – required settings

6. Click *OK* to save the settings.
   ➥ The connection will be created.
7. Click the checkbox to establish the connection.

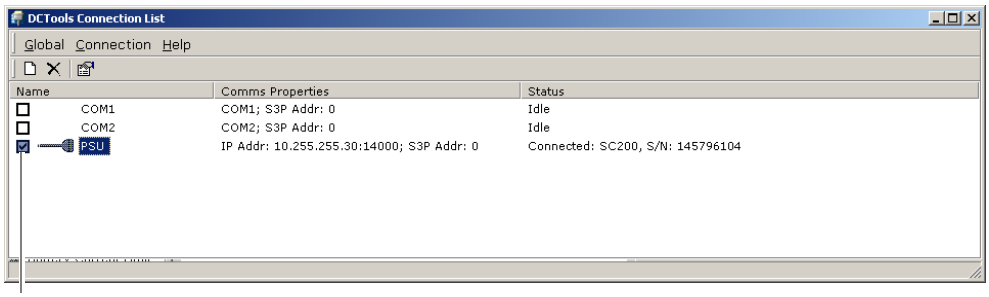

Figure 11.33 "DCTools" application – establish connection

➥ The connection to the SC200 is being established.

➥ The application window of the "DCTools" application opens:

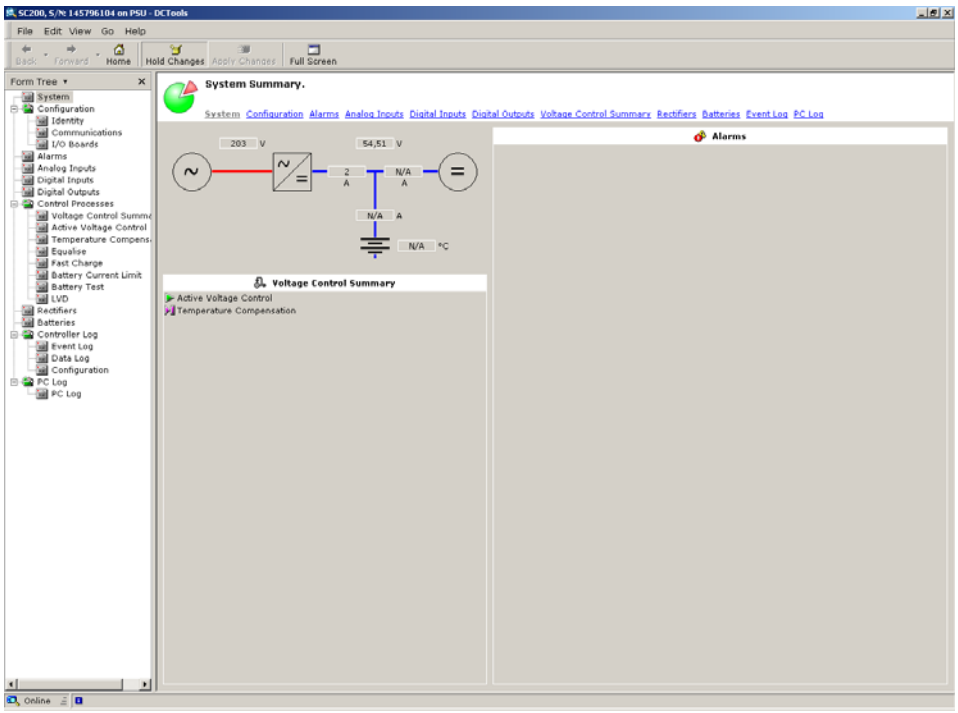

Figure 11.34 "DCTools" application – connection established

8. In the menu, click on *File* > *ICE Backup/Restore*.
   ➥ The following dialogue box will be displayed:

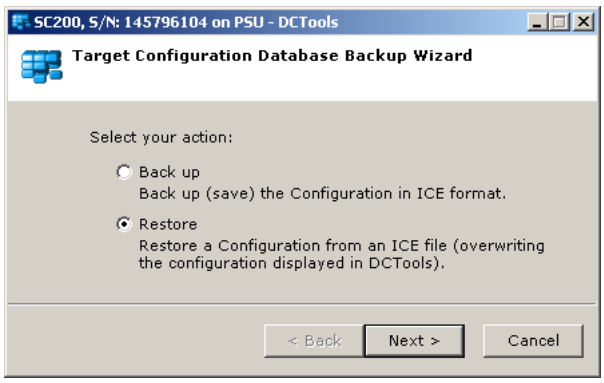

Figure 11.35 "DCTools" application – "Target Configuration ..." dialogue box

9. Select the *Restore* item.
10. Click *Next >*.

➥ The following dialogue box will be displayed:

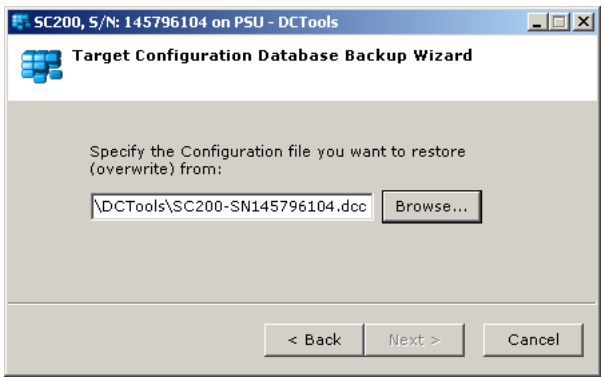

Figure 11.36 "DCTools" application – "Target Configuration ..." dialogue box

11. Click *Browse* to select the configuration file of the SC200.
    ➥ The following dialogue box will be displayed:

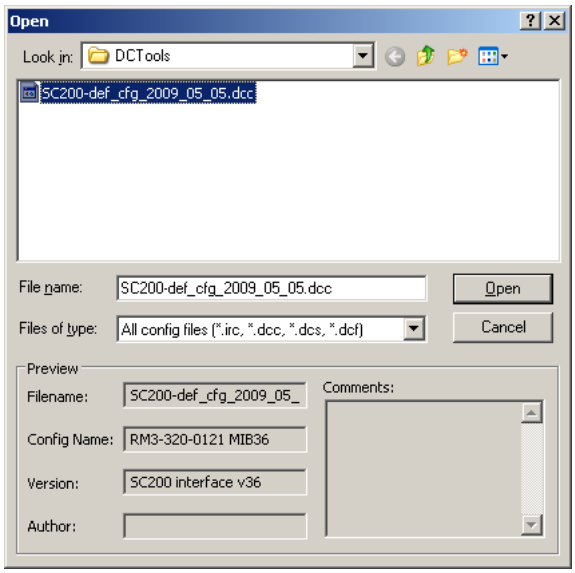

Figure 11.37 "DCTools – "Open" dialogue box

12. Navigate to the configuration file of the SC200, refer to Table 11.31 on page 209.
13. Select the configuration file.
14. Click *Open* to open the configuration file.
    ➥ The configuration file will be opened and the corresponding configuration parameters will be loaded.

➥ The following dialogue box will be displayed after the configuration files have been loaded successfully:

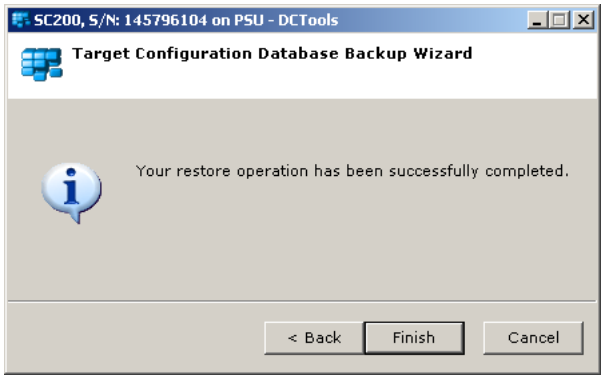

Figure 11.38 "DCTools" application – "Target Configuration ..." dialogue box

15. Click *Finish* to close the dialogue box.
16. In the *Form Tree* area of the application window, navigate to the level *Configuration* > *Communications*, refer to Figure 11.39:

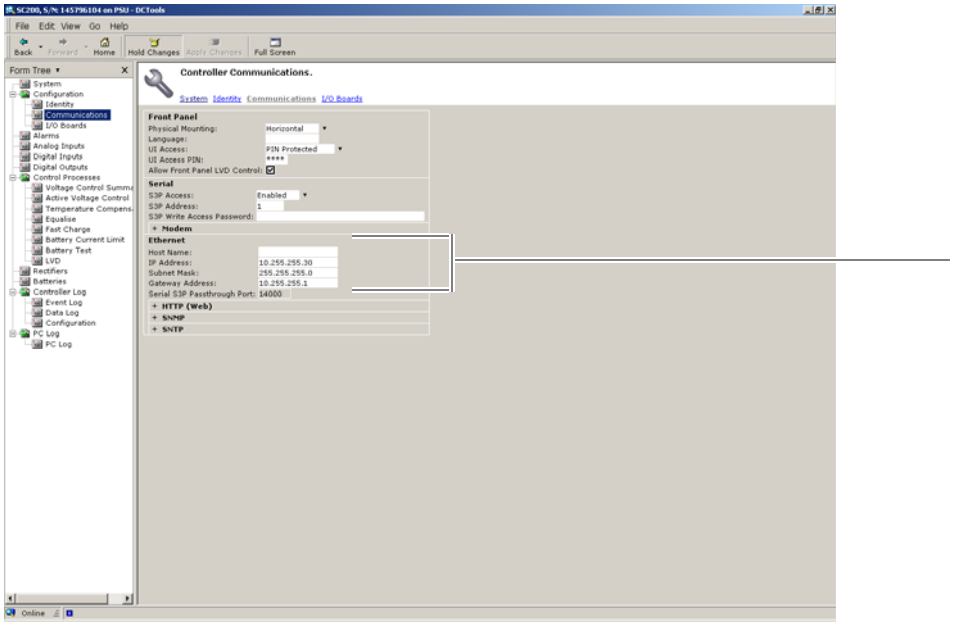

Figure 11.39 "DCTools" application – "Ethernet" area

17. Check the settings of the *Ethernet* area, refer to Table 11.33 on page 213.
18. Exit the application.

✓ You have successfully loaded the configuration file of the SC200.

Uninstalling the "DCTools" application

The "DCTools" application facilitates extensive configuration of the SC200. For this reason, the application must be uninstalled after having configured the SC200 since it is not needed for the functional operation.

The "DCTools" application can be uninstalled via "Add or Remove Programs" in the Windows Control Panel.

Proceed as follows to uninstall the "DCTools" application:

Preparation:
✓ The installation of the SC200 must have been completed.
✓ Administrator rights must have been granted for the respective installation directory.

Carry out the following steps:
1. Start the Windows Control Panel via the *Windows Start Menu* > *Settings* > *Control Panel* > *Software*.
2. Select the "DCTools" application in the list of installed programs and click the "Remove" button to uninstall the application.
   ➥ The *Select Uninstall Method* dialogue opens.
3. Ensure that *Automatic* has been selected and proceed according to the instructions of the Setup wizard.

✓ You have successfully completed the uninstall process.

11.9 Replacing cavity couplers – optional (cavity variants only)

Depending on the number of carriers, up to two equipment cabinets are used for the DIB-500 R4.1 in the cavity variant. The cavity couplers (one per carrier) are installed in the respective equipment cabinet(s) of the DIB-500 R4.1. With more than four carriers, the equipment racks are positioned next to each other on site and connected with each other.

The tasks listed in the following table must be performed for the replacement of a cavity coupler.

Table 11.34 Overview of the tasks to be performed (Replacing cavity couplers – optional (cavity variants only))

Tasks/work steps	Described in
Temporary service interruption	Section 8.1 on page 163
Replacing a cavity coupler	Section 11.3.1 on page 177
Adjusting a cavity coupler – optional (cavity variant only)	Section 6.2 on page 143
Recommissioning after a temporary service interruption	Section 9.1 on page 167

11.9.1 Replacing a cavity coupler

As many as eight cavity couplers can be installed in a DIB-500 R4.1. Each pair of cavity coupler is installed on a mounting plate on the front of the equipment rack. Each cavity coupler is fastened to the mounting plate with four attachment screws from below and two attachment screws from behind. Four screws fasten the mounting plate to the equipment cabinet. To remove a cavity coupler, first remove the mounting plate and then remove the screws fastening the cavity coupler to the mounting plate. The second (operable) cavity coupler stays attached to the mounting plate.

The following sections describe the removal and installation of a cavity coupler.

Procedure described refers to one cavity coupler

The procedure described in the following refers to one cavity coupler. Depending on the DIB-500 R4.1 variant, the work steps may have to be repeated for further cavity couplers.

11.9.1.1 Removing a cavity coupler

The procedure for removing a cavity coupler is described in the following.

Proceed as follows to remove a cavity coupler:

Preparation:

✓ The tools and aids must be available, refer to section 11.2.7 on page 174.

Carry out the following steps:

1. Switch off the voltage supply by flipping down the On/Off switch, refer to Figure 3.15 on page 43.

Specified cable lengths

All cables have specified lengths and must not be mixed. Mark the removed cables during the uninstallation, if necessary, and reconnect the removed cables again to the original connection during reinstallation.

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

2. Disconnect all the cables connected to the component, refer to Figure 3.31 on page 78.

3. Remove the cables, which lead to the top equipment rack and are connected to the insulators that are located on the same mounting plate as the respective cavity coupler, see Figure 3.31 on page 78.
4. Remove the fastening screws of the mounting plate on which the respective cavity coupler is installed using a size 2 cross-head screwdriver, see Figure 11.40.

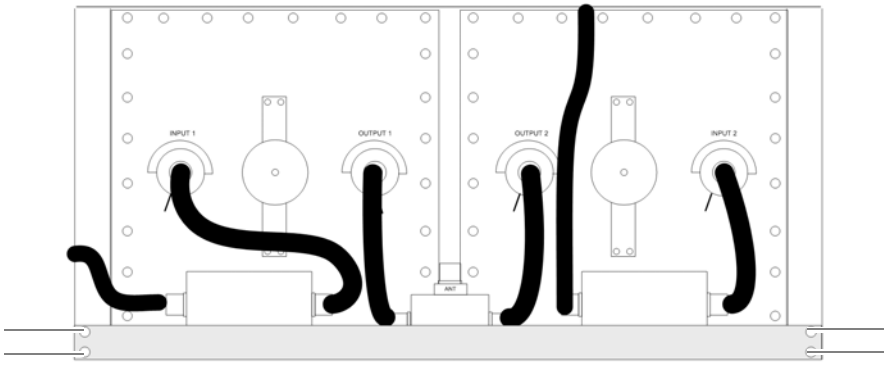

Figure 11.40 Attachment screws of the mounting plate

5. Now cautiously pull out the mounting plate with the components fastened to it from the front of the equipment cabinet along the holder.
6. Remove the fastening screws of the component to be replaced at the underside of the mounting plate.
7. Remove the fastening screws at the rear side of the cavity coupler with a size 2 cross-head screwdriver

✓ You have successfully removed the cavity coupler.

11.9.1.2 Installing the new cavity coupler

The procedure for installing the new cavity coupler is described in the following.

Proceed as follows to install the cavity coupler:

Preparation:
✓ The tools and aids must be available, refer to section 11.2.7 on page 174.
✓ You need the mounting screws removed with the component.

Carry out the following steps:

WARNING

Risk of injury

The equipment rack features sharp edges on the inside. Risk of injury if you do not wear protective gloves.

➔ Always wear protective gloves for the following process steps.

1. Install the component on the mounting plate by tightening the corresponding attachment screws at the rear of the mounting plate again. Use a size 2 cross-head screwdriver for this purpose.

2. Fasten the component on the mounting plate by tightening the corresponding attachment screws on the underside of the mounting plate again. Use a size 2 cross-head screwdriver for this purpose.
3. Slide the mounting plate with the component fastened on it back in via the front of the equipment cabinet.
4. Fasten the mounting plate with the component mounted on it on the equipment rack again, refer to Figure 11.40 on page 220. Use a size 2 cross-head screwdriver for this purpose.

Specified cable lengths

All cables have specified lengths and must not be mixed. Mark the removed cables during the uninstallation, if necessary, and reconnect the removed cables again to the original connection during reinstallation.

5. Correctly reconnect all the cables at the front side of the cavity coupler and at the insulators, Figure 3.31 on page 78.
6. Switch on the power supply again by flipping up the On/Off switch; see Figure 3.15 on page 43.

✓ You have successfully installed the cavity coupler.

11.10 Replacing the GPS protector – optional

The GPS protector is a passive and thus maintenance-free hardware component mounted on the GPS antenna connection of the equipment rack.

Replacing the GPS protector

If you do not have any GPS satellite reception or only restricted reception, the following function tests should be performed first of all, refer to section 7.6 on page 159. A defective GPS protector cannot be repaired; it has to be disposed of appropriately.

The tasks listed in the following table must be performed to replace the GPS protector.

Table 11.35 Overview of the tasks to be performed (Replacing the GPS protector – optional)

Tasks/work steps	Described in
Temporary service interruption	Section 8.1 on page 163
Removing the GPS protector	Section 11.10.1 on page 222
Installing the GPS protector - optional	Section 5.9 on page 117
Connecting antennas	Section 5.10 on page 119
Recommissioning after a temporary service interruption	Section 9.1 on page 167

11.10.1 Removing the GPS protector

The procedure for removing the GPS protector is described in the following.

Proceed as follows to remove the GPS protector:

Preparation:
✓ The preparatory measures must be completed, refer to Table 11.35 on page 221.

Carry out the following steps:

NOTICE

Risk of damage from electrostatic discharge (ESD)

The DIB-500 R4.1 can be damaged if antennas are connected or disconnected during the switched-on state. The GPS antenna connection is particularly sensitive to electrostatic discharge (ESD).

➔ Ensure that the DIB-500 R4.1 is switched off before connecting or disconnecting antennas.

1. Remove the GPS antenna cable from the GPS protector.
2. Unscrew the GPS protector from the GPS antenna connector.

✓ You have successfully removed the GPS protector.

11.10.2 Installing the GPS protector

The procedure corresponds to the description in section 5.9 on page 117.