DIB-500 R4.1
Digital Indoor Base Station
Site Requirements
PV 08.01.xx

90DIB500R41SR_FCC02 – 99.1

ROHDE&SCHWARZ

Secure Communications

Site Requirements

31848 Bad Münder, Germany

Printed in Germany - Subject to change - Data without tolerance limits is not binding.

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1 Notes on the document

This chapter provides information on using the document. It also provides information on the requirements for using the product.

1.1 Objectives of the document

The present document describes the site requirements of all the available variants of the product. All the requirements described in the present document must be met to ensure intended use of the product at your site / in your service room.

The service room must have been equipped as required before the product is installed in this room.

The present document describes the following site requirements:

- Requirements for the Service Room
- Electrical System Requirements

Unintended Use

If the location / service room of the product does not meet the requirements detailed below, the product is not used as intended. The plant operator is responsible for the resulting impairment of the operation or damage to the product. For this reason, comply with all the requirements specified below.

1.2 Intended audience of the document

The present document reverts to all the persons, who

- determine, equip and prepare the installation site of the product.
- operate the product.

Use within the scope of site inspection/acceptance

The present document can be used as a basis for the site inspection and acceptance.

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 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.

1.4 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. If necessary, please contact Rohde & Schwarz Professional Mobile Radio GmbH to request the applicable documents.

These are:

- Technical data,

  describe the technical properties of the product
- Installation, Operation and Service Manual

  describes the proper installation, the electric connection, the proper operation, the maintenance and care as well as the replacement of components incorporated in the product.
- IP/VoIP Requirement Manual

  describes the requirements for securing the IP communication within ACCESSNET®-T IP mobile radio networks as well as outside, e.g. via VoIP telephone systems (Voice-over-IP, VoIP).
- 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.

1.5 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.

Rohde & Schwarz Professional Mobile Radio GmbH
Fritz-Hahne-Straße 7
D-31848 Bad Münder

Germany

Telephone:+49 (0)5042/9 98-0
Fax: +49 (0)5042/9 98-105
www.pmr.rohde-schwarz.com

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.

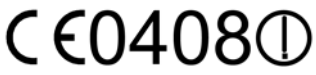

Figure 2.1 Conformity: CE marking

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 solely intended to be used as an base station in the ACCESSNET®-T IP mobile radio system. It is used in this application to transmit voice communication between subscribers, which are equipped with an appropriate mobile.

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.

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 for this purpose. For optimum reception properties, antenna diversity is available.

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).

3.1 Antenna coupling variants

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.

4 Requirements concerning the operation room

This chapter describes the requirements for the service room that must always be met to ensure proper operation of the product element as intended at all times.

4.1 Infrastructure

The following section describes the infrastructure requirements for the site/service room.

4.1.1 General requirements

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

- The operation room must be self-contained to ensure that the system technology is protected at all times (protection against animals, for example).
- Unimpeded access to all the service and supply rooms must be possible.
  - The required access width to the operation room depends on the dimensions and the weight of the equipment rack, refer to section 4.1.3.1 on page 20, and on the condition of the operation room.
    However, a minimum access width of 800 mm is required. An access width of at least 1,200 mm is recommended for transports involving an angle.
  - Access doors must feature an inside width of at least 800 mm.
  - Opening heights (door, window and elevator openings, etc.) are dependent on the free area in front of the access opening and, if necessary, the depth of the respective elevator.
  - To position the equipment rack using lifting or transport equipment (e.g. lift trucks), appropriate openings may have to be provided in the operation room.
- Service and access rooms must be suitable for the expert installation of any required feed lines.

Scope of the site requirements

When the building or the operation room is/are modified, the equipment rack site must still meet the site requirements.

4.1.2 Requirements concerning the base

To ensure the proper operation of the product, the base must meet the following demands:

- The floor of the operation room must be solid and level.
- The floor of the operation room must consist of fireproof materials.
- All the floors of the operation and access rooms must:
  - be designed to bear the mechanical load of the equipment rack, refer to the table in section 4.1.3.1 on page 20.
    Appropriate weight distribution measures must be taken as required, e.g. the use of a supporting metal plate.
  - be designed for the mechanical loads of any lifting equipment used.

4.1.3 Required space

The following section describes the demands on the:

- Required space for the equipment rack/s of the product,
- Required space for the uninterruptible power supply/supplies (UPS).

4.1.3.1 Required space for the equipment rack/s of the product

The space required in the service room for an equipment rack depends on the actual size of the equipment rack (please refer to the table below) and on the head space to be added, e.g. for hinges and head space for service purposes.

For the service interruption and for recommissioning, the voltage source on site must be accessible at all times.

Table 4.1 Dimensions and Weights

Supported carriers		1/2	3/4	5/6[1)]	7/8[1)]
Width	Hybrid	600 mm	600 mm		
	Cavity[2)]				
	High Power		---	---	---
	FlexibleTx		600 mm	---	---
Height	Hybrid	910 mm			
	Cavity[2)]	1.530 mm			
	High Power	910 mm	---	---	---
	FlexibleTx	910 mm		---	---
Depth	Hybrid	600 mm	600 mm		
	Cavity[2)]				
	High Power		---	---	---
	FlexibleTx		600 mm	---	---
Weight	Hybrid	max. 80 kg	max. 100 kg	max. 180 kg	max. 200 kg
	Cavity[2)]	max. 130 kg	max. 150 kg	max. 280 kg	max. 300 kg
	High Power	max. 75 kg	---	---	---
	FlexibleTx	max. 75 kg	max. 95 kg	---	---

1) consisting of two collocating equipment racks (dimensions according to the respective variant)

2) consisting of two stacked equipment racks (lower equipment rack for cavity coupler)

Planning recommendations

For a potential expansion of the network at a later point of time, space for additional equipment racks should be reserved on site.

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.

Figure 4.1 shows the space required when setting up the DIB-500 R4.1.

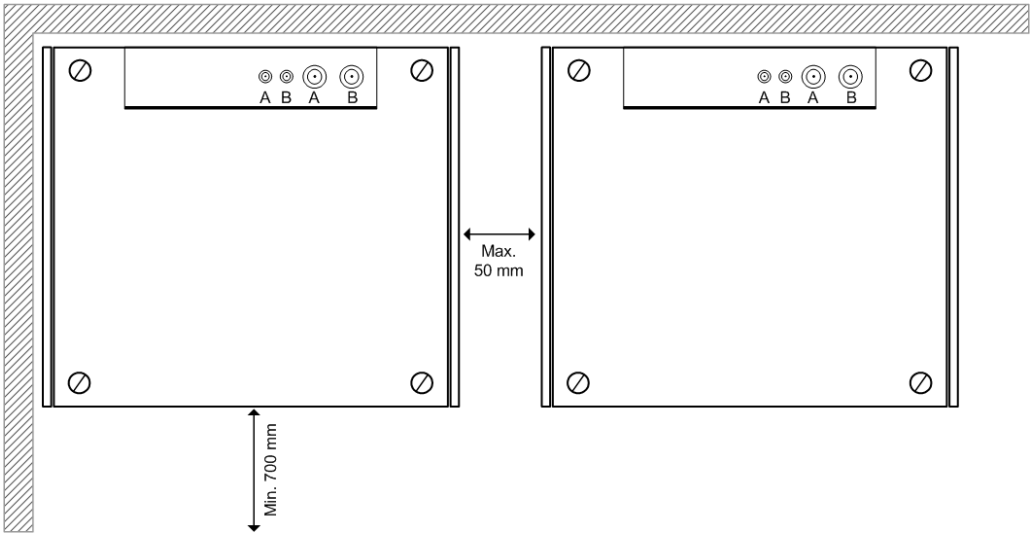

Figure 4.1 Space required for setting up the DIB-500 R4.1

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.

4.1.3.2 Required space for the uninterruptible power supply/supplies (UPS)

To control voltage fluctuations and to protect the product against voltage failures, the use of an uninterruptible power supply (UPS) is advisable.

For this reason, apart from the space required for the equipment racks, the space required for the UPS (according to the specifications of the manufacturer) must also be added. Also observe the required distances to or from other equipment racks (consumers) as well as cable lengths that result from the connection option between UPS and consumer.

4.1.4 Requirements for external antenna coupling system – 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.

Responsibility for the installation, commissioning and maintenance of the external antenna coupling system

The operating company is responsible for the proper installation, commissioning and maintenance of external antenna coupling systems unless this is an integral part of the contract concluded with Rohde & Schwarz Professional Mobile Radio. An installer who may have been entrusted with the installation/commissioning and/or maintenance of the antenna coupling system is responsible for complying with all the applicable requirements and for the metrological tests required afterwards.

The operator is responsible for ensuring that:

- all of the requirements listed in the following are met at any time.
- equipment for overload protection and lightning protection has been provided at the installation site.

Table 4.2 describes the requirements for external antenna coupling systems. The requirements for the individual components are described in Table 4.3 .

Table 4.2 Requirements for external antenna coupling systems.

Constituent	Property/demand		Value/Value range
Isolation between Tx and Rx antenna	with common Tx/Rx antenna via duplex filter with separate Tx/Rx antennas via antenna coupling and bandpass filter		≥ 80 dB
	Isolation with common Tx/Rx antenna	Tx bandpass	80 dB
		Rx bandpass	80 dB
		Antenna coupling	0 dB
	Isolation with separate Tx/Rx antenna	Tx bandpass	55 dB
		Rx bandpass	55 dB
		Antenna coupling	25 dB

Table 4.2 Requirements for external antenna coupling systems.

Constituent	Property/demand		Value/Value range
Hybrid antenna coupling system	Return loss	at all connections	≥ 22 dB
	Isolation	between Tx inputs	≥ 22 dB
Cavity antenna coupling system	VSWR	at all Tx inputs	1.3
	Isolation	at minimum carrier distance	≥ 10 dB

Table 4.3 Requirements for the individual components of external antenna coupling systems

Constituent	Property/demand		Value/Value range
Isolator	Impedance		50 Ω
	Insertion loss	at 25 °C	≤ 0.5 dB (recommended)
	Isolation	at 25 °C	≥ 50 dB
	VSWR		1.2
	Input power at the Tx input		100 W (nominal)
	Reverse power	for 10 minutes	60 W
		without VSWR monitoring permanently	60 W
	VSWR monitoring	For recording faults at the antenna system, the operator must implement a separate VSWR monitoring system.	---
Duplex filter	Impedance		50 Ω
	Insertion loss (Rx)	at 25 °C	≤ 1.1 dB (required)
	Insertion loss (Tx)	at 25 °C	≤ 1.1 dB (recommended)
	3rd order intermodulation component (IM 3)	2 x 43 dBm, 1 MHz distance	-135 dBc
	Input power at antenna connection and Tx input		according to the fed input power
	Isolation	between all frequency bands	≥ 80 dB
	Return loss	at all connections	≥ 22 dB
Bandpass filter	Impedance		50 Ω
	Insertion loss (Rx)	at 25 °C	≤ 1.1 dB (required)
	Insertion loss (Tx)	at 25 °C	≤ 1.1 dB (recommended)
	3rd order intermodulation component (IM 3)	2 x 43 dBm, 1 MHz distance	-135 dBc
	Input power at the Tx input		according to the fed input power
	Rejection	at upper stopband	≥ 55 dB
	Return loss	at all connections	≥ 22 dB

4.1.5 Preparing the antenna system

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.

Table 4.4 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 4.4 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

Further information

For more information on the technical characteristics and for wiring diagrams of the different variants, please refer to the Installation and Operation Manual.

Independent of the operating mode, the respective Tx (/Rx) antennas must already be installed and the corresponding connecting cables must be available in the operation room.

Recommendations for reception

Rohde & Schwarz Professional Mobile Radio GmbH recommends the use of diversity reception for optimum reception properties.

For specifications on the cables required, please refer to section 5.1.2 on page 32.

Responsibility for the installation, commissioning and maintenance of an antenna system

The operating company is responsible for the proper installation, commissioning and maintenance of an appropriate antenna system, unless this is an integral part of the contract concluded with Rohde & Schwarz Professional Mobile Radio GmbH. An installer who may have been entrusted with the installation/commissioning and/or maintenance of the antenna system is responsible for complying with all the applicable requirements and for the metrological tests required afterwards. In addition, equipment for protecting the antenna cables against lightning must be provided.

4.1.6 Adjustment of the GPS antenna

Each equipment rack features a separate GPS antenna connection but only one GPS antenna is required per network element DIB-500 R4.1. For network elements made up of multiple equipment racks, the clock and time reference signals are synchronized.

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.

The 24 GPS satellites in total are not positioned geostationarily. For this reason, the location of the GPS antenna must be chosen to ensure that the reception is not impaired/disturbed by any obstacles.

It is best to install the GPS antenna on the roof of a building. It is also possible to install it on an upright mast with a diameter of 60 mm. Irrespective of the installation method used, always ensure a good circumferential visibility (angle for unobstructed sight of the sky according to the recommendations of the manufacturer). The angle of the GPS antenna supplied is 90 °. The orientation of the GPS antenna must ensure that at least four satellites are received.

A minimum distance of 5 m must be kept between the GPS antenna and the Tx antenna(s) since the decoupling established must be as large as possible - especially for carriers in the range of 393 to 395 MHz, since the fourth harmonic wave in this case is in the range of the received signal of the GPS signal.

For specifications on the cables required, please refer to section 5.1.2 on page 32.

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.

4.2 Environment

This section describes the environmental condition requirements for the site/service room that must be met for a proper and intended operation of the product.

Table 4.5 gives an overview of the environmental conditions that must be ensured. The following sections describe the environmental conditions in detail.

Table 4.5 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

4.2.1 Operating temperature

The product has been designed for specified temperature ranges, refer to Table 4.5 on page 26.

For operating the product, however, a constant ambient temperature of 20 °C to 25 °C is recommended.

For this reason, periodical temperature checks using a thermometer with the possibility of storing the maximum and minimum temperatures is recommended.

An air-conditioning system can be used to control the temperature in the operation room. The thermal dissipation loss of the product as well as of other technical equipment operated in the operation room must be taken into consideration when controlling the operating temperature. The maximum thermal dissipation loss corresponds to the power consumption, refer to Tabelle 5.5 on page 30.

Responsibility of the operator

The use of an air conditioning system is advisable. The operating company is responsible for the proper installation and the operation of an appropriate air conditioning system.

For information on alternatives to an air conditioning system, please revert to the service partner responsible for your company.

4.2.2 Humidity

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

- The service room must be dry and closed to maintain a constant relative humidity of 50 %, if possible (recommended for slowing down the aging process of integrated components).
- Unimpaired air supply to the equipment rack must be ensured.

The ventilation concept of the DIB-500 R4.1 provides for the optimum vertical ventilation of the incorporated components inside the equipment rack. In this case, the air is drawn in through the perforated equipment rack door and all the dirt and dust particles are filtered out via the ventilator unit. Subsequently, the air is discharged through the top of the perforated equipment rack door.

4.2.3 Dust concentration

The product was developed for use in a municipal industrial area. The average dust concentration per year in a municipal industrial area amounts to a value of up to 200 µg/m³. The dust concentration in the operation room of the product must not exceed this value.

Operation rooms that are not completely closed require an appropriate housing.

To ensure a minor dust concentration, the use of an overpressure system for the operation room is advisable.

Responsibility of the operating company

The use of an overpressure system is advisable. The operating company is responsible for the proper installation and the operation of an appropriate overpressure system.

The applicable standards and guidelines for the ambient conditions of the product are set forth in Table 4.5 on page 26.

4.3 Grounding and overvoltage protection

The following chapter describes the requirements for the grounding and overvoltage protection of the site/operation room to ensure that the product can always be used as intended.

The applicable national regulations / the applicable regulations of the respective country of use shall apply for the grounding and the overvoltage protection.

The cross-section of the earthing conductor must be at least 6 mm^2. These earthing conductors must comply with the requirements of DIN VDE 0100 Part 540 (IEC 60364-5-54). According to DIN EN 62305-1 (VDE 0185-305-1), potential equalisation must be installed between the lightning protection system and the electrical system.

Standards and Guidelines

Possible as the case may be required measures for the installation of earthing and bonding appliances of telecommunications equipment can be found in ETSI EN 300 253 V2.1.1.

4.3.1 Overvoltage protection of the equipment rack (V_{AC}/V_{DC})

Each equipment rack (apart from the equipment rack(s) of the cavity variant) of the DIB-500 R4.1 features a connection panel, via which the integrated components are supplied with voltage and grounded.

The protective ground connection of the voltage supply connector of the equipment rack is not a sufficient protection of the system against pulse voltages, such as those that occur during a thunderstorm.

For this reason, the equipment rack must be protected against overvoltages at the installation site through appropriate grounding equipment to prevent damage to the system technology.

Responsibility for the installation, commissioning and maintenance of a grounding and overvoltage system

The operating company is responsible for the proper installation, commissioning and maintenance of an appropriate grounding and overvoltage system, unless this is an integral part of the contract concluded with Rohde & Schwarz Professional Mobile Radio GmbH. It is advisable to obtain the opinion of an expert and to implement the safety measures accordingly.

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.

Table 4.6 lists the requirements for the lightning surge protector.

Table 4.6 Requirements for the lightning surge protector

Property	Requirement/Value
Overvoltage discharger	Gas discharge tube[1)]
Trigger voltage	90 V

1) Depending on the manufacturer, the gas discharge tubes may have to be ordered separately and integrated into the overvoltage discharger.

It must also be ensured that all interfaces of the product are secured against transient overvoltages. These short-term inductive, capacitive or static overvoltages of a few milliseconds occur, e.g. because of adjacent interference sources, and can interfere with voltage supply and signal feed lines.

Standards and Guidelines

For information on potential or required measures for installing safety equipment against transient overvoltages for the V_{DC} voltage supply, please refer to the standard ETSI TR 100 283.

The required measures for installing safety equipment against transient overvoltages for the V_{AC} voltage supply are described in section 4.3.2 on page 29.

4.3.2 Overvoltage protection of the voltage supply (V_{AC})

For V_{AC} voltage supply systems, ensure that the voltage source on site meets the following demands:

- The voltage supply circuit of the voltage source must not exceed 275 V_{AC}.
- The voltage source must be connected to a grounding system. The voltage between the grounding connector and earth must not exceed 275 V_{AC}.
- Appropriate safety measures must be taken to protect the voltage supply circuit of the voltage source against overvoltages.
- A sub-distribution system including a fuse must be available for each equipment rack in the voltage supply circuit of the voltage source.

Standards and Directives

Possible and required measures for installing safety means as a protection against overvoltages can be found in the standard DIN VDE 0100 Part 540 (IEC 60364-5-54).

Responsibility for the installation, commissioning and maintenance of a grounding and overvoltage system

The operating company is responsible for the proper installation, commissioning and maintenance of an appropriate grounding and overvoltage system, unless this is an integral part of the contract concluded with Rohde & Schwarz Professional Mobile Radio GmbH. It is advisable to obtain the opinion of an expert and to implement the safety measures accordingly.

4.3.3 Overvoltage protection of the supply lines

All the supply cables (HF/AF and data supply cables) must be grounded and fused.

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

- All the RF feed lines must be grounded appropriately.
- The GPS supply line(s) must be protected by means of appropriate overvoltage protection elements, refer to section 4.3.1 on page 28.
- All the AF and data supply cables must be protected through appropriate overvoltage protection elements.

Responsibility for implementing overvoltage protection measures

The responsibility for the proper execution of the overvoltage protection measures is determined project-specifically as required.

5 Requirements concerning the electrical system

This chapter describes the requirements for the electric system that must be met to ensure proper operation of the product as intended at all times.

5.1 Cable requirements and cable specifications

The following sections describe general cable requirements and cable specifications for data and HF cables that must be met for the proper operation of the product at the installation location.

5.1.1 General cable requirements

All the feed lines must be identified or labelled according to their functions, e. g. the grounding cable with "grounding + the name of the network element".

All the feed lines must be routed or suspended so that:

- Operation of the device is not impaired
- Tripping hazards for operators are safely prevented
- The required minimum distances are maintained, see section 4.1 on page 19,
- The manufacturer's specification/information for the cables and connectors used are followed. If necessary, contact the respective manufacturer to obtain this information.

Excess cable lengths required

The excess cable lengths required are derived from the corresponding termination points inside the equipment rack and from the position of the equipment cabinet in the operation room. The cables must not be subject to any tensile stress whenever the equipment cabinet has to be moved for service work (refer to section 4.1.3 as of page 20). An excess cable length of at least 1.5 m is recommended.

5.1.2 Cable specifications for the data and RF cables

The following table lists all the suitable cable types and their specifications.

Table 5.1 Cable specifications for data and RF cables

Interfaces		Cable type	Connector type	Impedance
External alarms		CAT5[1)]	LSA+[1)] connection via the E1 connection panel	---
		20 to 14 AWG	Screwless terminals for 0.5 to 2-mm^2 – connection via the alarm input/output module of the voltage supply unit (optional)	---
Ethernet		CAT5	RJ-45	100 Ω
RF antenna	Hybrid	Coaxial	2*7/16" connector	50 Ω
	Cavity			
	High Power			
Tx transmitter output / RX receiver output	FlexibleTx	Coaxial	N connector	50 Ω
GPS antenna		Coaxial (≤10 dB attenuation)[2)]	N connector	50 Ω

1) AWG type: Conductor diameters: solid wire 0.40 mm to 0.80 mm, stranded wire 7 x 0.12 mm to 0.32 mm. Outside diameter: solid conductors and wires 0.70 to 1.60 mm.
Please not that after a connection with ≥ 0.65 mm^2 connection with ≤ 0.65 mm^2 is no longer possible.
2) at 1,500 MHz

5.2 Voltage supply

Each equipment rack (apart from the equipment rack(s) of the cavity variant) of the DIB-500 R4.1 features a connection panel, via which the integrated components are supplied with voltage and grounded.

Table 5.2 Voltage supply

Voltage supply (rated voltage)	| 48 V_{DC} (voltage range from 44 to 55 V_{DC}) | optionally 100 V_{AC} to 240 V_{AC} (frequency: 50 - 60 Hz)
lower voltage supply limit value	44 V_{DC}

Table 5.3 describes the required number of voltage supply connectors on site as a factor of the voltage supply and the number of carriers. Depending on the voltage supply and the number of installed transceiver modules, up to two rectifier modules are integrated per equipment rack.

Table 5.3 Required voltage supply connectors

Voltage supply	Required voltage supply connectors			
Number of carriers	1/2	3/4	5/6	7/8
V_{DC}	1 x 48 V_{DC}		2 x 48 V_{DC}	
170 V_{AC} - 240 V_{AC} (nominal)	1 x 220 V_{AC}		2 x 220 V_{AC}	
100 V_{AC} - 170 V_{AC} (nominal)	1 x 110 V_{AC}	2 x 110 V_{AC}	3 x 110 V_{AC}	4 x 110 V_{AC}

Table 5.4 describes the number of rectifier modules as a factor of the voltage supply.

Table 5.4 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

Recommended connection

For installation and service purposes, the availability of a 230 V_{AC} mains socket for plugs with earthing contact in the operation room is recommended. This power connection must be identified appropriately.

The following sections describe the requirements concerning the electrical system as a factor of the power supply:

- Voltage supply (VDC)
- Voltage supply (VAC)

5.2.1 Voltage supply (V_{DC})

To ensure the proper operation of the product, the requirements concerning the following location constituents must be met:

- Voltage supply connector (VDC)
- Cable specifications of voltage supply cables (VDC)
- Fuse protection (VDC)

5.2.1.1 Voltage supply connector (V_{DC})

For the proper operation of the product, a voltage supply connection according to the type of connection must be available in the operation room.

Standards and Guidelines

The requirements to the power supply of telecommunications equipment with direct current (DC) can be found in ETSI EN 300 132-2 V2.1.2.

To control voltage fluctuations and to protect the product against voltage failures, the use of an uninterruptible power supply (UPS) is advisable.

A UPS serves for ensuring uninterrupted power supply in the case of voltage fluctuations or a temporary failure of the primary power supply. The dimensioning of the UPS depends on the duration of the time that may have to be bridged as well as on the consumer power the UPS needs to provide security for.

When dimensioning the cross section of the connecting cable between the UPS and the product, be sure to keep the voltage loss of the connecting cable as low as possible. Otherwise the UPS may not be able to provide the desired power failure bridging time. The UPS cannot provide the power failure bridging time, for example, if the discharge protection threshold of the UPS plus the voltage loss of the connecting cable is smaller than the lower voltage supply limit value (refer to Table 5.2 on page 32) of the product with battery supply.

Responsibility of the Operating Company

The use of an uninterruptible voltage supply (UPS) is advisable. The operating company is responsible for the proper installation and operation of appropriate uninterruptible power supply systems.

5.2.1.2 Cable specifications of voltage supply cables (V_{DC})

Each equipment rack (apart from the equipment rack(s) of the cavity variant) of the DIB-500 R4.1 features a connection panel, via which the integrated components are supplied with voltage and grounded.

For the proper operation of the product, a voltage supply cable according to the connection type, refer to section 5.2 on page 32, must be available in the operation room.

The rating of the voltage supply cable must be appropriate for the respective power consumption of the network element and comply with further requirements and cable specifications as applicable, refer to the table below.

Planning recommendations

To take potential network expansions later on into account, the increased power consumption and thus appropriately dimensioned voltage supply cables should be provided for.

Table 5.5 Requirements and cable specifications for the voltage supply cable (V_{DC})

Number of carriers	1	2	3	4	5	6	7	8
Power consumption[1)]	350 W	550 W	900 W	1,100 W	1,450 W	1,650 W	2,000 W	2,200 W
Recommended length, voltage supply cable	2.5 m[2)]				2.5 m[2]			
Recommended cross-section, voltage supply cable	4 mm^2				4 mm^2			

1) with V_{DC} voltage supply with an output rating of 50 W per carrier, with V_{AC} voltage supply (optional) the power consumption is increased by the factor 1.1.

2) The use of longer voltage supply cables may cause malfunctions.

The terminals of the voltage supply connection are adequate for voltage supply cables up to a cable cross section of max. 10 mm^2.

The length and cross-section of the voltage supply cable

For the specification of the voltage supply cable, the length and the cross-section must always be taken into consideration. Always ensure that the required voltage is applied to the equipment cabinet.

Standards and Guidelines

The requirements to the power supply of telecommunications equipment with direct current (DC) can be found in ETSI EN 300 132-2 V2.1.2.

5.2.1.3 Fuse protection (V_{DC})

Each equipment rack (apart from the equipment rack(s) of the cavity variant) of the DIB-500 R4.1 features a connection panel, via which the integrated components are supplied with voltage and grounded.

Insufficient fuse protection of the power supply may impair the operation of the product. The construction of automatic circuit breakers depends on the characteristics of the required voltage supply cable (power consumption, refer to section 5.2.1.2 on page 34) as well as the length of cable.

Standards and Guidelines

Required measures for the construction of automatic circuit breaker can be found in IEC 60950-1, Information technology equipment – Safety, part 1: General Requirements.

The DIB-500 R4.1 is equipped with an automatic cutout for each transceiver module. The properties and demands on the fusing to ensure tripping of the automatic cutouts are described in the following.

Table 5.6 describes the properties and demands on the fusing for a V_{DC} voltage supply.

Table 5.6 Fusing – properties and demands for a V_{DC} voltage supply

Constituent	Property/demand	Value/Value range
transceiver module automatic cutout	Rated current	13 A
	Response time	< 2 s[1)]
Voltage source on site	Rated current	30 A at 1,100 W
Fusing of the voltage supply cables	Rated current	32 A[2)]
	Trigger characteristics	B

1) with 1.3 times the value of the rated current
2) with the recommended cross section of the voltage supply cable of 4 mm^2

5.2.2 Voltage supply (V_{AC})

To ensure the proper operation of the product, the requirements concerning the following location constituents must be met:

- Fuse protection (VAC)
- Cable specifications of voltage supply cables (VDC)
- Fuse protection (VDC)

5.2.2.1 Voltage supply connector (V_{AC})

For the proper operation of the product, a voltage supply connector according to the connection type in the operation room must be available.

Country-specific laws and provisions

Always observe the applicable laws and regulations of the respective country for setting up low-voltage systems.

With a V_{AC} voltage supply, the product/system 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 Schuko plug at the mains socket(s),

  with this connection variant, the mains socket(s) 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 provided is 2.5 m.

One Schuko plug 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 Schuko plugs

The Schuko plug 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.

5.2.2.2 Cable specifications of voltage supply cables (V_{AC})

In the version of the product/system with V_{AC} voltage supply, one voltage supply cable per rectifier module is available via the mounting frame. The voltage supply cable(s) is/are routed out through the grommet of the equipment rack. This/these voltage supply cable(s) is/are already connected to the mounting frame and can be connected to the voltage source on site.

5.2.2.3 Fuse protection (V_{AC})

Each equipment rack (apart from the equipment rack(s) of the cavity variant) of the DIB-500 R4.1 features a connection panel, via which the integrated components are supplied with voltage and grounded.

Insufficient fuse protection of the power supply may impair the operation of the product. The construction of automatic circuit breakers depends on the characteristics of the required voltage supply cable (power consumption, refer to section 5.2.1.2 on page 34) as well as the length of cable.

Standards and Guidelines

Required measures for the construction of automatic circuit breaker can be found in IEC 60950-1, Information technology equipment – Safety, part 1: General Requirements.

In the case of a V_{AC} voltage supply, the voltage supply source on site must be protected by an appropriate overload protection for each supply line independent of the connection variant.

Table 5.7 describes the requirements concerning the overload protection on site by an external fuse. This overload protection protects the cable between the voltage source and the mains socket/fixed connection.

Table 5.7 Requirements concerning the overload protection of the voltage source on site

External fuse per supply line	16 A[1)]

1) with a min. cross section of the voltage supply cable of 1.5 mm^2

Internal and external fuses

Each rectifier module is equipped with internal fast-acting fuses with the following values 16 A, 250 V. The response times of the external fuses must be longer than those of the internal fuses. Otherwise, the external fuse would blow immediately and the equipment rack would be de-energized.

Figure 5.1 shows the time-current curves (response times) of the internal fuses. The response times of the external fuses must always be longer.

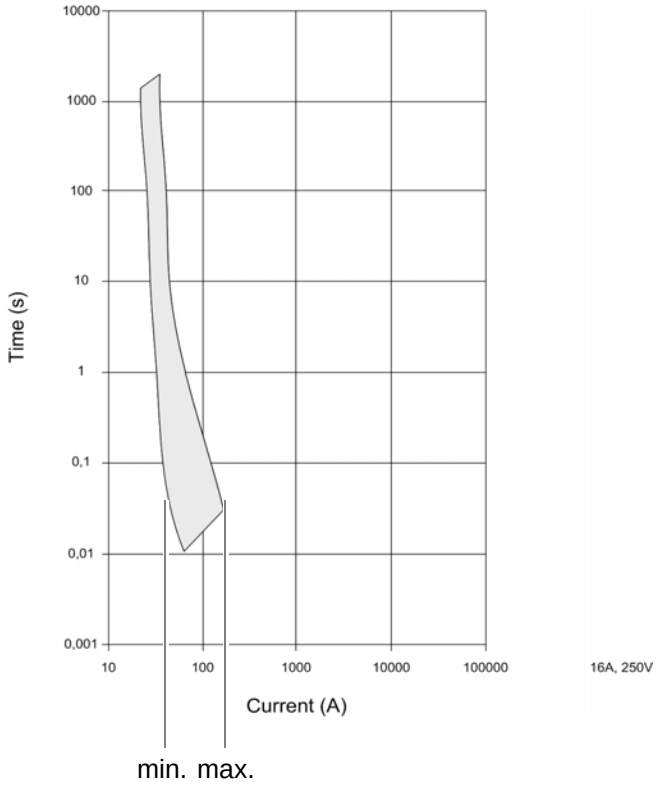

Figure 5.1 Time-current curves (response times) of the internal fuses

6 Requirements concerning the transport network

The transport network is subject to technical requirements that must be adhered to for the operation of a ACCESSNET®-T IP network.

The requirements on the transport network are described in the corresponding product documentation, see Table 6.1.

Table 6.1 Required product documents

Product	Document type
ACCESSNET®-T IP	IP/VoIP Requirement Manual