

# R&S®FE50DTR

## External Frontend

## Manual



1179318002

Version 04

**ROHDE & SCHWARZ**

Make ideas real



This manual describes the following R&S®FE50DTR model and its option:

- FE50DTR, variant K2: 50 GHz up-/down-converter (1347.4099K02)

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The following abbreviations are used throughout this manual: R&S®FE50DTR is abbreviated as R&S FE50DTR, R&S®FSV3000 and the R&S®FSVA3000 are abbreviated as R&S FSV/A and R&S®SMW200A is abbreviated as R&S SMW.

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# 1 Safety and regulatory information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

## Target audience

The target audience is developers and technicians. The required skills and experience depend on the used operating concept.

## Intended use

The product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

## Where do I find safety information?

Safety information is part of the product documentation. It warns you of potential dangers and gives instructions on how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- In [Chapter 1.1, "Safety instructions"](#), on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

## 1.1 Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

## Safety instructions

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Reconfigure or adjust the product only as described in the product documentation or the data sheet. Any other modifications can affect safety and are not permitted.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at <https://www.rohde-schwarz.com/support>.

**Lifting and carrying the product**

The maximum weight of the product is provided in the data sheet. You can lift or carry the product by yourself, if you can manage the weight on your own. Alternatively, you can use lifting or transporting equipment. Follow the instructions provided by the equipment manufacturer.

**Choosing the operating site**

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

**Setting up the product**

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

### Connecting to power

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death. Replace parts that are relevant to safety only by original parts, e.g. power cables or fuses.

Take the following measures for your safety:





- Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.
- Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.
- Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.
- If you connect the product to an external power supply, use the one delivered with the product or recommended in the product documentation. The external power supply must conform to the country-specific regulations.
- Only connect the product to a power source with a fuse protection of maximum 20 A.
- Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

## Cleaning the product

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

## Meaning of safety labels

Safety labels on the product warn against potential hazards.


	Potential hazard Read the product documentation to avoid personal injury or product damage.
	Electrical hazard Indicates live parts. Risk of electric shock, fire, personal injury or even death.
	Hot surface Do not touch. Risk of skin burns. Risk of fire.
	Protective conductor terminal Connect this terminal to a grounded external conductor or to protective ground. This connection protects you against electric shock if an electric problem occurs.

## 1.2 Labels on R&S FE50DTR

Labels on the casing inform about:

- Personal safety, see ["Meaning of safety labels"](#) on page 8
- Product and environment safety, see [Table 1-1](#)
- Identification and network information, see [Electronic label, page 26](#)

**Table 1-1: Labels regarding R&S FE50DTR and environment safety**

	Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life. For more information, see <a href="#">"Disposing electrical and electronic equipment"</a> on page 42.
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## 1.3 Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.



**WARNING**

Potentially hazardous situation. Could result in death or serious injury if not avoided.

**NOTICE**

Potential risks of damage. Could result in damage to the supported product or to other property.

## 1.4 Where to find key documents on Rohde & Schwarz

Certificates issued to Rohde & Schwarz that are relevant for your country are provided at [www.rohde-schwarz.com/key-documents](http://www.rohde-schwarz.com/key-documents), e.g. concerning:

- Quality management
- Environmental management
- Information security management
- Accreditations

## 1.5 Korea certification class A



이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

## 2 Documentation overview

This section provides an overview of the R&S FE50DTR user documentation. Unless specified otherwise, you find the documents at:

[www.rohde-schwarz.com/manual/fe50dtr](http://www.rohde-schwarz.com/manual/fe50dtr)

### 2.1 Manual

This manual introduces the R&S FE50DTR and describes how to set up and work with the product. It also provides information on maintenance, storage and disposal. A printed version is delivered with the product.

For information on how to configure and use the R&S FE50DTR in setups with a Rohde & Schwarz vector signal generator and Rohde & Schwarz vector signal analyzer, see the user manual of these instruments.

### 2.2 Printed safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

### 2.3 Data sheet

The data sheet contains the technical specifications of the R&S FE50DTR. It also lists the options and their order numbers.

See [www.rohde-schwarz.com/brochure-datasheet/fe50dtr](http://www.rohde-schwarz.com/brochure-datasheet/fe50dtr)

### 3 Key features

The R&S FE50DTR External Frontend features:

- Frequency up- and down-conversion, e.g., for 5G NR [mmWave](#) testing
- mmWave frequencies from 36 GHz to 50 GHz
- Low phase noise signal generation and signal analysis
- RF connectors with:
  - Specified output power ([PEP](#)) of -30 dBm to 0 dBm
  - Input power (PEP) of -100 dBm to 30 dBm
- Simultaneous receive mode ([Rx](#)) and transmit mode ([Tx](#))
- LAN plug-and-play solution fully controlled, e.g., by an R&S SMW or R&S FSV/A
- Small size, easy usage and operation
- Short cabling distances to the device under test [DUT](#)

For a detailed specification, refer to the data sheet.

## 4 Preparing for use

Here, you can find basic information about setting up the product for the first time.

### 4.1 Lifting and carrying

Carry the R&S FE50DTR with the top of the external frontend facing upwards.

See ["Lifting and carrying the product"](#) on page 6.

### 4.2 Unpacking and checking

1. Unpack the R&S FE50DTR carefully.
2. Retain the original packing material. Use it when transporting or shipping the R&S FE50DTR later.
3. Using the delivery notes, check the equipment for completeness.
4. Check the equipment for damage.

If the delivery is incomplete or equipment is damaged, contact Rohde & Schwarz.

### 4.3 Choosing the operating site

Specific operating conditions ensure proper operation and avoid damage to the R&S FE50DTR and connected devices. For information on environmental conditions such as ambient temperature and humidity, see the data sheet.

See also ["Choosing the operating site"](#) on page 6.

## Electromagnetic compatibility classes

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the data sheet.

- Class B equipment is suitable for use in:
  - Residential environments
  - Environments that are directly connected to a low-voltage supply network that supplies residential buildings
- Class A equipment is intended for use in industrial environments. It can cause radio disturbances in residential environments due to possible conducted and radiated disturbances. It is therefore not suitable for class B environments. If class A equipment causes radio disturbances, take appropriate measures to eliminate them.

## 4.4 Setting up the R&S FE50DTR

See also:

- ["Setting up the product"](#) on page 6
- ["Intended use"](#) on page 5

The R&S FE50DTR is used exclusively in test setups with a vector signal generator, e.g. the R&S SMW, and a vector signal analyzer, e.g. the R&S FSV/A.

Typical test setups for [OTA](#) testing require short cabling distances between the R&S FE50DTR and the antenna, see [Figure 4-1](#).

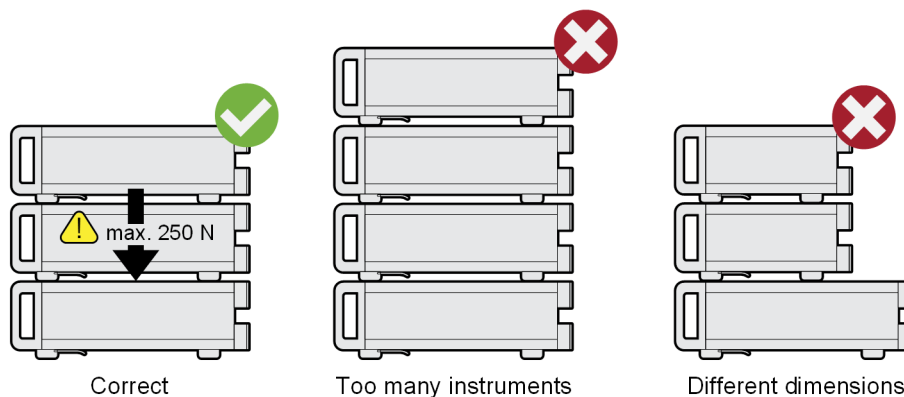
### To place the R&S FE50DTR on a bench top

For testing, you can place the R&S FE50DTR on a bench top.

1. Place the R&S FE50DTR on a stable, flat and level surface. Ensure that the surface can support the weight of the R&S FE50DTR. For information on the weight, see the data sheet.
2. **WARNING!** A stack of products can fall over and cause injury. Never stack more than three products on top of each other. Instead, mount them in a rack.

Stack as follows:

- All instruments must have the same dimensions (width and length).
- The overall load on the lowest instrument must not exceed 250 N.



### 3. **NOTICE!** Overheating can damage the product.

Prevent overheating as follows:

- Keep a minimum distance of 3 cm between the fan openings at the front panel and at the rear panel of the R&S FE50DTR and any object in the vicinity.
- Do not place the R&S FE50DTR next to heat-generating equipment such as radiators or other instruments.

See also [Chapter 4.9, "Connecting the R&S FE50DTR"](#), on page 18.

## 4.5 Considerations for test setup

### Cable selection and electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Besides the cables delivered with the R&S FE50DTR, use high-quality shielded cables for the following connector types:
  - SMA: RF cables that match this connector type.  
How to: [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18.
  - LAN: at least CAT6+ cables.  
How to: [Chapter 4.7, "Connecting to LAN"](#), on page 16
  - USB: double-shielded USB cables. The length of passive USB cables must not exceed 1 m.
- Always terminate open cable ends.

- Ensure that connected external devices comply with EMC regulations.

### Signal input and output levels

Information on signal levels is provided in the data sheet. Keep the signal levels within the specified ranges to avoid damage to the R&S FE50DTR and connected devices.

### Preventing electrostatic discharge (ESD)

Electrostatic discharge is most likely to occur when you connect or disconnect a DUT.

- **NOTICE!** Electrostatic discharge can damage the electronic components of the product and the device under test (DUT).

Ground yourself to prevent electrostatic discharge damage:

- a) Use a wrist strap and cord to connect yourself to ground.
- b) Use a conductive floor mat and heel strap combination.

### Blocking DC components

- **NOTICE!** Risk of instrument damage. DC voltage at the RF connectors can damage the instrument.
  - Never apply direct currents (DC) to the RF connectors.  
Make sure that the values do not fall below the DC limits as given in the data sheet.
  - If the RF input signal has a DC component, insert a DC blocker.

## 4.6 Connecting to power

For safety information, see "[Connecting to power](#)" on page 7. For information on the external power supply, see the data sheet.

The power supply connector is located on the rear panel of the R&S FE50DTR.

- Connect the DC power cable to the socket of the power supply connector. Only use the DC power cable delivered with the R&S FE50DTR.

If connected to power, the R&S FE50DTR is switched on automatically. On the front panel of the R&S FE50DTR, the "Power" LED switches from gray to green. [Table 4-1](#) provides an overview on power states.

**Table 4-1: Overview power states**

LED	Power state
● gray	Power Off
● green	Power On
● red	Error

Required ratings of the DC input level and maximum current are listed next to the socket and in the data sheet.

## Troubleshooting

Both a red "Power" LED and red "LAN" LED indicate hardware problems, e.g. switched off fans at the R&S FE50DTR. If hardware problems occur, the R&S FE50DTR switches to a safe state. The LAN connection is aborted.

How to: ["To resolve hardware problems"](#) on page 39

## 4.7 Connecting to LAN

### Network environment

Before connecting the product to a local area network (LAN), consider the following:

- For internet or remote access, use secured connections if applicable.
- Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.
- When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product.



## To connect to LAN

The connector is located on the rear panel of the R&S FE50DTR.

- Connect the LAN socket via an RJ-45 cable to the LAN.

## IP address assignment

The IP address is assigned automatically by one of the following methods:

- By default, the R&S FE50DTR is configured to use DHCP (dynamic host configuration protocol) and no static IP address is configured. If switched on and connected to the LAN, the R&S FE50DTR displays the IP address information on the electronic label with "IP Addr.". See [Chapter 5.3, "Electronic label"](#), on page 26.
- If the network does not use a DHCP server, R&S FE50DTR obtains and assigns its IP address via the Auto-IP/Zeroconf (APIPA) protocol.

## LAN connection states

On the front panel of the R&S FE50DTR, the LAN LED indicates the LAN connection state. The table below provides an overview.

**Table 4-2: Overview LAN connection states**

LED	LAN connection state
● no light / gray	Not active
● green	Connected to LAN
● orange	Connected to control instrument
● red	Error

## Troubleshooting

If you have LAN connection issues, see the user manual of an R&S signal generator or an R&S signal analyzer, e.g. FSV3000, chapter „Troubleshooting External Frontend Control“.

Both a red "Power" LED and red "LAN" LED indicate hardware problems, e.g. switched off fans at the R&S FE50DTR. If hardware problems occur, the R&S FE50DTR switches to a safe state. The LAN connection is aborted.

How to: ["To resolve hardware problems"](#) on page 39

## 4.8 Connecting to SMA and 1.85 mm

The "RF A/RF B" connectors are 1.85 mm female connectors. The connectors are located on the front panel of the R&S FE50DTR.

"IF Out A/IF Out B", "LO In/LO Out" and "Ref In" are SMA female connectors. The connectors are located on the rear panel of the R&S FE50DTR.

The following step-by-step description applies to both connector types SMA and 1.85 mm.

1. Use an RF cable, that matches the connector.  
See "[Cable selection and electromagnetic interference \(EMI\)](#)" on page 14.
2. **NOTICE!** Risk of connector damage and cable damage. Excessive tightening can damage the cables and the connectors.  
To connect the RF cable with the connector, proceed as follows:
  - a) Carefully align the connector of the cable along a common axis.
  - b) Mate the connectors along the common axis until the male pin of the inner connector engages with the female socket of the outer connector.
  - c) When screwing the connectors, only turn the nut of the outer connector until the connectors are firmly coupled.
  - d) Torque the nut to the specified limit using a calibrated torque wrench. Hold the opposite connector part stationary with a spanner.  
For applicable torque values, see chapter "Handling" of the application note 1MA99:  
<https://www.rohde-schwarz.com/apnote/1MA99>
3. **NOTICE!** Risk of instrument damage. You can damage the R&S FE50DTR, when you exceed maximum input levels and voltages of the connectors.  
Set an input level at the connectors of the R&S FE50DTR within the range as given in the data sheet.

## 4.9 Connecting the R&S FE50DTR

The R&S FE50DTR operates properly, only when connected to a vector signal generator and/or a vector signal analyzer, e.g. R&S SMW/R&S FSV/A.

## To connect the R&S FE50DTR

The R&S FE50DTR is off but connected to power.

Relevant connectors for connection are located on the rear panel of the R&S FE50DTR.

1. You can control the R&S FE50DTR via LAN connection between R&S FE50DTR and the vector signal generator and/or the vector signal analyzer.  
How to: [Chapter 4.7, "Connecting to LAN"](#), on page 16
2. Connect required SMA connectors.  
How to: [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18.

Operating external frontends, e.g. the R&S FE50DTR, requires a control connection (LAN) with the vector signal generator or vector signal analyzer. To establish this connection, see the following sections:

- ["To control the R&S FE50DTR with a vector signal analyzer"](#) on page 28
- ["To control the R&S FE50DTR with a vector signal generator"](#) on page 33

## Test setups

Test setups with dedicated connections depend on the operation mode of the external frontend. [Figure 4-1](#) illustrates a typical test setup where the external frontend operates in Tx (transmit) mode and Rx (receive) mode.

For detailed information on how the R&S FE50DTR is used in test setups and the connections for each operation mode, see [Chapter 6, "Operating the instrument"](#), on page 27.

## Example: OTA measurement test setup for mmWave signals

Typically, [mmWave](#) signals are transmitted and received over-the-air (OTA) inside an RF shield box.

The figure below illustrates a test setup with one external frontend connected to a vector signal generator, vector signal analyzer and a cross-polarized Vivaldi antenna. The antenna is mounted inside an RF shield box.

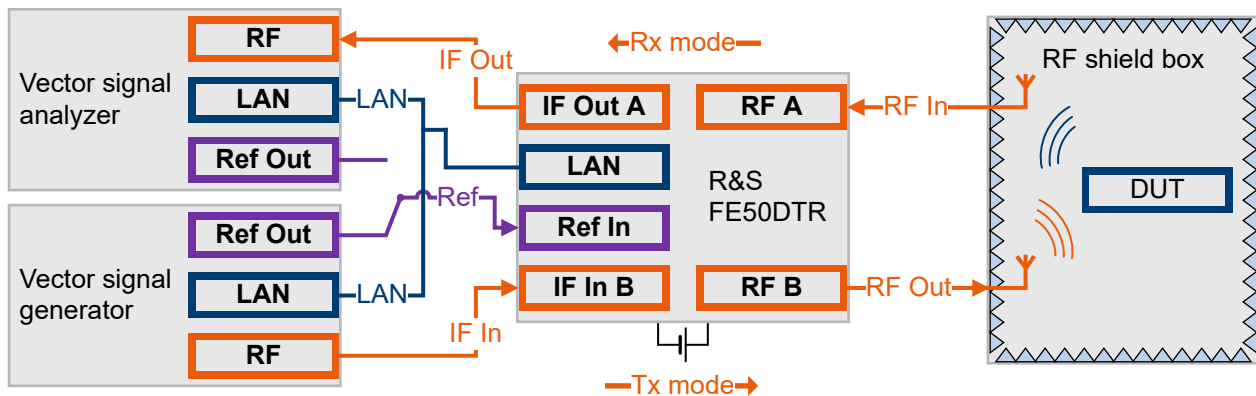


Figure 4-1: OTA microwave test setup

For more information refer to the following documents:

- R&S SMW-K553 Frontend Control user manual: Chapter "Connecting and Operating External Frontends"
- R&S FSV/A user manual: Chapter "External Frontend Control"

## 4.10 Switching on or off

Once [connected to power](#), the R&S FE50DTR switches on automatically. If the R&S FE50DTR is switched off but connected to power, you can switch on the R&S FE50DTR manually.

### To switch on the R&S FE50DTR manually

The R&S FE50DTR is switched off, but connected to power. The "Power" LED is gray. See [Table 4-1](#).

- On the rear panel of the R&S FE50DTR, press the "Power" key . See [Chapter 5.2.8, "Power key"](#), on page 26.

The "Power" LED changes to green. The R&S FE50DTR boots.

### To switch off the R&S FE50DTR

The R&S FE50DTR is switched on.

- **NOTICE!** Risk of data loss. If you disconnect the product from power when it is in the ready state, you can lose settings and data. Shut it down first.

Press the "Power" key .

The "Power" LED changes to gray.

**To disconnect from power**

The R&S FE50DTR is switched off.

- ▶ Disconnect the DC power cable from the socket of the power supply connector.

## 5 Instrument tour

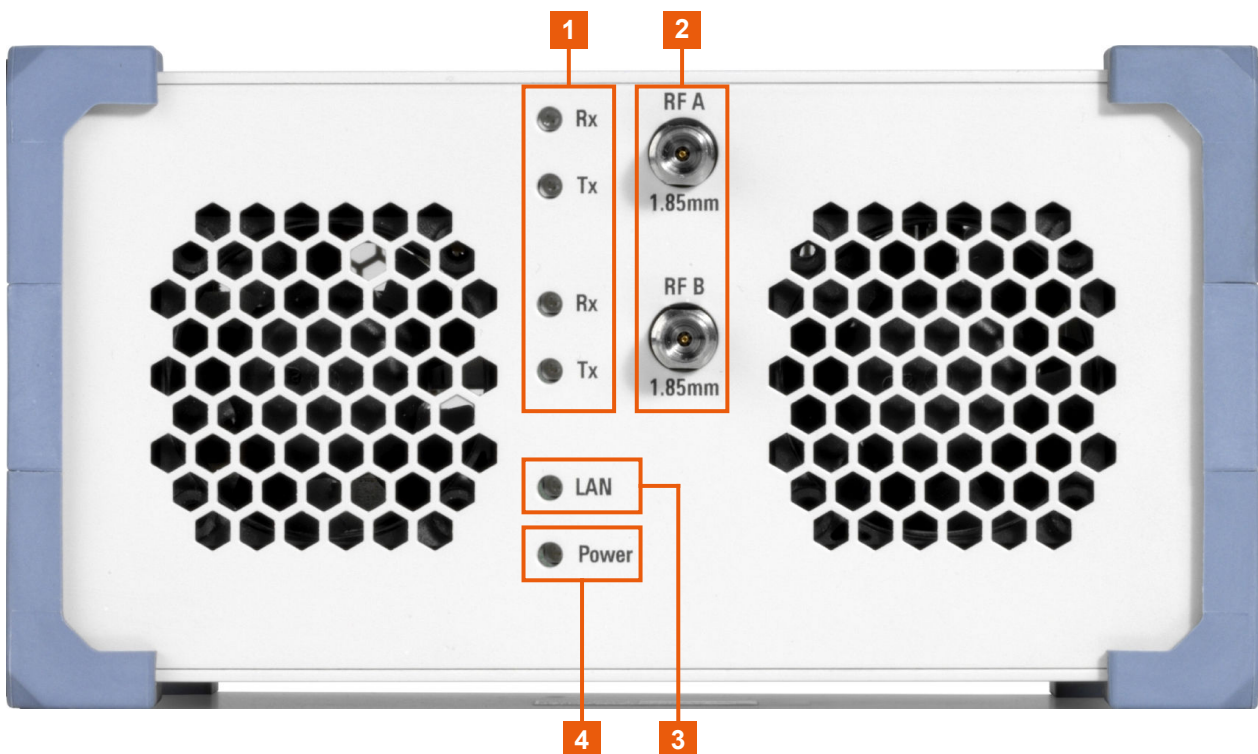
This chapter provides an overview of the control elements and connectors of the R&S FE50DTR.

The meanings of the labels on the R&S FE50DTR are described in [Chapter 5.3, "Electronic label"](#), on page 26.

### 5.1 Front panel tour

This section gives an overview of the front panel elements of the R&S FE50DTR.

The maximum input levels and voltages of the connectors on the front panel must not be exceeded, see ["Signal input and output levels"](#) on page 15.



**Figure 5-1: R&S FE50DTR front panel**

- 1 = Rx/Tx status LEDs,, page 23
- 2 = RF connectors, page 23
- 3 = LAN status LED, page 17
- 4 = Power status LED, page 16

### 5.1.1 RF connectors

Two bi-directional 1.85 mm female connectors "RF A"/"RF B" for input and output of RF signals. RF signals have a frequency range of 36 GHz to 50 GHz.

- "RF A": Input of the RF signal from the DUT. This signal is down-converted to the frequency, which is measurable for the vector signal analyzer, e.g., R&S FSV/A.
- "RF B": Output of the RF signal to the DUT. This signal has a frequency value as set at the vector signal generator, e.g., R&S SMW.

How to: [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

#### RF signal center frequency

Consider that the RF signal has a certain bandwidth. So the ranges supported for center frequency settings are smaller.

#### Rx mode and Tx mode



You can use the RF connectors for input ("Rx" = receive mode) and output ("Tx" = transmit mode) of RF signals. At each connector, one of these modes can be active at a time.

The modes are configurable at the R&S FSV/A (Rx mode) and R&S SMW (Tx mode), see [Chapter 6, "Operating the instrument"](#), on page 27.

### 5.1.2 Status LEDs

To the left of the RF connectors "RF A/RF B", there are LEDs indicating the operation mode ("Rx") and transmit mode ("Tx").

**Table 5-1: Overview Rx/Tx**

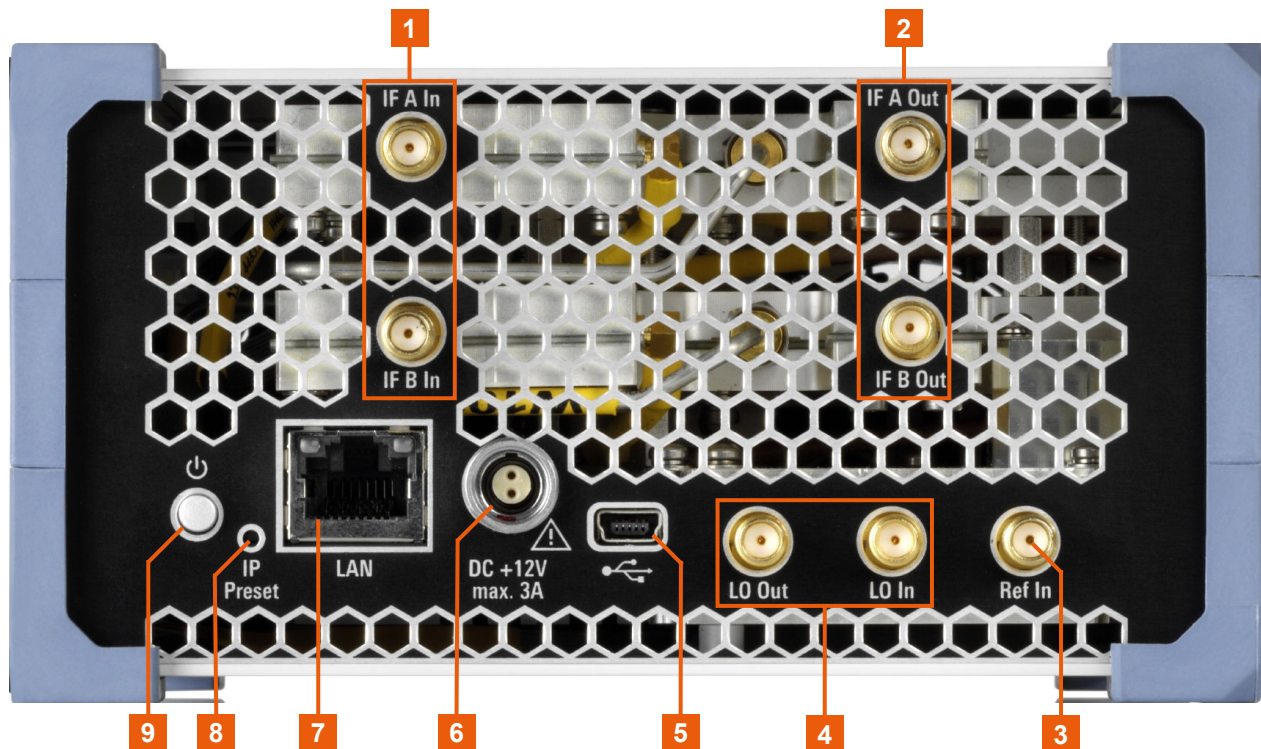
LED	"Rx" mode	"Tx" mode
 no light / gray	Not active	Not active
 green	Receive mode	Transmit mode

Also, there are status LEDs indicating the power state and the LAN connection state, see [Table 4-1](#) and [Table 4-2](#).



## 5.2 Rear panel tour

This section gives an overview of the rear panel elements of the R&S FE50DTR.



**Figure 5-2: R&S FE50DTR rear panel**

- 1, 2 = IF connectors, page 24
- 3 = Ref In connector, page 25
- 4 = LO In/LO Out connectors, page 25
- 5 = USB In connector, page 25
- 6 = Power supply connector, page 25
- 7 = LAN connector, page 25
- 8 = IP Preset key, page 26
- 9 = Power key, page 26

### 5.2.1 IF connectors

SMA female connectors for input and output of the intermediate frequency (IF) signal.

- "IF In B": Input of the IF signal from the vector signal generator, e.g., R&S SMW. This signal is up-converted to the frequency value set at the R&S SMW.



- "IF Out A": Output of the IF signal to the vector signal analyzer, e.g., R&S FSV/A. This signal has a frequency, which is measurable for the R&S FSV/A.

How to: [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

The current external frontend firmware does not support "IF In A" as IF input and does not support "IF Out B" as IF output.

## 5.2.2 Ref In connector

SMA female connector for providing a reference signal for oscillators inside the R&S FE50DTR.

How to: [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

## 5.2.3 LO In/LO Out connectors

SMA female connectors for local oscillator input and output in setups with more than one R&S FE50DTR.

The connectors are reserved for future use.

## 5.2.4 USB In connector

Type-B USB 2.0 input connector for service purposes. The connector is reserved for future use.

## 5.2.5 Power supply connector

Main power supply connector for connection of the external DC power supply.

How to: [Chapter 4.6, "Connecting to power"](#), on page 15

## 5.2.6 LAN connector

RJ-45 connector to connect the R&S FE50DTR to a LAN. Connection is required to control the R&S FE50DTR by a vector signal generator and/or a vector signal analyzer.

How to: [Chapter 4.7, "Connecting to LAN"](#), on page 16

### 5.2.7 IP Preset key

Key to preset IP address of the R&S FE50DTR.

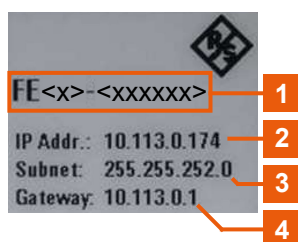
### 5.2.8 Power key

Power key to switch on and switch off the R&S FE50DTR.

How to: [Chapter 4.10, "Switching on or off"](#), on page 20

## 5.3 Electronic label

The electronic label is located on the right side panel of the frontend casing. If connected to a LAN, it displays specific network parameters, see [Table 5-2](#).



**Table 5-2: Electronic label elements**

Label	Label element	Description
1	FE<x>-<xxxxxx>	<Instrument name>-<Serial number> Displays the hostname that contains the instrument name (FE<x>) and the 6-digit serial number (<xxxxxx>) of the instrument. Each instrument has an individual hostname. You can use this hostname to search for your instrument in a LAN instead of the IP address.
2	IP Addr.	Displays the IP address of the instrument in the network.
3	Subnet	Displays the bit group of the subnet in the host identifier.
4	Gateway	Displays the gateway address. This address identifies the router that is used to forward traffic to destinations beyond the local network. The router belongs to the same network as the instrument.

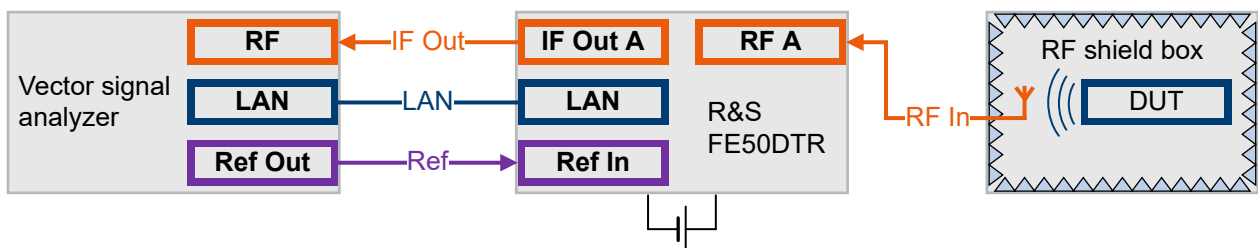
## 6 Operating the instrument

You can operate the R&S FE50DTR in single receive mode (Rx), single transmit mode (Tx) or simultaneous mode. In simultaneous mode, the R&S FE50DTR operates in Rx and Tx mode simultaneously also referring to dual transmit receive DTR operation.

### 6.1 Operating the R&S FE50DTR in Rx mode

In Rx mode, the R&S FE50DTR receives a high-frequency RF signal from the device under test (DUT). It downconverts this signal using its own internal local oscillator to an intermediate frequency (IF) signal that is a low-frequency signal. The R&S FE50DTR outputs and transmits the IF signal to the vector signal analyzer.

#### Test setup



The following step-by-step descriptions use an R&S FSV/A as vector signal analyzer covering the following topics:

- ["To connect the R&S FE50DTR for Rx mode"](#) on page 27
- ["To control the R&S FE50DTR with a vector signal analyzer"](#) on page 28
- ["To configure frequency settings at the vector signal analyzer"](#) on page 30

If supported, the descriptions for other Rohde & Schwarz vector signal analyzers are analogous.

#### To connect the R&S FE50DTR for Rx mode

The R&S FE50DTR is [connected to power](#) and [switched on](#).

- Connect all connectors for connections between the R&S FE50DTR and R&S FSV/A, and R&S FE50DTR (RF in) and DUT as in [Table 6-1](#).

## Operating the R&amp;S FE50DTR in Rx mode

**Table 6-1: Signals and connections in Rx mode**

Signal	R&S FE50DTR	Vector signal analyzer e.g, R&S FSV/A
Reference	"Ref In"	Connector "REF Output" Freq.: 640 MHz, 10 MHz
LAN (Control)	"LAN"	"LAN"
IF Out	"IF Out A"	"RF Input 50Ω"
RF In	"RF A"	-

How to:

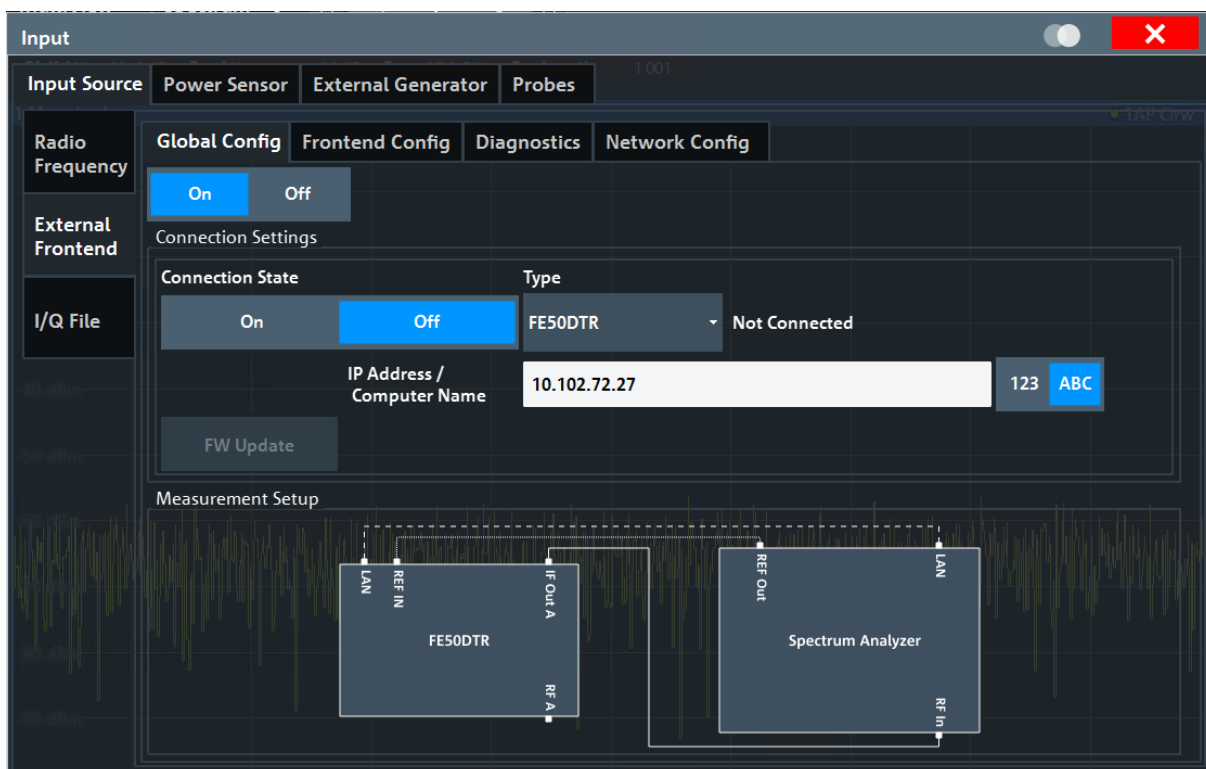
- [Chapter 4.7, "Connecting to LAN"](#), on page 16
- [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

### To control the R&S FE50DTR with a vector signal analyzer

The R&S FSV/A controls the R&S FE50DTR using a secure socket layer (SSL) control connection via LAN. This step-by-step description explains how the R&S FSV/A locks the R&S FE50DTR to control the R&S FE50DTR exclusively.

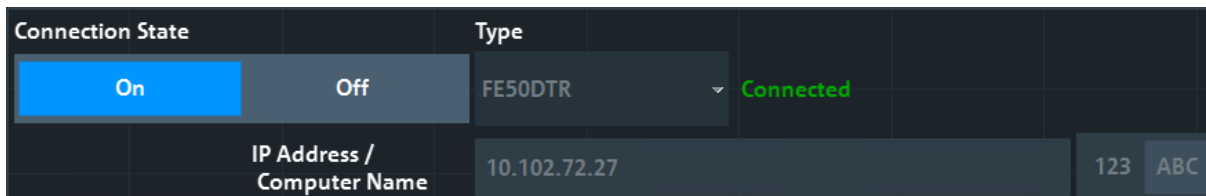
1. Check, that no other instrument controls the R&S FE50DTR.  
The LAN LED on the front panel of the R&S FE50DTR must be green, see ["LAN connection states"](#) on page 17.
2. At the R&S FSV/A, open a measurement channel for an I/Q-based application, such as the I/Q Analyzer ([Mode]).
3. Select [Input / Output] > "Input Source Config" > "Input Source" > "External Frontend".
4. On the "Global Config" tab, enable general use of the external frontend for the application ("On").  
The connection settings become available.
5. Select the "Type" of connected frontend.
6. Enter the IP address or computer name (hostname) of the connected R&S FE50DTR.  
You can find the information on the electronic label on the side panel of the R&S FE50DTR, see [Chapter 5.3, "Electronic label"](#), on page 26.

## Operating the R&amp;S FE50DTR in Rx mode



7. Set the "Connection State" to "On".

It can take up to 10 seconds until the R&S FSV/A sets up the control connection to the R&S FE50DTR. The displayed status of the control connection switches from "Not Connected" (white) to "Connected" (green).



The control connection is established. The LAN LED on the front panel of the R&S FE50DTR switches from green to orange.

8. Optionally, check the network settings of the R&S FE50DTR.
- Select the "Network Config" tab.
  - Check, that the correct "IP Address" and "Subnet Mask" are assigned.

Radio Frequency	Global Config	Frontend Config	Diagnostics	Network Config
External Frontend	Network Settings			
	IP Address			
	Subnet Mask			
	DHCP	<input checked="" type="radio"/> On <input type="radio"/> Off		
	<input type="button" value="Apply Network Settings"/>			

By default, DHCP is enabled and the IP address of the external frontend is assigned automatically.

9. Optionally, if you need to change the network settings, proceed as follows:
  - a) Disable DHCP ("DHCP" > "Off").
  - b) Adjust the network settings according to your test setup.
  - c) Click "Apply Network Settings".

**i** If you change the network configuration to "DHCP" > "On", the connection to the R&S FE50DTR is aborted. You must re-establish a connection to the frontend as in step 4).

If you have connection issues, see section „Troubleshooting External Frontend Control“ in the R&S FSV/A user manual.

### To configure frequency settings at the vector signal analyzer

This step-by-step description explains how the R&S FSV/A configures frequency settings at the R&S FE50DTR. Test setups typically require a defined setting of the frequency band configuration at the R&S FE50DTR. Configure this setting in the "Frontend Config" dialog of R&S FSV/A.

1. To define IF range and internal LO of the R&S FE50DTR, set the "Frequency Band Config" mode:
  - "IF High": A higher IF is used on the external frontend, resulting in a higher IF input frequency at the R&S FSV/A.

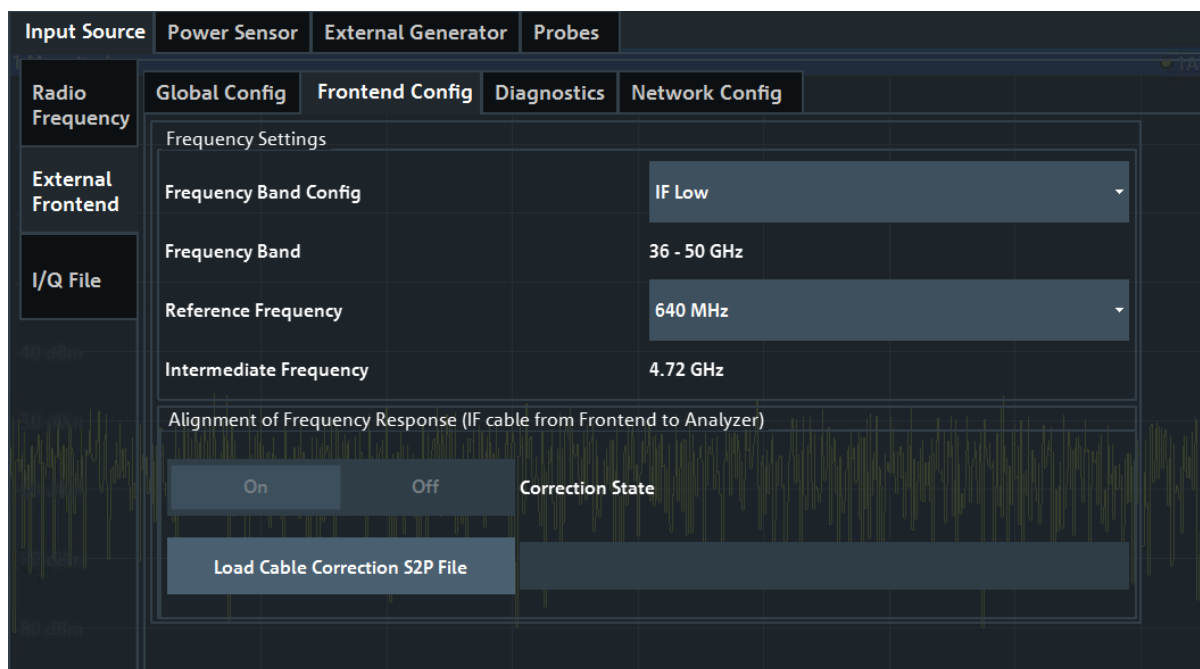
## Operating the R&amp;S FE50DTR in Tx mode

Use this setting, e.g., if you need an extended analysis bandwidth (> 400 MHz) at the vector signal analyzer (option B1000).

- "IF Low": A lower IF is used on the external frontend, resulting in a lower IF input frequency at the R&S FSV/A.

The used IF and the frequency band of the input signal are set automatically.

2. Set the reference frequency for the internal LO of the external frontend.



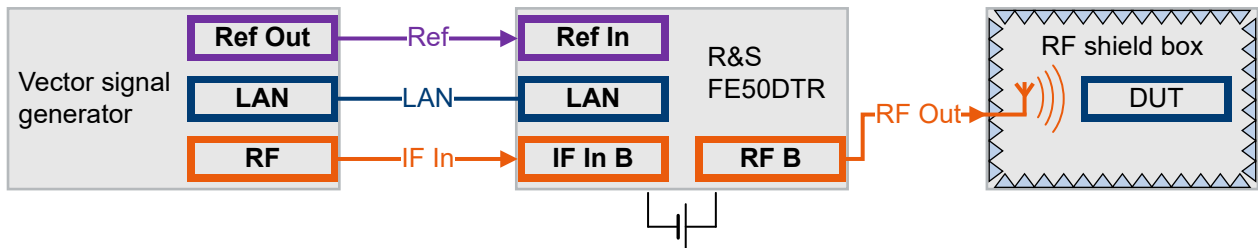
FE50DTR-type frontends can be used by an analyzer and a signal generator simultaneously. In this case, both channels use the same internal LO and thus both signal paths operate on the same frequency. Therefore, make sure that the frequency band configuration is identical on both instruments.

## 6.2 Operating the R&S FE50DTR in Tx mode

In Tx mode, the R&S FE50DTR receives a low frequency IF signal from the vector signal generator. It upconverts this signal using its own internal local oscillator (LO) to a high-frequency RF signal. The R&S FE50DTR outputs and transmits this RF signal to the DUT.

## Operating the R&amp;S FE50DTR in Tx mode

## Test setup



The following step-by-step descriptions use an R&S SMW as vector signal generator.

- ["To connect the R&S FE50DTR for Tx mode"](#) on page 32
- ["To control the R&S FE50DTR with a vector signal generator"](#) on page 33
- ["To configure frequency settings at the vector signal generator"](#) on page 35

If supported, the descriptions for other Rohde & Schwarz vector signal generators are analogous.

## To connect the R&amp;S FE50DTR for Tx mode

The R&S FE50DTR is [connected to power](#) and [switched on](#).

- Connect all connectors for connections between the R&S FE50DTR and R&S SMW, and R&S FE50DTR (RF Out) and DUT as in [Table 6-2](#).

**Table 6-2: Signals and connections in Tx mode**

Signal	Vector signal generator e.g, R&S SMW	R&S FE50DTR
Reference	Connector "REF OUT" Frequency: 1 GHz, 10 MHz	"Ref In"
LAN (Control)	"LAN"	"LAN"
IF In	"RF A"/"RF B"	"IF In B"
RF Out	-	"RF B"

How to:

- [Chapter 4.7, "Connecting to LAN"](#), on page 16
- [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

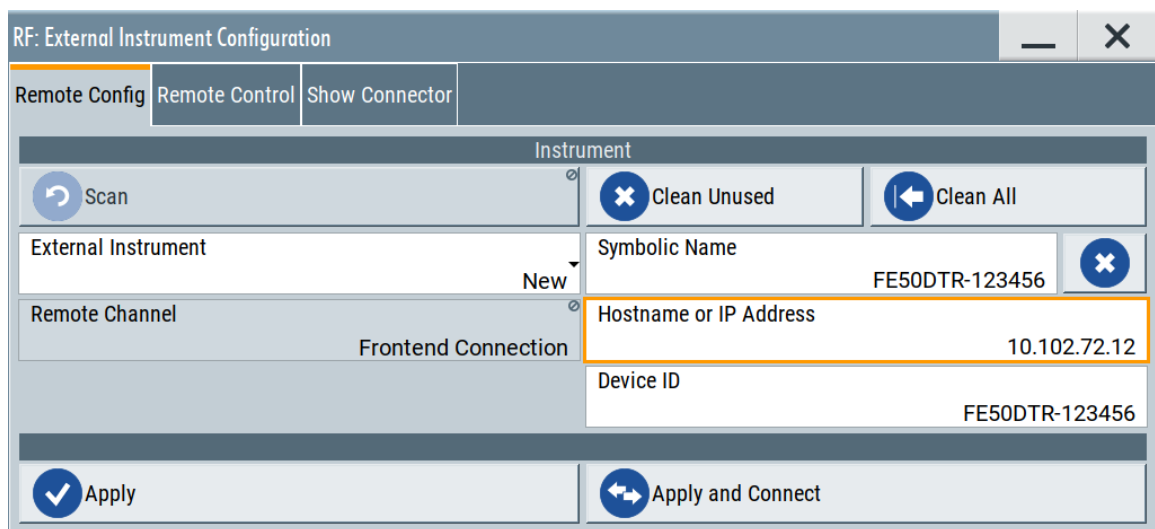


## Operating the R&amp;S FE50DTR in Tx mode

**To control the R&S FE50DTR with a vector signal generator**

The R&S SMW controls the R&S FE50DTR using a secure socket layer (SSL) control connection via LAN. The following step-by-step description explains how the R&S SMW locks the R&S FE50DTR to control the R&S FE50DTR exclusively.

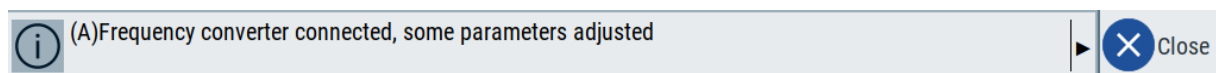
1. Follow steps 1) and 2) of ["To control the R&S FE50DTR with a vector signal analyzer"](#) on page 28.
2. In the external frontend network configuration dialog of the R&S SMW, set the IP address or hostname and device ID of the R&S FE50DTR.
  - a) To access, select "System Configuration" > "External RF und I/Q" > "RF A" > "External Instrument" > "Config".
  - b) Set the correct "IP Address" or "Hostname" and "Device ID".



The setting "Remote Channel" > "Frontend Connection" indicates that the SSL control connection is used for frontend control.

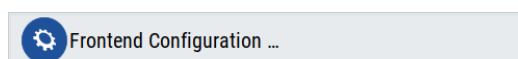
3. Click "Apply and Connect".

A message displays, if the remote connection to the external frontend is established or not.



**Figure 6-1: Message displaying established remote connection**

4. Configure the connection mode between external frontend and R&S SMW:
  - a) Click "Frontend Configuration".




## Operating the R&amp;S FE50DTR in Tx mode

b) Define the "Connection Mode" between R&S SMW and R&S FE50DTR:


- "Auto": Default setting. If the R&S SMW outputs the IF signal ("RF" > "On") to the external frontend, the R&S SMW locks the external frontend and uses the external frontend exclusively.
- "Lock": The R&S SMW locks the external frontend permanently.
- "Simultaneous RX/TX": The R&S SMW locks the SSL connection to the external frontend once for Tx operation and releases the external frontend. A connected vector signal analyzer can take over control of the external frontend, see ["To control the R&S FE50DTR with a vector signal analyzer"](#) on page 28.

5. In the "System Config > System Configuration > External RF und I/Q" dialog, check the control connection state.

Multi Instrument	Fading/Baseband Config	I/Q Stream Mapper	External RF and I/Q	Overview					
Display Mapped Connectors									
Connect All Remote		Disconnect All Remote		Auto Connect <input type="checkbox"/>					
Preset behavior: Keep connections to external instruments <input type="checkbox"/>									
	Dir	External Instrument	I/Q Conn	Rem Conn	Instrument Name	RF Coup	RF Frequency /Hz	RF Level /dBm	RF State
RF A	Out	Config...			FE50DTR-123456	On	Δ: 0.00	Δ: 0.00	Off
RF B	Out	Config...							

The "RF A" > "Rem Conn" field displays an active control connection: 

The control connection is established, the LAN LED on the front panel of the R&S FE50DTR switches from green to orange.

 If you change the network configuration, e.g. the IP address, the connection to the R&S FE50DTR is aborted. You must re-establish a connection to the frontend as in step 3).

If you have connection issues, see section „Troubleshooting External Frontend Control“ in the R&S SMW-K553 Frontend Control user manual.

## Operating the R&amp;S FE50DTR in simultaneous mode

**To configure frequency settings at the vector signal generator**

Test setups typically require a defined setting of the frequency band configuration R&S FE50DTR. Configure this setting in the "RF Frontend" dialog of the R&S SMW.

1. To define IF range and internal LO of the R&S FE50DTR, set the "Frequency Band Config" mode:
  - "IF High": Requires an R&S SMW equipped with frequency option R&S SMW-B1012 or higher.  
A higher IF is used on the external frontend. Use this setting, e.g., if your measurement setup requires high analysis bandwidths (> 400 MHz) at the R&S FSV/A.
  - "IF Low": A lower IF is used on the external frontend.

The used IF and the used frequency band of the RF input signal are set automatically.

2. Set the reference frequency for the internal LO of the external frontend.

RF Frontend : FE50DTR-100810	
Settings	Versions / Options   Attenuator   Cable Correction
Reference Frequency	640 MHz
Intermediate Frequency	4.720000000000 GHz
Connection Mode	Simultaneous RX/TX
Active RF Connector	RF B
Frequency Band Configuration	
Frequency Band Config	IF Low
Frequency Band 1	36.00 GHz ... 50.00 GHz

FE50DTR-type frontends can be used by an analyzer and a signal generator simultaneously. In this case, both channels use the same internal LO and thus both signal paths operate on the same frequency. Therefore, make sure that the frequency band configuration is identical on both instruments.

## 6.3 Operating the R&S FE50DTR in simultaneous mode

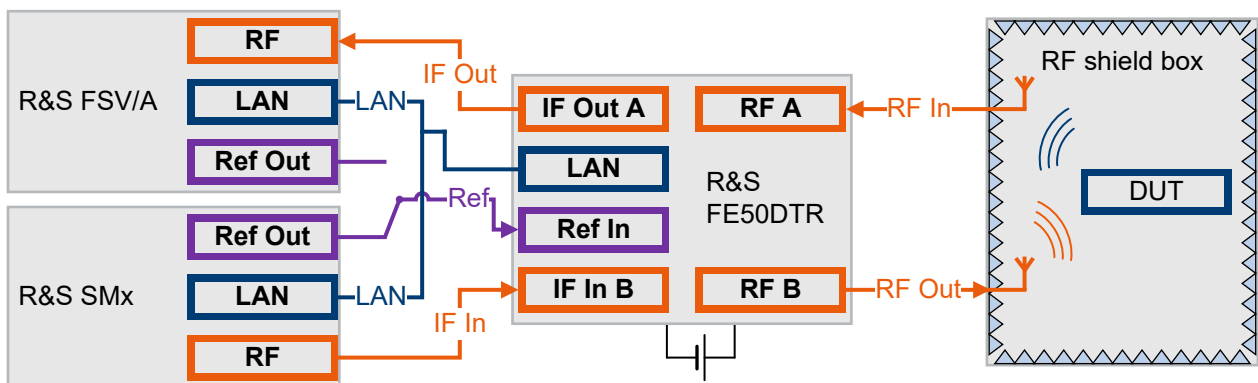
In simultaneous mode, the R&S FE50DTR operates in Tx mode and Rx mode simultaneously. The R&S FE50DTR receives a low frequency IF signal from the vector signal generator. It upconverts this signal using its own internal local oscil-

## Operating the R&amp;S FE50DTR in simultaneous mode

lator (LO) to a high-frequency RF signal. The R&S FE50DTR outputs and transmits this RF signal to the DUT.

The DUT processes the signal and responds with a high-frequency RF signal that the R&S FE50DTR receives. The R&S FE50DTR downconverts the received signal using its own internal LO to an intermediate frequency (IF) signal that is a low-frequency signal. The R&S FE50DTR outputs and transmits the IF signal to the vector signal analyzer.

## Test setup



The following step-by-step descriptions use an R&S SMW as vector signal generator and R&S FSV/A as vector signal analyzer.

- ["To connect the R&S FE50DTR for simultaneous mode"](#) on page 36
- ["To control the R&S FE50DTR"](#) on page 37
- ["To configure frequency settings"](#) on page 38

If supported, the descriptions for other Rohde & Schwarz instruments are analogous.

## To connect the R&amp;S FE50DTR for simultaneous mode

The R&S FE50DTR is [connected to power](#) and [switched on](#).

- Connect all connectors for connections between the R&S FE50DTR and R&S SMW, R&S FE50DTR and R&S FSV/A, and R&S FE50DTR (RF in) and DUT as in [Table 6-1](#).

## Operating the R&amp;S FE50DTR in simultaneous mode

**Table 6-3: Simultaneous mode R&S FE50DTR signal and connections**

Signal	Vector signal generator e.g., R&S SMW	R&S FE50DTR	Vector signal analyzer e.g., R&S FSV/A
Reference	Connector: "REF Out" Freq.: 1 GHz, 10 MHz	"Ref In"	Connector "REF Output" Freq.: 640 MHz, 10 MHz
LAN (Control)	"LAN"	"LAN"	"LAN"
IF In	"RF A"/"RF B"	"IF In B"	-
IF Out	-	"IF Out A"	"RF Input 50Ω"
RF In	-	"RF A"	-
RF Out	-	"RF B"	-

How to:

- [Chapter 4.7, "Connecting to LAN"](#), on page 16
- [Chapter 4.8, "Connecting to SMA and 1.85 mm"](#), on page 18

**To control the R&S FE50DTR**

Either the R&S SMW or R&S FSV/A controls the R&S FE50DTR exclusively using a secure socket layer (SSL) control connection via LAN. For correct operation, the R&S FE50DTR operates in Tx mode first and requires control by the R&S SMW. For analysis, the R&S FE50DTR also operates in Rx mode and requires control by the R&S FSV/A.

1. At the R&S SMW, establish the control connection to the R&S FE50DTR.  
How to: ["To control the R&S FE50DTR with a vector signal generator"](#)  
on page 33
2. At the R&S SMW, set "Connection Mode" > "Simultaneous RX/TX".  
In this state, the connection is locked by the R&S SMW when you change frontend settings. For example, when changing the carrier frequency at the R&S SMW.  
After applying these changes at the R&S FE50DTR, the R&S SMW releases the lock of the R&S FE50DTR for control by the R&S FSV/A.
3. At the R&S FSV/A, establish the control connection to the R&S FE50DTR.  
How to: ["To control the R&S FE50DTR with a vector signal analyzer"](#)  
on page 28  
In this state, the connection is locked by the R&S FSV/A permanently.
4. If you want to change frontend settings at the R&S SMW, disable the control connection between R&S FSV/A and R&S FE50DTR.

## Operating the R&amp;S FE50DTR in simultaneous mode

- a) At the R&S FSV/A on the "Global Config" tab, set "Connection State" to "Off".

Connection State		Type		
On	Off	FE50DTR	Not Connected	
IP Address / Computer Name		10.102.72.27	123	ABC

The connection is aborted. The R&S FSV/A releases the lock of the R&S FE50DTR.

- b) At the R&S SMW, change the frontend settings according to your setup. How to: ["To configure frequency settings at the vector signal analyzer"](#) on page 30
- c) If you want to measure with the changed configuration of the R&S FE50DTR, reestablish the control connection between R&S FSV/A and R&S FE50DTR ("Connection State" > "On").

### To configure frequency settings

Simultaneous mode operation of the R&S FE50DTR requires an identical setting of the frequency band configuration at the R&S SMW and at the R&S FSV/A.

How to:

- [Configure frequency settings at the R&S SMW.](#)
- [Configure frequency settings at the R&S FSV/A.](#)

The frequency band configuration depends on the equipment of the vector signal generator and vector signal analyzer. [Table 6-4](#) illustrates exemplary configurations of R&S SMW and R&S FSV/A and availability of the frequency band configuration modes "IF High" and "IF Low".

**Table 6-4: Analyzer/signal generator equipment and frequency band configuration**

Analyzer model	Analyzer hardware	Analysis bandwidth	Signal generator hardware	Band configuration
R&S FSV(A)3007	<= B400	<= 400 MHz	B1006, B1007	"IF Low"
R&S FSV(A)3007	<= B400	<= 400 MHz	>= B1012	"IF Low"
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	<= B400	<= 400 MHz	B1006, B1007	"IF Low"

## Other operational tasks and troubleshooting

Analyzer model	Analyzer hardware	Analysis bandwidth	Signal generator hardware	Band configuration
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	<= B400	<= 400 MHz	>= B1012	"IF Low", "IF High"
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	>= B1000	<= 400 MHz	B1006, B1007	"IF Low"
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	>= B1000	> 400 MHz	B1006, B1007	-
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	>= B1000	<= 400 MHz	>= B1012	"IF Low", "IF High"
R&S FSV(A)3013 R&S FSV(A)3030 R&S FSV(A)3044	>= B1000	> 400 MHz	>= B1012	"IF High"

## 6.4 Other operational tasks and troubleshooting

### Other operational tasks

Other operational tasks with the R&S FE50DTR include:

- Correcting IF cable losses
- Calibrating the external frontend
- Checking and updating the firmware of the external frontend

For a description of these tasks, see the documentation of the control instrument:

- Chapter „How to Use an External Frontend“ in the R&S FSV/A user manual.
- Chapter „Operating external frontends“ in the R&S SMW-K553 Frontend Control user manual.

### To resolve hardware problems

Both a red "Power" LED and red "LAN" LED indicate hardware problems, that result in a malfunction of the R&S FE50DTR.

## Other operational tasks and troubleshooting

If both the "Power" LED and the "LAN" LED are red, proceed as follows:

1. Switch off the R&S FE50DTR.  
No disconnection of the cabling is required.
2. Switch on the R&S FE50DTR.

How to: [Chapter 4.10, "Switching on or off"](#), on page 20

If hardware problems persist, contact Rohde & Schwarz customer support.

For a comprehensive description of all troubleshooting tasks, see section „Troubleshooting External Frontend Control“ in the R&S FSV/A user manual and R&S SMW-K553 Frontend Control user manual.



## 7 Transporting

### **Packing**

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection. You can also contact your local Rohde & Schwarz service center for advice.

### **Securing**

When moving the R&S FE50DTR in a vehicle or using transporting equipment, make sure that the R&S FE50DTR is properly secured. Only use items intended for securing objects.

### **Transport altitude**

Unless otherwise specified in the data sheet, the maximum transport altitude without pressure compensation is 4500 m above sea level.

## 8 Maintenance, storage and disposal

The product does not require regular maintenance. It only requires occasional cleaning. It is however advisable to check the nominal data from time to time.

### 8.1 Cleaning

Do not use any liquids for cleaning. Cleaning agents, solvents (thinners, acetone), acids and bases can damage the front panel labeling, plastic parts and display.

### 8.2 Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the data sheet.

### 8.3 Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

#### Disposing electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.



**Figure 8-1: Labeling in line with EU directive WEEE**

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely

**Disposal**

fulfills its obligation to take back and dispose of electrical and electronic waste.  
Contact your local service representative to dispose of the product.

## 9 Contacting customer support

### Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

### Contact information

Contact our customer support center at [www.rohde-schwarz.com/support](http://www.rohde-schwarz.com/support), or follow this QR code:



*Figure 9-1: QR code to the Rohde & Schwarz support page*

# Glossary: Abbreviations and definitions

## D

**DTR:** Dual transmit receive

Refers to simultaneous Tx and Rx operation of the R&S FE50DTR.

**DUT:** Device under test

## F

**FE:** Frontend

## M

**mmWave:** Millimeter wave

## O

**OTA:** Over the air

## P

**PEP:** Peak envelope power

## R

**Rx:** Receive mode

## T

**Tx:** Transmit mode

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