Rosenberger

PIM Rack Analyzer

User Manual

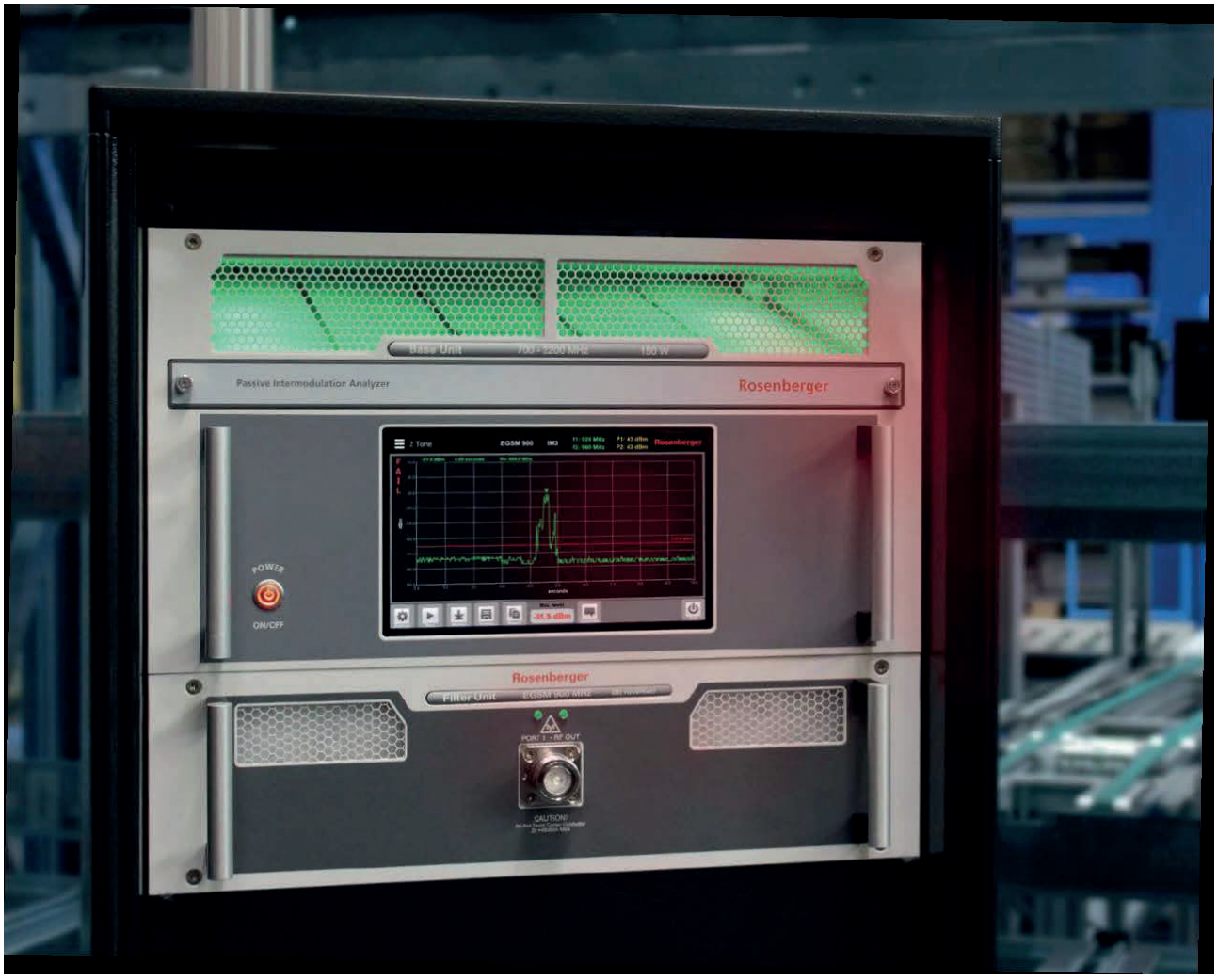


Table of Contents

1 General Information and Safety Instructions

Operation which deviates from the intended purpose of the product, failure to observe this documentation, the use of insufficiently qualified personnel as well as unauthorized modifications will exclude the manufacturer from any liability for resulting damage and will render any warranty void.

People with cardiac simulators must not be exposed to the magnetic field of the batteries, the battery unit, the power unit or the charging cable.

Rosenberger makes every effort to keep the safety standards of our products up to date to offer our customers the highest possible degree of safety. Our products and the required accessories are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the attached CE Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, please contact Rosenberger.

Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for production & laboratory use and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any intention other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and a basic knowledge of the English language. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills are allowed to use the product. If personal safety gear is required in order to use the Rosenberger PIM Rack Analyzer, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to any subsequent users.

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation.

Operating conditions and operating positions

The product must only be operated under the operating conditions and in the positions specified by the manufacturer. The product's ventilation must not be obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death and product damage. Applicable local or national safety regulations and rules for the prevention of accidents must be observed during all work.

- Never switch output power on (in manual mode or remote mode) without a load or terminated OUT connected to the test port.
- Unless otherwise specified, the following requirements apply to this product: IP protection 2X, pollution severity 2, overvoltage category 2, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of +-10 % shall apply to the nominal voltage and +- 5 % to the nominal frequency.
- Do not place the product on surfaces, vehicles, cabinets or tables that, for reasons of weight or stability, are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). Installation that is not carried out as described in the product documentation could result in personal injury or death.
- Do not cover the heat sink or ventilation openings.
- Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or death.

Electrical safety

If the information on electrical safety is not observed at all or to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

- Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If the equipment is used at different voltages, the power fuse of the product may have to be changed accordingly.
- In the case of products in safety class I with movable power cord and connector, operation is only permitted using sockets with an ground contact and protective ground connection.
- Intentionally breaking the protective ground connection either in the feed line or in the product itself is not permitted. Doing so may result in an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
- The plug on the connecting cable serves as the disconnecting device for disconnecting the product from the AC supply network. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of the connecting cable, approx. 2.5 m). Functional or electronic switches are not suitable for disconnecting the product from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
- Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper working order. By taking appropriate safety measures and laying the power cable carefully, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
- The product must only be operated in TN/TT networks fused with max.
  16 A (230 VAC) / 20 A (110 VAC)

- Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks may occur and result in fire and/or injuries.
- Do not overload any sockets, extension cords or connector strips; doing so can result in fire or electric shocks.
- For measurements in circuits with voltages Vrms > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
- Ensure that connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1 / EN60950-1 or IEC61010-1 / EN 61010-1 standards that apply in each case.
- Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
- If a product is to be permanently installed, the connection between the PG terminal on site and the product's PG conductor must be made first before any other connection is made. The product must only be installed and connected by a licensed electrician.
- For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
- Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
- Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
- Unless specified otherwise, products are not liquid-proof (see also section "Operating conditions and operating positions", item 1.) Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer an electric shock or the product itself may be damaged, which can also lead to personal injury.
- Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.

Operation

- Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
- Operation of the PIM Rack Analyzer can produce electromagnetic radiation. Ensure that the radiation levels do not exceed the limits stipulated by national regulations. Persons with pacemakers and pregnant women are especially at risk.
- Before you move or transport the product, read and observe the section titled "Transport".

- Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
- Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.

Repair and service

- The product may only be opened by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
- Adjustments, replacement of parts, maintenance and repairs may only be performed by electrical experts authorized by Rosenberger. Only original parts can be used for replacing safety parts (e.g. power switches, power transformers, fuses). A safety test must always be performed after safety parts have been replaced (visual inspection, PG conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps to ensure the continued safety of the product.

Transport

- The product may be very heavy. Therefore, it must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a second person) to avoid back or other physical injuries.
- The user is responsible for securely fastening the products to or on the transport or lifting equipment. Observe the safety regulations issued by the manufacturer of the transport or lifting equipment. Non-compliance may result in personal injury or material damage.
- If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

- If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
- If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions issued by the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Cleaning

- Prior to cleaning the product, disconnect it completely from the power supply. Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol (except in the case of the test port), acetone or diluents for cellulose lacquers.
- Use pressurized air or alcohol-soaked cotton swabs to clean the test port.

2 Package Contents

Please keep the original boxes and all packaging materials and use them in the same way as received when sending back the unit, e.g. for calibration, service. This way the risk of damage during transport can be minimized.

Before doing anything else, please check that all parts are contained in your shipment. If anything is missing, contact Rosenberger. See the information below for a description of the contents of the main unit packaging. The filter unit comes in a separate box.

Packaging

- Base unit
- Power cable (country-specific)
- DTF zeroing adapter
- Torque wrench
- Adjustable flat wrench
- USB stick

Unpacking the box

When opening the box, remove the accessory box and foam at the top first. With the help of a second person,lift the unit out of the box using the foldable handles at the side and on the front panel. The center of gravity is at the side handles – do not carry the unit by the front panel handles!

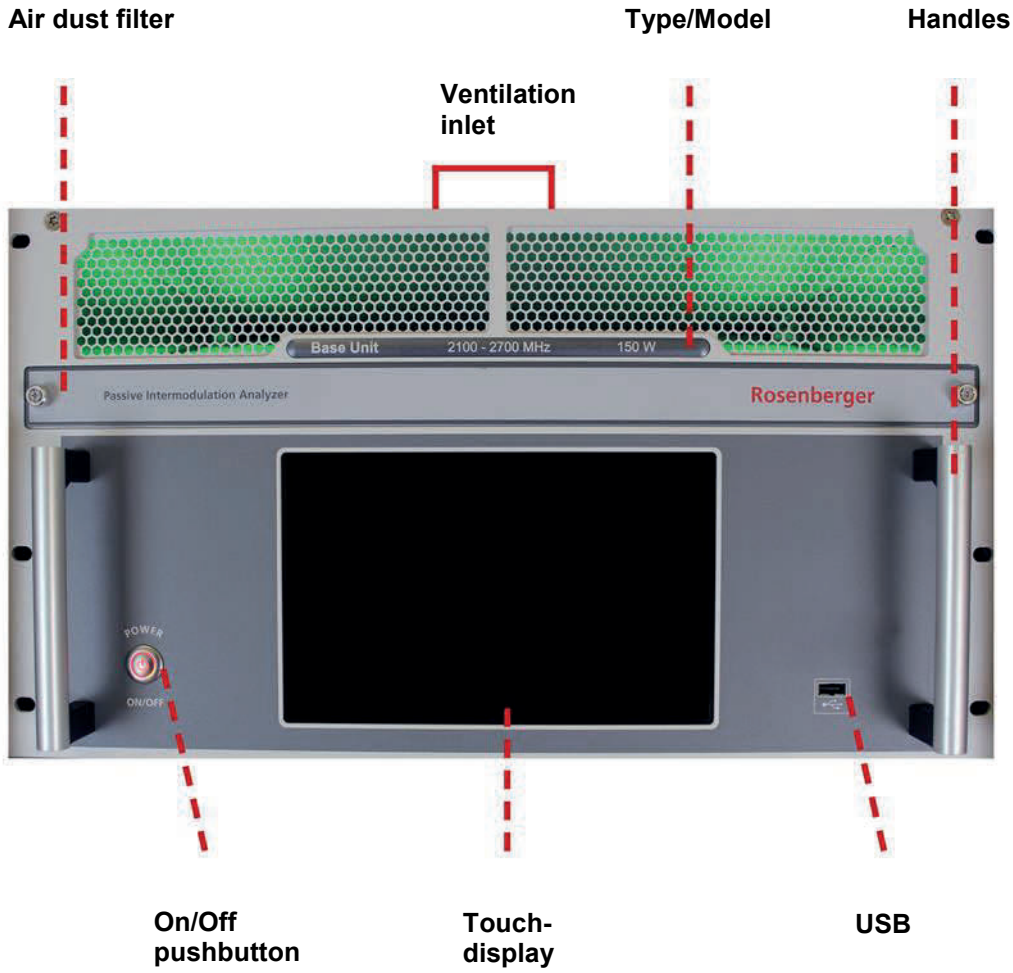
3 PIM Rack Analyzer Product Description

Dear customer, thank you for purchasing the Rosenberger PIM Rack Analyzer. The PIM Rack Analyzer allows you to perform PIM and VSWER_Distance_to_Fault (DTF) measurements. The plug-and-play filter units and the broadband base units from 700-2200 MHz and 2100-2700 MHz ensure maximum flexibility.

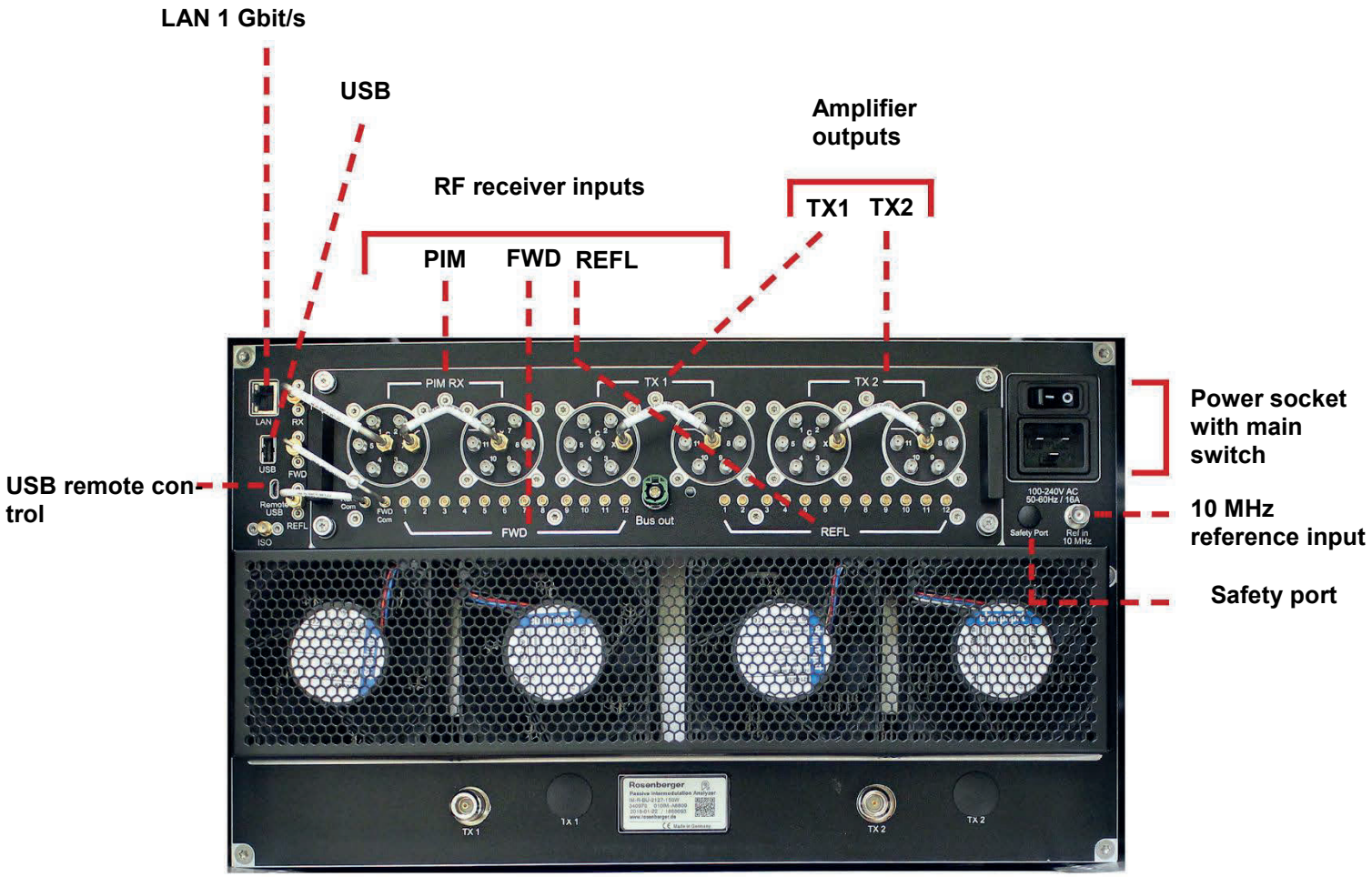
3.1 Overview

Do not cover cooling fan or ventilation inlets, otherwise the device may overheat.

Front


Air dust filter
Ventilation inlet
Type/Model
Handles
Base Unit
2100 - 2700 MHz
150 W
Passive Intermodulation Analyzer
Rosenberger
POWER
ON/OFF
On/Off pushbutton
Touch-display
USB

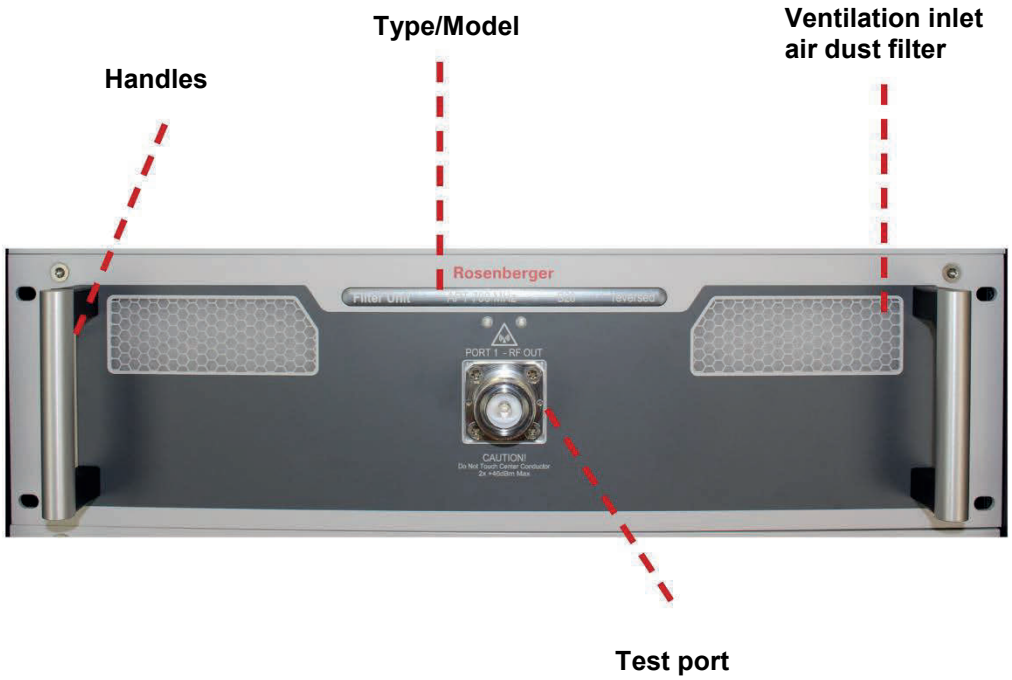
Back


LAN 1 Gbit/s
USB
Amplifier outputs
RF receiver inputs
TX1 TX2
PIM FWD REFL
USB remote control
Power socket with main switch
10 MHz reference input
Safety port
PIM RX
TX 1
TX 2
FWD
REFL
Bus out
100-240V AC
50-60Hz / 16A
Safety Port
Ref in
10 MHz
LAN
RX
USB
FWD
Remote USB
REFL
ISO
FWD Com
Com
Rosenberger

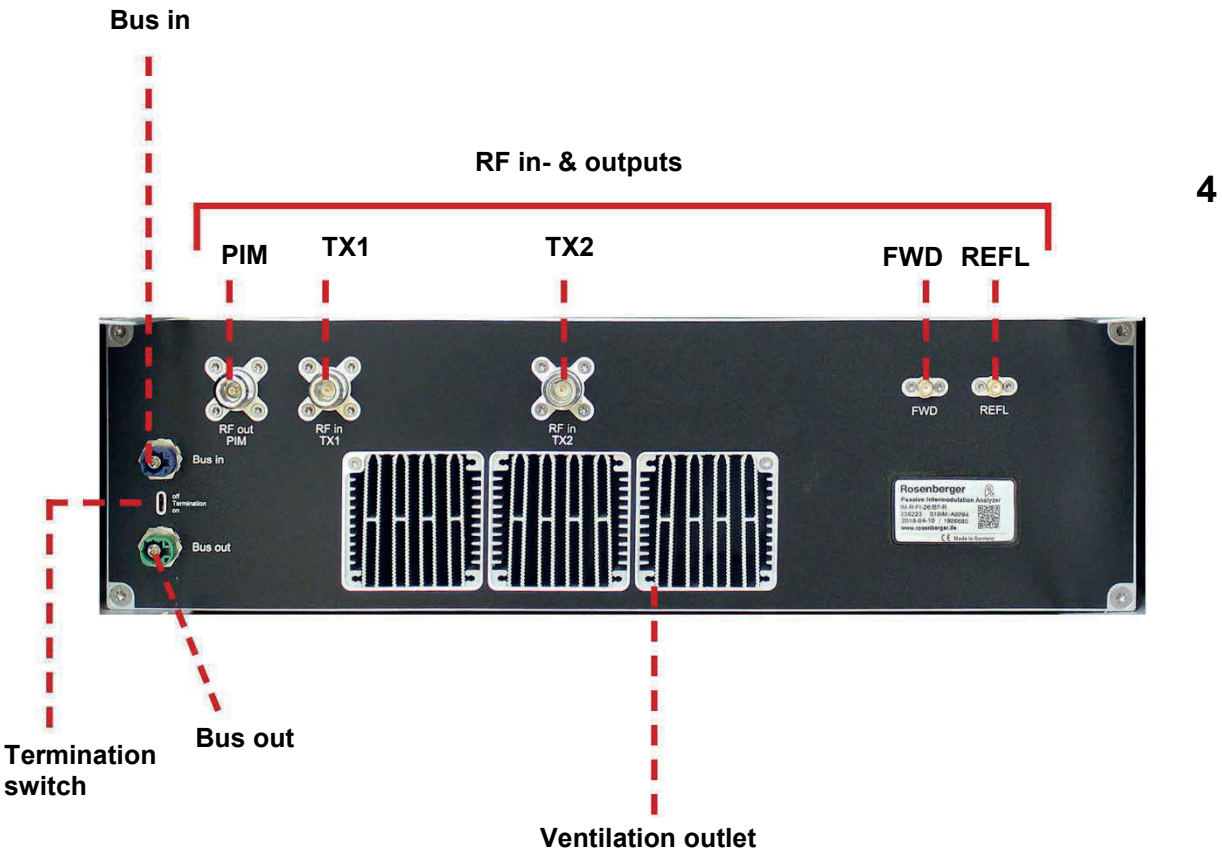
3.2 Filter

Filter units are available with preassembled 7-16 (4.3-10 on request).

Front



Back



4 Setting Up the Device

Always ensure that the device is stable and that the environmental conditions – listed under Chapter 1 – Section: *Operating conditions and operating positions* – are acceptable before starting to use the PIM Rack Analyzer.

Please disconnect the unit from the power supply before reconfiguring the RF cabling of the switch matrix.

Required tools (not included in the scope of delivery)

Small flat-head screwdriver (for switching the termination switch)
8 mm + 18 mm flat wrench (for tightening the SMA and N plugs)

Recommended: 8 mm (0.9 Nm) + 18 mm (1.1 Nm) torque wrenches (for tightening the SMA and N plugs)

Small flat-head screwdriver

Flat wrench

8 mm

18 mm

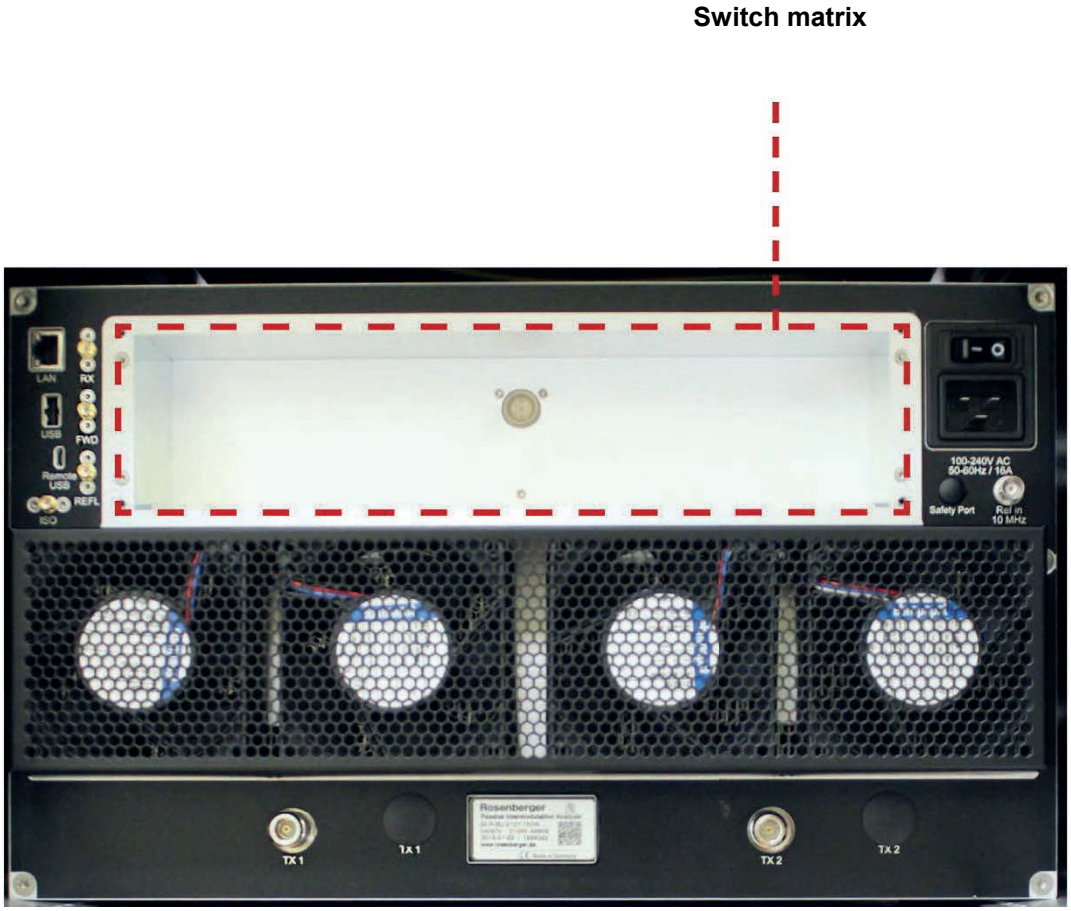
Torque wrench

8 mm (0.9 Nm)

18 mm (1.1 Nm)

4.1 Switch Matrix Installation and Cabling of First Filter Unit

1. Mount the switch matrix on the back of the base unit (IM-R-BU-xxx).
   Hand-tighten the knurled screws.



2. 11-way switch matrix only: Mount the cables W125, W126, W127 on PIM RX (X to X), TX1 (X to X) and TX2 (X to X).

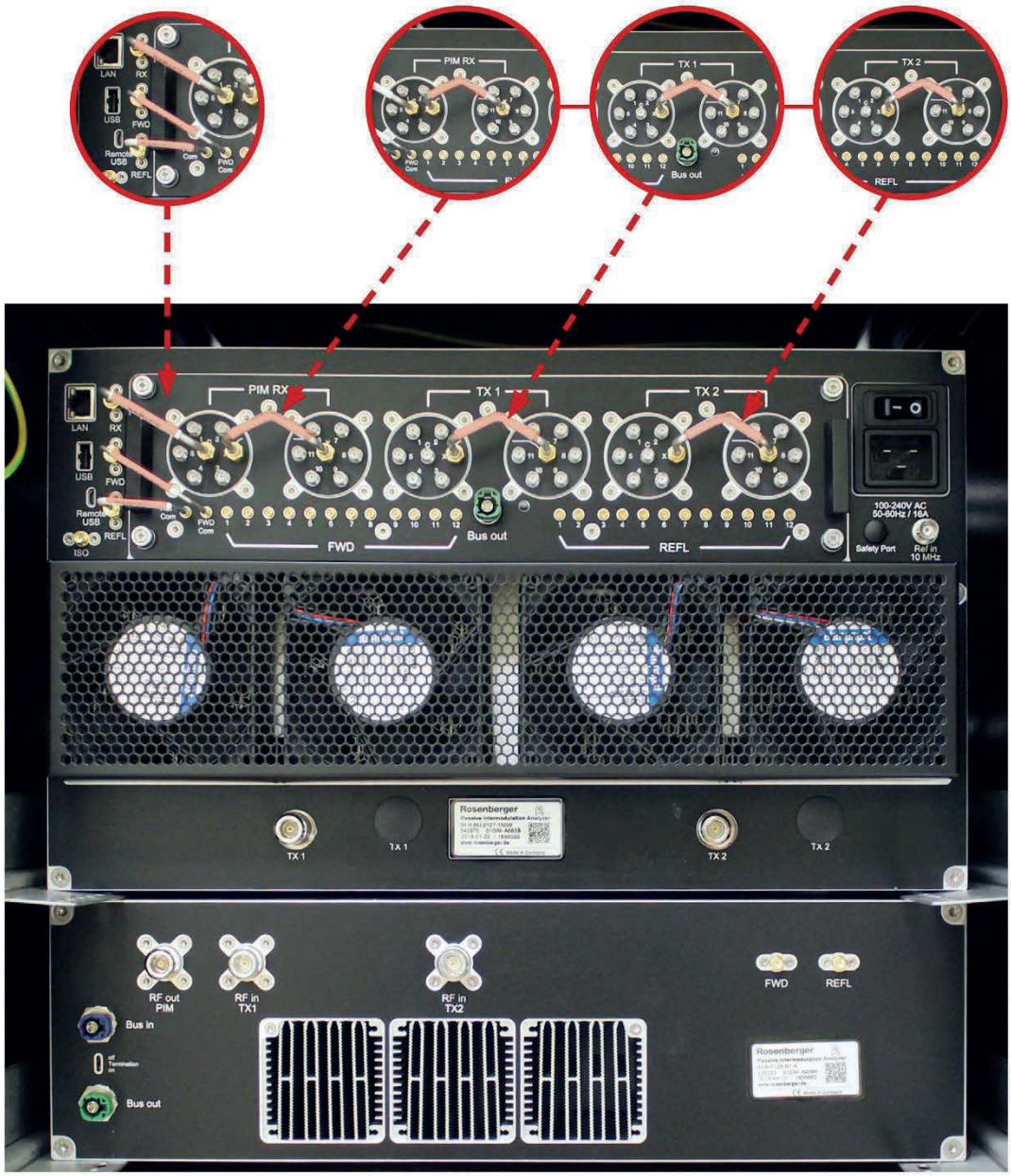
3. Mount cable W122 between REFL and REFL-Com, W121 between FWD and FWD-Com and W120 between RX and RX-C (make sure that the longer end of cable W120 is mounted on the RX connector).

W120 (RX – RX-C)
W121 (FWD – FWD-Com)
W122 (REFL – REFL-Com)

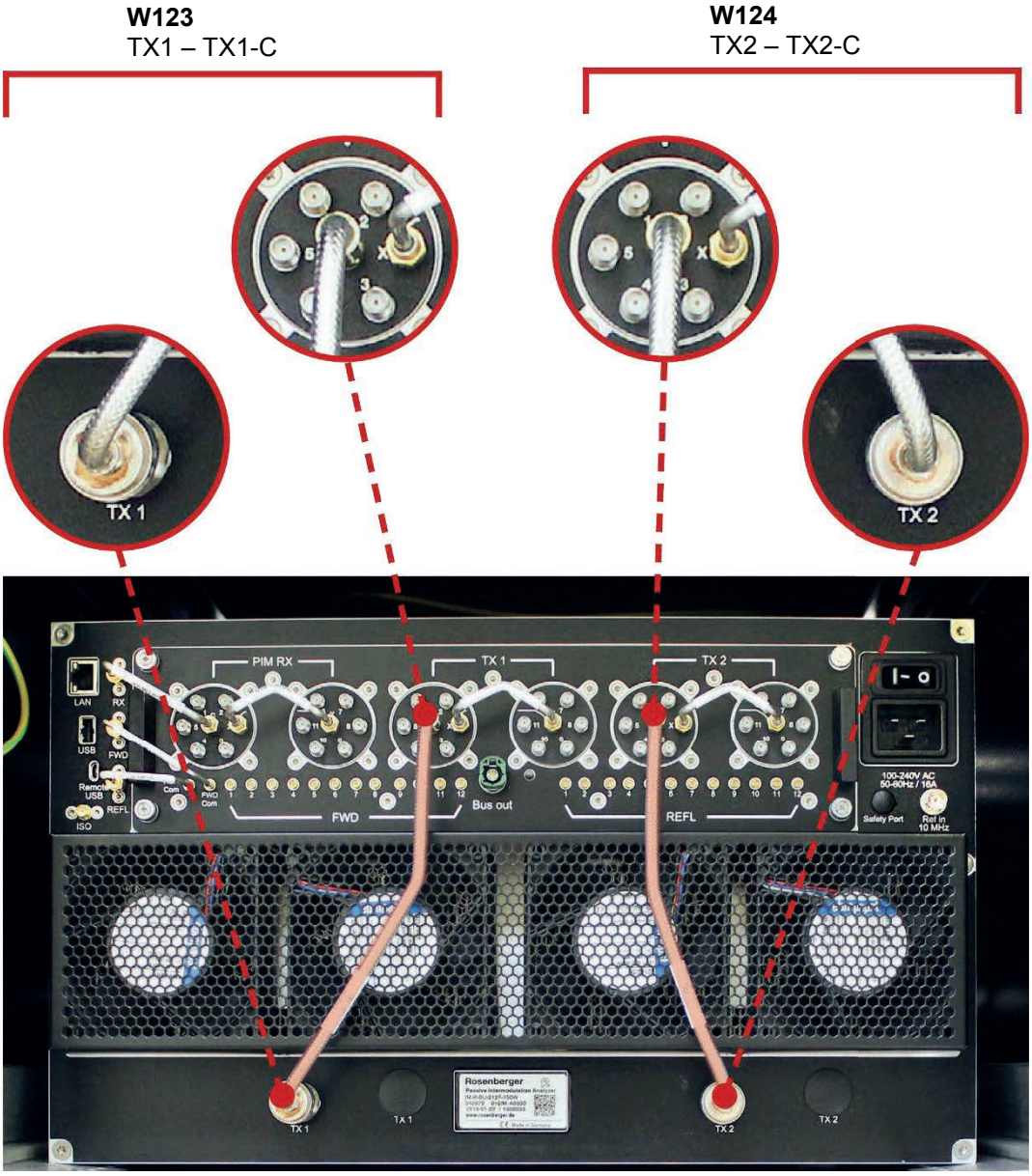
W125
PIM RX
(X to X)

W126
TX1
(X to X)

W127
TX2
(X to X)



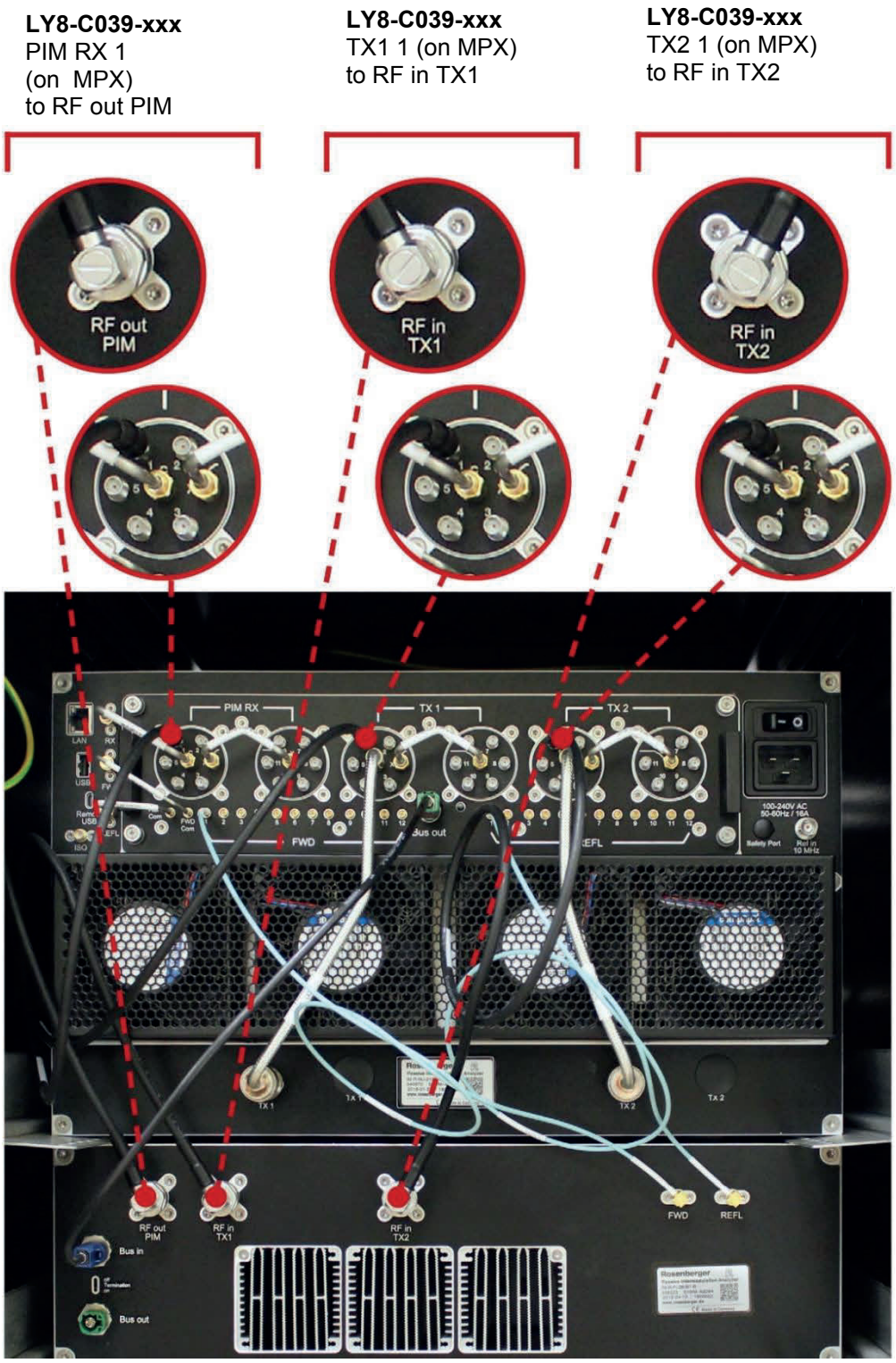
4. Mount cables W123 and W124 between the amplifier outputs and relay common (TX1 and TX1-C, Tx2 and TX2-C).



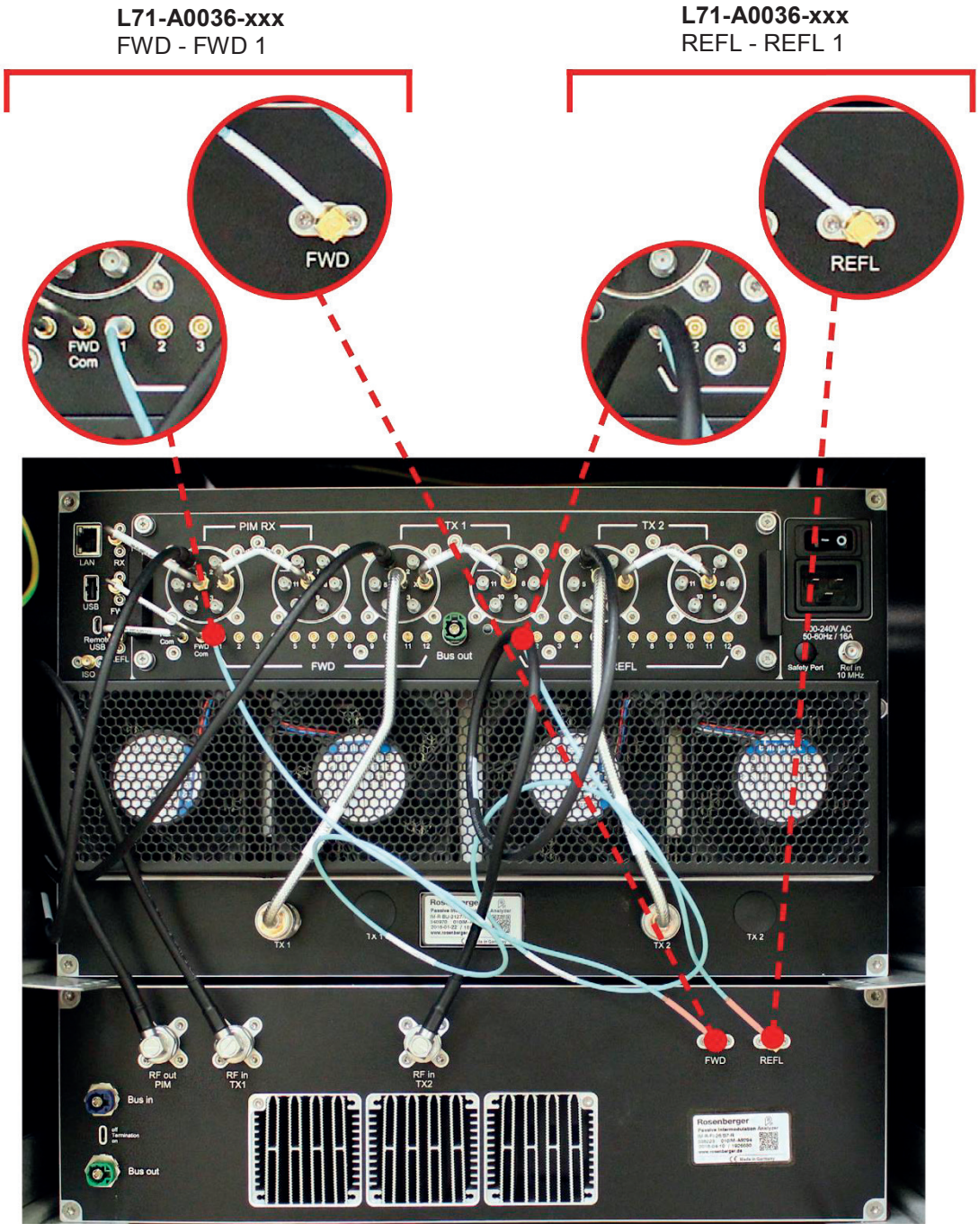
5. Mount cable LY8-C039-xxx for each path (xxx corresponds to the length; two different lengths depending on the distance between base unit and filter)

   PIM RX (on switch matrix) to RF out PIM (on filter unit)
   TX1 (on MPX) to RF in TX1 (on filter unit)
   TX2 (on MPX) to RF in TX2 (on filter unit)

   When mounting, please make sure that the position on the switch matrix is the same for all paths. E.g. all cables for one filter must be in position 1.

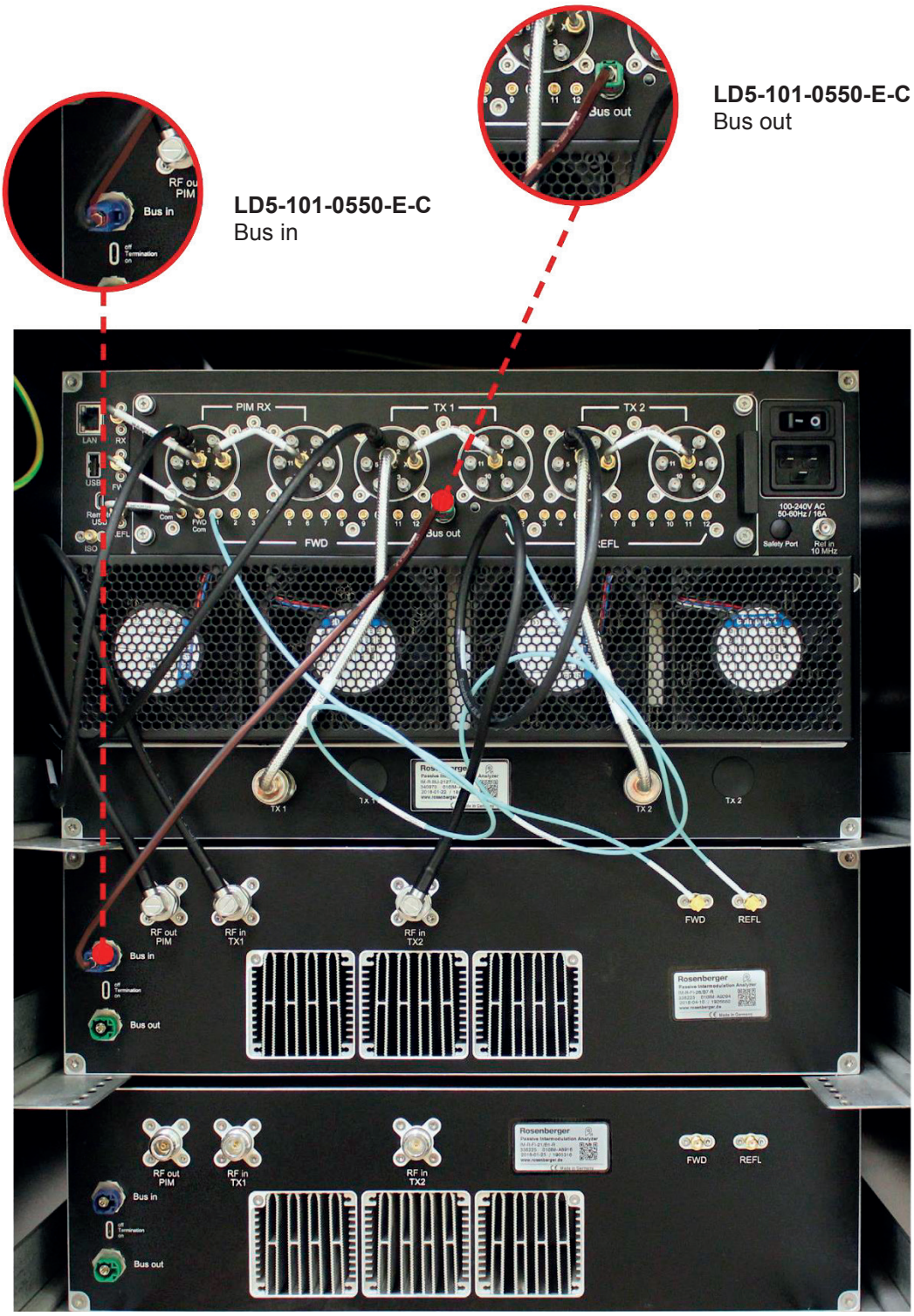


6. Take two L71-A0036-xxx cables (xxx corresponds to the length; two different lengths depending on the distance between base unit and filter) and mount them from FWD to FWD and from REFL to REFL. Please make sure that the position on the switch matrix is the same for all paths. **E.g. both cables must be in position 1.**



Please insert the SMP plug of the L71-A0036-xxx cable carefully and straight

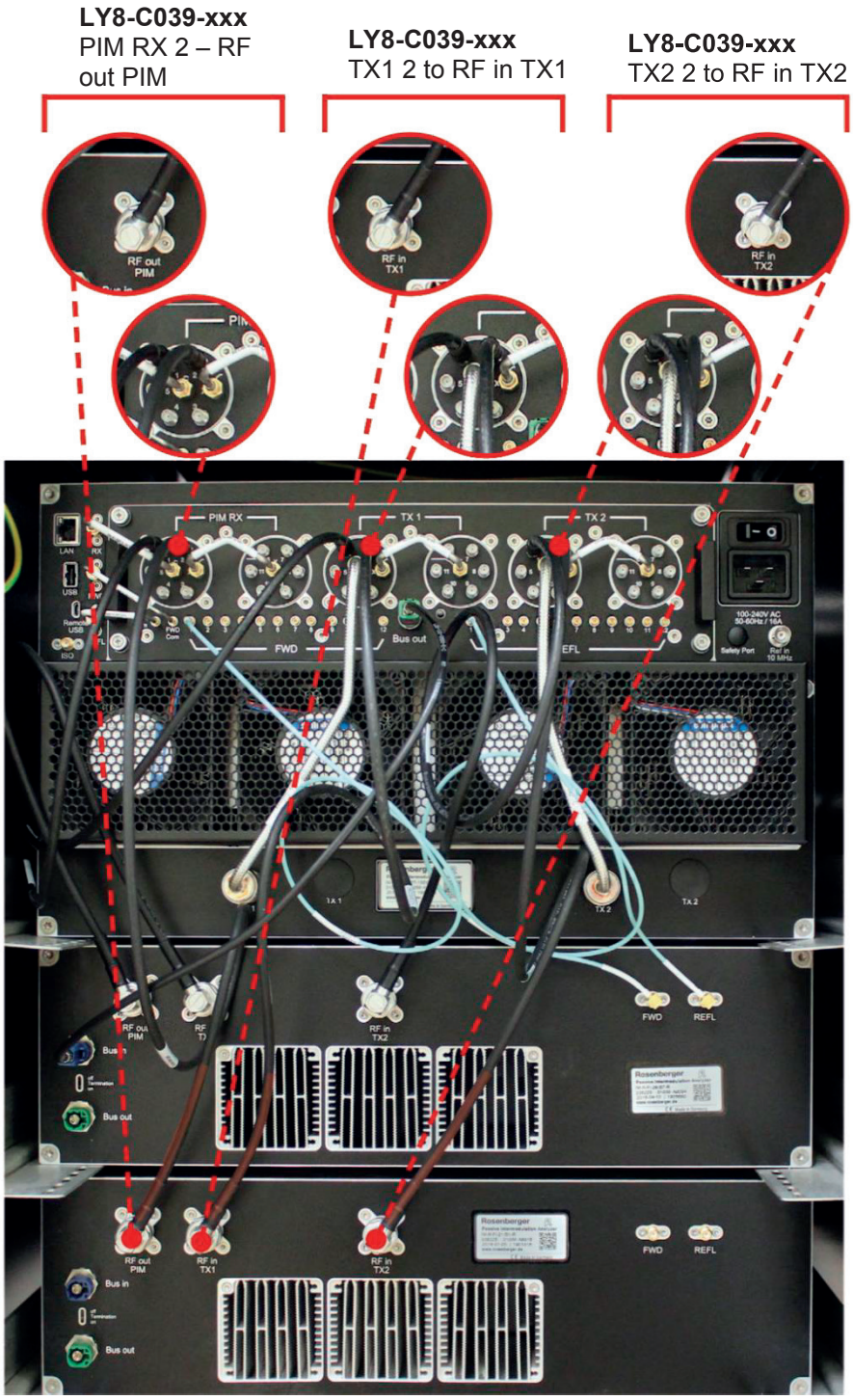
7. Take the LD5-101-0550-E-C cable and plug it into “Bus out” (green) on the switch matrix and “Bus in” (blue) on the filter.



If you are not connecting another filter, change the position of the termination switch to ON. If you are connecting further filters, the position of the termination switch must be set to OFF.

4.2 Cabling of Additional Filter

1. Mount cable LY8-C039-xxx for each path.
   PIM RX (on MPX) to RF out PIM (on filter unit)
   TX1 (on MPX) to RF in TX1 (on filter unit)
   TX2 (on MPX) to RF in TX2 (on filter unit)

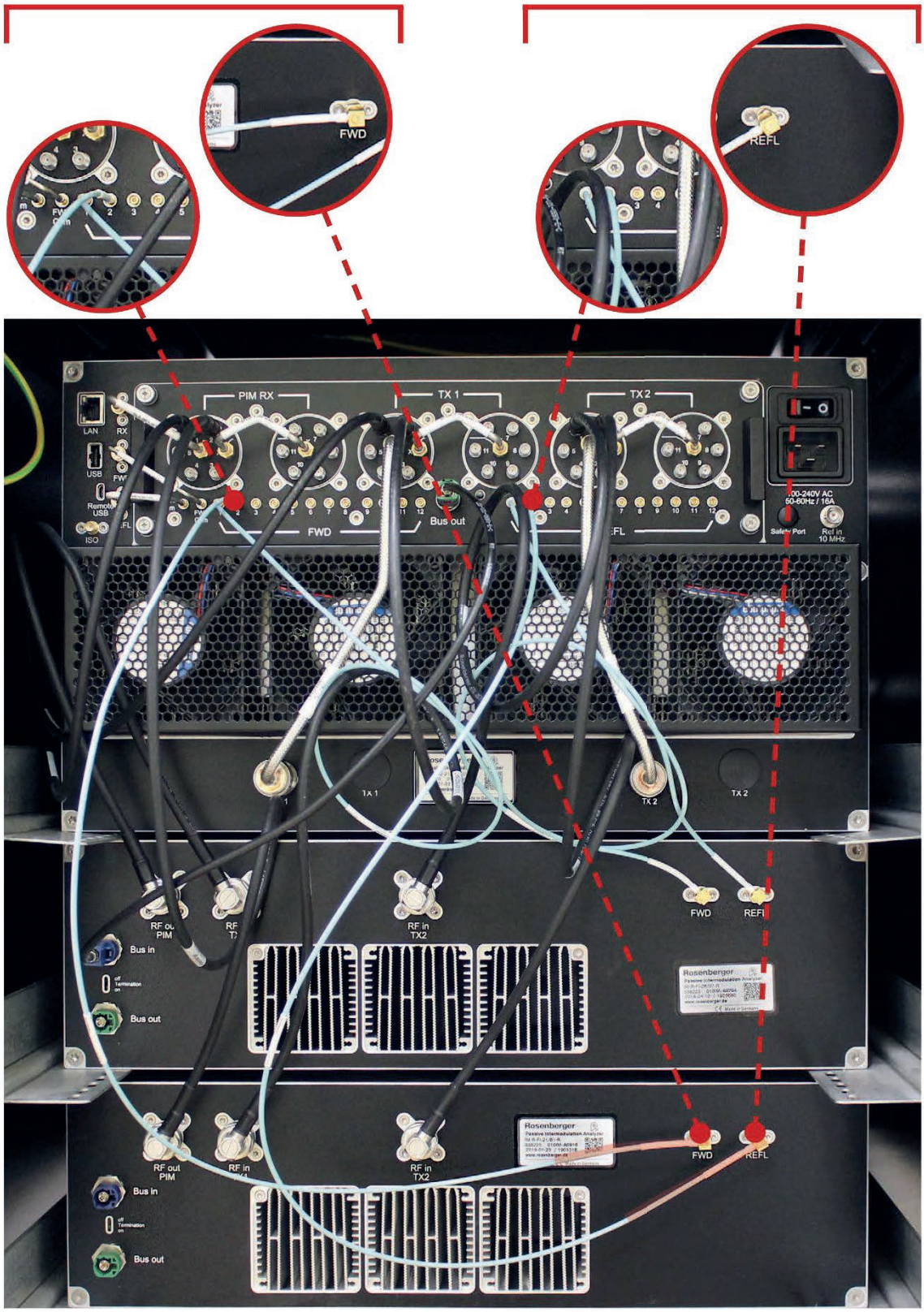


When mounting, please make sure that the position on the switch matrix is the same for all paths. E.g. all cables for this filter must be in position 2.

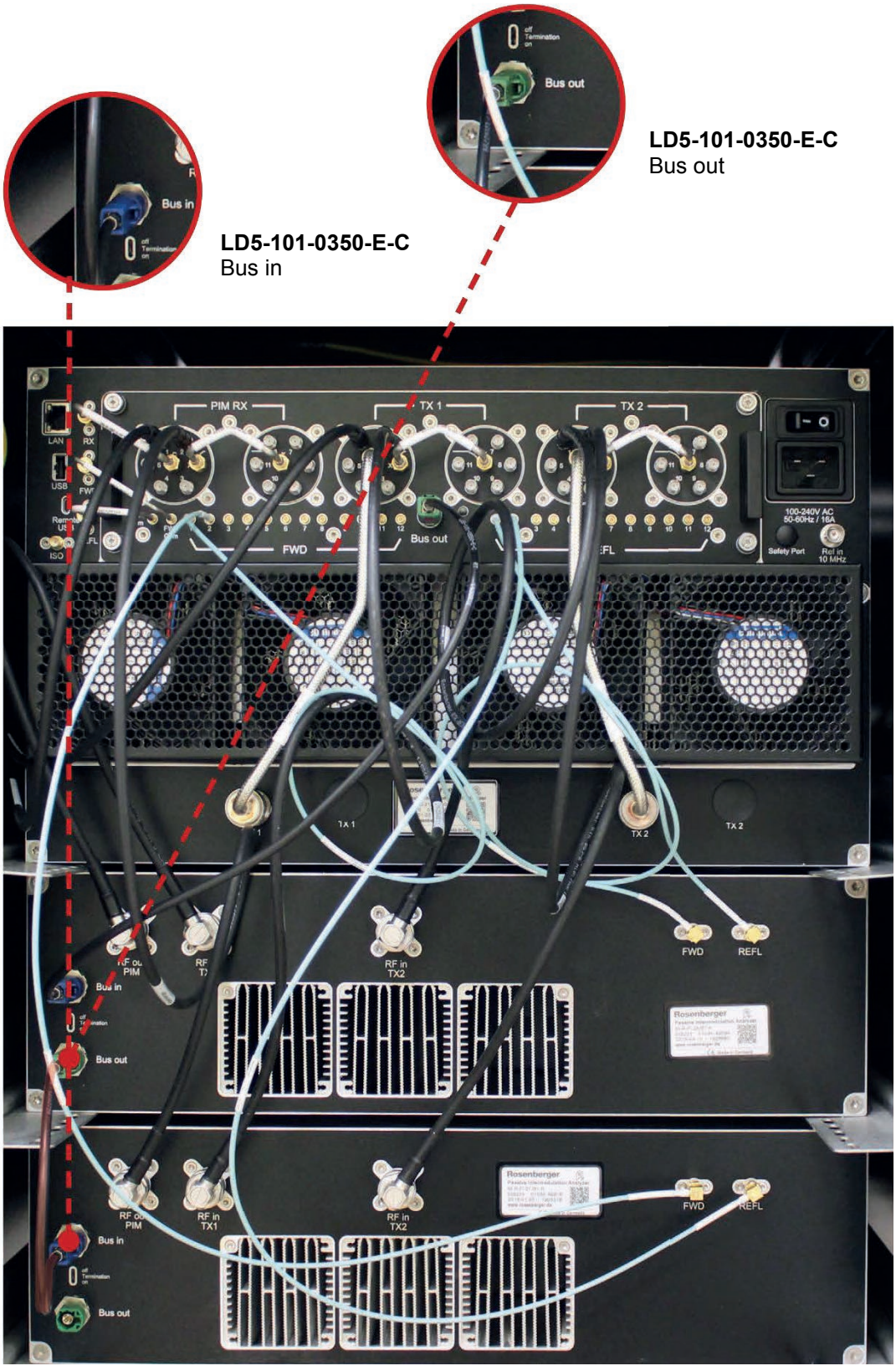
2. Take two L71-A0036-xxx cables and mount them from FWD to FWD and from REFL to REFL. Please make sure that the position on the switch matrix is the same for all paths. E.g. both cables must be in position 2.

L71-A0036-xxx
FWD- FWD 2

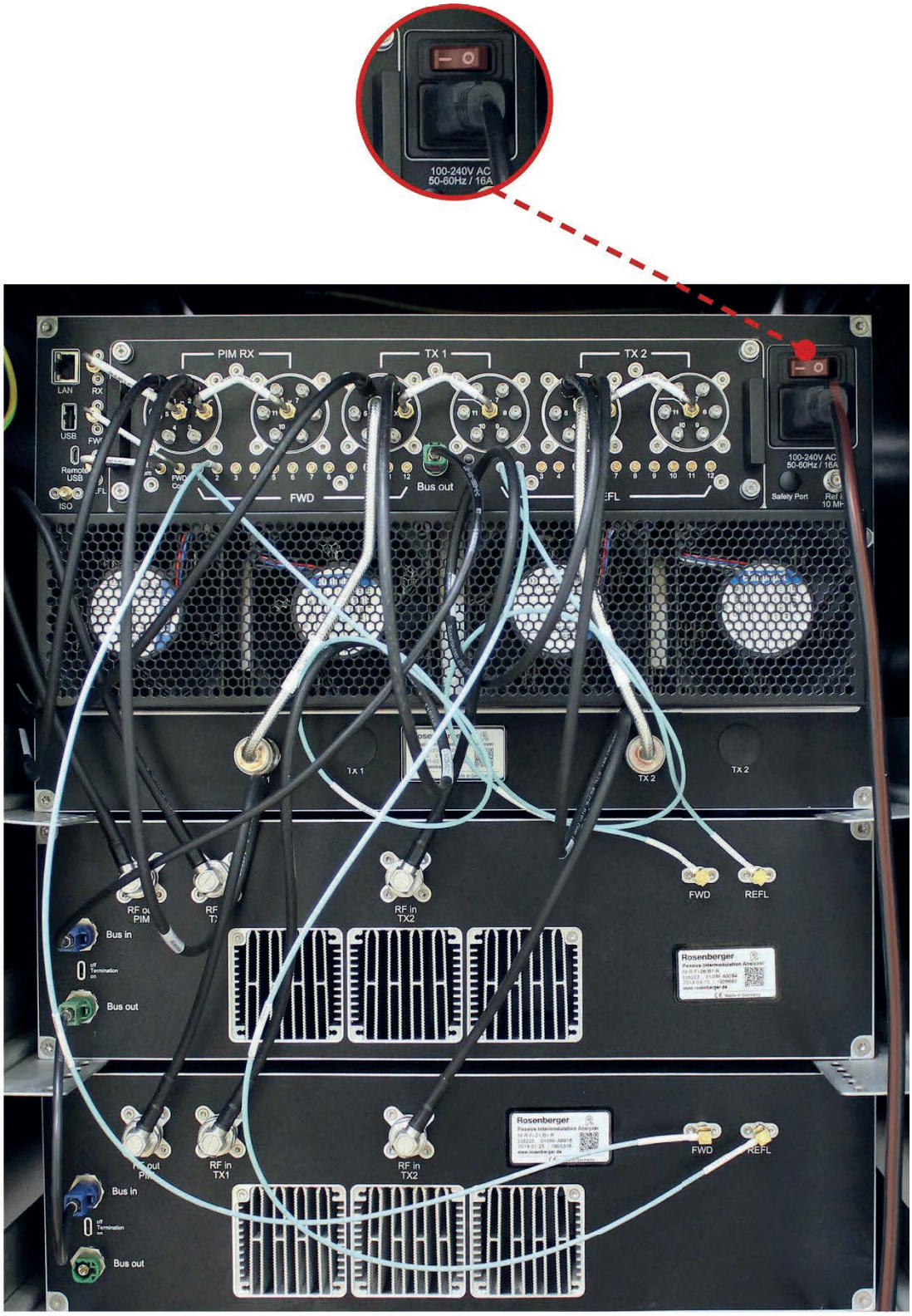
L71-A0036-xxx
REFL - REFL 2



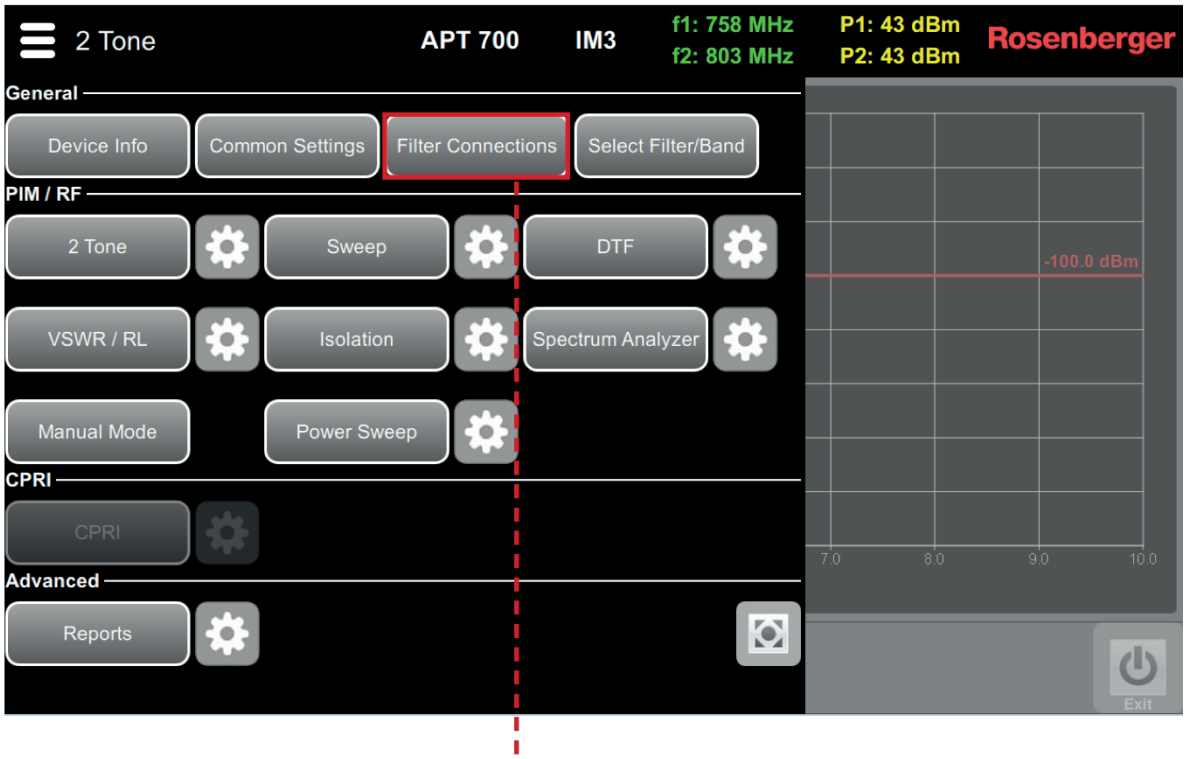
3. Take the LD5-101-0350-E-C cable and plug it into “Bus out” on the previous filter and “Bus in” on the current filter.



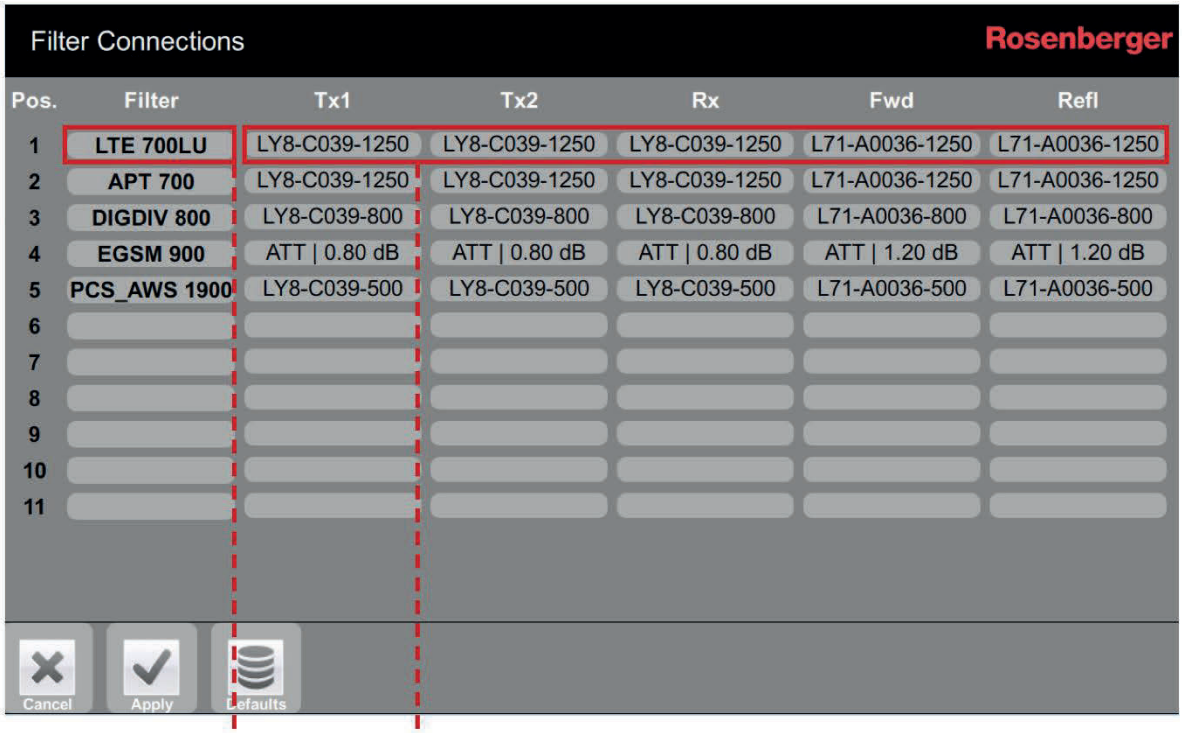
4. If you are not connecting another filter, change the position of the termination switch to ON and change the switch on the previous filter to OFF.
   After checking all connections for correctness and torque, connect the unit to the power supply again.



4.3 Software Setup



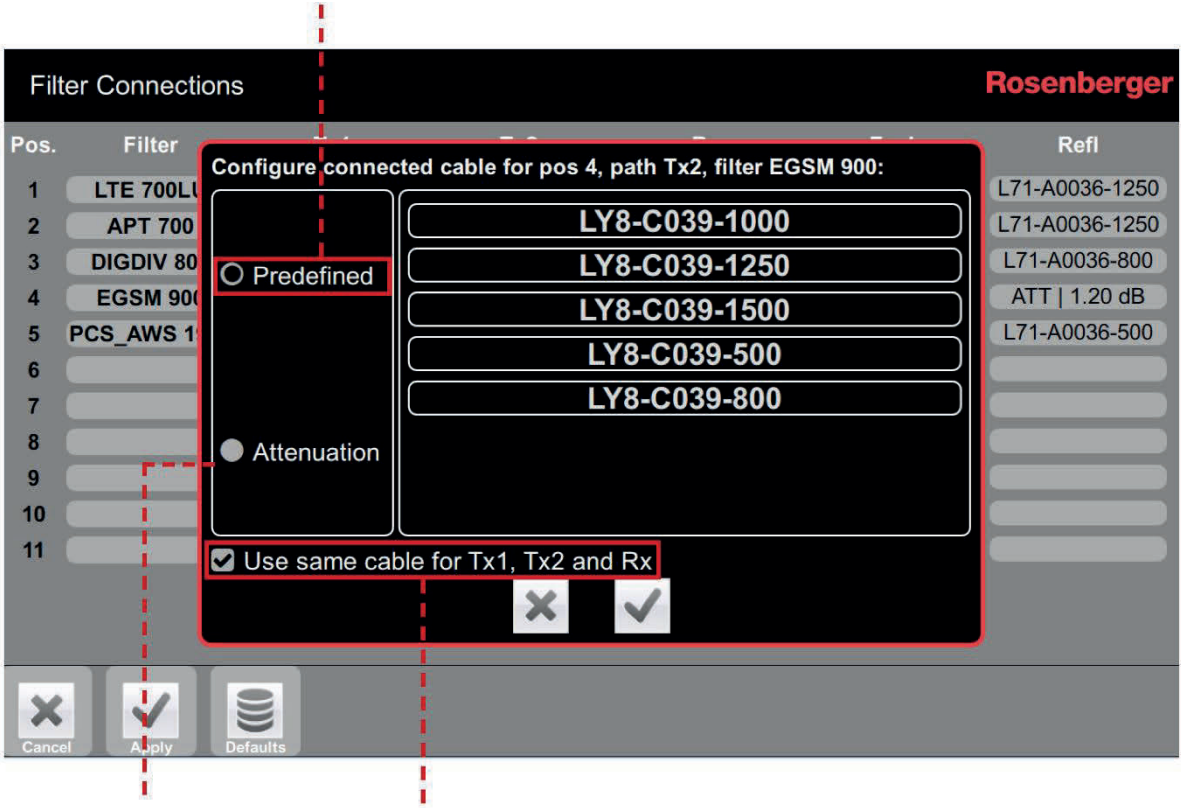
Open the main menu and "Filter Connections"



Select the connected filter unit for each switch matrix position

Select the cables used for each path (see cable connection dialog)

1. **Either select one of the predefined and standard-accessory cables or**



2. Select a custom-defined *.s2p file or use a single attenuation value

3. Optional: Copy the same selection for the remaining paths of this filter.

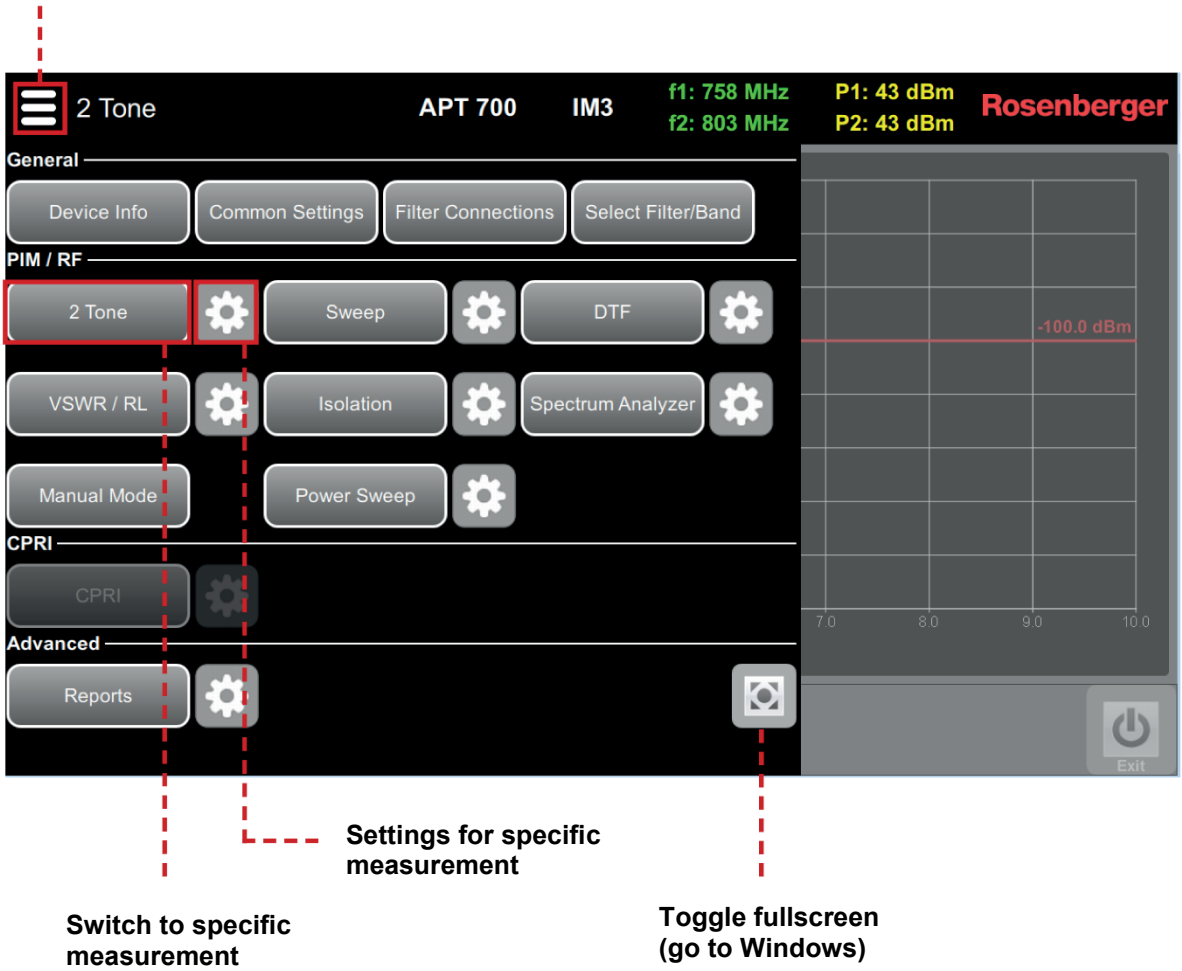
4. **Repeat for every filter unit**
5. **Apply settings**
6. **Select filter as described in the “Software Operation” chapter (See page 36)**

5 Measurement Settings

5.1 Main Menu

The main menu can be accessed from every screen with the button in the upper left corner. It allows you to switch between all the different measurement types and settings.

Toggle in menu



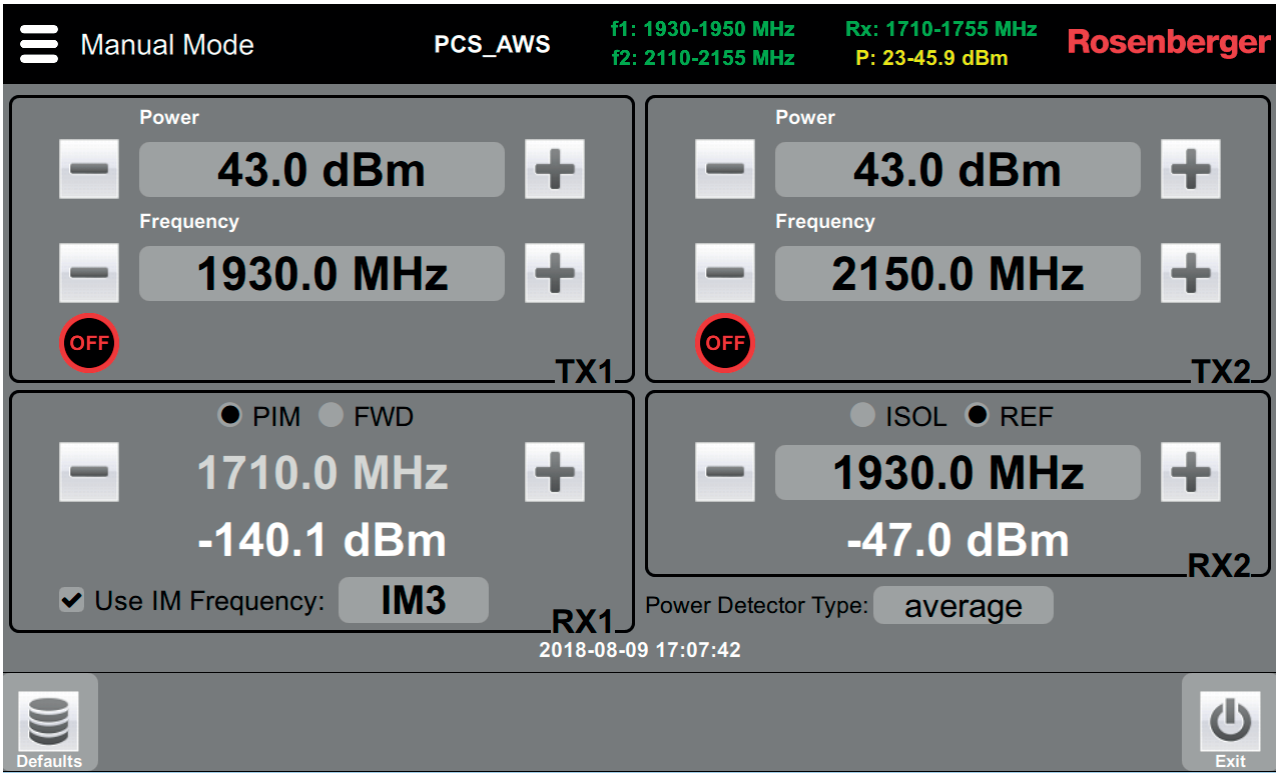
Settings for specific measurement

Switch to specific measurement

Toggle fullscreen (go to Windows)

5.2 Manual Mode

Manual controlling of test carrier's power and frequency while observing receiver frequency and signal strength in real time. Used to characterize DUT behavior and find and try out appropriate settings for regular RF measurements.

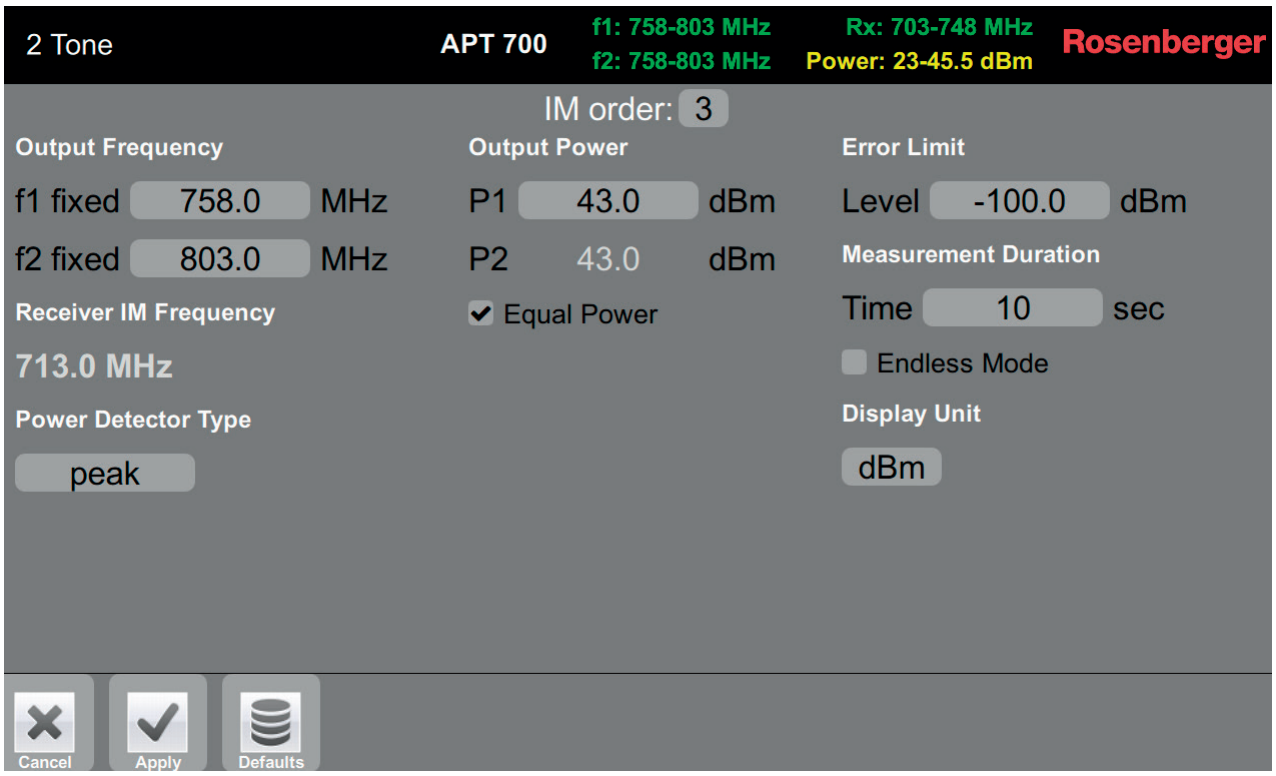


Group	Parameter	Description
TX1	Frequency f_1	Frequency setting for CW carrier 1
	Power f_1	Power setting for CW carrier 1
	On | Off f_2	Enable or disable carrier 2
TX2	Frequency f_2	Frequency setting for CW carrier 2
	Power f_2	Power setting for CW carrier 2
	On | Off f_2	Enable or disable carrier 2
RX1	Path RX_1	Choose between PIM or FWD monitor path
	Frequency RX_1	Set frequency where RX_1 is listening
	IM order + Use IM Frequency	Choose between IM_2 | IM_3 | IM_5 | IM_7… depending on filter and set RX_1 to a frequency derived from f_1, f_2 and IM order settings
RX2	Path RX_2	Choose between ISOLation or REFL monitor path
	Frequency RX_2	Set frequency where RX_2 is listening
Power Detector Type	AVG | Peak	Choose between average and peak mode for receiver

5.3 2 Tone

Measuring PIM under dynamic stress (e.g. tap with a tool to simulate tower movements during wind). Two fixed-frequency CW carriers stimulate PIM at the DUT while the PIM level is recorded over time and displayed.

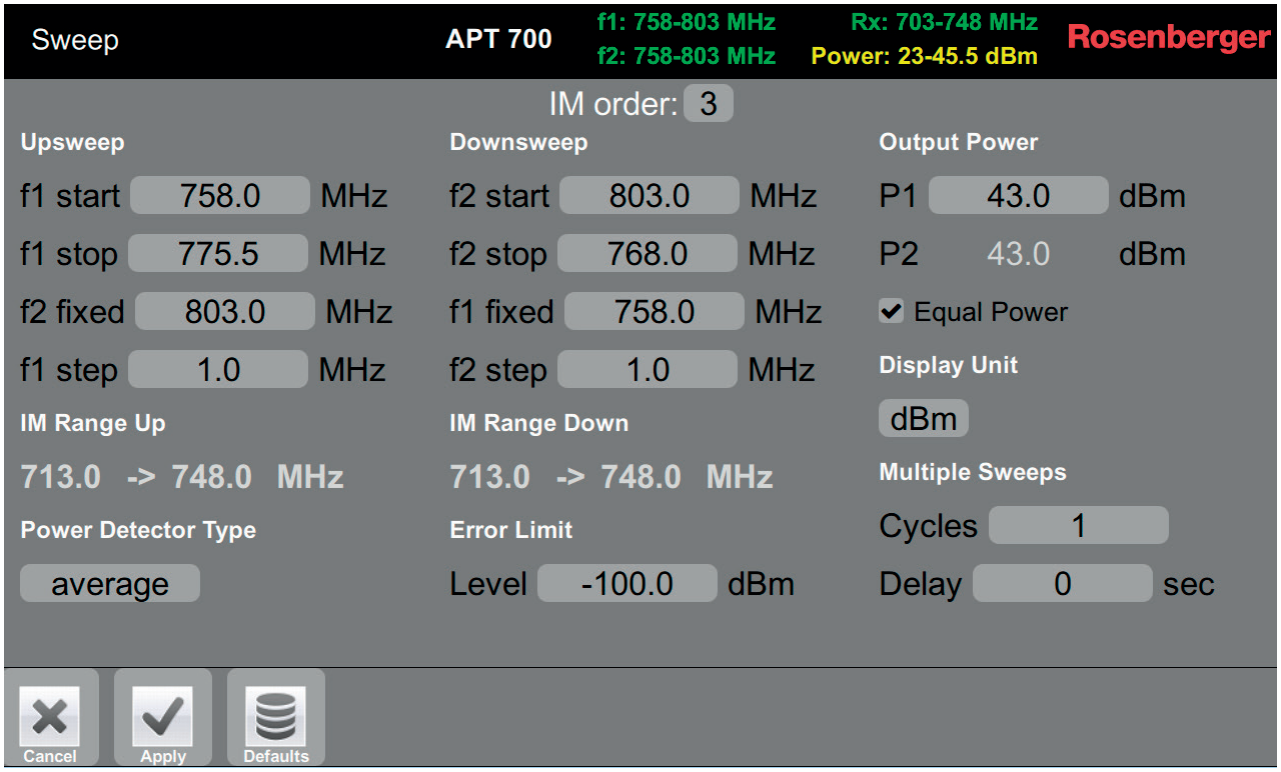
Select power detector type “peak” to measure short, intermittent signals. Switch to “average” to get the lowest possible noise floor.



Group	Parameter	Description
Stimulus	Frequency f_1	Frequency setting for CW carrier 1
	Frequency f_2	Frequency setting for CW carrier 2
	Power f_1	Power setting for CW carrier 1
	Power f_2	Power setting for CW carrier 2 – can be coupled to Power f_1
Measurement Setup	IM order	Choose between IM_2 | IM_3 | IM_5 | IM_7… measurements
	Time	Set time duration of 2 Tone measurement
	Endless Mode	Run 2 Tone measurement until stop is pressed
	Display Unit	Choose between dBm (absolute) and dBc (relative to carriers)
Alarm Setup	Error Limit	Set error limit level
Power Detector Type	AVG | Peak	Choose between average and peak mode for receiver

5.4 Sweep

Measuring PIM with swept carrier frequencies. Allows detection of multiple PIM sources in the signal path. An unsteady graph would indicate that more than one PIM source is present because all reflected PIM waves would interfere positively and negatively over frequency.



Group	Parameter	Description
Upsweep	Frequency f_1	Frequency from-to setting of swept carrier 1
	Frequency f_2	Frequency setting for fixed carrier 2
	Step size	Frequency step size for swept carrier
	Power f_1	Power setting for carrier 1
Downsweep	Frequency f_2	Frequency from-to setting of swept carrier 2
	Frequency f_1	Frequency setting for fixed carrier 1
	Step size	Frequency step size for swept carrier
	Power f_2	Power setting for carrier 2 (must be equal if unit dBc is used)
Measurement Setup	IM order	Choose between IM_2 | IM_3 | IM_5 | IM_7… measurements
	No. of Cycles	Set wait time between multiple sweeps
	Endless Mode	Run sweep measurement until stop is pressed
	Display Unit	Switches scale between dBm (absolute) and dBc (relative to carriers)
Alarm Setup	Error Limit	Set error limit level
Power Detector Type	AVG | Peak	Choose between average and peak mode for receiver

5.5 VSWR \ RL

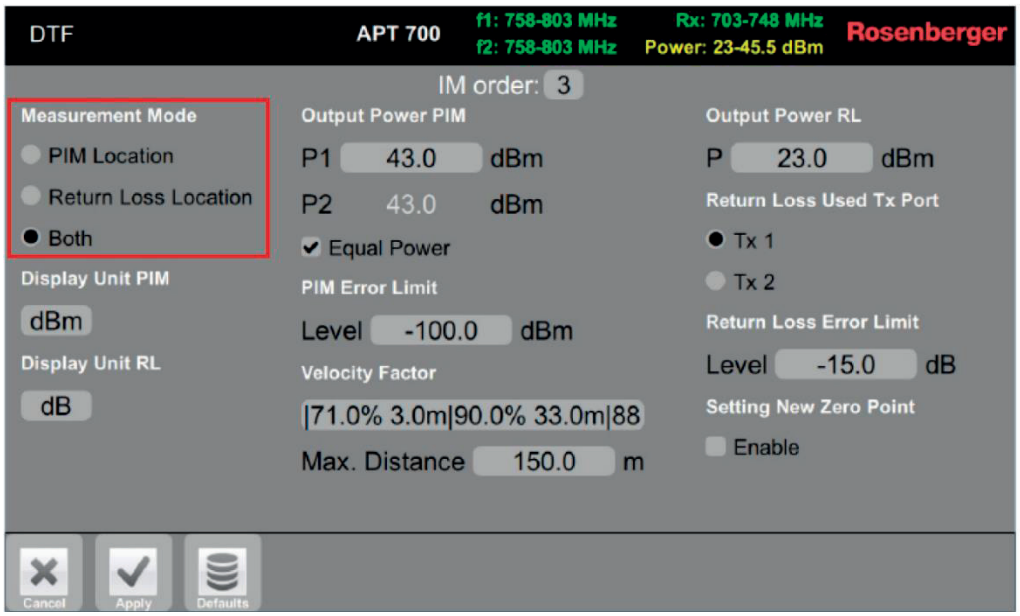
Measures if components in the signal path are impedance-matched or not. High RL or VSWR values mean that signals are reflected back instead of passing the mismatched component.

Group	Parameter	Description
Stimulus	Frequency	Frequency from-to setting of swept carrier
	Step Size	Frequency step size for swept carrier
	Power	Power setting for carrier
Measurement Setup	Display Unit	Choose between dB (return loss) and VSWR factor (1:1.0 – 1:∞)
	Error Limit	Set error limit level
	No. of Cycles	Set number of sweep cycles per measurement

5.6 DTF

**Measuring the distance to the PIM fault and return loss fault position.
The graph plots the PIM and RL values over distance, so even multiple sources can be detected and the level measured. The velocity factor has to be known for accurate display scaling.**

In order to perform DTF measurements, the filter needs to be zeroed (PIM and return loss) first. The zeroing only needs to be done once after a new filter is inserted for the first time (if the filter is changed afterwards the equipment will use the stored value that was created for this filter by means of zeroing) and it can only be done on the device, not on the tablet.



Group	Parameter	Description
Measurement Setup	Measurement Mode	Choose between distance to PIM only | distance to RL only | both
	Velocity Factor	Sets the cable type or user-defined velocity factor for proper scaling of the distance measurement (x-axis)
Distance to PIM	Power f_1	Power setting for carrier 1
	Power f_2	Power setting for carrier 2 (must be equal if unit dBc is used)
	Equal Power	Couples Power f_2 to Power f_1 so that only one has to be adjusted
	Error Limit	Sets error limit level
	Display Unit	Switches scale between dBm (absolute) and dBc (relative to carriers)
Distance to RL	Power	Choose between IM_2 | IM_3 | IM_5 | IM_7… measurements
	Error Limit	Set error limit level
	Freq. / Channel	Select channel where previous measurement showed worst point
	Display Unit	Select scale between dB (return loss) and VSWR factor (1:1.0 – 1:∞)
Setting New Zero Point	On / Off	Enables the zeroing buttons to allow reconfiguration of zero distance (e.g. set an offset to end of jumper)

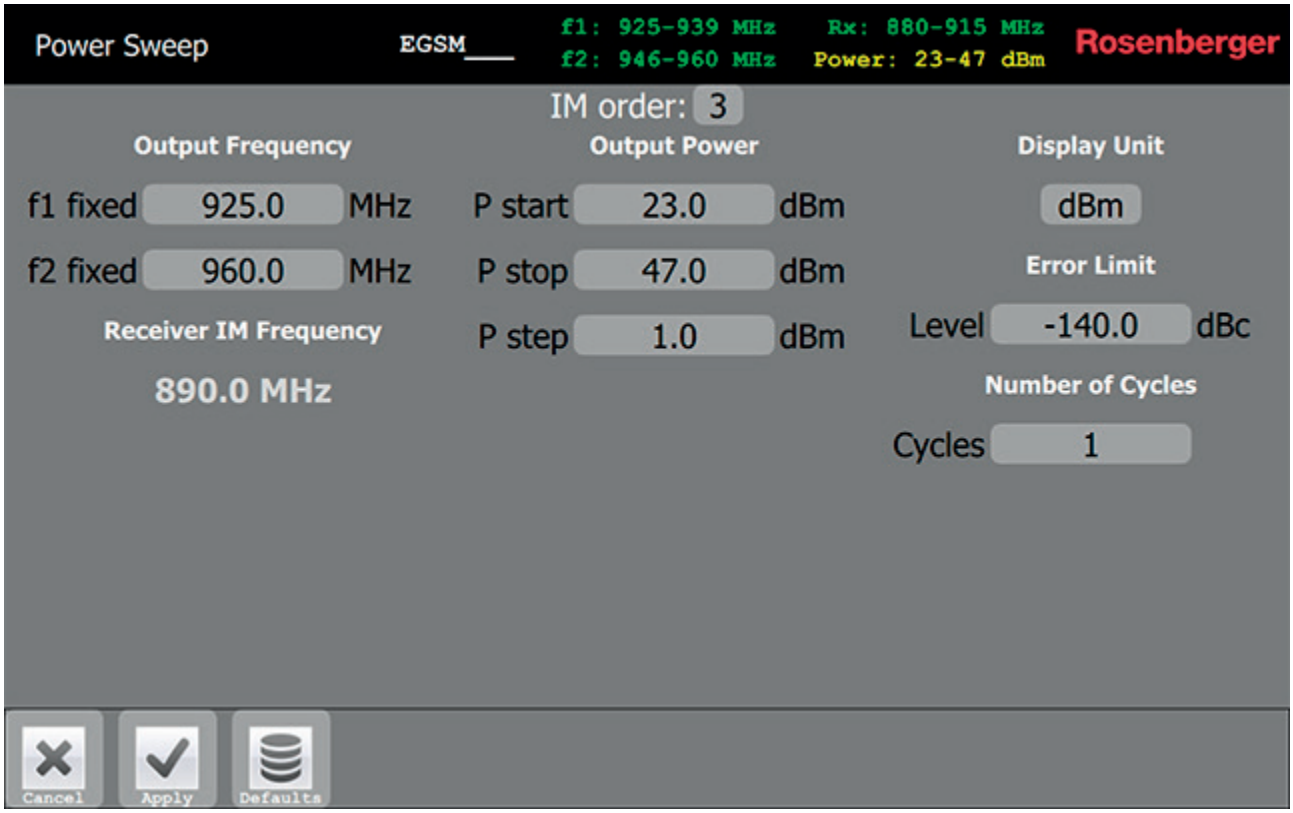
5.7 Isolation

Measuring the isolation between separate RF paths (e.g. decoupling of two antennas or separate polarizations). For this purpose, a signal is transmitted from the PIM measuring port (7-16 or 4.3-10) and the leakage is received at the N-connector.

Group	Parameter	Description
Stimulus	Frequency	Frequency from-to setting of swept carrier
	Step Size	Frequency step size for swept carrier
	Power	Power setting for carrier
Measurement Setup	Error Limit	Set error limit level
	No. of Cycles	Set number of sweep cycles per measurement

5.8 Power Sweep

Measuring PIM as a function of power to the DUT. Because PIM is an extremely nonlinear effect with many causes, it is hard to predict the power level at which PIM will start to rise. PIM sources or measurement headroom can be identified in this manner.



Group	Parameter	Description
Sweep Setup	Frequency f_1	Frequency setting for CW carrier 1
	Frequency f_2	Frequency setting for CW carrier 2
	Frequency f_{IM}	Shows resulting IM frequency from f_1 f_2 setting
	Power	Power sweep from-to setting of both carriers
	Step size	Power increase per step for power sweep
Measurement Setup	IM order	Choose between IM_2 | IM_3 | IM_5 | IM_7… measurements
	No. of Cycles	Set number of sweep cycles per measurement
	Display Unit	Switches scale between dBm (absolute) and dBc (relative to carriers)
Alarm Setup	Error Limit	Set error limit level
Power Detector Type	AVG | Peak	Choose between average and peak mode for receiver

5.9 Spectrum Analyzer

Measuring the uplink spectrum prior to PIM measurements is useful to detect if interferences (e.g. mobile devices transmitting unintentionally) are disturbing the PIM measurement. The RF power density on the graph shows if there are static signals which must be ignored on PIM measurements.

Group	Parameter	Description
Measurement Setup	Frequency	Frequency from-to setting of monitoring range (in RX range)
	Reference Level	Level of reference line (Line 9)
	Scale	Power scale between lines
	Resolution BW	Resolution bandwidth (frequency resolution and noise floor)
	Video BW	Video bandwidth (smoothens dynamic signals)
Display Setup	Detector	Choose between peak | average | min
	Persistence	Switch between persistence mode # of cycles | Off
Alarm Setup	Error Limit	Set error limit level

6 Software Operation

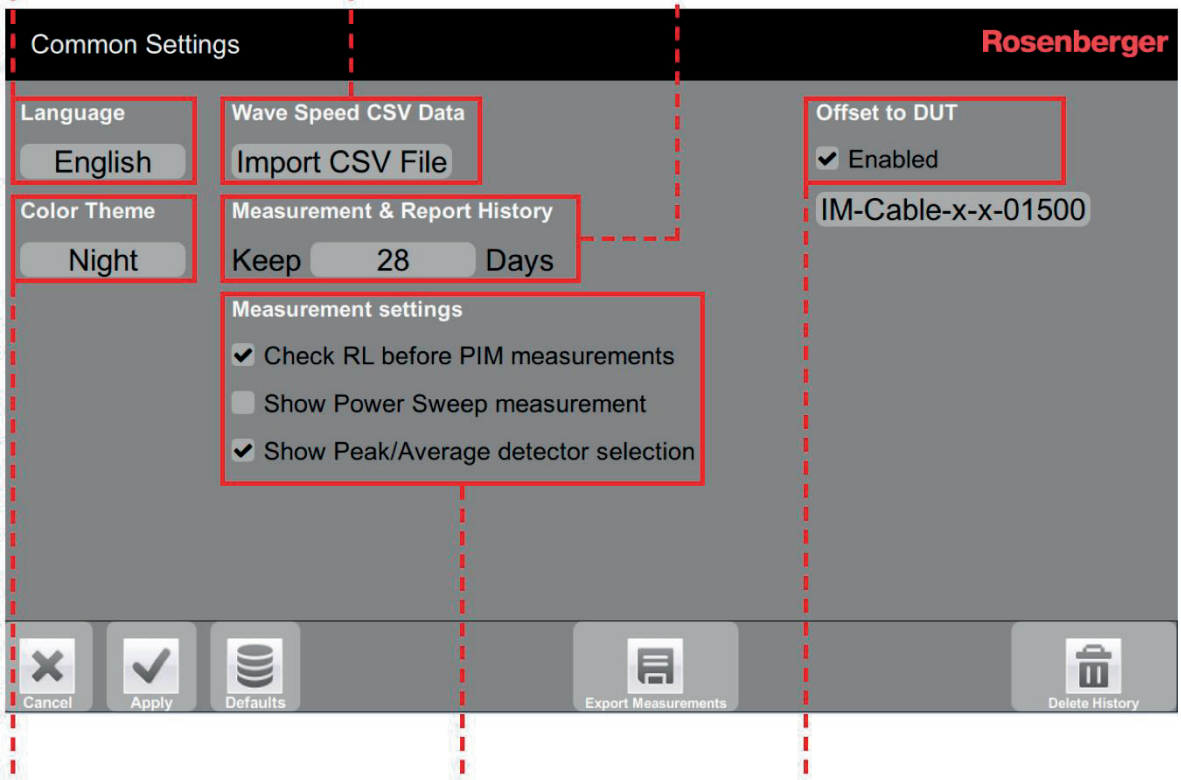
The PIM Rack Analyzer runs on Microsoft Windows 7. If you install additional software or change system settings, Rosenberger can no longer guarantee flawless operation. Please back up your data (e.g. reports) on a regular basis.

6.1 Common Settings

Tap to cycle through available languages.

Import a CSV file containing your custom jumper cable velocities. See application note for details

Specify how long measurement data should be kept in the history. Too many stored measurements may slow down synchronization with remote software.



The color theme "Day" offers better readability in bright environments, e.g. with bright light shining on the screen

Various special functions or features can be activated or deactivated here.

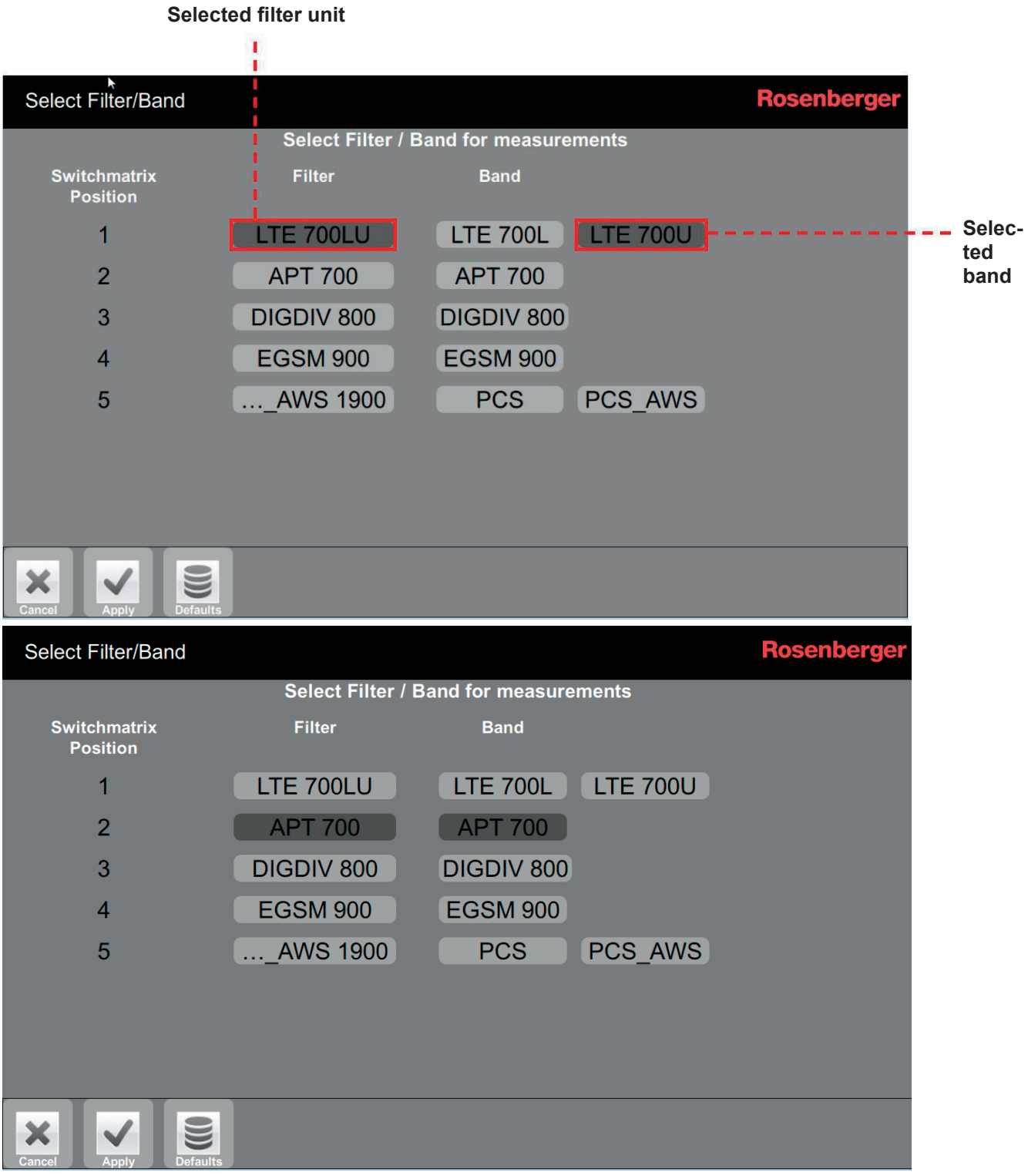
It is advisable to keep "Check RL before PIM measurements" activated – it protects the unit from excessive VSWR and device damage caused by hot plugging.

Select a predefined jumper cable or set an offset in dB. If enabled, output power and receive level are increased by that value to compensate cable loss.

WiFi Configuration: Activate internal HotSpot for remote control or join a WiFi network. This feature is not available in the rack system

If output offset is active, output power is increased by that value. Thus the configurable output power for each measurement may be reduced depending on the maximum power of the amplifiers and the currently selected filter.

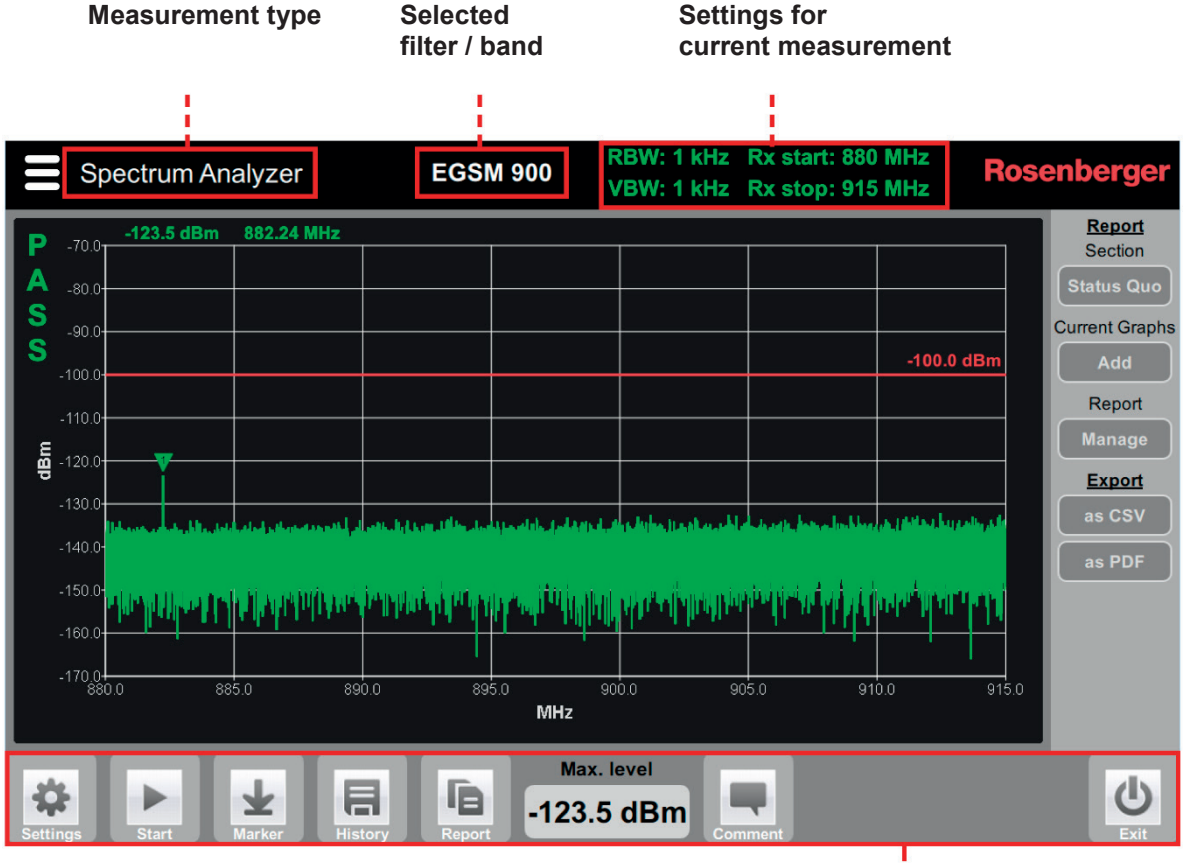
6.2 Filter / Band Selection



Filter units with multi-band support: Additional band is selected here.
Standard filter unit: Band is automatically selected.

6.3 Measurement Screen

The following picture shows the measurement screen for “VSWR \ RL”.
The explanations of the screen elements apply to all other measurement types too.



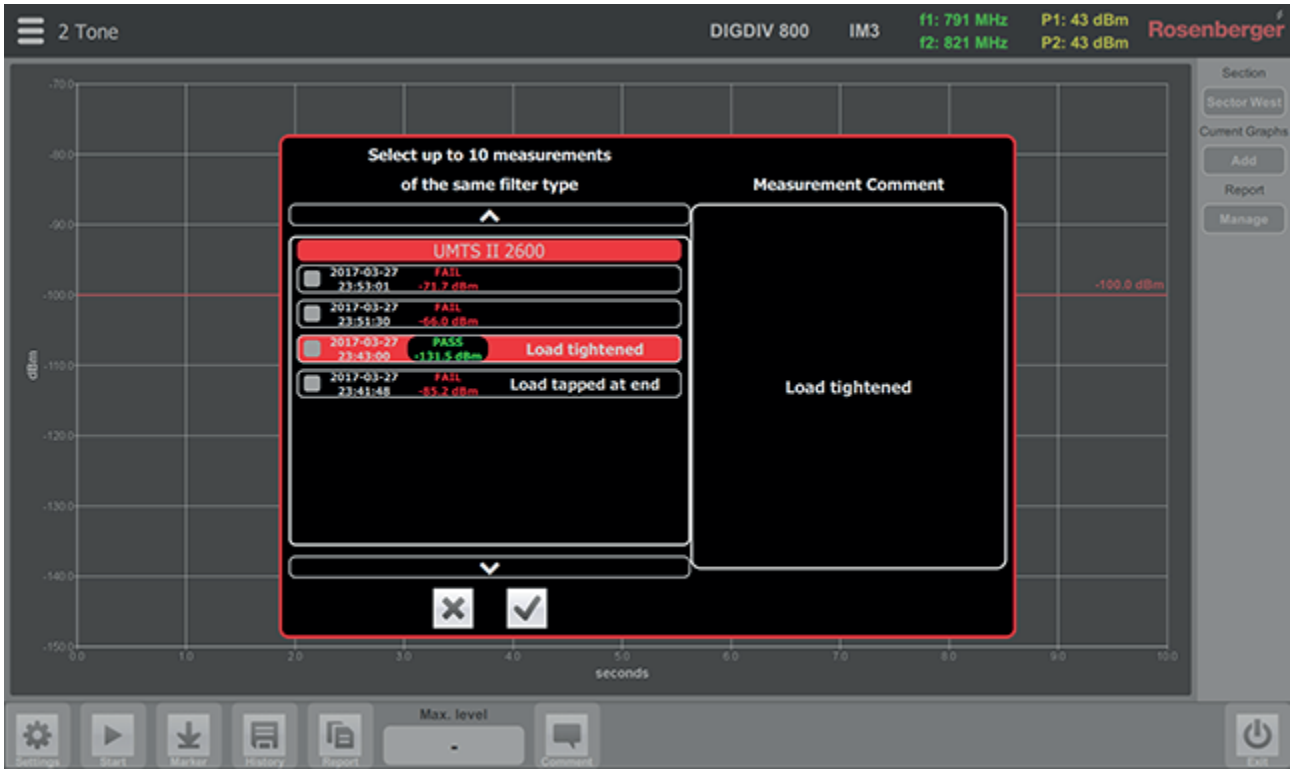
Settings: Adjust settings for current measurement
Start (Stop): Start / Stop measurement
Marker: Set / Adjust markers
History: Show history of measurements
Report: Create measurement report
Comment: Add a comment to the measurement performed (appears in history and report)
Exit: Exit PIM Analyzer application

Each measurement trace is kept for fourteen days (default) with a measurement comment and date/time. The time span can be changed in the Common Settings screen.

6.3.1 History

Check entries to compare several measurement traces or reload them to add them to a report.

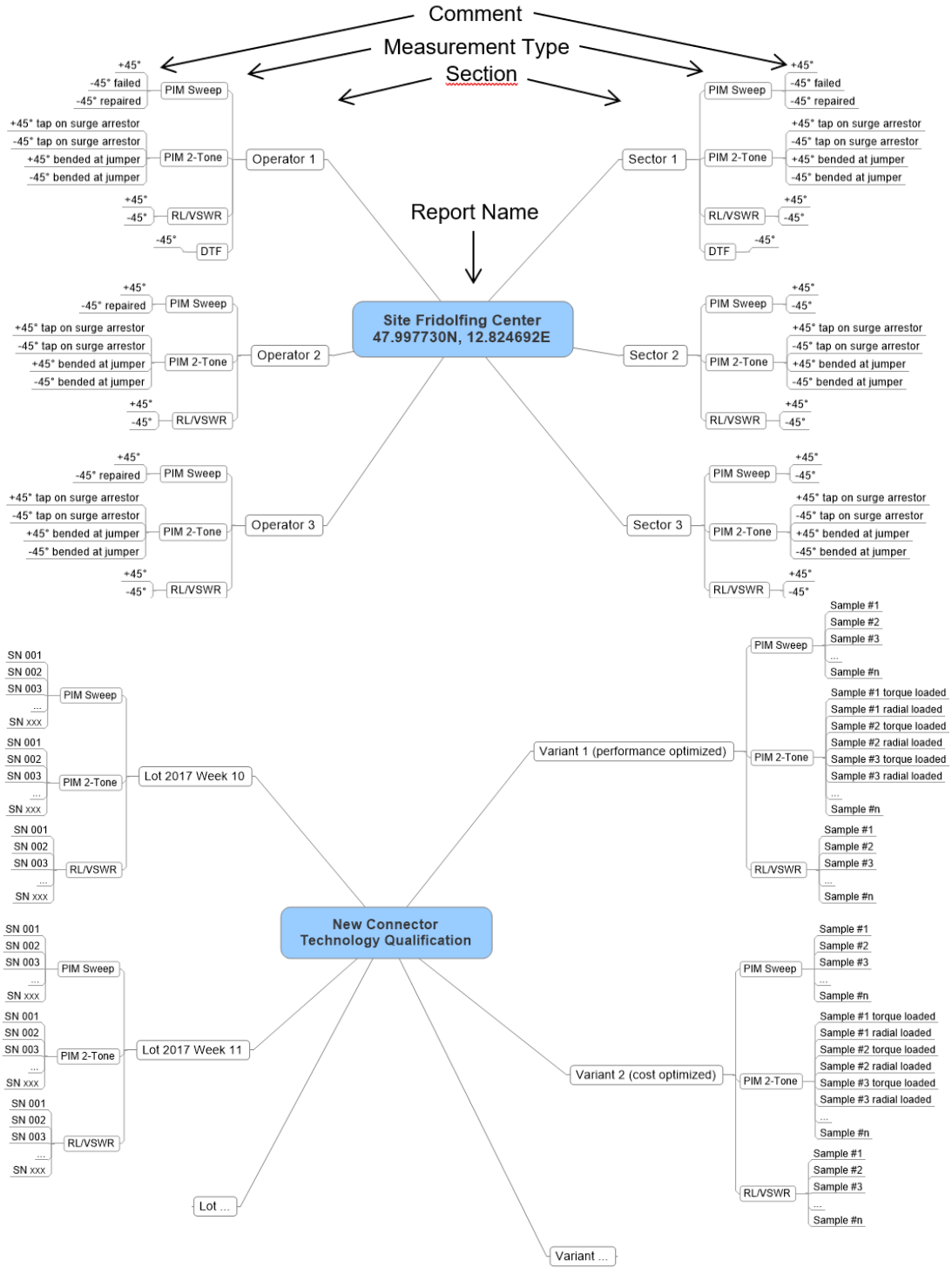
The history is synchronized with the tablet during connection – old measurements can be viewed and reports can be created offline using the tablet only.



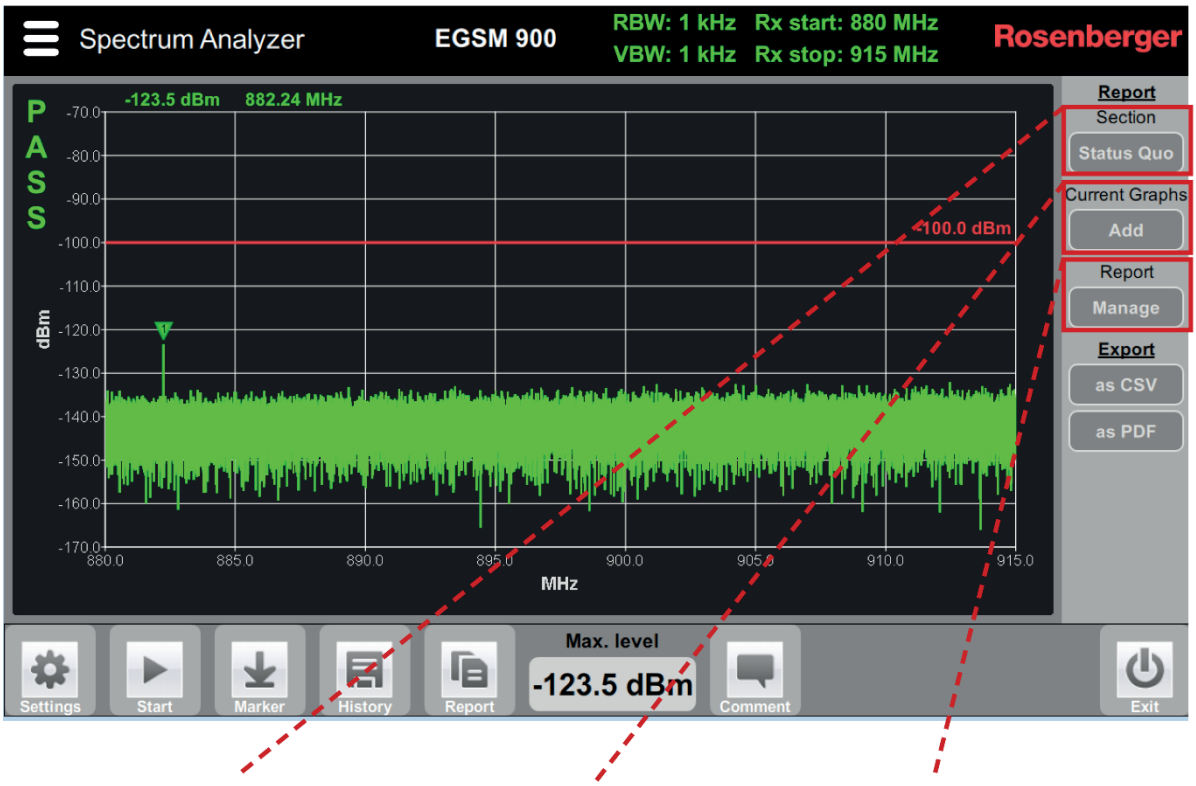
6.4 Report Generation

6.4.1 Creating a Full Report

A report is not only a collection of measurements – it contains a complete set of documentation to provide evidence of the PIM performance of a “device under test”. It includes test parameters, comments, pass/fail check and title sheet with company logo, operator name, equipment serial and so on. By default, similar measurements relating to one section are grouped into a graph on one page to save paper and increase comparability; this can be switched off in the menu. The following graphics show examples of how reports can be structured:



The “Report” button can be found on every measurement screen. After a measurement has been performed, you can tap on it to display a sidebar menu.



A report is divided into sections which hold the individual measurements. To add a measurement to your report you will have to create a section first. If a section already exists you can select it here.

Add this measurement to the selected section of your report.

Show all the saved measurement graphs and create a final report with them. This function can also be accessed in the main menu via the “Report” button.

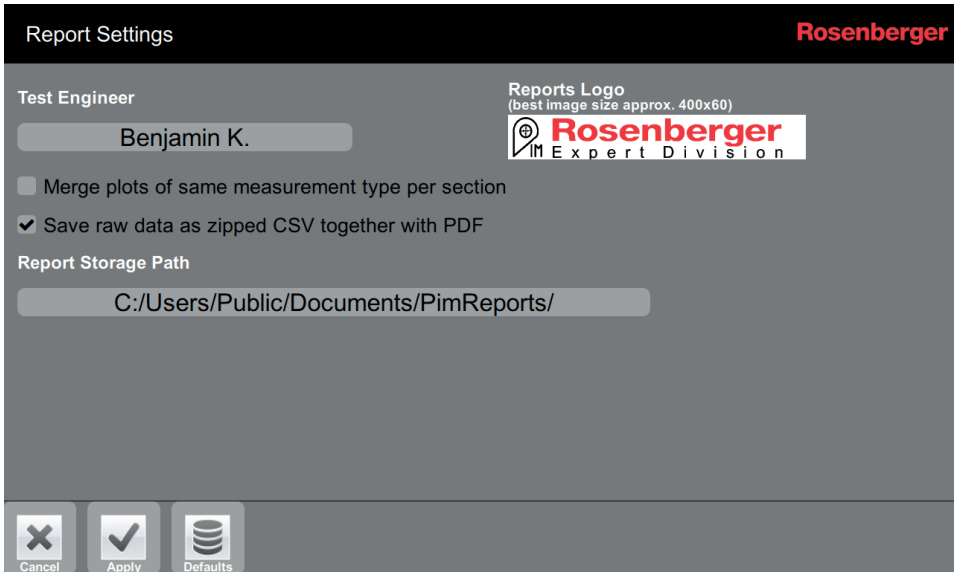
In the “Manage Report” screen all your saved measurements can be seen and arranged for the report. Additionally you can set common attributes of your report.

Create PDF: The configured report is saved as a pdf file in the default folder automatically. You can copy the file to a USB stick or different location by hitting “Share” in the popup dialog.

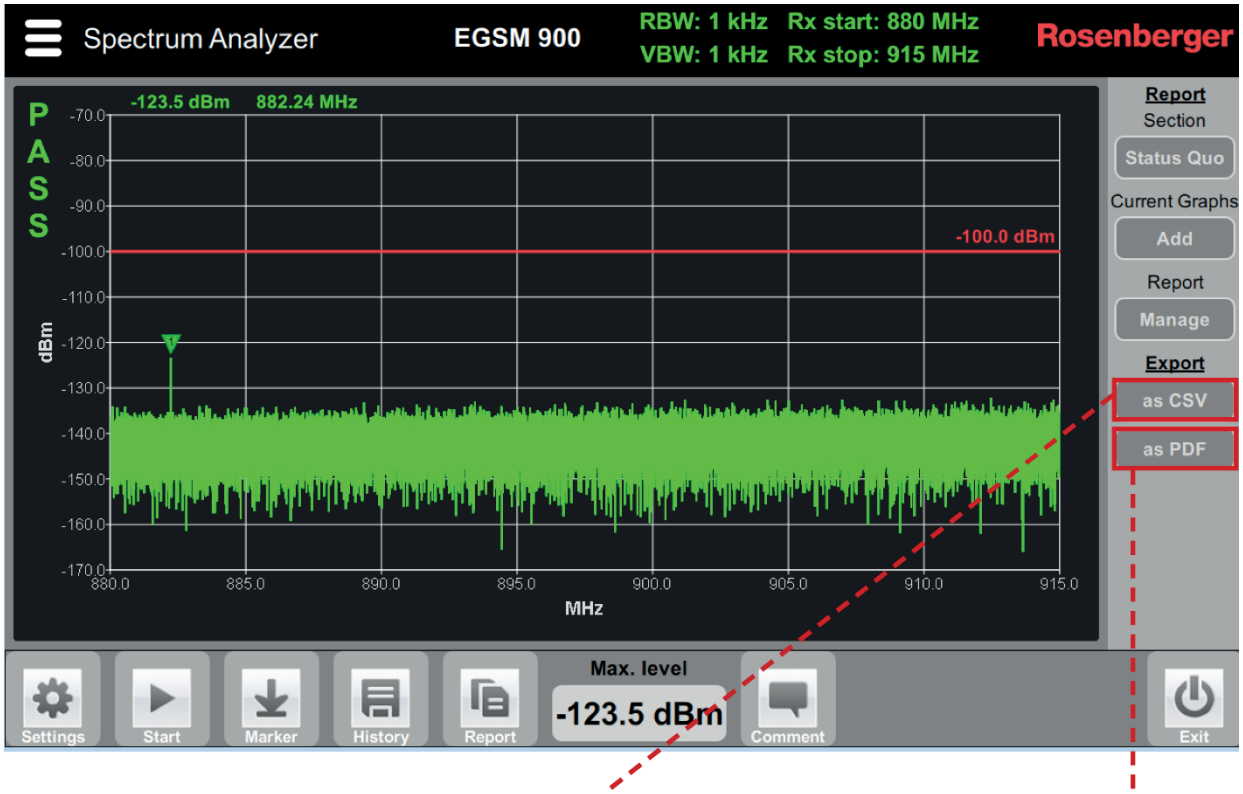
New Report: Start a new blank report file, set the overall report title and create sections (e.g. Sector East, 2nd Floor, … or Production Lot1, Production Lot2, …). Measurements which were added are listed with Frequency Band, Measurement Type, Pass/Fail and Date in the selected target section.

Report History: Reload report configurations from the past (e.g. if you noticed a typo in a comment in the report yesterday, or failed to add a trace and want to overwrite the old report).

Report Settings: Configure operator’s name, logo and the default report output path. If “merge same measurements per section” is checked, all measurements with similar settings are combined in one graph with a legend showing the comments. If unchecked each measurement produces one page of paper.



6.4.2 Creating a Single-Page Report



Export current measurement values into a CSV text file. Storage path can be set in “Report Settings” via “Manage Report”

Export current measurement into a single-page PDF. Storage path can be set in “Report Settings” via “Manage Report”

6.4.3 Exporting Measurement Data as CSV

The raw data of each measurement trace can be exported into a comma-separated file (CSV) to enable customized postprocessing and data archiving. The CSV file is simply generated from the graph that is currently shown using the Report and Export as CSV buttons. The file name is automatically created from the measurement type and the current date + time. The file is saved to the folder selected in Reports -> Manage -> Settings.

The CSV file can be imported into Microsoft Excel with a semicolon separator and decimal dot. Important (especially in Germany): When files are opened directly with Excel, it uses the global operating system language setting for the decimal separator – therefore Excel will display a value of 1.2 as February 1st. Please change your regional Windows settings to a decimal dot instead of a comma. The file itself contains correct data – it is only shown differently in Excel.

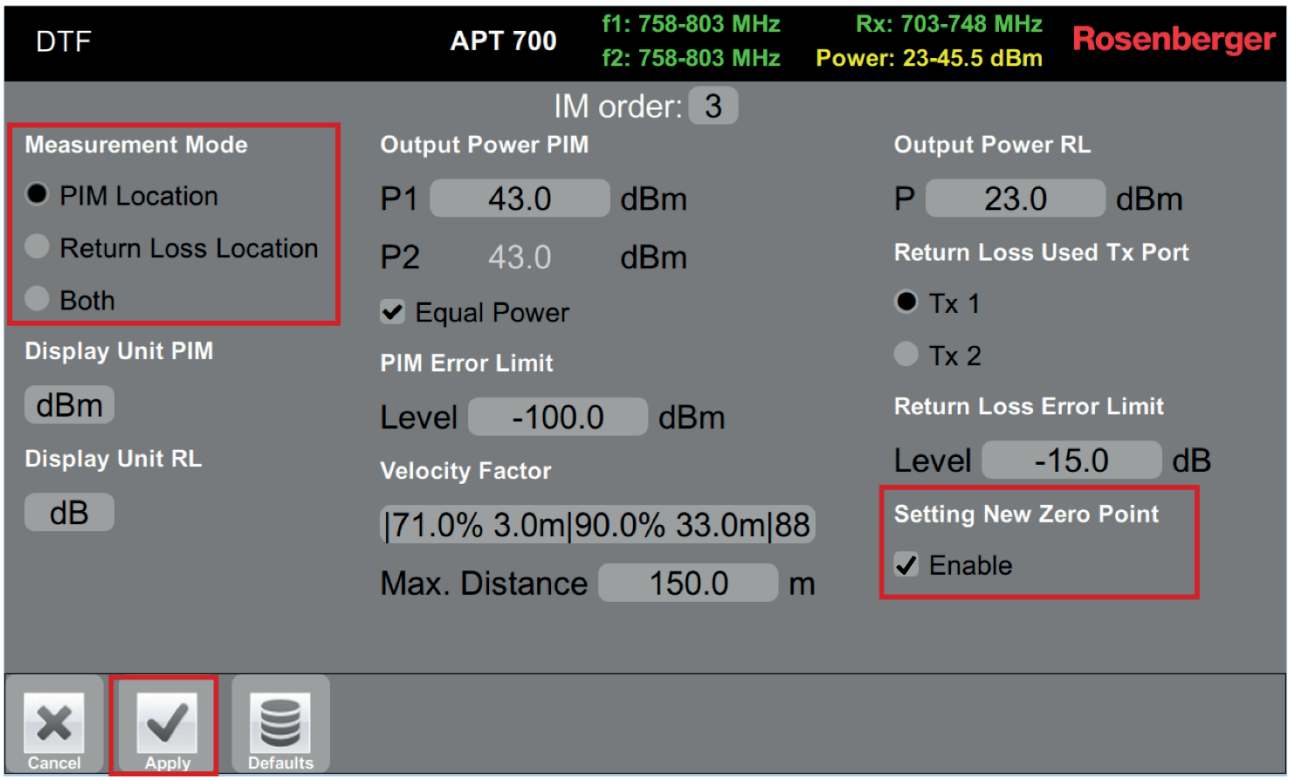
We reserve the right to modify the data structure without notice.

6.4.4 Saving a Screenshot

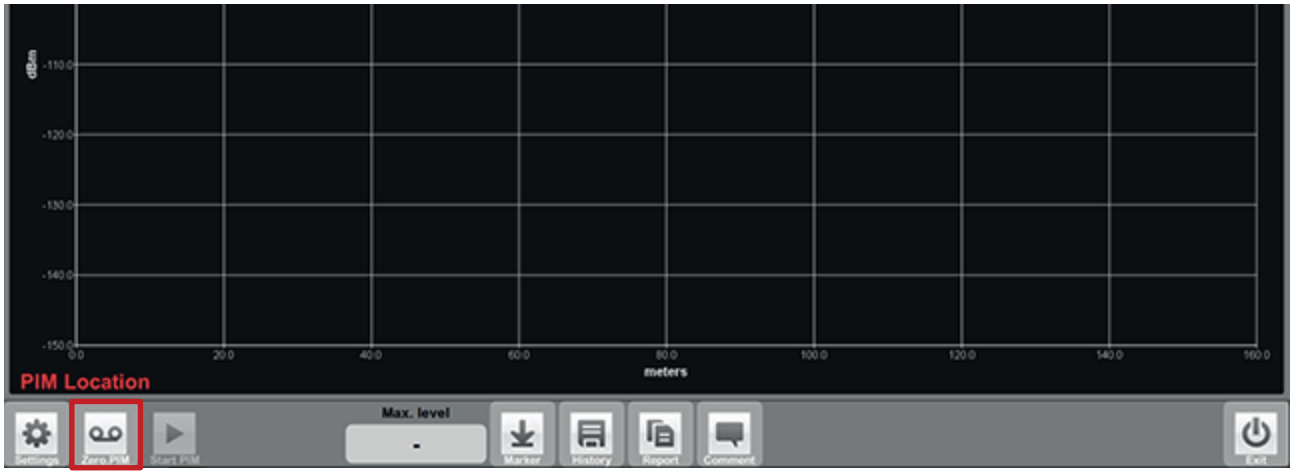
Exports a picture of the current graph.

6.5 Zeroing PIM

Before the first PIM DTF measurement, the unit must be zeroed. In the settings screen for the DTF measurement, choose “PIM Location” under “Measurement Mode”, check the “Enable” checkbox under “Setting New Zero Point” and apply the settings.



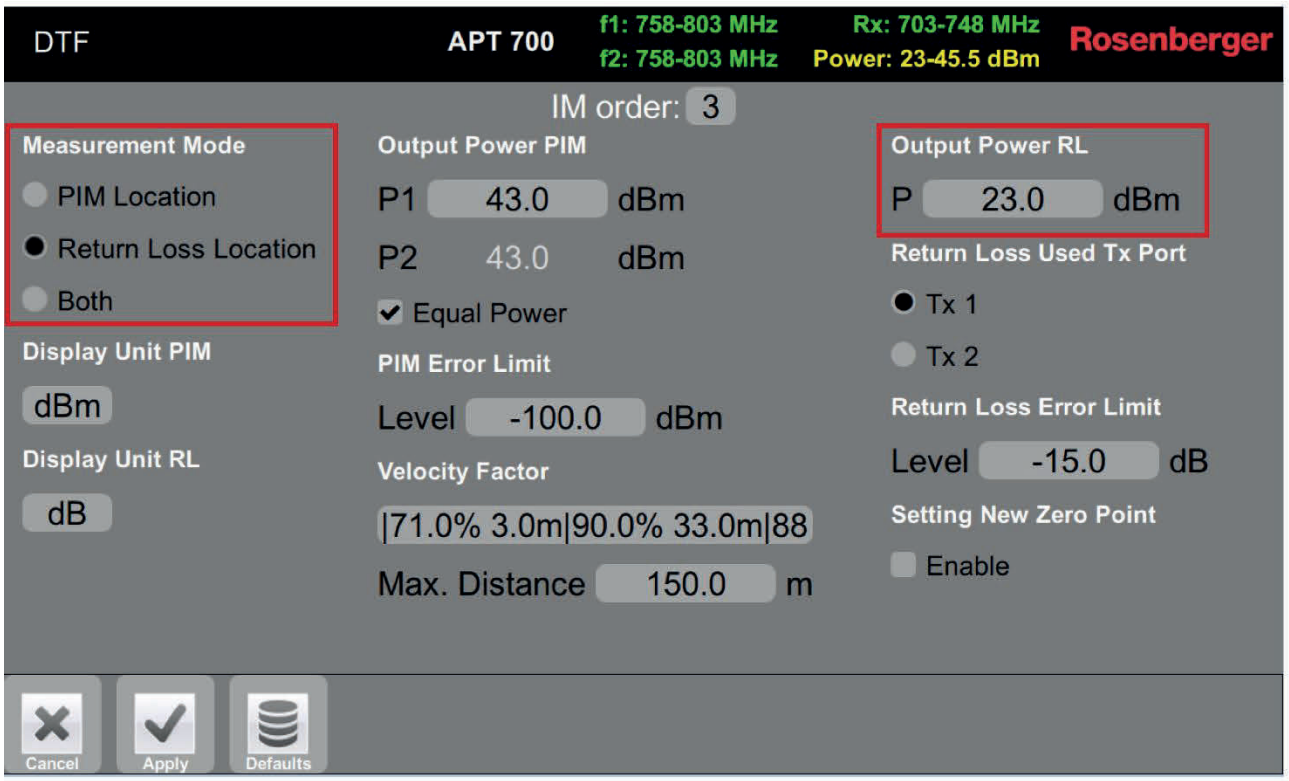
After that, connect the DTF zeroing adapter and a low PIM load at the desired zero point. To start zeroing PIM, click on “Zero PIM” at the bottom of the DTF measurement screen.



After successful zeroing, “PASS” is displayed and the zero point is then set. To avoid mistakes in subsequent measurements, please uncheck the “Enable” checkbox in the DTF settings screen. The “Zero PIM” button on the measurement screen then disappears. The zeroing can also be used to set an offset.

6.5.1 Zeroing Return Loss

Return loss is zeroed **without** a load / adapter at the end of the cable. “Return Loss Location” must be checked in the DTF settings screen. Also make sure that “Output Power RL” is set to 23 dBm.

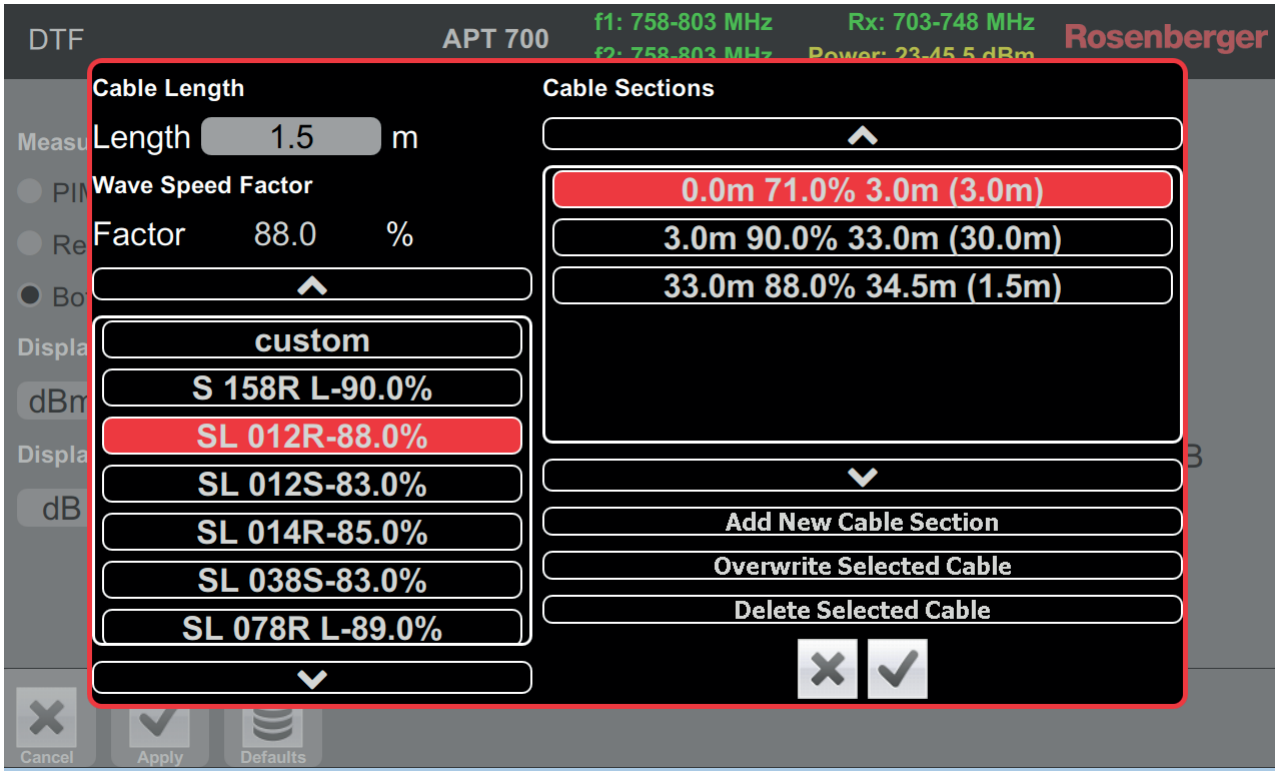


After successful zeroing, “PASS” is displayed and the zero point is then set. To avoid mistakes in subsequent measurements, please uncheck the “Enable” checkbox in the DTF settings screen. The “Zero RL” button on the measurement screen then disappears.

6.5.2 Setting the velocity factor of the signal path (+Application Note DTF)

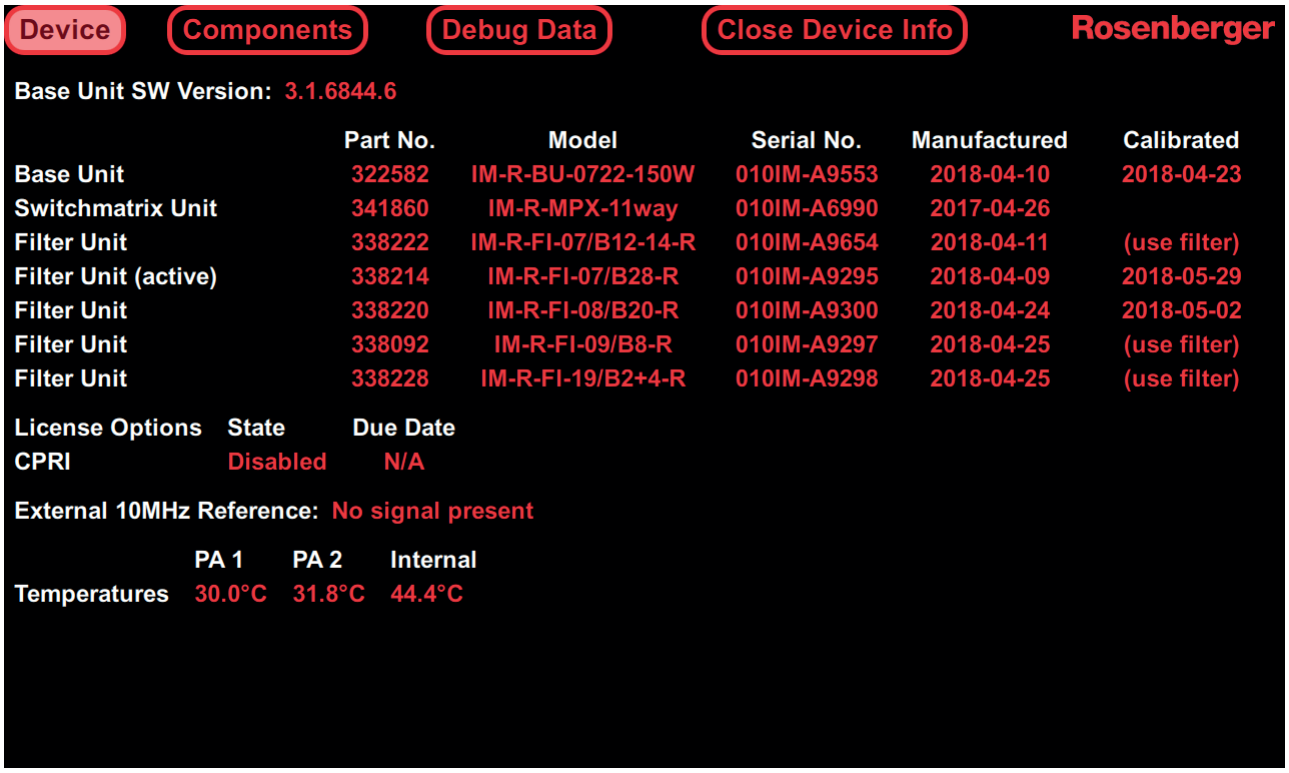
In order to increase the accuracy of distance measurements, the velocity factor of the signal path can be set up in sections. Enter the cable length and select a predefined cable from the table (or a custom-defined factor) and hit “Add new cable” to create a list of subsequent cable sections from the zero point to the “end” of possible PIM occurrences.

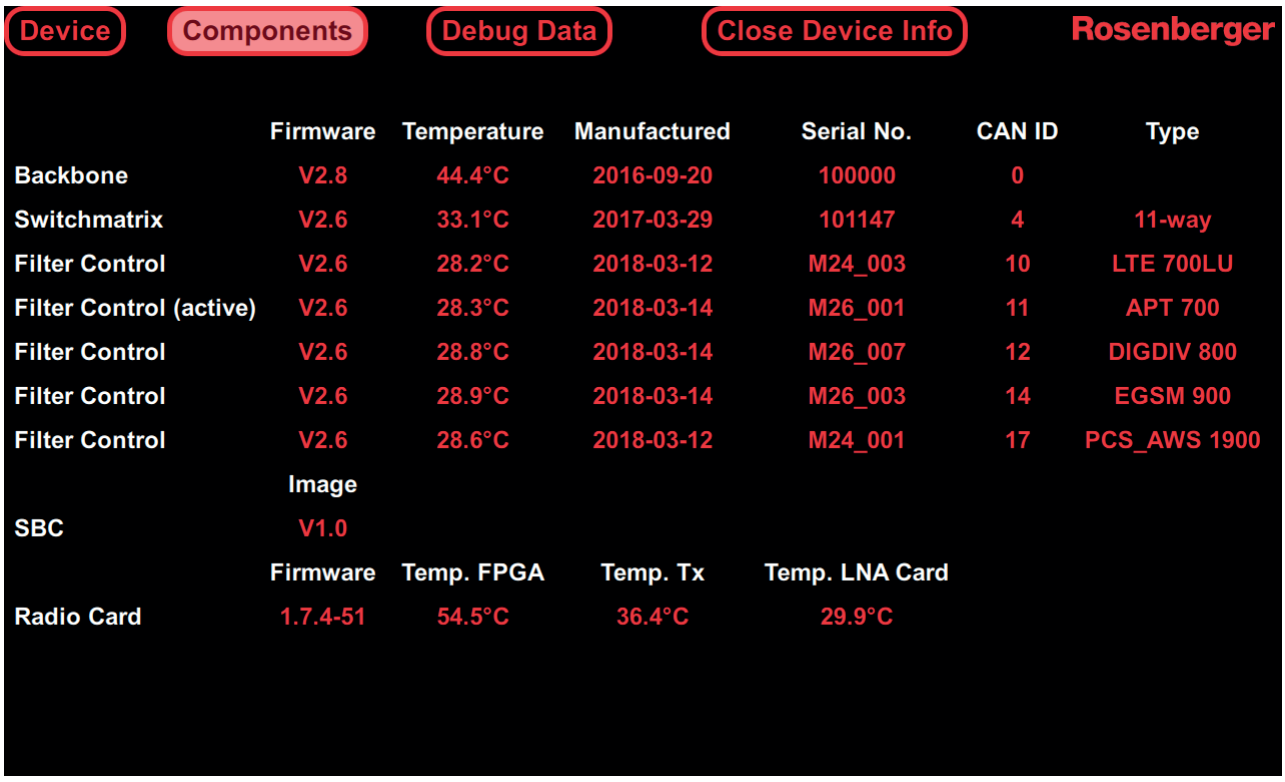
The given example includes a 3 m jumper (1/2” R) and a 30 m feeder (7/8” R) + 1.5 m jumper (1/2” R). Everything beyond the last entry is treated as “Air” with 100% because the antenna is almost unknown anyway.



6.6 Device Info

The “Device Info” screen shows useful information about your PIM Rack Analyzer device, e.g. manufacturing and calibration dates of the filters and base unit.





6.7 Defining Own Buttons for Section Names

When generating reports, measurement results are put into a file structure in the following hierarchy:
Report name => Section => Measurement Type => Comment

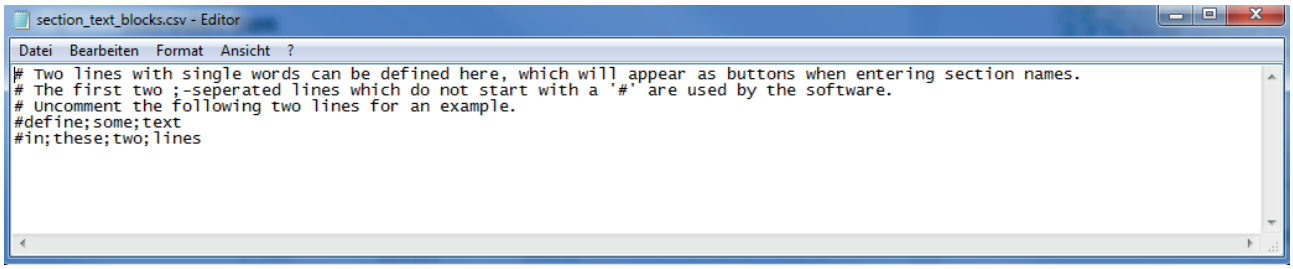
Whereas measurement type information is provided automatically, the report name and comments are filled in manually by the operator, as this is individual measurement-specific data. However, in many applications, the designations for sectors are the same. In order to avoid having to create the same section names individually with every new report, it is possible to pre-define your own buttons for section names as default buttons in the report menu. In order to use this functionality, SW version 2.10 or later is required.

The following example shows how to define your own buttons for section names step by step.

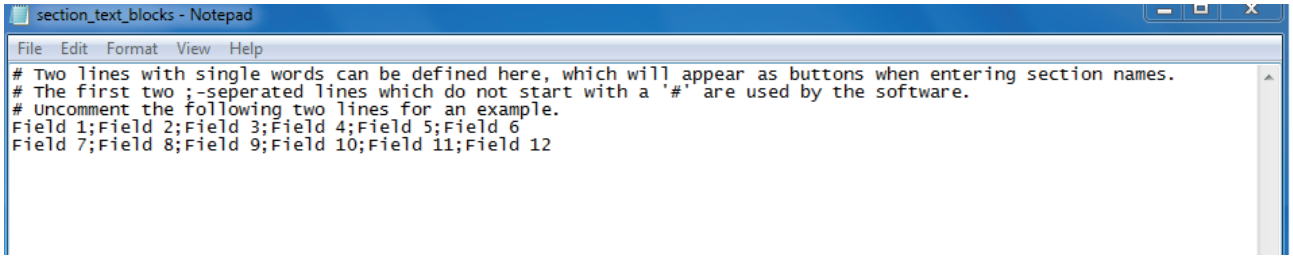
1. **Open CSV file**
   With SW version 2.10 (or later), the required .csv file will be installed automatically.

In order to process the data, open the .csv file from the following directory:
C:\Software\PimAnalyzer\userconfig Datei section_text_blocks.csv

2. In order to start defining your own buttons for section names, uncomment the last two lines by removing the hash key:

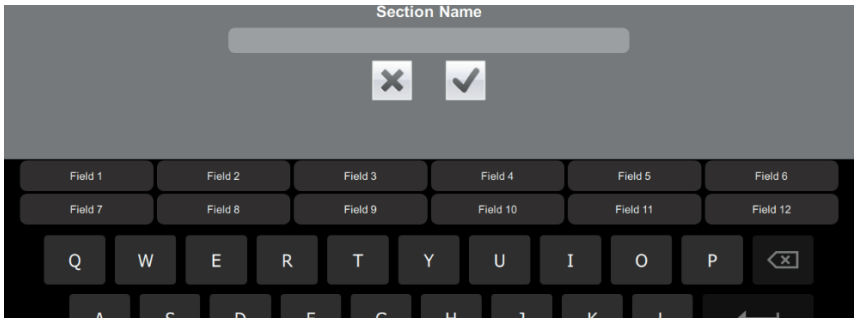


4. *Replace the words in the last two lines with your desired section name. Make sure the field names are separated by a semicolon:*



5. Close the .csv file and save the entered data.

6. Open the PIM Analyzer application and go to the report section. Now you can start to add measurement data to the new sectors by selecting “create new” in the sector section and selecting one of the pre-defined buttons.



6.8 Updating the PIM Analyzer Software

To benefit from the latest improvements and to ensure reliable and secure operation of the PIM Rack Analyzer it is important to keep the software up to date. The following steps describe how to install software updates for the PIM Analyzer software:

1. Go to http://www.rosenberger.com/pia to download the latest software version and register for update notifications.
2. Close the PIM Analyzer application.
3. Run the Setup file PimAlphaSetup-x.x.exe on the PIM Analyzer's Windows system, typically from a USB stick.
4. Start the PIM Analyzer application, and check the software version under Menu -> Device Info.

7 Remote Control

Remote control will be implemented soon in an upcoming release. Documentation will be provided as soon as the update is released. We apologize and ask for your understanding.

8 Maintenance of the Device

8.1 Handling

Only use the PIM Rack Analyzer in line with the intended purpose and comply with this documentation to prevent damage.

8.2 Cleaning

Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol (except in the case of the test port), acetone or diluents for cellulose lacquers. Use pressurized air or alcohol-soaked cotton swabs to clean the test port. Ventilation outlets can be cleaned with pressurized air.

8.3 Calibration & Repair

Note that any repairs or calibration of the device not performed by Rosenberger can have a negative impact on the flawless operation of the device and will render any warranty void.

**Device is deleted / reset to factory settings during calibration / service.
Please save all required data beforehand.**

Always use the original packaging material for shipping.

To ensure maximum measurement precision, we recommend a calibration interval of 12 months. If you wish to send back a unit for calibration or repair, please contact us prior to shipment to ensure a smooth transaction. Refer to the last chapter of this manual for global support addresses.

Calibration FAQs

- Calibration: Calibration of the unit based on the values defined in the initial factory-provided calibration. Check for latest firmware update.
- Calibration frequency: To ensure maximum measurement precision we recommend a calibration interval of 12 months.
- Cycle time: Standard cycle time is 10 working days after receipt of unit.
- Service options: We are happy to provide information about additional service options

9 Measurement Examples

The following instructions are only recommendations. The actual requirements of PIM testing and verification can vary depending on specifications.

9.1 RF Measurements

General checklist for determining PIM:

1. **Tighten RF connectors using appropriate torque**
2. **Clean connector interfaces with alcohol, Q-tip and compressed air**
3. **Replace components (e.g. feeder connector)**

9.1.1 PIM Acceptance Test

1. Select appropriate filter unit according to your frequency requirements
2. Connect DUT to the test port of the selected filter unit (LED green)
3. Terminate DUT with a low PIM load (60Z150-001, -012, -020)
3. Perform a 2 Tone measurement while tapping on your DUT to simulate mechanical stress (e.g. wind)
4. Perform a sweep measurement over the widest possible frequency range
5. If PIM is not within specified limits, refer to 9.1.2
6. If PIM is within specified limits, create a test report and save it

9.1.2 Troubleshooting a PIM Problem

1. Select appropriate filter unit according to your frequency requirements
2. Connect DUT to the test port of the selected filter unit (LED green)
3. Terminate DUT with a low PIM load (60Z150-001, -012, -020)
4. Use the spectrum analyzer to evaluate interference signals from external sources (e.g. mobile phones or other operator creating strong PIM signals) and eliminate them if present
5. Perform a sweep measurement to evaluate whether the PIM depends on frequency
    i. If no PIM is present, perform a 2 Tone measurement with a tap test
    ii. If PIM is present, perform a DTF measurement to measure the distance to the static PIM in meters. If the value is not within cabling length, an environmental influence is causing the problem (e.g. absorbers, other material in test chamber)
9. Fix the PIM problem you have located
10. Perform an acceptance test as described in 9.1.1.

10 Troubleshooting

10.1 Reporting Software Problems to Rosenberger

If you experience any problems relating to the use of the PIM Analyzer software, in order to make sure we can analyze the problem quickly and provide an effective solution, please follow these steps to provide related debug data to your Rosenberger sales/service partner:

If the issue is reproducible without using the tablet:

1. Make sure that the latest software is installed
2. Restart the PIM Analyzer software
    a. If the problem is that the PIM Analyzer software is not starting, execute C:\Software\PimAnalyzer\PiaDebugData.exe instead
3. Reproduce the issue
4. Go to Device Info -> Debug Data and generate a debug data zip file.
5. Send the file to pia_service@rosenberger.com along with the exact steps describing what has been done with the device

10.2 How to Avoid Common Problems

Problem	Probable causes	Possible remedy
Device will not turn on	- Device is not connected to power grid - Main switch is turned off - Malfunction within the power grid	Check all cabling connections for power supply. Check if the main switch is turned to ‘on’ and ensure your power grid is working properly.
Software is no longer responding to any user actions.	- Microsoft Windows operating system is not working properly anymore	Press and hold the power button until the device powers off. You can now turn it on by pressing the button again.
Unstable PIM	- Test port loose, worn out or dirty - Interference from external device (e.g. mobile phone)	Change the test port connector. Use the spectrum analyzer function to observe possible interferences.

11 Technical Specifications

11.1 Base Unit

11.1.1 Main Features

- Broadband RX & TX base model 698-2200 MHz with outstanding PIM performance (typ. <-130 dBm)
- Continuous wave signal (no pulse), conformity with IEC 62037 – 1, full power to PIM source
- Up to 11 filters connected to one base unit
  (optional 6-way / 11-way switch matrix)
- No production downtime when setup is rearranged
- Intuitive software operation
- Automated report generation
- Antenna isolation measurements
- DTF measurement
  - PIM vs. distance (< 0.3 m accuracy)
  - VSWR vs. distance
- Measurement modes
  - Passive intermodulation:
    - PIM vs. frequency
    - PIM vs. time
  - VSWR/return loss with high RF power
  - RF spectrum analyzer
  - Isolation measurement
- Made for 24/7 production use, temperature-controlled fan system, easy-to-replace dust filter
- CPRI PIM tests (HW option on request, option for later SW release)

11.1.2 Product Description

The versatile rack-type **P**assive **I**ntermodulation **A**nalyzer (PIA) system provides an easy way to precisely determine the intermodulation characteristics and other RF parameters in a wide frequency range for

- Antennas
- Connectors
- Filters and combiners
- Transmission lines
- Jumpers
- Splitters

This PIA is designed to measure the reversed/transmitted intermodulation products in production lines. The **b**ase **u**nit (BU) is equipped with a Windows computer, RF baseband hardware and two broadband power amplifiers according to the frequency range. It can be operated manually from the built-in touchscreen or via a network connection either via remote desktop or a remote command interface for integration in production tools.
The test system is completed by attaching one or more (up to eleven) **f**ilter **i**nserts (FI) using a 1:1 cable or a switch matrix (MPX) which can be installed easily by the user. Band switching is carried out automatically when the measurement band is changed.

The user-friendly graphical touch interface enables easy report generation for every measurement, while guided measurements (planned in future release) force staff to follow predefined test patterns.

The test setup complies with the test methods suggested by proposal paper IEC 62037 (IEC SC 46D.WG6).

11.1.3 General

Display	9” touch screen, readable in sunlight
Dimensions	6 HU 550 mm (266 × 483 × 650 H×W×D)
Weight	43 kg
RF ports - **F TX out** - **RX, isolation & VSWR** - **Opt. switch matrix**	 N-type (if no switch matrix is used) SMA-type SMA (TX & RX) and SMP-type (VSWR)
User interface ports	2×USB, LAN
AC power supply	100-250 VAC
Frequency stability	± 2.5 ppm

11.1.4 RF PIM Analyzer (Base Unit) -150W Option

IM order	3rd, 5th, 7th, 9th, 11th, 13th, 15th, 17th
Output power **At test port of most 3 dB coupled filters***	26 – 52 dBm 23 – 46 dBm
Residual PIM	< -128 dBm (> 171 dBc @ 2x +43 dBm) <- 131 dBm (> 174 dBc @2x +43 dBm) typ.
PIM vs. distance - **Accuracy / resolution** - **Range**	 < 0.3 m , all bands Depends on number of PIM sources and accuracy of cable velocity factor Down to -120 dBm PIM, 0 – 150 m
Frequency range (seamless)	698 … 2700 MHz
Filter units	Switchable between connected filter inserts via software

11.1.5 CPRI PIM Analyzer (SW Option)

Fiber interface	CPRI up to Rate 7 SFPs built into base unit (various types on request)
IM order	3rd, 5th,7th
Carrier types	LTE5, LTE10, LTE20, (LTE15 on request)
PIM range	-130 dBm noise floor (depends on RRH NF & bandwidth)

* Max. adjustable power is reduced automatically depending on hardware setup. Some special filters/bands may have higher attenuation and possible output power is reduced – see datasheet for details

11.1.6 RF Isolation Measurement

Frequency	Downlink frequency band of filter unit
RF output	+23 – 46 dBm
RF input	+27 dBm max. operating +30 dBm max. no damage +50 VDC max. no damage
Isolation - **Accuracy** - **Resolution**	0 – 60 dB 1.5 dB 0.1 dB

11.1.7 RF VSWR / Return Loss

Frequency	Downlink frequency band of filter unit
VSWR	1.10 – 20.00
Return loss	1.00 – 25.00 dB
Distance to VSWR fault - **Accuracy / resolution** - **Range**	 0.2 m (typ.) Depends on number of mismatch sources and accuracy of cable velocity factor 0 – 150 m

11.1.8 RF Spectrum Analyzer

Frequency	Uplink frequency band of filter unit
Resolution bandwidth	120 Hz to 20 MHz RBW
Noise floor	-135 dBm DANL at 1 kHz
Amplitude accuracy	±1.0 dB typ, ±1.5 dB max
RF input	-40 dBm max. operating +10 dBm max. no damage

11.1.9 Environmental

Operating temperature range	-10°C to +40°C
Storage temperature range	-20°C to +80°C
Relative humidity	5% to 95% RH non-condensing
Mechanical shock	1G

11.1.10 User Interfaces

Keyboard/USB memory	2 × USB A connector (one each on front and back panel)
Remote control	1 × LAN, 1 × Micro-USB B connector
Reference	1 × BNC 10 MHz
CPRI	2 × SFP built in on request, LC duplex on front panel
Isolation	Port 1: 7-16 Port 2: SMA-type
Supply	1 × DC magnetic connector

11.2 Filter Units

11.2.1 Main Features

- Outstanding PIM performance
- Industrial 24/7 ready
  - Forced air cooled depending on usage
  - Easy-to-replace air filters
- Plug-and-play system reconfiguration
  - Automatic detection in base unit
    - Factory calibrated
- Wideband hybrid coupler design
- Space-saving 3 HU height
- Field-replaceable test port
  - 7-16 DIN and 4.3-10 DIN

11.2.2 General

Dimensions (w/o connectors)	482.6 × 550 × 132.5 mm (W×L×H) 19”, 3 HU, depth 550 mm
Weight	10-16 kg (depends on frequency band)
Internal ports	3 × N, 2 × SMA, 2 × HSD
RF port	Field-replaceable test port 7-16 DIN, 4.3-10 DIN (opt)

11.2.3 Environmental

Operating temperature range	-10°C to +40°C
Storage temperature range	-20°C to +80°C
Relative humidity	5% to 95% RH non-condensing
Mechanical shock	1G

11.2.4 Compatibility / Supported Base Unit

The filter unit must correspond to the frequency range of the base units.

Base unit 0722	Filter units 07, 08, …, 21
Base unit 2127	Filter units 21, …, 26

11.2.5 IM-R-FI-07/B12-14-R (LTE700 L+U)

ETSI band	B12 - 14, B17
Transmit path - **Range**	 728 – 764 MHz
Receive path - **Range B12+17** - **Range B13+14**	 698 – 716 MHz 776 – 798 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	15.5 kg

11.2.6 IM-R-FI-07/B28-R (APT700)

ETSI band	B28
Transmit path - **Range**	 758 – 803 MHz
Receive path - **Range**	 703 – 748 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	16 kg

11.2.7 IM-R-FI-08/B20-R (DigDiv800)

ETSI band	B20
Transmit path - **Range**	 791 – 821 MHz
Receive path - **Range**	 832 – 862 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	13.5 kg

11.2.8 IM-R-FI-08/B5-R (AMPS850)

ETSI band	B5
Transmit path - **Range**	 869 – 894 MHz
Receive path - **Range**	 824 – 851 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	13 kg

11.2.9 IM-R-FI-09/B8-R (EGSM900)

ETSI band	B8
Transmit path - **Range**	 925 – 960 MHz
Receive path - **Range**	 880 – 915 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	13 kg

11.2.10 IM-R-FI-14/B11+21-R (LTE1400)

ETSI band	B11 + 21
Transmit path - **Range**	 1475.9 – 1510.9 MHz
Receive path - **Range**	 1427.9 – 1462.9 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	kg

11.2.11 IM-R-FI-18/B3-R (DCS1800)

ETSI band	B3
Transmit path - **Range**	 1805 – 1880 MHz
Receive path - **Range**	 1710 – 1785 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	11.5 kg

11.2.12 IM-R-FI-19/B2+4-R (PCS/AWS1900)

ETSI band	B2 + 4
Transmit path - **Range TX1** - **Range TX2 (B2 PCS)** - **Range TX2 (B4 AWS)**	 1930 – 1950 MHz 1970 – 1995 MHz 1970 – 2155 MHz
Receive path - **Range (B2 PCS)** - **Range (B4 AWS)**	 1850 – 1910 MHz 1710 – 1755 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	13.5 kg

11.2.13 IM-R-FI-21/B1-R (UMTS2100)

ETSI band	B1
Transmit path - **Range**	 2110 – 2170 MHz
Receive path - **Range**	 1920 – 2060 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	12 kg

11.2.14 IM-R-FI-23/B30-R (WCS) (opt. on request)

ETSI band	B30
Transmit path - **Range**	 2345 MHz – 2360 MHz
Receive path - **Range**	 2305 MHz – 2335 MHz
Residual PIM	-128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	kg

11.2.15 IM-R-FI-26/B7-R (LTE II 2600)

ETSI band	B7
Transmit path - **Range**	 2620 – 2695 MHz
Receive path - **Range**	 2445 – 2590 MHz
Residual PIM	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
Weight	12.5 kg

11.3 Part Number Designation

IM-R-FI-*xxxx-yy*		***Base unit***
xxxx:	0722:	700-2200 MHz broadband amplifier & receiver
	2127:	2100-2200 MHz broadband amplifier & receiver
yy:	150W:	150 W output power
M-R-MPX-*xxxx*		***Base unit***
xxxx:	6way:	6-way switch matrix (connect up to 6 filters)
	11way:	11-way switch matrix (connect up to 11 filters)
IM-R-FI-*xxxx*-y		***Filter unit 7-16 test port***
xxxx:	07/B12-14:	LTE700LU (ETSI band 12 to 14)
	07/B28:	APT700 (ETSI band 28)
	08/B20:	DigDiv (ETSI band 20)
	08/B5:	AMPS (CDMA 800) (ETSI band 5)
	09/B8:	EGSM (ETSI band 8)
	14/B11+21:	LTE1400 (ETSI band 11 & 21)
	18/B3:	DCS (ETSI band 3)
	19/B2+4:	PCS + AWS (ETSI band 2 & 4)
	21/B1:	UMTS (ETSI band 1)
	23/B30:	WCS (ETSI band 30)
	26/B7:	W UMTS II / LTE II (ETSI band 7)
y:	R:	Reflected PIM measurements (1 port)
	T:	Transmitted and dual-port measurements (2 ports) (on request)
IM-R-HWO-xxxx		**Hardware option**
xxxx:	ExtCtrl	External control interface to enable/disable amplifiers and receive RF-ON warning
IM-R-SWO-xxxx		**Software option**
xxxx:		Available on request
IM-R-ACSRY-xxxx		**Accessory**
xxxx:	Fil-BU:	9 cs air filter mats for base unit 52 cs air filter mats for filter unit

11.4 Order Number Example

IM-R-BU-0722-150W	Base unit with broadband amplifier 700-2700 MHz, receiver, fiber CPRI unit
IM-R-MPX-6way	Single battery pack
IM-R-FI-07/B28-R	Filter unit for APT700 (ETSI band 28)
IM-R-FI-19/B2+4-R	Filter unit for EGSM900 (ETSI band 2+4)
IM-R-ACSRY-Fil-BU	Filter mats for base unit

12 CE Declaration of Conformity

Place and date:	**Fridolfing, August 21st, 2007, update**
Manufacturer:	**Rosenberger Hochfrequenztechnik GmbH & Co. KG**
Address:	**Hauptstraße 1, 83413 Fridolfing, Germany**

declare under our sole responsibility that the product

Intermodulation test set
IM-07S, IM-08S, IM-09S, IM-18S, IM-19S, IM-21S, IM-26S, IM-35S
IM-07P, IM-08P, IM-85P, IM-09P, IM-18P, IM-19P, IM-21P, IM-26P, IM-35P
IM-07P-BB, IM-08P-BB, IM-85P-BB, IM-09P-BB, IM-18P-BB, IM-19P-BB, IM-21P-BB,
IM-0710-BB, IM-1822-BB, IM-2526-BB, IM-3435-BB, IM-0722-BB
IM-A-BU-0727, IM-B-BU-0727, IM-R-BU-0722-150W, IM-R-BU-2127-150W

to which this declaration relates is in conformity with the following EC directives:

73/23/EEC Low Voltage Directive
89/336/EEC Electromagnetic Compatibility Directive

and complies with the following standards or normative documents:

Safety

- EN 61010-1-1

EMC

- EN 55022
- EN 50082-2
- EN55011: Group 1 Class A
- EN 61000-4-2
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-6

Christian Entsfellner
Product Manager
R&D PIA Manager

13 Accessories

IM-R-MPX-6way or -**11way**
Switch matrix with support for a maximum of 6 or 11 filters

IM-R-ACSRY-FiI-BU or **-FI**
Set of dust air filter mats for base/filter unit

IM-R-HWO-ExtCtrl
External control / signaling interface

13.1 Filter Units

Rosenberger no.	Frequency band	ETSI band	Transmit path range	Receive path range	Residual PIM
IM-R-FI-06/B71-R (opt. on request)		71	617 – 652 MHz	663 – 698 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-07/B12-14-R	(LTE700 L+U)	12 - 14, 17	728 – 764 MHz	**B12+17** 698 – 716 MHz **B13+14** 776 – 798 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-07/B28-R	APT 700	28	758 – 803 MHz	703 – 748 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-08/B20-R	DigDiv 800	20	791 – 821 MHz	832 – 862 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-08/B5-R	AMPS850	5	869 – 894 MHz	824 – 851 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-09/B8-R	EGSM 900	8	925 – 960 MHz	880 – 915 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-14/B11+21-R	LTE 1400	11, 21	1475.9 – 1510.9 MHz	1427.9 – 1462.9 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-18/B3-	DCS 1800	3	1805 – 1880 MHz	1710 – 1785 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-19/B2+4-R	PCS/AWS1900	2, 4	**TX1** 1930 – 1950 MHz **TX2 (B2 PCS)** 1970 – 1995 MHz **TX2 (B4 AWS)** 1970 – 2155 MHz	**(B2 PCS)** 1850 – 1910 MHz **(B4 AWS)** 1710 – 1755 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-21/B1-R	UMTS2100	1	2110 – 2170 MHz	1920 – 2060 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-23/B30-R (opt. on request)	WCS	30	2345 MHz – 2360 MHz	2305 MHz – 2335 MHz	-128 dBm (< -171 dBc), referred to 2 × +43 dBm
IM-R-FI-26/B7-R	LTE II 2600	7	2620 – 2695 MHz	2445 – 2590 MHz	< -128 dBm (< -171 dBc), referred to 2 × +43 dBm

13.2 Other Accessories

	Part number	Description
Useful accessories	IM-R-HWO-ExtCtrl	External control/signaling interface
	IM-R-ACSRY-Fil-BU	10 air filter mats for base unit (420x375x15 mm, polyolefin, filter class G2, flammability F1)
	IM-R-ACSRY-Fil-FI	50 air filter mats for filter unit (130x45x15 mm, polyolefin, filter class G3, flammability F1)
Spare parts	60S101-KIMN1	7/16 test port saver for use on filter
	60S164-K00N1	4.3/10 test port saver for use on filter
Low PIM adapters	60S101-KIMN1	7/16 male to 7/16 female adapter
	60S101-SIMN1	7/16 male to 7/16 male adapter
	60K101-KIMN1	7/16 female to 7/16 female adapter
	60S153-KIMN1	7/16 male to N female adapter
	53S160-KIMN1	7/16 female to N male adapter
	60S164-K00N1	7/16 male to 4.3/10 female adapter
	60S164-S00N1	7/16 male to 4.3/10 male adapter
	60K164-S00N1	7/16 female to 4.3/10 male adapter
PIM standards	60S110-KxxN1	• **-110 dBm standard adapter (band-specific) included with every filter unit (7/16 DIN type)**
	64S110-KxxN1	• **-110 dBm standard adapter (band-specific) included with every filter unit (4.3/10 DIN type)**
	• **xx: 07 LTE700; 08 DigDiv|AMPS; 09 EGSM; 18 DCS; 19 PCS/AWS;** • **21 UMTS; 26 LTE2600; other frequencies on request**	
Low PIM terminations	60Z150-001	Low PIM termination (19” rack type, 3 HU)
	60Z150-012	Low PIM termination (benchtop type)
	60Z150-020	Low PIM termination (portable, with male & female ports)
Tools	60W000-002	32 mm torque wrench
	53W010-000	18 mm torque wrench

	99W057-000	Adjustable flat wrench
Corrugated Test cables	LC02-186-4000	Test cable 7/16 male / 7/16 male 4.0 m
	LC02-186-1500	Test cable 7/16 male / 7/16 male 1.5 m
	LC02-188-4000	Test cable 7/16 male / N male 4.0 m
	LC02-188-1500	Test cable 7/16 male / N male 1.5 m
	SLJ12SP-60M64M-2.0m-00	Test cable 7/16 male / 4.3/10 male 2.0 m
	SLJ12SP-64M64M-2.0m-00	Test cable 4.3/10 male / 4.3/10 male 2.0 m
Super flex test cables	IM-Cable-716m-716m-3000	Test cable 7/16 male / 7/16 male 3.0 m
	IM-Cable-716m-4310m-3000	Test cable 7/16 male / 4.3/10 male 3.0 m
	IM-Cable-4310m-4310m-3000	Test cable 4.3/10 male / 4.3/10 male 3.0 m

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