Rosenberger

Much More Than Technology

Passive DAS Solutions

SITE SOLUTIONS

Rosenberger Site Solutions – Much More Than Technology

The Rosenberger Site Solutions Group designs, manufactures and provides solutions for the wireless infrastructure market. Our products and systems offer innovative and leading-edge designs with focus on high performance and quality. Having an efficient network implementation in mind, we focus on total site kitting, logistics and delivery time leading to reduced cost of ownership. Globally present, the Rosenberger Site Solutions Group offers extensive local support making Rosenberger Site Solutions a partner instead of just a supplier.

Content

Home of Innovation 4

Rosenberger Worldwide 6

Components for Passive DAS Systems 8

- Passive Splitters 10
- Directional Couplers 11
- Hybrid Combiners 12
- Termination Loads 13
- Attenuators 14
- DAS In-Building Antennas 15
- 4.3-10 Connectors 18
- Universal Preperation Tool 19
- Low-PIM, On-Site Connector Installation 20
- 4.3-10 Coaxial Cables and Connectors 21
- Adaptors 22
- PIM Measurement 23
- Field Strength Measurements at the Rosenberger HQ 25
- PIM Site Analyzer α 26

Index 30

Home of Innovation

A global network of Rosenberger research & development and production centers provides innovation, optimized cost structure and outstanding local customer service.

The Rosenberger headquarters located in Fridolfing in the southeast part of Bavaria, Germany

Rosenberger Worldwide

Rosenberger has more than 11,300 employees at the headquarters, manufacturing plants and sales offices in Europe, Asia as well as in North and South America, who are engaged in development, manufacture and sales of the products.

Rosenberger is always near you with its capable partners in the most important industrial countries when you need competent advice and trouble-free delivery on location.

In many countries, Rosenberger subsidiaries are active in the manufacture of connectors and cable assemblies. This facilitates flexibility on location and provides a national element that can help in reducing tax and customs charges.

With the establishment of a European assembly and logistics center in eastern Hungary together with the complete manufacturing plants in China and India, Rosenberger has, on the one hand, established a sustainable competitive advantage by international comparisons, and on the other hand, makes a useful contribution to the industrial development of emerging economies.

Rosenberger Global Network

Company Headquarters

- Fridolfing, Germany

Europe

- Austria: Timelkam
- Denmark: Lynge
- Germany: Augsburg, Laufen, Neuenbürg, Radeberg
- Hungary: Jászárokszállás, Jászberény, Nyírbátor, Taksony
- Italy: Vimercate
- Spain: Madrid
- Sweden: Kista, Vallentuna
- UK: Bradford

North America

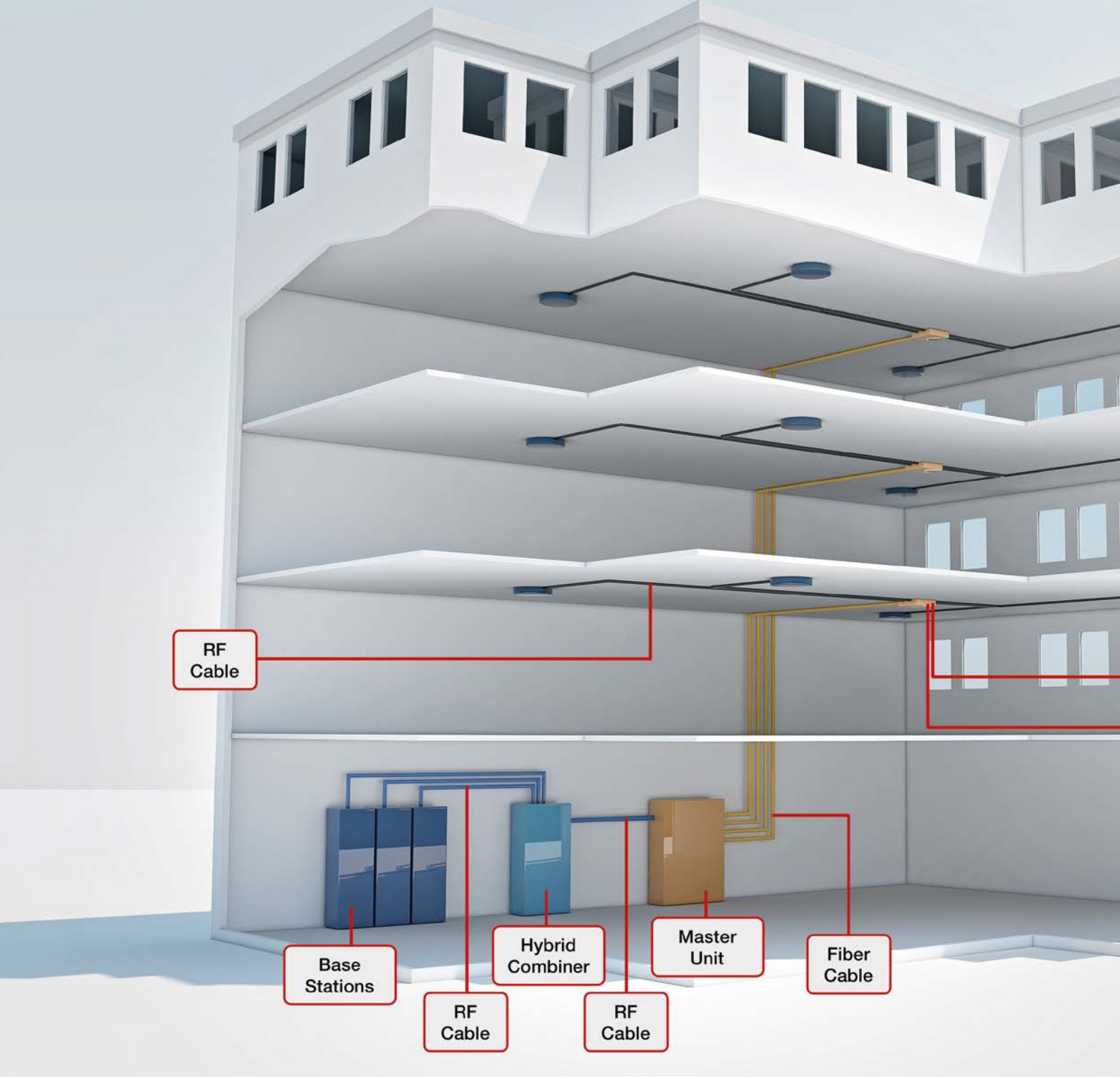
- Mexico: Apodaca
- USA: Akron, Pennsauken, Lake Charles

South America

- Brazil: Cacapava - São Paulo
- Chile: Santiago

Asia

- China: Beijing, Dianshan Hu, Dongguan, Shanghai
- India: Manesar, Goa, Pune
- Japan: Tokyo
- Korea: Suwon-City



Components for Passive DAS Systems

With the development of modern wireless communication technologies, mobile communications networks are deployed requiring wideband universal passive components. Rosenberger supplies a complete range of passive components for wireless Distributed Antenna Systems (DAS) for in-building coverage such as splitters, combiners, termination loads, attenuators, and antennas.

Easy to install, Rosenberger DAS components ensure reliable, high quality and low PIM operation.


Antenna
Splitter
Remote Unit


Rooftop Antenna
Rooftop Antenna
Repeater
Repeater
Diplexer
Hybrid Combiner
Antenna
Antenna
Directional Coupler
Splitter
Antenna
Directional Coupler
Splitter
Antenna
Antenna
Antenna

Passive Splitters

Available in 2 through 4-way with customized 5 and 6-way versions available on request, Rosenberger's passive splitters are designed for best in class performance and value. Covering the entire frequency range from 698 - 4200 MHz with PIM performance up to -160 dBc, these splitters support low-PIM DAS applications.

Features and Benefits

- Guaranteed PIM performance
- Low VSWR and loss
- High power performance

Rosenberger No.	Number of Splits	Frequency Band	PIM	Power Handling	Environmental	Interface
S-2-11F-64F-T	2	698 - 4200 MHz	-160 dBc	300 W	IP65	4.3-10 female
S-3-11F-64F-T	3					
S-4-11F-64F-T	4					

Directional Couplers

Directional couplers are used to divide an input signal into two proportional power levels. Designed with minimal internal connections, these couplers provide low PIM and high isolation and cover a frequency range from 698 to 4200 MHz.

Features and Benefits

- Guaranteed PIM performance
- High isolation, low VSWR and loss
- High power performance

Rosenberger No.	Coupling Ratio	Frequency Band	PIM	Power Handling	Environmental	Interface
DC-6-11F-64F-T	6 dB	698 - 4200 MHz	-160 dBc	300 W	IP65	4.3-10 female
DC-8-11F-64F-T	8 dB					
DC-10-11F-64F-T	10 dB					
DC-12-11F-64F-T	12 dB					
DC-15-11F-64F-T	15 dB					
DC-20-11F-64F-T	20 dB					
DC-30-11F-64F-T	30 dB					

Hybrid Combiners

Available in broadband and band-specific versions, these hybrid combiners allow for the combining of multiple technologies within the same band. The excellent PIM performance of up to -161 dBc, low insertion loss, and low VSWR make these combiners an excellent choice for DAS applications.

Features and Benefits

- Low PIM and high isolation, low VSWR and insertion loss
- High reliability
- Simple installation

Rosenberger No.	Number of Splits	Frequency Band	PIM	Power Handling	Environmental	Interface
HM-3-11F-64F-T	2/2	698 - 4200 MHz	-160 dBc	300 W	IP65	4.3-10 female
HM-6-11F-64F-T	4/4					

Termination Loads

Rosenberger's low-PIM loads are used to terminate open transmission lines such as a non-used port of a hybrid coupler or combiner.

Features and Benefits

- Outstanding PIM performance
- Operating power 10 - 100 W

Rosenberger No.	Frequency Band	PIM	Power Handling	Interface
L-2-64M-01	698 - 2700 MHz	-160 dBc	2 W	4.3-10 female
L-10-64F-T3			10 W	
L-50-64F-T3	698 - 4200 MHz	-160 dBc	50 W	
L-100-64F-T3			100 W	
L-200-64F-T3			100 W	

Attenuators

Rosenberger offers a wide range of attenuators.

Features and Benefits

- Guaranteed PIM performance
- High isolation, low VSWR and loss
- Rugged aluminum housing for long lasting, reliable performance

Rosenberger No.	Frequency Band	VSWR	PIM	Power Handling	Interface
A-xx-50-64-T3	698 - 2700 MHz	1.20	-161 dBc	50 W	4.3-10 male to 4.3-10 female
A-xx-100-64-T3				100 W	
A-xx-50-11F-64-T3	698 - 4200 MHz	1.25		50 W	
A-xx-100-11F-64-T3				100 W	

DAS In-Building Antennas

The Rosenberger broadband in-building antennas are suitable for all indoor distribution systems mainly installed in shopping malls, restaurants, office buildings, or sports facilities.

Features and Benefits

- Ultra-wideband Indoor Ceiling and Panel Mounting Antenna
- Smooth design
- Vertical polarization
- 2G/3G/4G/5G
- Small and compact

Rosenberger No.	Frequency Band	Antenna Type	PIM	Connector	Product
8FW-OD-3-64K-11F	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband ceiling mounting SISO	-150 dBc	4.3-10 female	
SL21OUCBE3S	698 - 2700 & 3300 - 3800 & 4900 - 6000 MHz	Ultra wideband ceiling mounting Low profile Ø 213 x 18.5 mm SISO	-150 dBc	4.3-10 female	
8FW/8FW-OD-6-64K-B6-11F	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband ceiling mounting, omni slim MIMO	-150 dBc	2 x 4.3-10 female	
SL21OUCBE3M	698 - 2700 & 3300 - 3800 & 4900 - 6000 MHz	Ultra wideband ceiling mounting Low profile Ø 213 x 18.5 mm MIMO	-150 dBc	2 x 4.3-10 female	
8FW-90-8-64K-11F	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband panel mounting SISO	-150 dBc	4.3-10 female	
8FW/8FW-65-8D-64K-11F	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband panel mounting MIMO	-150 dBc	2 x 4.3-10 female	

DAS In-Building Antennas

Rosenberger No.	Frequency Band	Antenna Type	PIM	Connector	Product
8FW-90-8-64K-11F-OD	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband panel mounting SISO Outdoor	-150 dBc	2 x 4.3-10 female	
8FW/8FW-65-8D-64K-11F-OD	698 - 960 & 1425 - 2700 & 3300 - 3800 MHz	Ultra wideband panel mounting MIMO Outdoor	-150 dBc	2 x 4.3-10 female	
S-Wave 0627/0627-33-14D-11	698 - 960 & 1695 - 2700 &	Ultra wideband narrow beam High capacity antenna MIMO Outdoor 806 x 836 x 135 mm	-150 dBc	2 x 4.3-10 female	
SLPUFCE3F	1710 - 3800 MHz	Ultra wideband panel mounting High capacity antenna 4 x 4 MIMO Outdoor 450 x 412 x 136 mm	-150 dBc	4 x 4.3-10 female	
5WMB-41	1695 - 2690 MHz	HB penta beam / 0.9m High capacity antenna Outdoor 896 x 1096 x 116 mm	-150 dBc	10 x 4.3-10 female	
9WMB-41	1695 - 2690 MHz	HB nona beam / 0.9m High Capacity antenna Outdoor 900 x 1644 x 116 mm	-150 dBc	18 x 4.3-10 female	

Rosenberger No.	Frequency Band	Antenna Type	PIM	Connector	Product
G2W33D-21	698 - 960 & 1695 - 2690 MHz	1L2H 33deg / 1.55m Embedded RET (AISG 2.0 compliant) Outdoor	-153 dBc	6 x 4.3-10 female	
S-Wave 0640FW-10/12-LP-64K	698 - 960 & 1425 - 1500 & 1710 - 2700 & 3400 - 4000 MHz	Ultra wideband Donor antenna Outdoor	-153 dBc	4.3-10 female	
SLOMNI280-00-64F	698 - 960 & 1710 - 2700 & 3400 - 3800 MHz	Ultra wideband Omni antenna Outdoor 154 x 51 mm	-153 dBc	4.3-10 female	
SL21DFFAENS-2	3400 - 3800 MHz	Omni antenna Outdoor 600 x 38 mm	-150 dBc	4.3-10 female	

4.3-10 Connectors

Features and Benefits

- Low, reliable, and constant PIM independent of torque
- Outstanding insertion/return loss
- Small foot print – 40% smaller than 7-16 connectors
- Low weight – 60% reduction compared to other RF interfaces

4.3-10 Series

7-16 Series

Connectors – Technical Data

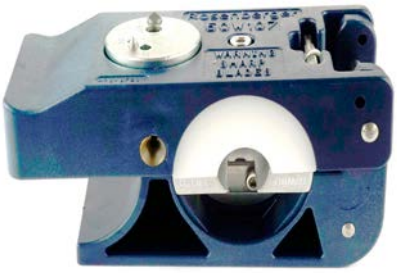
Connector Type	4.3-10
Minimum flange size	25.4 mm
Return loss	≥ 36 dB @ DC to 4 GHz ≥ 32 dB @ 4 GHz to 6 GHz
RF leakage	≥ 120 dB @ DC to 3 GHz (screw, HEX) ≥ 90 dB @ DC to 3 GHz (hand-screw) ≥ 70 dB @ 3 to 6 GHz (push-pull)
Passive intermodulation	≥ 166 dBc @ 2 x 43 dBm
Degree of protection (water tightness)	IP68 (@ 25 m, 1 hour)
Mating cycles	≥ 100
Coupling mechanisms	Screw (HEX), hand-screw, push-pull
Coupling torque (screw-on type)	> 5 Nm
Mating cycles	≥ 100
Coupling mechanisms	Screw (HEX), hand-screw, push-pull
Coupling torque (screw-on type)	> 5 Nm

64W022-001
99W057-000

Torque Wrench and Spanners

Rosenberger No.	Description	Torque Setting	Opening
64W022-001	Torque wrench for 4.3-10	5 ± 0.3 Nm	22 mm
53W010-000	Torque wrench for N	1.1 Nm	18 mm
60W000-002	Torque wrench for 7-16	25 Nm	32 mm
99W057-000	Spanner, adjustable		0 - 35 mm
99W057-001	Spanner, adjustable		0 - 46 mm

Universal Preparation Tool



Preparation Tools

Rosenberger No.	Description
60W107-C09	Stripping tool for 1/4" S (superflex)
60W107-C01	Stripping tool for 1/4" S (flex)
60W107-C08	Stripping tool for 1/2" S (superflex)
60W007-C03	Stripping tool for 1/2" R (flex)
60W007-C05	Stripping tool for 7/8" R
60W110-C06	Stripping tool for 1 1/4" R
60W110-C07	Stripping tool for 1 5/8" R
SLZ0002-000	Cable cutter up to 1 1/2"
SLZ0002-1001	Cable cutter up to 1 5/8"
SLZ0009-000	Cleaning Kit

Low-PIM, On-Site Connector Installation

To achieve the best PIM test results we recommend following the procedures below in addition to the recommendations outlined in the assembly instructions included with each individual connector.

It is very important to keep the prepped cable and connectors absolutely clean of dirt, metal particles, and scratches.

Prepare the cable according to assembly instructions (e.g. with tool 60W107-Cxx).

Use a plastic tool for removing the cut-off bond on the dielectric (e.g. SLT004-000).

On cables with tube inner conductor, remove burrs and sharp edges on the inside of the conductor (e.g. flaring tool integrated in tool 60W107-Cxx).

Before finally attaching the connector to the cable, clean the contact areas of the cables with alcohol by using non-metallic cleaning brushes/tools (e.g., SLZ0009-000).

4.3-10 Coaxial Cables and Connectors

4.3-10 Cable Connectors – Super Flexible Corrugated Cables

Connector Type	Rosenberger No.		
	1/4" Super flexible corrugated	3/8" Super flexible corrugated	1/2" Super flexible corrugated
4.3-10 male straight; screw type	64S1C7-C09N1	64S1C7-C02N1	64S1C7-C08N1
4.3-10 male right angle; screw type	64S2C7-C09N1	64S2C7-C02N1	64S2C7-C08N1
4.3-10 female straight; screw type	64K1C7-C09B1	64K1C7-C02B1	64K1C7-C08B1

4.3-10 Cable Connectors – Flexible Corrugated Cables

Connector Type	Rosenberger No.			
	1/2" Flexible corrugated	7/8" Flexible corrugated	1 1/4" Flexible corrugated	1 5/8" Flexible corrugated
4.3-10 male straight; screw type	64S1C7-C03N1	64S1C7-CX5N1	64S1D7-C06N1	64S1D7-C07N1
4.3-10 male right angle; screw type	64S2C7-C03N1			
4.3-10 female straight; screw type	64K1C7-C03B1	64K1C7-CX5B1	64K1D7-C06B1	64K1D7-C07B1

R = Ring corrugation
S = Spiral corrugation
PE = Polyethylene
FRNC = Flame-retardant & halogen- free (IEC 60332)
*higher ratings on request

Coaxial Cables Overview

Rosenberger No.				
Cable Dimension	Flexible (R)	Super flexible (S)	Low Loss (L)	CPR-Ratings*
1/4"	SL 014 R PE SL 014 R FRNC	SL 014 S PE SL 014 S FRNC		E_{ca}
3/8"		SL 038 S PE SL 038 S FRNC		E_{ca}
1/2"	SL 012 R PE SL 012 R FRNC	SL 012 S PE SL 012 S FRNC		E_{ca} $B2_{ca}$ s1 d1 a1
7/8"			SL 078 R L PE SL 078 R L FRNC	E_{ca} $B2_{ca}$ s1 d0 a1
1 1/4"			SL 114 R L PE SL 114 R L FRNC	E_{ca} $B2_{ca}$ s1 d1 a1
1 5/8"			SL 158 R L PE SL 158 R L FRNC	E_{ca} D_{ca} s2 d2 a1

Adaptors

These precision adaptors can be used at the test port of the analyzer or its extension cable to provide an interface compatible with the specified system test point before starting the calibration process. The PIM optimized adaptors ensure optimum accuracy and stability for testing.

65S153-KIMN1

60S101-SIMN1

64S101-S00N1

64S189-KD0N1

Rosenberger No.	Interface
53S101-S00N5	N male – N male
53K102-K00N5	N female – N female
53S164-S00N1	N male – 4.3-10 male
53S164-K00N1	N male – 4.3-10 female
53K164-S00N1	N female – 4.3-10 male
53S201-K00N5	N male – N female

60S101-SIMN1	7-16 male – 7-16 male
60S101-KIMN1	7-16 male – 7-16 female
60K101-KIMN1	7-16 female – 7-16 female
60S153-KIMN1	7-16 male – N female
53S160-SIMN1	7-16 male – N male
53S160-KIMN1	7-16 female – N male
53K160-KIMN1	7-16 female – N female
60S164-S00N1	7-16 male – 4.3-10 male
60S164-K00N1	7-16 male – 4.3-10 female
60S231-K00N1	7-16 male – 7-16 female

64S101-S00N1	4.3-10 male – 4.3-10 male
64S101-K00B1	4.3-10 male – 4.3-10 female
64K101-K00B1	4.3-10 female – 4.3-10 female
64K501-K00B1	4.3-10 female – 4.3-10 female – bulkhead adaptor
64S201-K00B1	4.3-10 male – 4.3-10 female

64S189-K00N1	NEX10® female – 4.3-10 male
64S189-S00N1	NEX10® male – 4.3-10 male
64K189-K00N1	NEX10® female – 4.3-10 female
64K189-S00N1	NEX10® male – 4.3-10 female

53S189-K00N1	NEX10® female – N male
53S189-S00N1	NEX10® male – N male
53K189-K00N1	NEX10® female – N female
53K189-S00N1	NEX10® male – N female

PIM Measurement

Excellent PIM performance is vital in today's mobile communications network. Rosenberger offers a complete range of PIM loads, measurement assemblies, and adaptors that meet our customers' expectations in terms of outstanding PIM performance.

PIM Load and Test Kits

For testing and troubleshooting, these high-quality precision loads are typically used to terminate system components at the characteristic impedance.

Rosenberger No.	Interface	Frequency	Product
60Z150-012	4.3-10 / 7-16	700 MHz to 3.6 GHz	
60Z150-020	7-16 male – 7-16 female	DC to 2.7 GHz	
IM-Load-Site 4.3-10	4.3-10 male – 4.3-10 female	DC to 2.7 GHz	

Measurement Assemblies

The PIM optimized measurement assemblies ensure optimum accuracy and stability for testing.

Rosenberger No.	Description	Product
IM-Cable-716m-4310m-xxx	7-16 male – 4.3-10 female	
IM-Cable-716m-716m-xxx	7-16 male – 7-16 male	
IM-Cable-4310m-4310m-xxx	4.3-10 male – 4.3-10 male	

xxx = cable length in mm

Test Adaptors

These precision adaptors can be used at the test port of the analyzer or its extension cable to provide an interface compatible with the specified system test point before starting the calibration process. The PIM optimized adaptors ensure optimum accuracy and stability for testing.

Rosenberger No.	Description	Product
60S164-K00N1	7-16 male – 4.3-10 male	
60S164-S00N1	7-16 male – 4.3-10 female	

PIM Test Kits

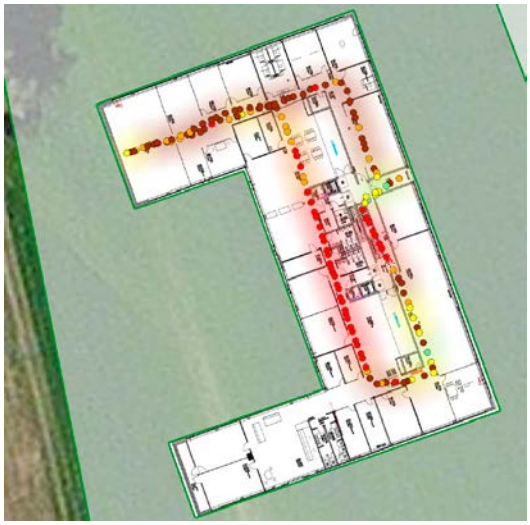
Carry out high-precision and quality test and measurements with the Rosenberger test kits including test cables, adaptors, load, and torque wrench.

Rosenberger No.	Description	Product
SLTK003-002	4.3-10 and 7-16 contains a high-power, low-PIM load, different adaptors, highly flexible test cable 4.3-10 male to 4.3-10 male, torque wrench	

Field Strength Measurements at the Rosenberger HQ in Fridolfing

A Rosenberger Passive Intermodulation Analyzer (3400-3600 MHz) with a WiMAX 3500 MHz filter unit was used as the test transmitter. Between the transmitting antenna and the test transmitter there was a 10 m long ½“ cable with approx. 2.3 dB @ 3600 MHz attenuation. The Omni SISO antenna was used as the antenna. The transmission power was 40 dBm.

Test setup of transmitter location



Display of measured values in the interior of an office building

PIM Site Analyzer α

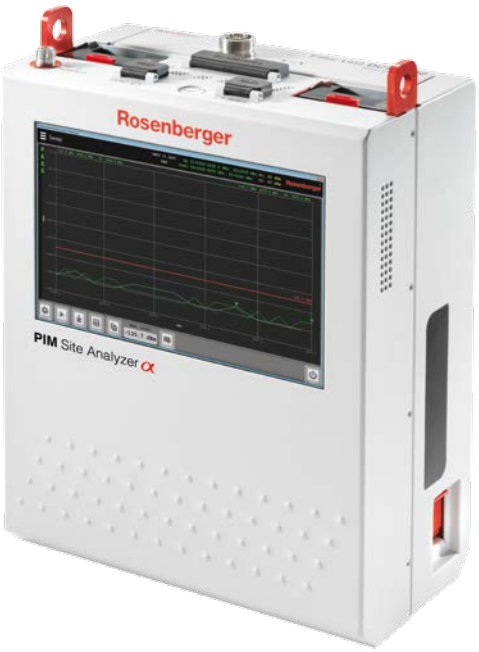
Stressed PIM Tests without any Calibration on Site

The Rosenberger portable and multifunctional broadband PIM Site Analyzer α provides the best alternative of performing the most precise and efficient PIM tests on site.

The PIM Site Analyzer α consists of a single Master Unit with band-specific, interchangeable filter units, since the form factor of the filter units is the same. Take out one filter unit, e.g., 900 MHz, and replace with another filter unit, e.g., 1800 MHz, without any calibration of the filter unit, potential adaptors, test cable, or operational mode(s). Future-proof Plug and Play concept covering 700 to 2700 MHz.

Features and Benefits

- Broadband Base Unit 700 - 2700 MHz with field interchangeable, band-specific filter units
- Stressed PIM tests – continuous wave (CW) signal simulates real operating conditions of the base station (in conformity with IEC 62037-1)
- Outstanding PIM performance <-125 dBm (<-130 dBm typ.)
- No on-site calibration
- Accuracy of < 0.3 m for PIM Distance to Fault (DTF) measurement
- Future-proof for upcoming bands



Additional Features

- In-built WiFi for remote control via optional 10“ Android tablet
- Operation via batteries or external power supply
- VSWR/return loss measurements
- Antenna isolation measurement
- Integrated spectrum analyzer
- 12“ touchscreen
- Intuitive software operation

Wide range of tools & accessories

Fast and easy interchangeable band filter units

Filter Units

- 700, 800, 900, 1800, 2100, 2600 MHz
  (other frequency bands on request)

Base unit includes

- 1 filter unit
- 2 batteries
- External power unit
- Charging cable

PIM Site Analyzer α Broadband Base Unit

Rosenberger No.	Frequency Range RX	Frequency Range TX	Power Output	RX Noise Floor
IM-B-BU-0727	698 - 2700 MHz	see filter units	26 / 49 dBm	< -135 dBm

Detailed specifications on request

PIM Site Analyzer α Filter Units for 7-16

Rosenberger No.	Frequency Band	E-UTRA	Frequency Range RX	Frequency Range TX	Power Output	Residual IM @ 2x43 dBm Reflected IM
IM-B-FI-700/B28	APT 700	28	703 - 748 MHz	758 - 803 MHz	+23 ... +46 dBm	< -168 dBc
IM-B-FI-800/B20	DigDiv	20	832 - 862 MHz	792 - 822 MHz		
IM-B-FI-900/B8+	EGSM 900	8	880 - 915 MHz	925 - 960 MHz		
IM-B-FI-1800/B3	DCS 1800	3	1710 - 1785 MHz	1805 - 1880 MHz		
IM-B-FI-1400/B11+21	LTE 1400	11, 21	1427.9 - 1462.9 MHz	1475.9 - 1510.9 MHz		
IM-B-FI-2100/B1	UMTS 2100	1	1920 - 2060 MHz	2110 - 2170 MHz		
IM-B-FI-2600/B7	UMTS II / LTE 2600	7	2545 - 2580 MHz	2620 - 2695 MHz		

Detailed specifications on request

PIM Site Analyzer α Filter Units for 4.3-10

Rosenberger No.	Frequency Band	E-UTRA	Frequency Range RX	Frequency Range TX	Power Output	Residual IM @ 2x43 dBm Reflected IM
IM-B-FI-700/B28-G	APT 700	28	703 - 748 MHz	758 - 803 MHz	+23 ... +46 dBm	< -168 dBc
IM-B-FI-800/B20-G	DigDiv	20	832 - 862 MHz	792 - 822 MHz		
IM-B-FI-900/B8+-G	EGSM 900	8	880 - 915 MHz	925 - 960 MHz		
IM-B-FI-1800/B3-G	DCS 1800	3	1710 - 1785 MHz	1805 - 1880 MHz		
IM-B-FI-1400/B11+21-G	LTE 1400	11, 21	1427.9 - 1462.9 MHz	1475.9 - 1510.9 MHz		
IM-B-FI-2100/B1-G	UMTS 2100	1	1920 - 2060 MHz	2110 - 2170 MHz		
IM-B-FI-2600/B7-G	UMTS II / LTE 2600	7	2545 - 2580 MHz	2620 - 2695 MHz		

Detailed specifications on request

PIM Site Analyzer α Battery Pack

Rosenberger No.	Capacity
IM-A-BU-BAT	99 Wh

PIM Site Analyzer α Bag

Rosenberger No.	Description
IM-B-ACSRY-BAG	Carry Bag for PIM Site Analyzer
IM-A-ACSRY-Backpack	Backpack for accessories
IM-A-Bat-Charger	External charger for batteries
IM-A-BU-PU-EF	External power supply unit, 750W


Rosenberger

Rosenberger No.

53K102-K00N5 22
53K160-KIMN1 22
53K164-S00N1 22
53K189-K00N1 22
53K189-S00N1 22
53S101-S00N5 22
53S160-KIMN1 22
53S160-SIMN1 22
53S164-K00N1 22
53S164-S00N1 22
53S189-K00N1 22
53S189-S00N1 22
53S201-K00N5 22
53W010-000 18
5WMB-41 16
60K101-KIMN1 22
60S101-KIMN1 22
60S101-SIMN1 22
60S153-KIMN1 22
60S164-K00N1 22
60S164-K00N1 24
60S164-S00N1 22
60S164-S00N1 24
60S231-K00N1 22
60W000-002 18
60W007-C03 19
60W007-C05 19
60W107-C01 19
60W107-C08 19
60W107-C09 19
60W110-C06 19
60W110-C07 19
60Z150-012 23
60Z150-020 23
64K101-K00B1 22
64K189-K00N1 22
64K189-S00N1 22
64K1C7-C02B1 21
64K1C7-C03B1 21
64K1C7-C08B1 21
64K1C7-C09B1 21
64K1C7-CX5B1 21
64K1D7-C06B1 21
64K1D7-C07B1 21
64K501-K00B1 22
64S101-K00B1 22
64S101-S00N1 22
64S189-K00N1 22
64S189-S00N1 22
64S1C7-C02N1 21
64S1C7-C03N1 21
64S1C7-C08N1 21
64S1C7-C09N1 21
64S1C7-CX5N1 21
64S1D7-C06N1 21
64S1D7-C07N1 21
64S201-K00B1 22
64S2C7-C02N1 21
64S2C7-C03N1 21
64S2C7-C08N1 21
64S2C7-C09N1 21
64W022-001 18
8FW-90-8-64K-11F 15
8FW-90-8-64K-11F-OD 16
8FW-OD-3-64K-11F 15
8FW/8FW-65-8D-64K-11F 15
8FW/8FW-65-8D-64K-11F-OD 16
8FW/8FW-OD-6-64K-B6-11F 15
99W057-000 18
99W057-001 18
9WMB-41 16
A-xx-100-11F-64-T3 14
A-xx-100-64-T3 14
A-xx-50-11F-64-T3 14
A-xx-50-64-T3 14
DC-10-11F-64F-T 11
DC-12-11F-64F-T 11
DC-15-11F-64F-T 11
DC-20-11F-64F-T 11
DC-30-11F-64F-T 11
DC-6-11F-64F-T 11
DC-8-11F-64F-T 11
G2W33D-21 17
HM-3-11F-64F-T 12
HM-6-11F-64F-T 12
IM-A-ACSRY-Backpack 27
IM-A-Bat-Charger 27
IM-A-BU-BAT 27
IM-A-BU-PU-EF 27
IM-B-ACSRY-BAG 27
IM-B-BU-0727 27
IM-B-FI-1400/B11+21 27
IM-B-FI-1400/B11+21-G 27
IM-B-FI-1800/B3 27
IM-B-FI-1800/B3-G 27
IM-B-FI-2100/B1 27
IM-B-FI-2100/B1-G 27
IM-B-FI-2600/B7 27
IM-B-FI-2600/B7-G 27
IM-B-FI-700/B28 27
IM-B-FI-700/B28-G 27
IM-B-FI-800/B20 27
IM-B-FI-800/B20-G 27
IM-B-FI-900/B8+ 27
IM-B-FI-900/B8+-G 27
IM-Cable-4310m-4310m-xxx 23
IM-Cable-716m-4310m-xxx 23
IM-Cable-716m-716m-xxx 23
IM-Load-Site 4.3-10 23
L-10-64F-T3 13
L-100-64F-T3 13
L-2-64M-01 13
L-200-64F-T3 13
L-50-64F-T3 13
S-2-11F-64F-T 10
S-3-11F-64F-T 10
S-4-11F-64F-T 10
S-Wave 0627/0627-33-14D-11 16
S-Wave 0640FW-10/12-LP-64K 17
SL 012 R FRNC 21
SL 012 R PE 21
SL 012 S FRNC 21
SL 012 S PE 21
SL 014 R FRNC 21
SL 014 R PE 21
SL 014 S FRNC 21
SL 014 S PE 21
SL 038 S FRNC 21
SL 038 S PE 21
SL 078 R L FRNC 21
SL 078 R L PE 21
SL 114 R L FRNC 21
SL 114 R L PE 21
SL 158 R L FRNC 21
SL 158 R L PE 21
SL21DEFAENS-2 17
SL21OUCBE3M 15
SL21OUCBE3S 15
SLOMNI280-00-64F 17
SLPUFCE3F 16
SLTK003-002 24

SLZ0002-000 19
SLZ0002-1001 19
SLZ0009-000 19

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www.rosenberger.com/siso

Rosenberger
Rosenberger Site Solutions GmbH
Mayerhofen 45A
83410 Laufen
Germany
Phone +49 8684 18-5000
siso@rosenberger.com
www.rosenberger.com/siso

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