

## Passive Intermodulation Analyzers Rack and Portable Types



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## ■ Basics – Passive Intermodulation

### Passive Intermodulation

Passive Intermodulation (PIM) is a nonlinear response of two or more signals of different frequencies mixing together in a passive device, e.g. antenna, cable, connector or splitter. Today, PIM has become a very serious and challenging task for mobile operators, equipment vendors and component manufacturers due to frequency planning in modern communication networks, the usage of high-power transmitters and more sensitive receivers in base stations. If a PIM with sufficient magnitude generated from a transmitter falls within an adjacent receiver channel, it causes serious interferences to the base station receiver and will significantly degrade the network quality of service.

The cause of PIM is very complex and uncertain. Even dirty surfaces, poor soldering, and loose connections will cause serious intermodulation. Hence, in theory, it cannot be calculated nor cannot be simulated by software. To verify the PIM and look for the root cause, specific test instruments are required.

### Passive Intermodulation Analyzers

Passive Intermodulation Analyzers (PIAs) are professional measurement instruments which are characterized by very low self intermodulation and high power level signal output. Their high accuracy receiver allows fast and precise measurements of the 3rd, 5th and 7th order intermodulation of passive devices under high-power conditions, e.g. connectors, cable assemblies, antennas, filters and other passive components.

### Applications

PIA Rack Types	PIA Portable Types	PIA Site Analyzers
Manufacturers of passive components	Site installation	Site installation (waterproof)
Research & Development	Mobile operators	
Laboratories	System integrators	
Calibration centers		

## ■ Definition of Intermodulation

### Passive Intermodulation

Intermodulation occurs when two or more signals mix on a non-linear device and create undesired output at other frequencies.

In a communications system, this means that signals in one channel may cause interference with adjacent channels.

Considering that an input signal contains two frequencies, intermodulation can be indicated as follows:

$$f_{IM} = mf_1 \pm nf_2$$

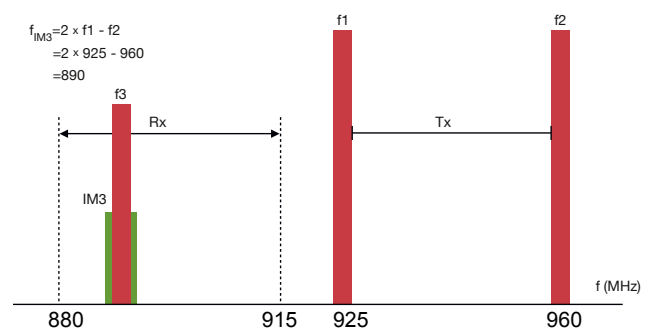
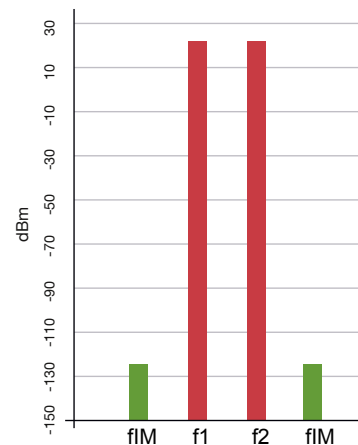
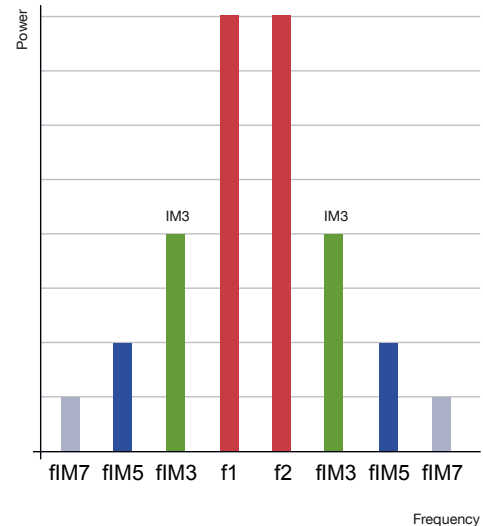
$f_1$  and  $f_2$  are carrier frequencies

$f_{IM}$  is the intermodulation frequency

$m+n$  is the order of  $f_{IM}$ . For example, when  $f_{IM}=2f_1 - f_2$ ,  $f_{IM}$  is called the 3rd order intermodulation frequency. Commonly, the 3<sup>rd</sup>, 5<sup>th</sup> and 7<sup>th</sup> order intermodulation signals will be considered. The 3<sup>rd</sup> order intermodulation signal always represents the worst case condition of unwanted signals generated since it is closest to the carriers and has the highest amplitude.

Intermodulation is normally specified in terms of dBm or dBc. For example, +43dBm (20Watt) is a typical input power level specified for device under test (DUT). If the allowable intermodulation level for DUT is required to be -117dBm, thus the specification is -117-43=-160dBc.

IEC-62037 is an international standard for RF connectors, cable assemblies and cable intermodulation level measurement. It defines the intermodulation level, test principle and test procedure. In IEC standard chapter 6, it requires the residual intermodulation of an analyzer should be at least 10dB below the specified value of DUT. In the above example, the residual intermodulation of the analyzer should be less than -170dBc. The less self-intermodulation is, the more accurate test result will be gotten.



## ■ Product Range - Passive Intermodulation Analyzers

### Rack Types

PIA rack types from Rosenberger precisely determine the intermodulation characteristics of connectors, cable assemblies, antennas and other passive components. They are specially designed for the use in production lines to measure the 3rd, 5th and 7th order intermodulation, but they also can be applied in R&D, laboratory and calibration centers.

Rack types are available as “reflected” types or “transmit & reflected” types, which operates in LTE 700, AMPS, EGSM, DCS, PCS, TD-SCDMA, UMTS II / LTE / BRS-EBS and WiMAX frequency bands.

Due to its RF know-how and many years' experience, Rosenberger can provide excellent customer service and individual technical support. Rosenberger Passive Intermodulation Analyzers can be customized according to specific requirements by realizing modularized assemblies and cost reductions. Furthermore, Rosenberger provides technical support, product training, calibration as well as maintenance on site.



Rack Type

### Portable Types

The portable Passive Intermodulation Analyzer from Rosenberger has been designed to quickly and accurately measure the intermodulation characteristics of connectors, cable assemblies, antennas, filters, tower mounted devices and other passive components – fast, simple and in high precision quality. The PIA can also be used for a precise analysis of the RF infrastructure quality and performance of radio base stations. The PIM Analyzer operates in LTE 700, AMPS, EGSM, DCS, PCS, UMTS, UMTS II / LTE / BRS-EBS and WiMAX frequency bands.

Delivered in a highly shock-proof, stable transport case, the portable Rosenberger PIA is ideally suited for outdoor and field measurements, e.g. radio base stations, as well as for laboratory and manufacturing applications.



Portable Type

### Site Analyzer

Especially designed for intermodulation measurements on sites. The analyzer is installed in a rugged, waterproof case (55 x 35 x 20 cm).



Site Analyzer



# Main Features

## Modular design

Operated by broadband power amplifier (700 MHz - 1000 MHz and 1800 MHz - 2200 MHz). Easy to upgrade for customer specific bands by using additional filter units.

## Dimensions

Rack types	19 inch rack - enough space for future upgrades, can be moved easily when needed
Portable types	450 mm x 400 mm x 200 mm, approx. 20 kg weight

## Measures

- 3rd, 5th, and 7th order reverse or forward passive intermodulation for:
- Antennas
- Transmission Lines
- Connectors
- Jumpers
- Filters and Combiners
- Splitters
- Other Passive Components, e.g. power mounted devices

## Outstanding Dynamic

Residual IM-Level (2 x 43 dBm, S/N = 10dB):	
< -171 dBc	Rack types
< -168 dBc	Portable types, site analyzers

## Operation / Measurement Modes

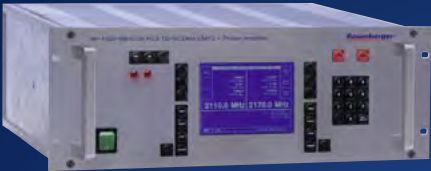
- all types - rack types, portable types, site analyzers
- Strip chart / two tone measurements
- Frequency sweep measurements

## Testport Power

all types - rack types, portable types, site analyzers
selectable from +36 to +46 dBm (2x)

## Control Software

Measurement modes	strip chart / two tone frequency sweep
Set up	frequencies and sweep range frequency step power level per carrier spectrum analyzer settings (resolution, span, sweep time) correction value setting for DUT <=> Test Port (ANT) IM Port <=> Analyzer limits for production mode memory function for different measurement set ups
Typical test time	5 ms / frequency step (depending on options and settings)
Remote control	GPIO, LAN (TCP / IP), USB



## ■ Band Specifications

### Rack Type

Analyzer Type	Frequency Band	RX Range	TX Range	Power Output	Test Port	Residual IM @2x43 dBm	
						Reflected IM	Transmitted IM
IM-0710-BB	LTE700	698-793 MHz	698-793 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
	AMPS	824-849 MHz	869-894 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
	EGSM	880-915 MHz	925-960 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
IM-1822-BB	DCS 1800	1710-1785 MHz	1805-1880 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
	PCS 1900	1850-1910 MHz	1930-1990 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
	TD-SCDMA	2015 MHz	2020/2025 MHz	" +36.....+46 dBm"	7-16 f	<-168 dBc	-
	UMTS	1920-2060 MHz	2110-2170 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
IM-2526-BB	UMTS II/LTE /BRS-EBS	2545-2580 MHz	2620-2695 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc
IM-3436-BB	WiMax	3410-3484 MHz	3510-3594 MHz	" +36.....+46 dBm"	7-16 f	<-171 dBc	<-168 dBc

### Portable Analyzer, Site Analyzer

Analyzer Type	Frequency Band	RX Range	TX Range	Power Output	Test Port	Residual IM @2x43 dBm	
						Reflected IM	
IM-07P, IM-07S	LTE700	693-730 MHz	745-793 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-08P, IM-08S	AMPS	824-849 MHz	869-894 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-09P, IM-09S	EGSM	880-915 MHz	925-960 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-18P, IM-18S	DCS1800	1710-1875 MHz	1805-1880 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-19P, IM-19S	PCS1900	1850-1910 MHz	1930-1990 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-21P, IM-21S	UMTS	1920-2060 MHz	2110-2170 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-26P, IM-26S	UMTS II/LTE/BRS-EBS	2545-2580 MHz	2620-2695 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	
IM-35P, IM-35S	WiMax	3410-3484 MHz	3510-3594 MHz	" +33.....+45 dBm"	7-16 f	<-168 dBc	

Detailed specifications on request



Rack Type Filter Unit for Transmitted & Reflected Measurements



Rack Type Filter Unit for Reflected Measurements

## ■ Ordering Information

### Basic Rack Type

Ordering Number	Description	
IM-07R	LTE700, Analyzer for Reflected Measurements	Operated by Broadband Power Amplifier IM-0710-BB
IM-07T	LTE700, Analyzer for Transmitted/Reflected Measurements	
IM-08R	AMPS800, Analyzer for Reflected Measurements	
IM-08T	AMPS800, Analyzer for Transmitted/Reflected Measurements	
IM-09R	EGSM900, Analyzer for Reflected Measurements	
IM-09T	EGSM900, Analyzer for Transmitted/Reflected Measurements	
IM-18R	DCS1800, Analyzer for Reflected Measurements	Operated by Broadband Power Amplifier IM-1822-BB
IM-18T	DCS1800, Analyzer for Transmitted/Reflected Measurements	
IM-19R	PCS1900, Analyzer for Reflected Measurements	
IM-19T	PCS1900, Analyzer for Transmitted/Reflected Measurements	
IM-21R	UMTS2100, Analyzer for Reflected Measurements	
IM-21T	UMTS2100, Analyzer for Transmitted/Reflected Measurements	
IM-26R	UMTS II/LTE/BRS-EBS, Analyzer for Reflected Measurements	Operated by Broadband Power Amplifier IM-2526-BB
IM-26T	UMTS II/LTE/BRS-EBS Analyzer for Transmitted/Reflected Measurements	
IM-35R	WiMax Analyzer for Reflected Measurements	Operated by Broadband Power Amplifier IM-3436-BB
IM-35T	WiMax Analyzer for Transmitted/Reflected Measurements	
IM-MPX	Multiplexer for Automatic Frequency Switch	



### Filter Units

Ordering Number	Description	
IM-FI-700R	LTE700 Filter unit for Reflected Measurements	Operated by Broadband Power Amplifier IM-1822-BB
IM-FI-700T	LTE700 Filter unit for Transmitted/Reflected Measurements	
IM-FI-800R	AMPS800 Filter unit for Reflected Measurements	
IM-FI-800T	AMPS800 Filter unit for Transmitted/Reflected Measurements	
IM-FI-900R	EGSM900 Filter unit for Reflected Measurements	
IM-FI-900T	EGSM900 Filter unit for Transmitted/Reflected Measurements	
IM-FI-1800R	DCS1800 Filter unit for Reflected Measurements	Operated by Broadband Power Amplifier IM-1822-BB
IM-FI-1800T	DCS1800 Filter unit for Transmitted/Reflected Measurements	
IM-FI-1900R	PCS1900 Filter unit for Reflected Measurements	
IM-FI-1900T	PCS1900 Filter unit for Transmitted/Reflected Measurements	
IM-FI-2100R	UMTS2100 Filter unit for Reflected Measurements	
IM-FI-2100T	UMTS2100 Filter unit for Transmitted/Reflected Measurements	
IM-FI-2600R	UMTS II / LTE / BRS-EBS Filter unit for Reflected Measurements	Operated by Broadband Power Amplifier IM-2526-BB
IM-FI-2600T	UMTS II / LTE / BRS-EBS Filter unit for Transmitted/Reflected Measurements	
IM-FI-3500R	WiMAX Filter unit for Reflected Measurements	Operated by Broadband Power Amplifier IM-3436-BB
IM-FI-3500T	WiMAX Filter unit for Transmitted/Reflected Measurements	
IM-FI-MPX	Multiplexer Filter Unit	





## Portable Type

Ordering Number	Description
IM-07P	LTE700, Analyzer for Reflected Measurements
IM-08P	AMPS800, Analyzer for Reflected Measurements
IM-09P	EGSM900, Analyzer for Reflected Measurements
IM-18P	DCS1800, Analyzer for Reflected Measurements
IM-19P	PCS1900, Analyzer for Reflected Measurements
IM-21P	UMTS2100, Analyzer for Reflected Measurements
IM-26P	UMTS II /L TE/BRS-EBS, Analyzer for Reflected Measurements
IM-35P	WiMax, Analyzer for Reflected Measurements



## Site Analyzers

Ordering Number	Description
IM-07S	LTE700, Analyzer for Reflected Measurements
IM-08S	AMPS800, Analyzer for Reflected Measurements
IM-09S	EGSM900, Analyzer for Reflected Measurements
IM-18S	DCS1800, Analyzer for Reflected Measurements
IM-19S	PCS1900, Analyzer for Reflected Measurements
IM-21S	UMTS2100, Analyzer for Reflected Measurements
IM-26S	UMTS II /LTE /BRS-EBS, Analyzer for Reflected Measurements
IM-35S	WiMax, Analyzer for Reflected Measurements



## Accessories

Ordering Number	Description
60S101-K50N1	7-16 Male to 7-16 Female Adapter
60S101-S50N1	7-16 Male to 7-16 Male Adapter
60K101-K50N1	7-16 Female to 7-16 Female Adapter
60S153-K50N1	7-16 Male to N Female Adapter
53S160-K50N1	7-16 Female to N Male Adapter
60S110-K07	-110 dBm Standard Adapter for LTE 700
60S110-K08	-110 dBm Standard Adapter for AMPS
60S110-K09	-110 dBm Standard Adapter for EGSM
60S110-K18	-110 dBm Standard Adapter for DCS
60S110-K19	-110 dBm Standard Adapter for PCS
60S110-K20	-110 dBm Standard Adapter for TD-SCDMA
60S110-K21	-110 dBm Standard Adapter for UMTS
60S110-K26	-110 dBm Standard Adapter for UMTS II/ LTE/ BRS-EBS
60S110-K35	-110 dBm Standard Adapter for WiMAX
60Z150-001	Low PIM Termination
60W000-000	32# Torque Wrench
53W008-000	18# Torque Wrench
L73-031-1500	Test Cable 7-16 Male/7-16 Male 1.5 m
L73-030-1500	Test Cable 7-16 Male/N Male 1.5 m
L73-032-1500	Test Cable N Male/N Male 1.5 m



Improper use of the Rosenberger product(s) could result in damage to the product(s) and the equipment/hardware being tested, it may also cause improper transmissions in violation of FCC regulations and may pose the risk of exposure to radiation and/or burns to the user.

It is the responsibility of the user/operator of the products to ensure that the product(s) are used in accordance with the manufacturer's specifications and in a safe manner. Rosenberger disclaims all liability from improper use of the products.

## ■ Company Profile

### 50 Years of Rosenberger – an Outstanding Story of Success

From its humble beginnings in a locksmith shop in the idyllic town of Tittmoning, Germany, over the last 50 years Rosenberger has developed into a worldwide operating company with an international reputation. The unique business sense and entrepreneurship of Hans (d.2007) and Katharina (d.2004) Rosenberger and, in ensuing years, the vision, management style and leadership of their three sons Hans, Bernhard and Peter lead Rosenberger to today's prominence.

For many years, the name Rosenberger has stood for future-innovative high frequency technology. Today, Rosenberger is one of the worldwide leading manufacturers of standard and customer-specific connectivity solutions in high frequency and fiber optic technology.

### Products and Applications

The product range covers RF coaxial connectors, RF test & measurement products, RF automotive connectors as well as fiber optic products and cable assemblies. The Mobilecom Infrastructure Products business unit offers cable system solutions for radio base stations – from the antenna down to the base station. Renowned companies in high-tech industries, e.g. telecommunication, data systems, medical electronics, test &

measurement, aerospace engineering or automotive electronics trust the precision and quality of Rosenberger products.

Rosenberger's custom machining center, the primary roots of the company, produces as a components system supplier (metal) components for the transmission, automotive and construction machine industries.

### The Rosenberger Group

The headquarters of Rosenberger is located in Fridolfing/ Tittmoning (Oberbayern, Germany) where today approx. 800 people are employed. Worldwide, the Rosenberger group operates 14 manufacturing and assembly locations as well as the Rosenberger sales network in Europe, Asia and North and South America where – in total – more than 3,000 employees develop, produce and sell our products.

### Superior Quality

The quality of our products and services is an essential part of our corporate strategy. In 2006, as evidence of our highly qualified and motivated employees, Rosenberger was honoured by the Bavarian Ministry for Economic Affairs with the Bavarian Quality Award in the category of industrial companies. Rosenberger is certified by ISO/TS 16949:2002, ISO 9001 and ISO14001.





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