

# RSWM-4X4R

Non-blocking 4X4 Switching Matrix 100 kHz ... 4000 MHz / 20 MHz ... 4000 MHz

## Features

- wideband
- high dynamic
- non-blocking
- 2 frequency variants
- compact 19", 1 U design

## Applications

- radio monitoring
- infotainment test
- research & development (R&D)
- test equipment



## At a Glance

Modern signal routing systems need a fast and free access to different signal sources like antennas or signal generators.

In receiving systems the large amount different analog and digital modulated signals like broadcast, cellular, WiFi, ISM and Bluetooth need high linearity for a low distortion transmission. Additional a low noise figure is very important in receiving systems for a transmission with high dynamic.

The RSWM-4X4R is right solution for modern radio monitoring and signal routing systems that must cover the frequency range up to 4 GHz to enable a free access to several signal sources like antennas or signal generators.

## Principal Block Diagram

The RSWM-4X4R has 4 equivalent inputs and 4 equivalent outputs. The matrix is a non-blocking type. Each output port can be connected to any input also one input can be route to more outputs without drop in transmission.



## Wear-free Solid State Switches

The switching elements in the RSWM-4X4R are solid state types. This ensures a short switching time and a huge number of switching cycles with a minimum of maintenance.

## High Channel Isolation

To avoid unwanted signal coupling between the channels RSWM-4X4R has high channel isolation. Adjacent channels with strong and weak signals have no influence to each other.

## Versatile Control

The device can be controlled either via the remote interfaces LAN and USB (SCPI-based ASCII-commands) or local via a MMI on the front panel. Additional RSWM-4XR offers a web based, user friendly GUI (Graphical User Interface).

## Synchronous Operation

The RSWM-4X4R offers two switching modes:

- Direct switch execution after receiving single commands.
- Common synchronous switching after executed by a SYNC command.

In the synchronous switching mode commands are received without execution. After receiving a SYNC command, all switching operations are done at the same time.

## External Triggering

Like many other products of Becker Nachrichtentechnik GmbH, the RSWM-4X4R offers a TRIGGER IO port. This interface provides a precise trigger pulse which complies with the physical execution of the applied switching command. Alternatively external pulses can be applied to the trigger port in order to trigger the execution of queued switching commands. Using this port, it is possible to link multiple devices to a synchronous switching compound.

## Two Frequency Variants

The RSWM-4X4R is available in two frequency variants:

-20 MHz ... 4000 MHz for V/UHF applications and  
-100 kHz ... 4000 MHz for broadcast applications

The variant 20 MHz ... 400 MHz is equipped with high pass filters in each input for an effective suppression of LF and HF signals from e.g. local AM radio stations.

The variant 100 kHz ... 4000 MHz covers the whole frequency range including AM range for a full transmission of broadcast signals including GNSS in signal routing applications.

## Filters for Short Wave

For operation in short wave applications, the variant 100 kHz ... 4000 MHz can be equipped with external mounting bandpass filters. With help of this filters out band signals are effectively suppressed to avoid unwanted distortions in the short wave range. The filters can be easily mounted on the RF input socket of the RSWM-4X4R.



## RF Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Impedance	$Z_{in} / Z_{out}$		50		Ohm	
low frequency	$f_{min}$		100	300	kHz	variant without VLF HF suppression
high frequency	$f_{max}$	4000	4500		MHz	
low frequency	$f_{min}$			20	MHz	variant with VLF HF suppression
high frequency	$f_{max}$	4000	4500		MHz	
VLF / HF suppression	$S_{21}$		-25	-15	dB	@ 5 MHz rel. 100 MHz
gain	$S_{21}$	-2	2	3	dB	$f < 1$ GHz
	$S_{21}$	-2	0	2	dB	$f \geq 1$ GHz
input return loss	$S_{11}$		-13	-8	dB	$f \leq 2$ GHz
	$S_{11}$		-10	-5	dB	$f > 2$ GHz
output return loss	$S_{22}$		-17	-12	dB	$f \leq 2$ GHz
	$S_{22}$		-15	-10	dB	$f > 2$ GHz
1 dB compression	$P_{1dB}$	+5	+8		dBm	$500 \text{ kHz} \leq f \leq 1 \text{ GHz}$
	$P_{1dB}$	+3	+7		dBm	$1 \text{ GHz} < f \leq 3 \text{ GHz}$
	$P_{1dB}$	-2	+3		dBm	$f > 3 \text{ GHz}$
reverse isolation	$S_{12}$		-60	-50	dB	
3 <sup>rd</sup> order intercept	OIP3	+18	+26		dBm	$1 \text{ MHz} \leq f \leq 2 \text{ GHz}$ , note 1
2 <sup>nd</sup> order intercept	OIP2	+30	+48		dBm	$1 \text{ MHz} \leq f \leq 1 \text{ GHz}$ , note 1
noise figure	NF		7	10	dB	$f \geq 5 \text{ MHz}$
channel isolation	$S_{32}$		-80	-45	dB	
output isolation	$S_{12}$		-35	-30	dB	
RF input power	$P_{RF}$			+15	dBm	no damage
maximum DC voltage	$U_{DC}$			20	V	all RF ports
ESD discharge resistor	$R_{ESD}$		4.7		k $\Omega$	all RF ports
RF connectors	$X_{RF}$		N female			
processing time	$t_{SW}$		15		ms	between two switching commands
trigger input	$X_{TRIG}$		BNC female			internal 1 k $\Omega$ pull up, active high
trigger level	$U_{TRIG}$		TTL (0 / 5 V)			
trigger offset	$t_{O\_FALL}$		6.5		$\mu$ s	50% trigger $\rightarrow$ 50% RF falling edge, note 2
	$t_{O\_RISE}$		1.1		$\mu$ s	50% trigger $\rightarrow$ 50% RF rising edge, note 2
switch rise time	$t_{RISE}$		1		$\mu$ s	10% $\rightarrow$ 90% RF
switch fall time	$t_{FALL}$		2		$\mu$ s	90% $\rightarrow$ 10% RF

Note 1: tested at  $P_{out} 2 \times -10\text{dBm}$ ;  $\Delta f = 2 \text{ MHz}$

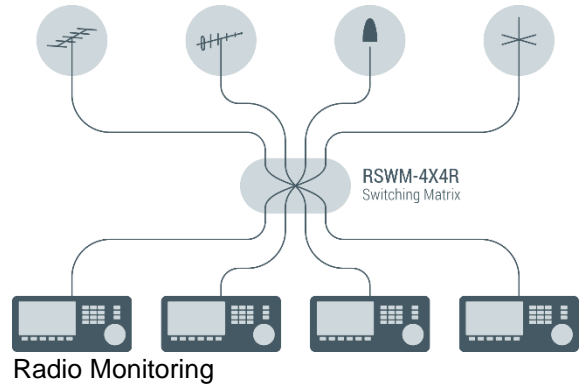
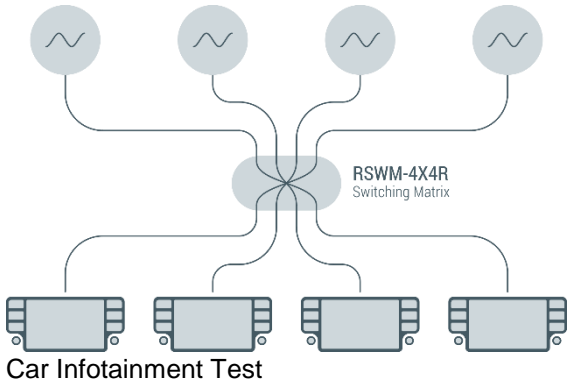
Note 2: capacitive load at 'TRIGGER IO' Port  $\leq 100\text{pF}$ , trigger mode "OUT"

**Common Specification**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
power supply		90	230	260	V	50 / 60 Hz AC
power consumption			18		W	
remote ports	LAN	10/100 BaseT		TCP/IP		RJ45 on rear side
	USB	2.0 (high speed)				USB type B
<b>Dimensions and weight</b>						
dimensions	W x H x D	approx. 482 x 44 x 265			mm	19" 1 U, without connectors and handles
weight	m		3.4		kg	
<b>Environment conditions</b>						
operating temp. range	T <sub>o</sub>	+5		+45	°C	
storage temp. range	T <sub>s</sub>	-40		+70	°C	
<b>Product conformity</b>						
Electromagnetic compatibility	EU: in line with EMC directive (2014/30/EC)				applied harmonized standards: EN 61326-1 (for use in industrial environment), EN 61326-2-1, EN 55011 (class B), EN 61000-3-2, EN 61000-3-3	
Electrical safety	EU: in line with low voltage directive (2014/35/EC)				applied harmonized standard: EN 61010-1	
<b>Ordering information</b>	RSWM-4X4R			1205.4102.1	20 MHz...4000 MHz	
	RSWM-4X4R			1205.4102.2	100 kHz...4000 MHz	



**Application Examples**

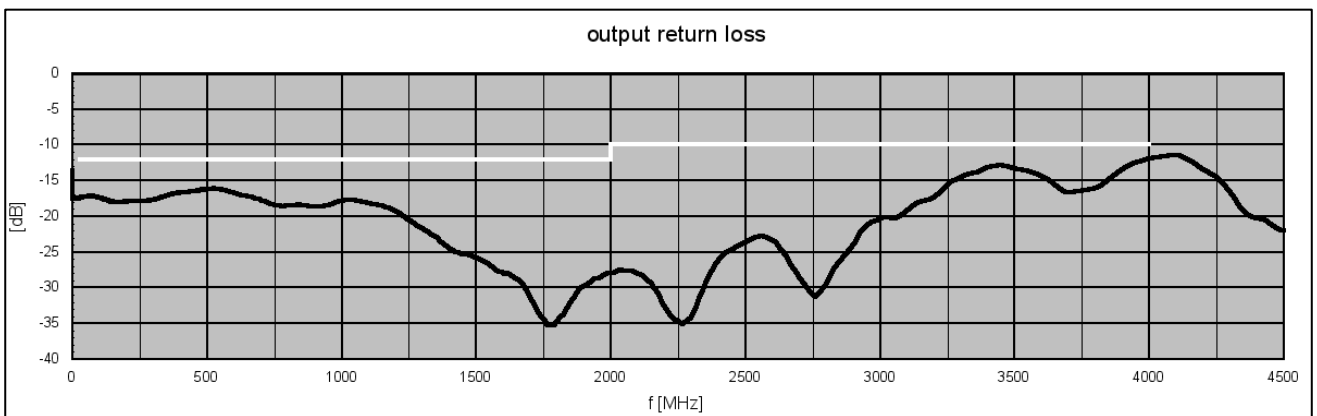
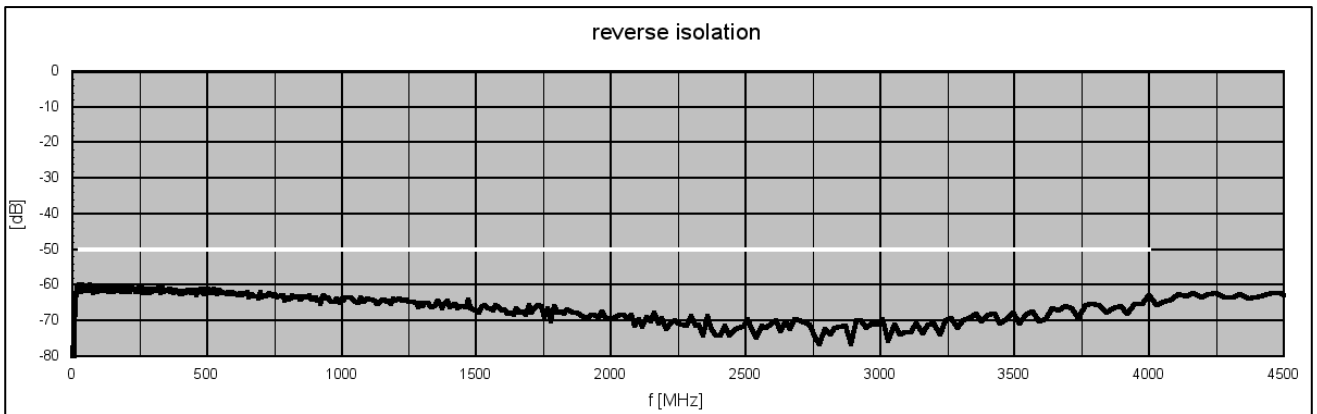
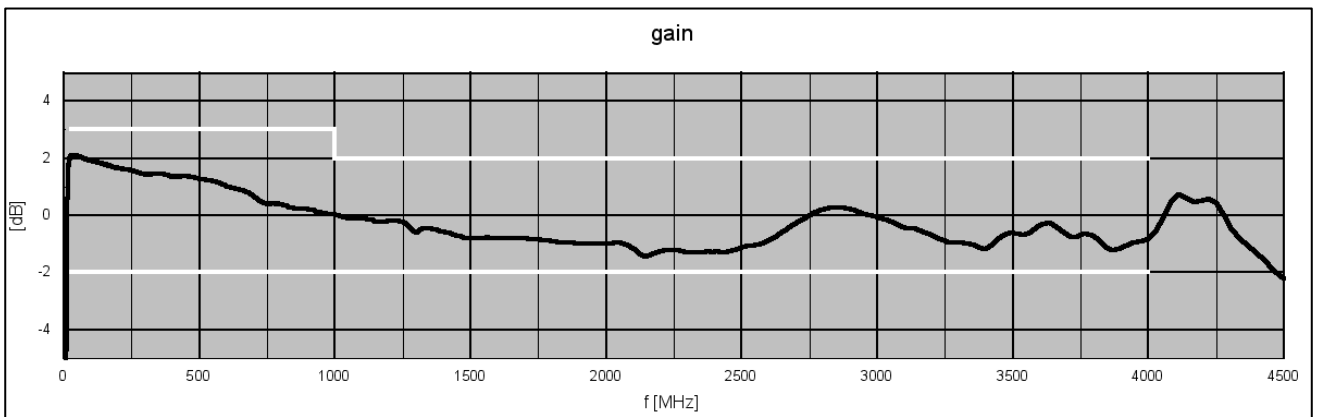
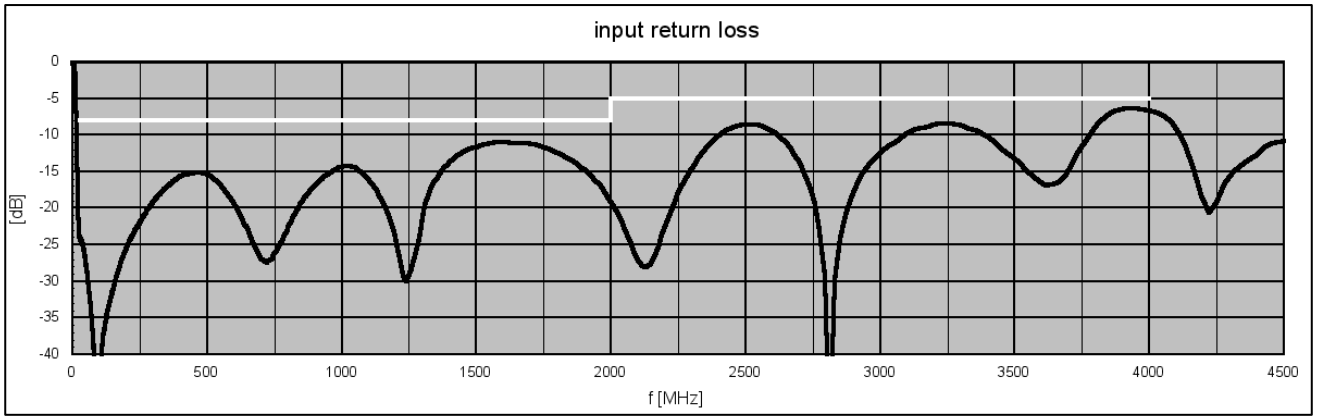


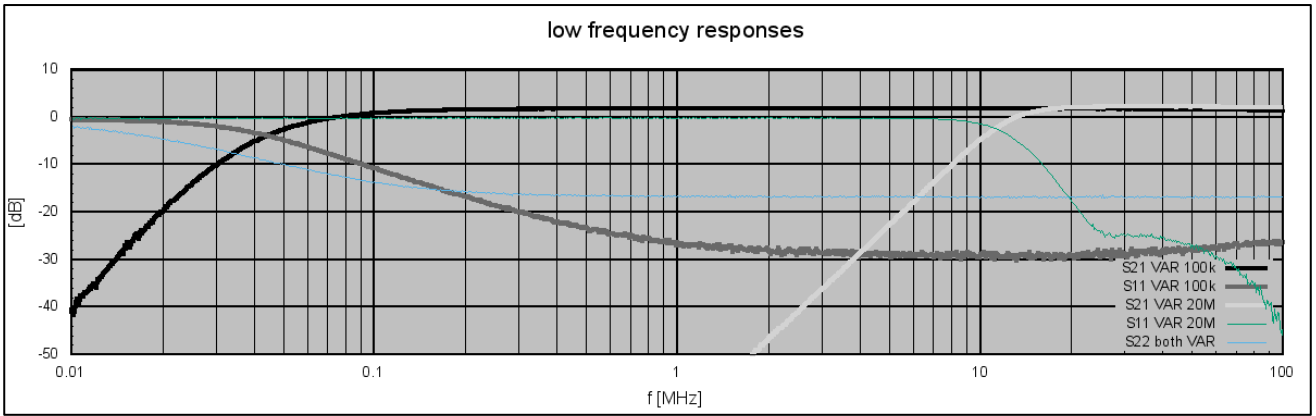
**Screenshot of Graphic User Interface**

The GUI allows the definition of application-specific labels to make the selection of inputs more meaningful.

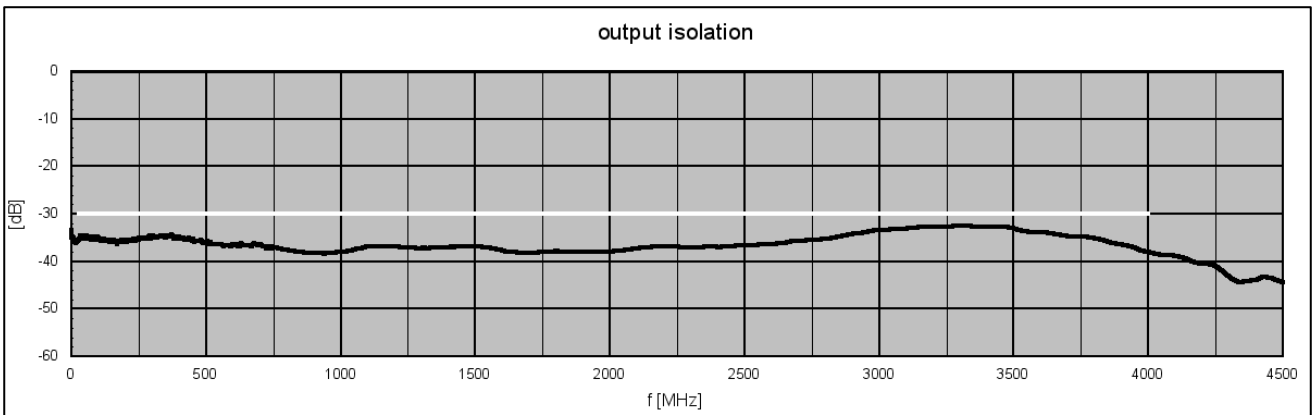
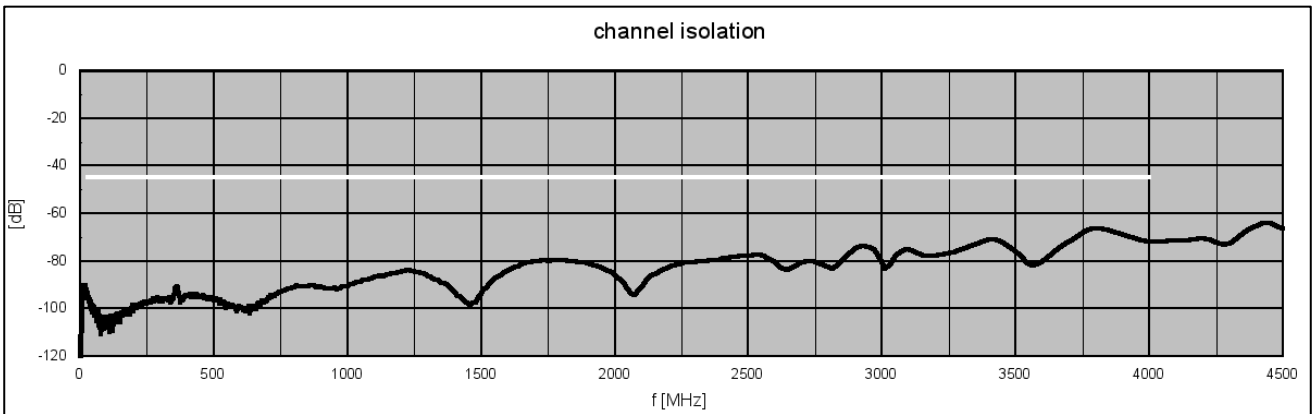


**S-Parameters (typical responses)**

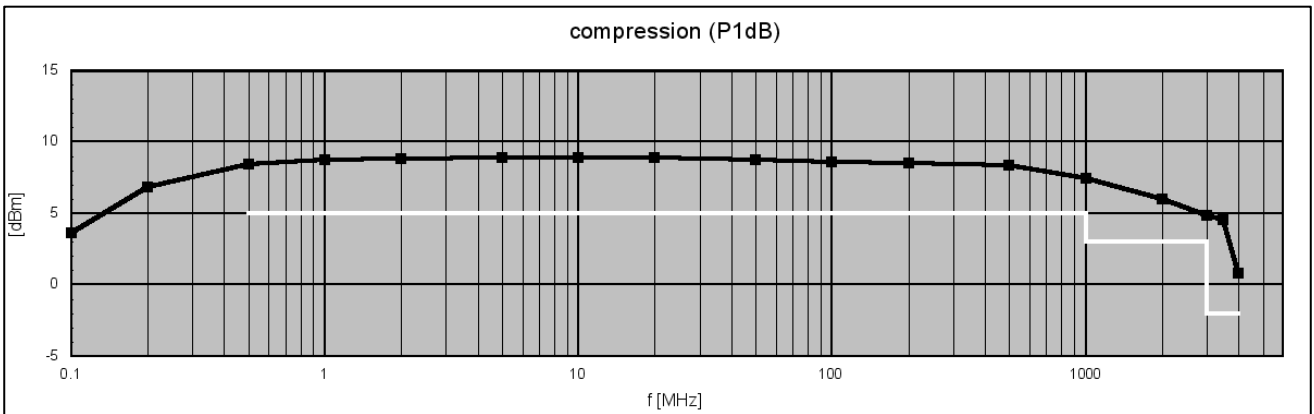
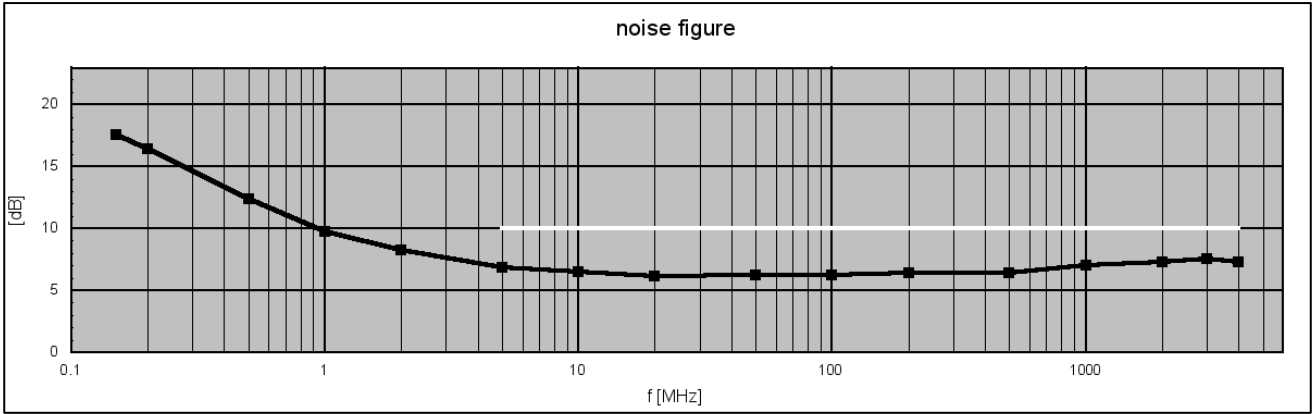




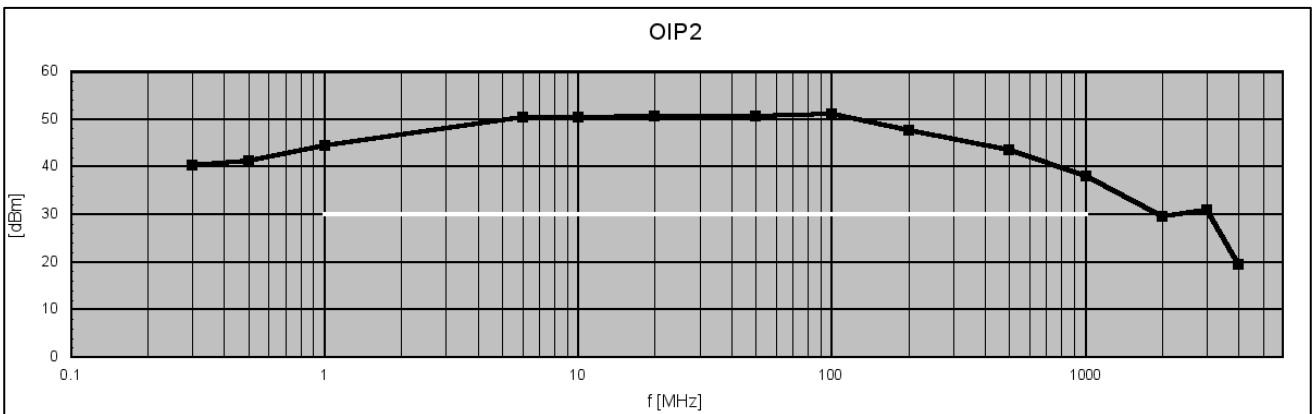
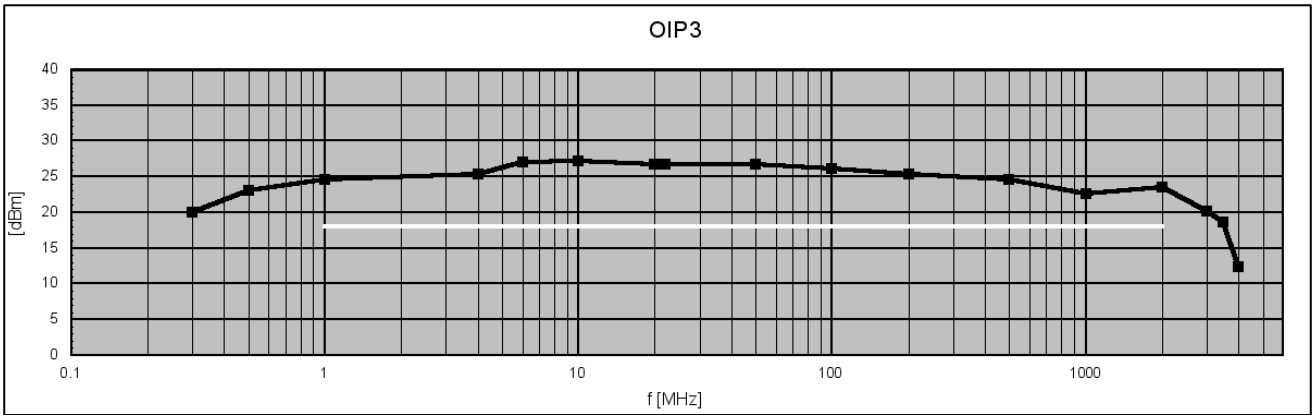
**Isolations (typical responses)**



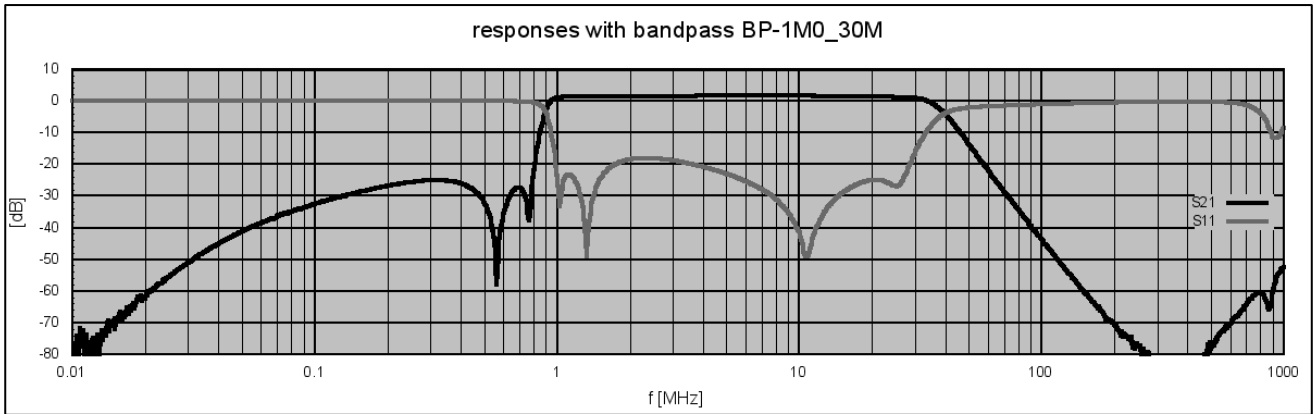
**Dynamic Range (typical responses)**



**Linearity (typical responses)**



## S-Parameters with band pass filter for short wave application



Transmission and input return loss with 1 ... 30 MHz band pass filter BP-1M0\_30M installed in RF input.

## Appearance of external mountable filter



Filters for short wave with different bandwidths are available. See table related products.



# Appearances

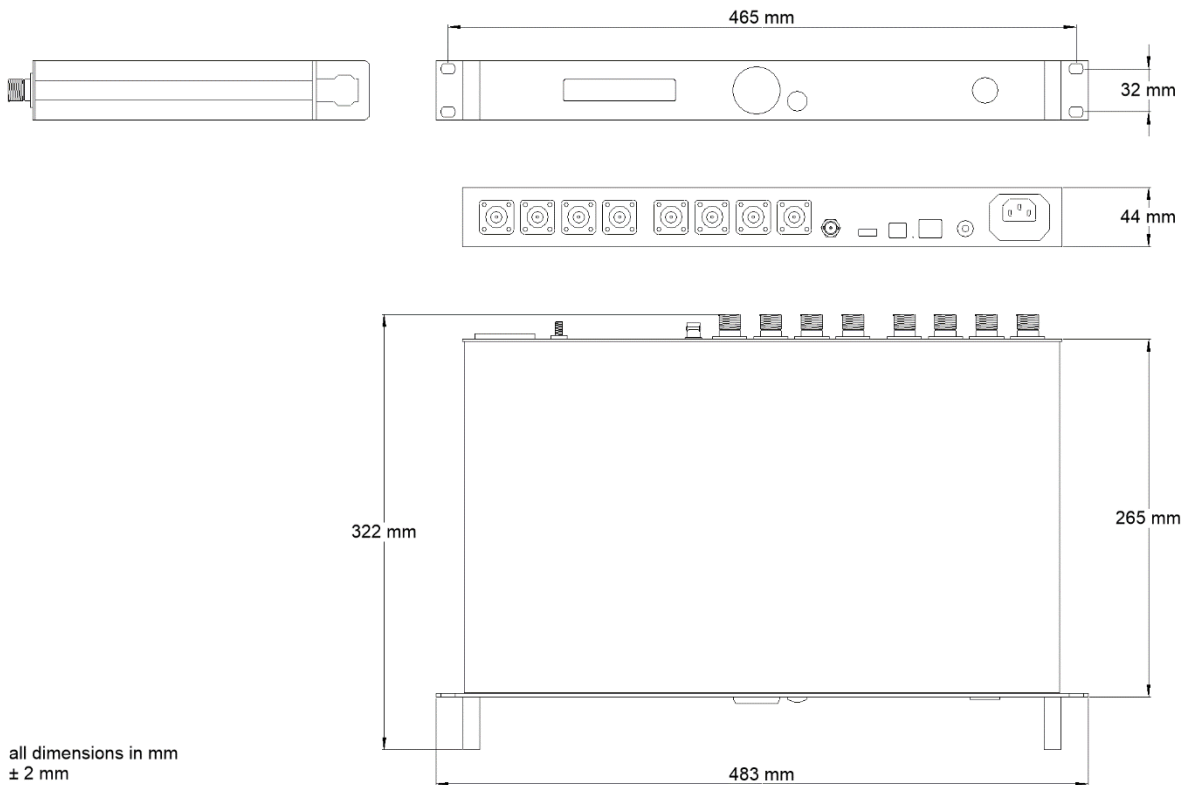
## Front View



## Rear View



## Dimensions



**Related Products** (External filters for short wave applications)

Product	P/N	Description
BP-0M5_30M	1502.6301.1	Band Pass Filter Module 0.5 ... 30 MHz 90 V surge arrestor and 100 kΩ ESD resistor to GND at input, level limiter, stop band rejections: 30 dB typ. $f < 400$ kHz, 45 dB typ. $80 \text{ MHz} \leq f \leq 200 \text{ MHz}$ , N RF connectors (male / female)
BP-1M0_30M	1502.6311.1	Band Pass Filter Module 1.0 ... 30 MHz 90 V surge arrestor and 100 kΩ ESD resistor to GND at input, level limiter, stop band rejections: 30 dB typ. $f < 800$ kHz, 45 dB typ. $80 \text{ MHz} \leq f \leq 200 \text{ MHz}$ , N RF connectors (male / female)
BP-1M7_30M	1502.6321.1	Band Pass Filter Module 1.7 ... 30 MHz 90 V surge arrestor and 100 kΩ ESD resistor to GND at input, level limiter, stop band rejections: 30 dB typ. $f < 1.3 \text{ MHz}$ , 45 dB typ. $80 \text{ MHz} \leq f \leq 200 \text{ MHz}$ , N RF connectors (male / female)
LP-30M	1107.6301.1	30 MHz Low Pass Filter Module Passband DC...30 MHz 90 V surge arrestor and 100 kΩ ESD resistor to GND at input, level limiter, stop band rejection: 45 dB typ. @ $80 \text{ MHz} \leq f \leq 200 \text{ MHz}$ , N RF connectors (male / female)

**Related Products** (Multicouplers and Matrices)

Product	P/N	Description
WSDU-1X8SR	1502.6102.x	High Dynamic 1X8 Shortwave Signal Distribution Unit 200 kHz ... 30 MHz LAN remote interface with SNMPv2 trap function. Variants with AC or DC power supply.
WSDU-1X8R	1107.6102.x	High Dynamic 8 Way Multicoupler 100 kHz ... 4000 MHz. Variants with AC or DC power supply.
WSDU-2X4R	1107.6202.x	High Dynamic 2 Section 4 Way Multicoupler 100 kHz ... 4000 MHz. Variants with AC or DC power supply.
WSDU-1X8ER	1501.6302.x	Extremely Wideband 1 to 8 Signal Distribution Unit 20 ... 8000 MHz LAN remote interface with SNMPv2 trap function. Variants with AC or DC power supply.
WSDU-2X4ER	1501.6102.x	Extremely Wideband 2 Section 1X4 Signal Distribution Unit 20 MHz... 8000 MHz. LAN remote interface with SNMPv2 trap function. Variants with AC or DC power supply.
RSWM-4X4R	1205.4102.x	Wideband 4X4 Switching Matrix, non-blocking- 2 variants: 100 kHz ... 4000 MHz and 20 MHz ... 4000 MHz, LAN remote interface with SNMPv2 trap function.
RSWM-4X4ER	1205.4202.1	Extremely Wideband 4X4 Switching Matrix 20 ... 8000 MHz, -non-blocking- LAN remote interface with SNMPv2 trap function.

