

# R&S® SMZ

## FREQUENCY MULTIPLIER FAMILY

Precise output levels from 50 GHz to 170 GHz



Product Brochure  
Version 04.02

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# AT A GLANCE

The R&S®SMZ family of frequency multipliers combines easy handling and precise output levels in the frequency range from 50 GHz to 170 GHz. It can be used in diverse applications, e.g. in the automotive sector with distance radars, in astronomy with sophisticated telescopes and in radar interferometry for analyzing the earth's surface.

The family of frequency multipliers consists of the models R&S®SMZ75 (from 50 GHz to 75 GHz), R&S®SMZ90 (from 60 GHz to 90 GHz), R&S®SMZ110 (from 75 GHz to 110 GHz) and R&S®SMZ170 (from 110 GHz to 170 GHz) as well as optional attenuators. The attenuator is integrated in the same housing as the frequency multiplier, which simplifies handling. The R&S®SMZ can be controlled via USB in different ways. The most convenient one is to use the R&S®SMZ together with the R&S®SMF100A or R&S®SMB100A microwave signal generator. This combination operates as a single unit allowing users to directly enter the wanted frequency and the target level at the R&S®SMZ output on the R&S®SMF100A or R&S®SMB100A (input of the target level is not possible for the R&S®SMZ170). The alternative is to use the R&S®SMZ-K1 external PC software for controlling the R&S®SMZ frequency multiplier and the microwave signal generator.

Compared with conventional setups, this one-box solution significantly simplifies setup and operation. Via USB the R&S®SMF100A or R&S®SMB100A receives all necessary data of the connected R&S®SMZ, such as the configuration, the multiplication factor and in particular the precalibrated frequency response. The R&S®SMF100A or R&S®SMB100A is able to perform automatic correction, which helps ensure that the frequency and level values set on the R&S®SMF100A or R&S®SMB100A will actually be available at the R&S®SMZ output. A costly, error-prone and time-consuming level measurement using level detectors or power sensors, which is common for conventional setups, is no longer required.

Very low single sideband phase noise is achieved owing to the interaction with the high-end R&S®SMF100A microwave signal generator. For a CW signal of 60 GHz, for example, an outstanding  $-100$  dBc (10 kHz offset) is achieved after six-fold frequency multiplication with the R&S®SMZ75.

## Key facts

- ▶ Wide frequency range
- ▶ Wide dynamic range
- ▶ Convenient easy handling
- ▶ High signal quality

Test setup containing the R&S®SMF100A microwave signal generator and the R&S®SMZ110 frequency multiplier.



# BENEFITS AND KEY FEATURES

## Wide frequency range

- ▶ Frequency ranges from 50 GHz to 75 GHz, 60 GHz to 90 GHz, 75 GHz to 110 GHz and 110 GHz to 170 GHz
- ▶ Two models (R&S®SMZ75 and R&S®SMZ110) cover the wide frequency range from 50 GHz to 110 GHz

## Wide dynamic range

- ▶ Mechanically controlled attenuator with a dynamic range of 25 dB
- ▶ Electronically controlled attenuator with a dynamic range of 15 dB

## Easy handling

- ▶ Automatic detection and control of the R&S®SMZ by means of the R&S®SMF100A or R&S®SMB100A microwave signal generator via USB
- ▶ Easy setups with the one-box solution consisting of the R&S®SMF100A or R&S®SMB100A, the R&S®SMZ plus an optional mechanically or electronically controlled attenuator (the attenuators are not available for the R&S®SMZ170)
- ▶ Frequency setting on the R&S®SMF100A or R&S®SMB100A, taking the connected R&S®SMZ into consideration
- ▶ Level setting on the R&S®SMF100A or R&S®SMB100A, taking the connected R&S®SMZ into consideration (only for built-in attenuator; with the mechanical attenuator, users must set the setting screw to the value displayed on the R&S®SMF100A or R&S®SMB100A)
- ▶ Automatic frequency response correction of the precalibrated R&S®SMZ, including attenuator by means of the R&S®SMF100A or R&S®SMB100A (with the mechanical attenuator, users must set the setting screw to the value displayed on the R&S®SMF100A or R&S®SMB100A)
- ▶ Use of the R&S®SMZ is also possible with any microwave signal generator that meets the level and frequency requirements; for the convenient operation of this setup the external PC software (R&S®SMZ-K1) can be used
- ▶ For frequency-, phase- and pulse-modulated signals

## High signal quality

- ▶ Very low single sideband phase noise when the R&S®SMF100A is used as a source
- ▶ High accuracy of the set output level
- ▶ Excellent matching



Models	
<b>R&amp;S®SMZ75</b>	<b>Frequency multiplier, 50 GHz to 75 GHz</b>
R&S®SMZ-B75M	Mechanically controlled attenuator
R&S®SMZ-B75E	Electronically controlled attenuator
<b>R&amp;S®SMZ90</b>	<b>Frequency multiplier, 60 GHz to 90 GHz</b>
R&S®SMZ-B90M	Mechanically controlled attenuator
R&S®SMZ-B90E	Electronically controlled attenuator
<b>R&amp;S®SMZ110</b>	<b>Frequency multiplier, 75 GHz to 110 GHz</b>
R&S®SMZ-B110M	Mechanically controlled attenuator
R&S®SMZ-B110E	Electronically controlled attenuator
<b>R&amp;S®SMZ170</b>	<b>Frequency multiplier, 110 GHz to 170 GHz</b>

# APPLICATION EXAMPLES

In both the civil sector and in A&D applications, the R&S®SMZ frequency multiplier, in combination with a microwave signal generator, is mainly used as a local oscillator (LO). An “ideal” CW signal with high spectral purity and accurate level is required.

## R&S®SMZ without attenuator connected to the R&S®SMF100A or R&S®SMB100A

Using the R&S®SMZ frequency multiplier is simple and basically the same in all applications. First, the R&S®SMZ is connected to the external voltage supply. Next, the USB connection is set up. The R&S®SMF100A or R&S®SMB100A microwave signal generator then automatically detects the type and characteristics of the connected R&S®SMZ.

The frequency that is to be present at the output of the R&S®SMZ can then be set directly on the R&S®SMF100A or R&S®SMB100A. The R&S®SMZ output level is displayed as a noneditable value on the R&S®SMF100A or R&S®SMB100A – on the basis of the precalibrated frequency response. Lastly, the R&S®SMF100A or R&S®SMB100A must be RF-connected with the R&S®SMZ.

## R&S®SMZ including mechanically controlled attenuator connected to the R&S®SMF100A or R&S®SMB100A

In this application, users can additionally set the actual level at the output of the R&S®SMZ. Since the R&S®SMF100A or R&S®SMB100A reads the frequency response of the R&S®SMZ including attenuator via USB, the frequency response can be taken into consideration when the level is entered on the R&S®SMF100A or R&S®SMB100A.

A special display shows the value for the setting screw. This value must be set manually on the mechanically controlled attenuator so that the nominal level and the actual level match at the output of the R&S®SMZ.

## R&S®SMZ including electronically controlled attenuator connected to the R&S®SMF100A or R&S®SMB100A

This is the easiest way to use the frequency multiplier: The frequency and the level are set on the R&S®SMF100A or R&S®SMB100A and the measurement can begin. The frequency response of the R&S®SMZ including attenuator is automatically taken into consideration. The settings for the electronically controlled attenuator are transmitted from the R&S®SMF100A or R&S®SMB100A to the R&S®SMZ via USB.

The R&S®SMZ110 including the mechanically controlled attenuator.



# SPECIFICATIONS

Specifications				
<b>Frequency</b>				
Input frequency range	R&S®SMZ75	8.33 GHz to 12.5 GHz		
	R&S®SMZ90	10 GHz to 15 GHz		
	R&S®SMZ110	12.5 GHz to 18.4 GHz		
	R&S®SMZ170	9.1 GHz to 14.2 GHz		
Output frequency range	R&S®SMZ75	50 GHz to 75 GHz		
	R&S®SMZ90	60 GHz to 90 GHz		
	R&S®SMZ110	75 GHz to 110 GHz		
	R&S®SMZ170	110 GHz to 170 GHz		
<b>Level</b>				
	R&S®SMZ75	R&S®SMZ90	R&S®SMZ110	R&S®SMZ170
Input level	+6.7 dBm to +7.3 dBm			
Output level	+5 dBm (typ.)	+11 dBm (typ.)	+12 dBm (typ.)	+8 dBm (typ.)
with mechanically controlled attenuator	+4 dBm (typ.)	+10 dBm (typ.)	+11 dBm (typ.)	–
with electronically controlled attenuator	+1 dBm (typ.)	+9 dBm (typ.)	+8 dBm (typ.)	–
Minimum output level				
with R&S®SMZ-B75M/-B90M/-B110M option (mechanically controlled attenuator)	< –25 dBm	< –25 dBm	< –25 dBm	–
with R&S®SMZ-B75E/-B90E/-B110E option (electronically controlled attenuator)	< –15 dBm	< –7 dBm	< –8 dBm	–
<b>Spectral purity</b>				
Harmonics	< –20 dBc (meas.)	< –20 dBc (meas.)	< –20 dBc (meas.)	< –20 dBc (meas.)
In-band spurious	< –20 dBc (typ.)	< –20 dBc (typ.)	< –20 dBc (typ.)	< –20 dBc (typ.)
Subharmonics (in-band)	R&S®SMZ75			
	50 GHz to 55 GHz		< –10 dBc (typ.)	
	> 55 GHz to 70 GHz		< –20 dBc (typ.)	
	> 70 GHz to 75 GHz		< –10 dBc (typ.)	
	R&S®SMZ90			
	60 GHz to 70 GHz		< –10 dBc (typ.)	
	> 70 GHz to 90 GHz		< –20 dBc (typ.)	
	R&S®SMZ110		< –20 dBc (typ.)	
	R&S®SMZ170			
	110 GHz to 120 GHz		< –10 dBc (typ.)	
	> 120 GHz to 145 GHz		< –20 dBc (typ.)	
	> 145 GHz to 170 GHz		< –15 dBc (typ.)	
<b>Connectors</b>				
Input	R&S®SMZ75/90/110/170		K female (50 Ω)	
Output	R&S®SMZ75		WR15 waveguide	
	R&S®SMZ90		WR12 waveguide	
	R&S®SMZ110		WM2540 (WR10) waveguide	
	R&S®SMZ170		WM1651 (WR6.5) waveguide	
Voltage supply	+9 V ± 540 mV			
Power supply	AC		100 V to 240 V ± 10%	
Dimensions	W × H × D		114 mm × 78 mm × 278 mm (4.49 in × 3.07 in × 10.94 in)	
Weight	max. (including frequency multiplier, attenuator and power supply)		1.4 kg (3.09 lb)	



# ORDERING INFORMATION

Designation	Type	Order No.
<b>Base unit</b>		
Frequency multiplier, 50 GHz to 75 GHz	R&S®SMZ75	1417.4004K02
Frequency multiplier, 60 GHz to 90 GHz	R&S®SMZ90	1417.4504K02
Frequency multiplier, 75 GHz to 110 GHz	R&S®SMZ110	1417.5000K02
Frequency multiplier, 110 GHz to 170 GHz	R&S®SMZ170	1417.5500K02
Including waveguide-to-waveguide adapter, DC power adapter, USB cable, hex ball driver 3/32, operating manual, CD-ROM with operating manual		
<b>Options</b>		
Mechanically controlled attenuator for the R&S®SMZ75	R&S®SMZ-B75M <sup>1)</sup>	1417.6007.02
Electronically controlled attenuator for the R&S®SMZ75	R&S®SMZ-B75E <sup>1)</sup>	1417.6107.02
Mechanically controlled attenuator for the R&S®SMZ90	R&S®SMZ-B90M <sup>1)</sup>	1417.6507.02
Electronically controlled attenuator for the R&S®SMZ90	R&S®SMZ-B90E <sup>1)</sup>	1417.6607.02
Mechanically controlled attenuator for the R&S®SMZ110	R&S®SMZ-B110M <sup>1)</sup>	1417.7003.02
Electronically controlled attenuator for the R&S®SMZ110	R&S®SMZ-B110E <sup>1)</sup>	1417.7103.02
<b>Software option</b>		
Software license for external PC software	R&S®SMZ-K1	1417.8400.02
<b>Recommended extras</b>		
Hardcopy manual (English)		1417.4027.32
Coaxial cable with SMA connectors, 50 Ω (length 0.5 m)		3586.9963.00
Coaxial cable with SMA connectors, 50 Ω (length 1.0 m)		3586.9970.00
Waveguide-to-waveguide adapter, WR6.5, HP/A-compatible (as test port saver)		1314.5815.00
Waveguide-to-waveguide adapter, WR10, HP/A-compatible (as test port saver)		1307.7074.00
Waveguide-to-waveguide adapter, WR12, HP/A-compatible (as test port saver)		1314.5796.00
Waveguide-to-waveguide adapter, WR15, HP/A-compatible (as test port saver)		1314.5780.00
USB cable, USB-A to USB-B (length 2.0 m)		1507.0567.00
DC power adapter		1307.8929.00
Hex ball driver 3/32		1307.8670.00

<sup>1)</sup> Factory-installed option (only a mechanically or electronically controlled attenuator can be fitted; no attenuator option is available for the R&S®SMZ170).

<b>Service options</b>		
Extended warranty, one year	R&S®WE1	
Extended warranty, two years	R&S®WE2	
Extended warranty, three years	R&S®WE3	
Extended warranty, four years	R&S®WE4	
Extended warranty with calibration coverage, one year	R&S®CW1	Please contact your local Rohde & Schwarz sales office.
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with calibration coverage, three years	R&S®CW3	
Extended warranty with calibration coverage, four years	R&S®CW4	



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