

R&S®SzM

FREQUENCY MULTIPLIER FAMILY

Precise output levels from 50 GHz to 170 GHz



Product Brochure
Version 01.00

ROHDE & SCHWARZ

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AT A GLANCE

The R&S®SZM 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®SZM75 (from 50 GHz to 75 GHz), R&S®SZM90 (from 60 GHz to 90 GHz), R&S®SZM110 (from 75 GHz to 110 GHz), R&S®SZM140 (from 90 GHz to 140 GHz) and R&S®SZM170 (from 110 GHz to 170 GHz). Depending on which base unit is selected, high output power, an attenuator or an isolator can be installed as options. To simplify handling, all three options are integrated in the same housing as the frequency multiplier. The R&S®SZM can be easily controlled by the R&S®SMA100B microwave signal generator via USB link. To enable control of the R&S®SZM via USB, the R&S®SMAB-K554 option must be installed on the R&S®SMA100B signal generator. This combination operates as a single unit allowing users to directly enter the desired frequency and the target level at the R&S®SZM output on the R&S®SMA100B GUI.

Compared with conventional setups, this one-box solution significantly simplifies setup and operation. Via USB the R&S®SMA100B receives all necessary data of the connected R&S®SZM, such as the configuration, the multiplication factor and in particular the precalibrated frequency response in order to provide the desired accurate output power.

The R&S®SMA100B is able to perform automatic correction, which helps ensure that the frequency and level values set on the R&S®SMA100B will actually be available at the R&S®SZM output. Costly, error-prone and time-consuming level measurement using level detectors or power sensors, which is common in conventional setups, is no longer required.

Very low single-sideband phase noise is achieved thanks to interaction with the high-end R&S®SMA100B microwave signal generator. For a CW signal of 60 GHz, for example, an outstanding -115 dBc (10 kHz offset) is achieved after four-fold frequency multiplication with the R&S®SZM75.

Key facts

- ▶ Wide frequency range
- ▶ Wide dynamic range
- ▶ Easy and convenient handling
- ▶ High signal quality



Test setup consisting of the R&S®SMA100B RF and microwave signal generator and the R&S®SZM170 frequency multiplier

BENEFITS AND KEY FEATURES

Wide frequency range

- ▶ Frequency ranges:
 - 50 GHz to 75 GHz (R&S®SzM75)
 - 60 GHz to 90 GHz (R&S®SzM90)
 - 75 GHz to 110 GHz (R&S®SzM110)
 - 90 GHz to 140 GHz (R&S®SzM140)
 - 110 GHz to 170 GHz (R&S®SzM170)
- ▶ Two models (e.g. R&S®SzM75 and R&S®SzM110) cover the wide frequency range from 50 GHz to 110 GHz

Wide dynamic range

- ▶ Mechanically controlled attenuator option with a dynamic range of 40 dB (typ.)
- ▶ Electronically controlled attenuator option with a dynamic range of 15 dB (typ.) if it is installed once, and 30 dB (typ.) if it is installed twice; if a high power option is not installed, the electronically controlled attenuator option can be installed twice

Easy handling

- ▶ Automatic detection and easy control of the R&S®SzM by means of the R&S®SMA100B microwave signal generator via USB when the R&S®SMAB-K554 option is installed on the R&S®SMA100B
- ▶ Easy setups with the one-box solution consisting of the R&S®SMA100B, the R&S®SzM plus an optional mechanically or electronically controlled attenuator¹⁾
- ▶ Frequency setting on the R&S®SMA100B, taking the connected R&S®SzM into consideration
- ▶ Level setting on the R&S®SMA100B, taking the connected R&S®SzM into consideration²⁾

¹⁾ The electronically controlled attenuator is not available for the R&S®SzM140 and R&S®SzM170.

²⁾ Only for built-in attenuator. With the mechanical attenuator, users must set the micrometer screw to the value displayed on the R&S®SMA100B.



R&S®SzM170 with micrometer screw (front and rear view)

- ▶ Automatic frequency response correction of the precalibrated R&S®SzM, including attenuator by the R&S®SMA100B³⁾
- ▶ Can be used with frequency, phase and pulse modulated input signals
- ▶ Optional test port adapter (TPA) is a straight waveguide and simplifies connection of the DUT; it protects internal assemblies and their flange and can be easily replaced if damaged
- ▶ Optional Faraday isolator suppresses reflections and leads to a defined matching at the waveguide output

High signal quality

- ▶ Very low single-sideband phase noise when the R&S®SMA100B is used as a source
- ▶ High accuracy of the set output level
- ▶ Excellent matching

³⁾ With the mechanical attenuator, users must set the micrometer screw to the value displayed on the R&S®SMA100B.

The R&S®SzM frequency multiplier can be equipped with the following options

Model	Mechanically controlled attenuator ¹⁾	Electronically controlled attenuator ^{1) 2) 3)}	High output power ³⁾	Isolator	Waveguide-to-waveguide adapter (test port adapter)
R&S®SzM75	•	•	•	•	•
R&S®SzM90	•	•	•	•	•
R&S®SzM110	•	•		•	•
R&S®SzM140	•			•	•
R&S®SzM170	•			•	•

¹⁾ Either a mechanically or an electronically controlled attenuator can be installed.

²⁾ The electronically controlled attenuator can be installed once or twice.

³⁾ If the high power option is installed, the electronically controlled attenuator can be installed only once.

APPLICATION EXAMPLES

In both the civil sector and in A&D applications, the R&S®SZM 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®SZM without attenuator connected to the R&S®SMA100B

Using the R&S®SZM frequency multiplier is simple and basically the same in all applications. First, the R&S®SZM is connected to the external power supply. Next, the USB connection is set up. With the installed R&S®SMAB-K554 option on the R&S®SMA100B microwave signal generator, the type and characteristics of the connected R&S®SZM are detected automatically.

The frequency to be present at the output of the R&S®SZM can then be set directly on the R&S®SMA100B. The R&S®SZM output level depending on the frequency is displayed as a non-editable value on the R&S®SMA100B. Lastly, the R&S®SMA100B must be RF-connected to the R&S®SZM.

R&S®SZM including mechanically controlled attenuator connected to the R&S®SMA100B

In this application, users can additionally set the actual level at the output of the R&S®SZM. Since the R&S®SMA100B with an installed R&S®SMAB-K554 option reads the frequency response of the R&S®SZM including attenuator via USB, the frequency response can be taken into consideration when the level is entered on the R&S®SMA100B.

A special display shows the value for the micrometer 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®SZM.

R&S®SZM including electronically controlled attenuator connected to the R&S®SMA100B

This is the easiest way to use the frequency multiplier: The frequency and the level are set on the R&S®SMA100B with an installed R&S®SMAB-K554 option and the measurement can begin. The frequency response of the R&S®SZM including attenuator is automatically taken into consideration. The settings for the electronically controlled attenuator are transferred from the R&S®SMA100B to the R&S®SZM via USB.



R&S®SZM170 including mechanically controlled attenuator

SPECIFICATIONS

Specifications

Frequency

Input frequency range and multiplication factor	R&S®SZM75	12.50 GHz to 18.75 GHz	× 4
	R&S®SZM90	15.00 GHz to 22.50 GHz	× 4
	R&S®SZM110	18.75 GHz to 27.50 GHz	× 4
	R&S®SZM140	15.00 GHz to 23.33 GHz	× 6
	R&S®SZM170	13.75 GHz to 21.25 GHz	× 8
Output frequency range	R&S®SZM75	50 GHz to 75 GHz	
	R&S®SZM90	60 GHz to 90 GHz	
	R&S®SZM110	75 GHz to 110 GHz	
	R&S®SZM140	90 GHz to 140 GHz	
	R&S®SZM170	110 GHz to 170 GHz	

Level

	R&S®SZM75	R&S®SZM90	R&S®SZM110	R&S®SZM140	R&S®SZM170
Input level (for all R&S®SZM models)	+7 dBm (typ.)				
Maximum output	+22 dBm (typ.)	+18 dBm (typ.)	+15 dBm (typ.)	+10 dBm (typ.)	+8 dBm (typ.)
Maximum attenuation	40 dB				
With R&S®SZM-B75M/-B90M/-B110M/-B140M/-B170M option (mechanically controlled attenuator)	40 dB				
With R&S®SZM-B75E/-B90E/-B110E option (electronically controlled attenuator)	15 dB, if installed once; 30 dB, if installed twice				

Connectors

Input	R&S®SZM75, R&S®SZM90, R&S®SZM110, R&S®SZM140, R&S®SZM170	2.92 mm, female
Output	R&S®SZM75	WR-15 waveguide
	R&S®SZM90	WR-12 waveguide
	R&S®SZM110	WM-2540 (WR10) waveguide
	R&S®SZM140	WM-2032 (WR8) waveguide
	R&S®SZM170	WM-1651 (WR6.5) waveguide

General data

Voltage supply		+12 V
Power supply	AC	100 V to 240 V, ± 10%
Dimensions (W × H × D)	without feet and feet-mount, without TPA and rear connectors	90 mm × 60 mm × 180 mm (3.5 in × 2.4 in × 7.1 in)
Weight		2 kg (5 lb)

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
Frequency multiplier, 50 GHz to 75 GHz	R&S®SzM75	1443.5004.02
Frequency multiplier, 60 GHz to 90 GHz	R&S®SzM90	1443.5104.02
Frequency multiplier, 75 GHz to 110 GHz	R&S®SzM110	1443.5204.02
Frequency multiplier, 90 GHz to 140 GHz	R&S®SzM140	1443.5304.02
Frequency multiplier, 110 GHz to 170 GHz	R&S®SzM170	1443.5404.02
Including DC power supply, user manual, USB cable, USB flash drive with setting values for micrometer screw (if R&S®SzM is equipped with mechanically controlled attenuator), hex ball driver 3/32, 4 × UNC4-40 7.6, 4 × UNC4-40 9.24 and 2 × IEEE dowel pins		
Hardware options for the R&S®SzM75		
Mechanically controlled attenuator	R&S®SzM-B75M	1443.5027.02
Electronically controlled attenuator	R&S®SzM-B75E	1443.5010.02
High output power	R&S®SzM-B75H	1443.5056.02
Isolator	R&S®SzM-B75I	1443.5040.02
Test port adapter, 40 mm	R&S®SzM-B75T	1443.5033.02
Hardware options for the R&S®SzM90		
Mechanically controlled attenuator	R&S®SzM-B90M	1443.5127.02
Electronically controlled attenuator	R&S®SzM-B90E	1443.5110.02
High output power	R&S®SzM-B90H	1443.5156.02
Isolator	R&S®SzM-B90I	1443.5140.02
Test port adapter, 40 mm	R&S®SzM-B90T	1443.5133.02
Hardware options for the R&S®SzM110		
Mechanically controlled attenuator	R&S®SzM-B110M	1443.5227.02
Electronically controlled attenuator	R&S®SzM-B110E	1443.5210.02
Isolator	R&S®SzM-B110I	1443.5240.02
Test port adapter, 40 mm	R&S®SzM-B110T	1443.5233.02
Hardware options for the R&S®SzM140		
Mechanically controlled attenuator	R&S®SzM-B140M	1443.5327.02
Isolator	R&S®SzM-B140I	1443.5340.02
Test port adapter, 40 mm	R&S®SzM-B140T	1443.5333.02
Hardware options for the R&S®SzM170		
Mechanically controlled attenuator	R&S®SzM-B170M	1443.5427.02
Isolator	R&S®SzM-B170I	1443.5440.02
Test port adapter, 40 mm	R&S®SzM-B170T	1443.5433.02
Recommended extras		
R&S®SzM control via USB by the analog R&S®SMA100B RF and microwave signal generator	R&S®SMAB-K554	1420.9884.02
Torque wrench, for waveguide flange screws	R&S®ZV-Z1000	1314.5467.02
Angled wrench, for waveguide flange screws	R&S®ZCAW	1175.1960.00
Angled torque wrench, for waveguide flange screws	R&S®ZCTW	1175.2014.02
Hex ball driver 3/32		1307.8670.00
Coaxial cable with K connectors, 50 Ω, length: 1.0 m		1348.3850.00

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