

R&S® TSME44DC, R&S® TSMS53DC ULTRACOMPACT DOWNCONVERTERS

R&S® TSMx upgrade for
5G NR mmWave measurements



Product Brochure
Version 08.00

ROHDE & SCHWARZ

Make ideas real



AT A GLANCE

The R&S®TSME44DC and R&S®TSMS53DC are designed to easily upgrade the R&S®TSMx network scanners to measure 5G NR signals in the mmWave frequency range. They perfectly extend the latest generation mobile network scanner family and provide all features for easy drive and walk testing. They are fully controlled by the R&S®TSMx and the corresponding software layers, which allows seamless, unattended operation.

With their broadband downconversion frequency ranges, the downconverters cover a huge part of the new mmWave frequency bands allocated for 5G NR networks. These new frequency bands show completely different behavior in terms of propagation and phase noise, which puts demanding requirements on measurement tools' hardware. Using mmWave frequencies necessitates beamforming for sufficient propagation.

To provide best sensitivity, image frequency rejection and lowest phase noise, the R&S®TSME44DC and R&S®TSMS53DC adjust internal parameters such as the intermediate frequency (IF) and the local oscillator (LO) to the measurement task. This takes place in the background and is unnoticeable by the user. It ensures that every single parameter is optimized for best system performance. The R&S®TSME44DC and R&S®TSMS53DC are future-proof. All models support multiple scanners for future 5G NR measurements tasks and ultra high performance measurement modes.



Typical setup for walk testing with a tablet controlling the R&S®TSMx6 autonomous mobile network scanner with battery pack and an R&S®TSME44DC or R&S®TSMS53DC ultracompact downconverter on top.

KEY FACTS

- ▶ Ultra broadband RF frequency range for downconversion
- ▶ R&S®TSME44DC: 24 GHz to 44 GHz
- ▶ R&S®TSMS53DC: 17 GHz to 53 GHz
- ▶ Fully controlled by R&S®TSMx network scanners to simplify operation and maximize performance
- ▶ Simultaneous mmWave and sub 6 GHz measurements with a single scanner
- ▶ Customized mechanical concept, fully compatible with the latest R&S®TSMx network scanner generation
- ▶ Future-proof concept (support of multiple scanners)
- ▶ Low power consumption

BENEFITS

Self-optimization in the background

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Fully controlled by the latest network scanner generation

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Simplifies multiple technology measurements

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Future-proof hardware concept

- ▶ Ready for future measurement tasks by supporting multiple network scanners
- ▶ New 5G NR measurement features via software updates

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Mechanically compatible with click-in system

- ▶ page 8

Optimized for backpack operation and walk testing

- ▶ Low power consumption, small form factor, low weight
- ▶ Large portfolio of accessories for easy operation

- ▶ page 9



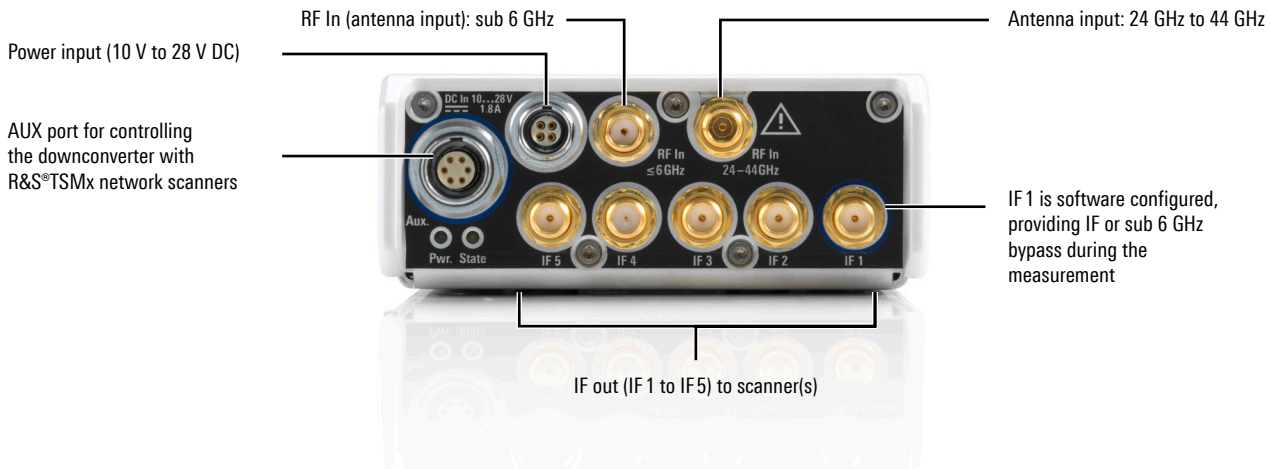
SELF-OPTIMIZATION IN THE BACKGROUND

Downconversion sounds simple, but it is actually a complex process that involves a lot of trade-offs and hardware components. Each downconverter requires a high-precision local oscillator that has to be set according to the measured frequency to ensure best sensitivity and lowest phase noise in the entire measurement system. The objective is a downconverted, distortion-free signal that does not influence the measurement results. Downconversion unavoidably leads to image frequencies that have to be filtered out to prevent collisions in the frequency domain. The downconverter optimizes all internal parameters for the configured measurement task and the connected scanners' RF parameters for best system performance in all supported frequency bands.

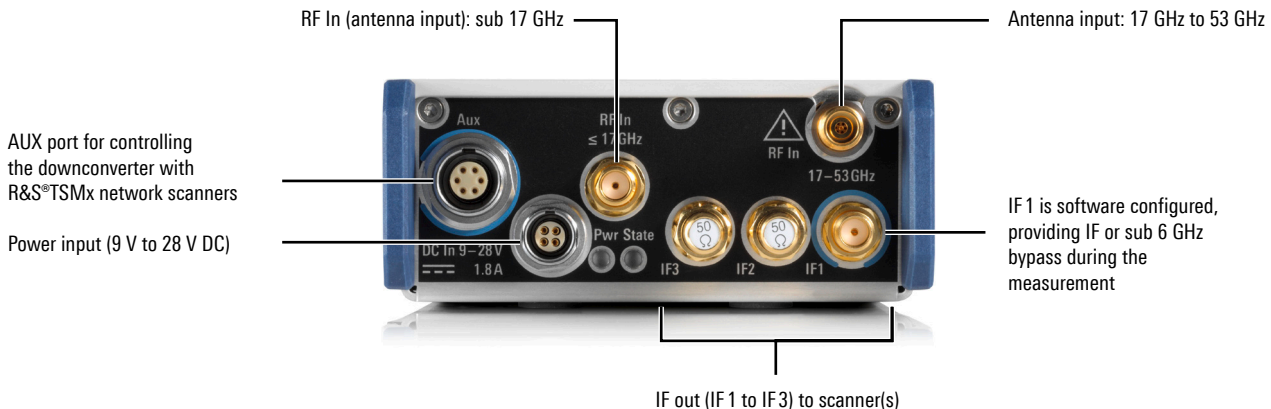
In general, bandwidth affects the degree of freedom for RF performance optimization. The supported frequency range is one of the main differences between the downconverters. The R&S®TSME44DC focuses on covering a wide frequency range from 24 GHz to 44 GHz. The R&S®TSM53DC uses an enhanced RF concept, which unifies bandwidth and performance. A comparison of the downconverters can be found in the specifications on page 10.

Downconverter interfaces

R&S®TSME44DC rear view



R&S®TSM53DC rear view

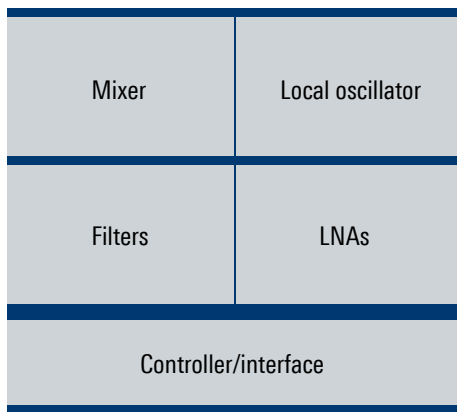


FULLY CONTROLLED BY THE LATEST NETWORK SCANNER GENERATION

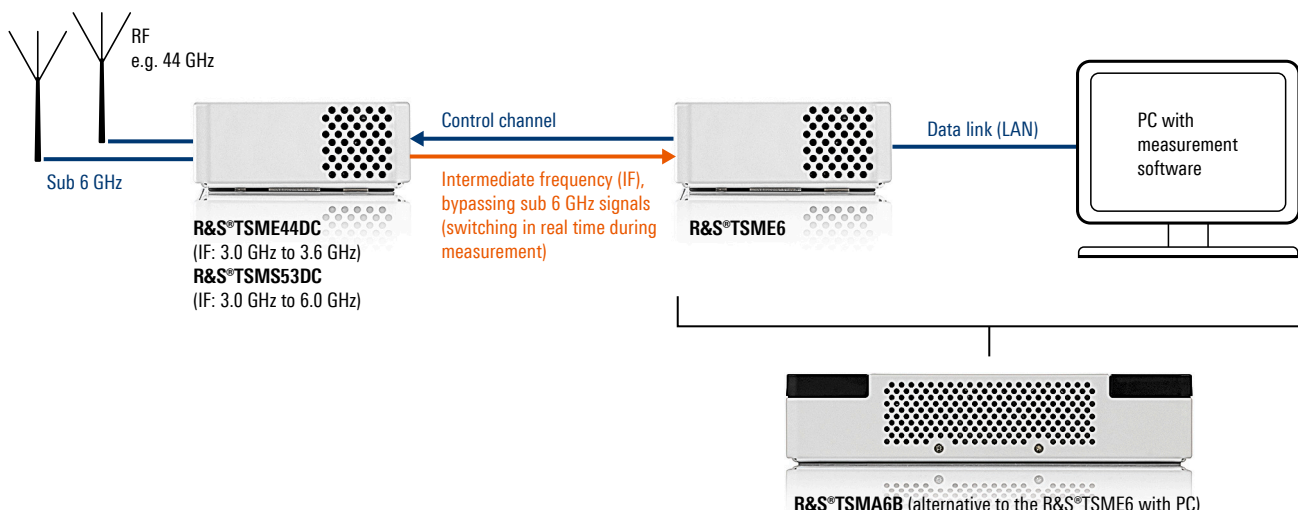
The R&S®TSME44DC and R&S®TSMS53DC enable the latest network scanner generation (R&S®TSME6 and R&S®TSMA6B) to measure in the mmWave frequency bands. Each mmWave frequency (e.g. RF = 44 GHz) is downconverted to an intermediate frequency that can be natively measured by the latest scanner generation (R&S®TSME44DC: IF = 3.0 GHz to 3.6 GHz, R&S®TSMS53DC: IF = 3.0 GHz to 6.0 GHz).

Measurement campaigns are typically very expensive. Saving money means significantly reducing the setup time and spending more time on the main task of collecting measurement data. It is therefore very important to streamline the instrument setup by eliminating as many user inputs as possible to achieve the best system performance. All internal RF parameters are automatically set based on the frequency configured in the measurement software.

Downconverter building blocks



Setup 1: Downconverter cabling for standard performance measurements

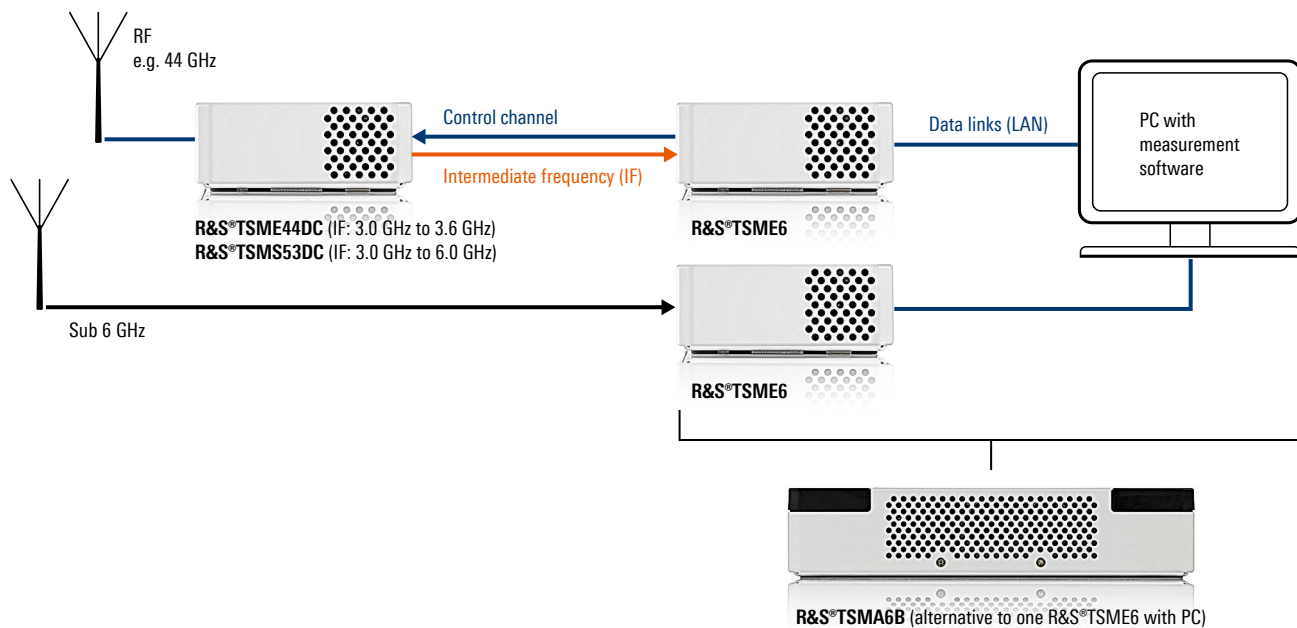


SIMPLIFIES MULTIPLE TECHNOLOGY MEASUREMENTS

Rohde&Schwarz network scanners are designed for measuring all major 3GPP technologies. 5G NR will initially be deployed in the non-standalone mode, which requires an LTE carrier as an anchor for the control channel and 5G NR carriers for major data transmission. The standard measurement setup (setup 1 on page 5) includes one downconverter and one R&S®TSME6. One network scanner can be used for simultaneous 5G NR mmWave and LTE/sub 6 GHz standard performance measurements. An alternative setup would be to use two network scanners for high-speed 5G NR and LTE/sub 6 GHz measurements (setup 2).

The user has maximum degree of freedom to use less hardware for standard performance (setup 1) or invest in more hardware for high speed (setup 2). In both cases, the setup is fully software-controlled. Operating the setup becomes very simple since the software can configure one IF port (IF 1) of the downconverter to bypass the sub 6 GHz signal (350 MHz to 6 GHz) coming directly from the antenna or to provide the downconverted IF signal. The switch between bypassing sub 6 GHz and IF signals can be performed in real time during the measurement for maximum measurement setup flexibility (setup 1).

Setup 2: Multiple technology measurements in high-speed mode



FUTURE-PROOF HARDWARE CONCEPT

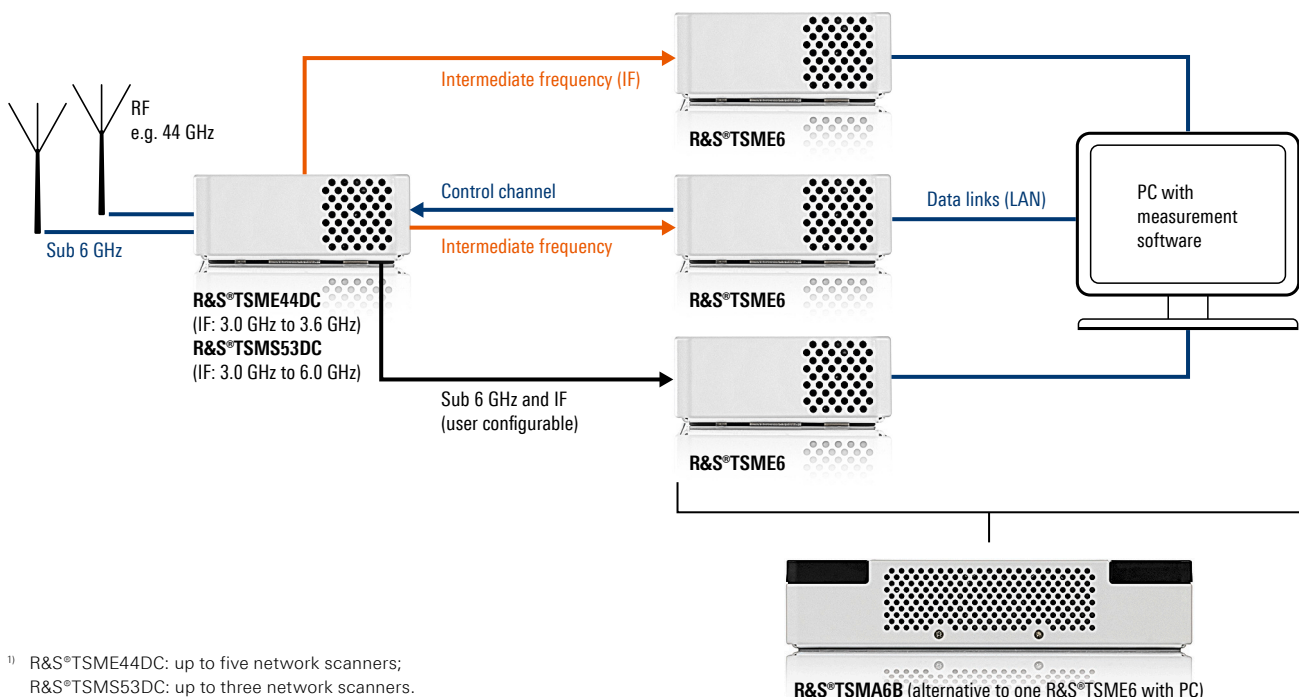
Ready for future measurement tasks by supporting multiple network scanners

Every investment in measurement tools is a long-term investment. It is expected that future features for 5G NR mmWave measurements will be added via a simple software upgrade since changing the hardware is cost-intensive. That is why the software controlled downconverters are equipped with multiple IF ports to support the connection of up to five¹⁾ network scanners, each measuring in its individual 20 MHz band within the IF range (R&S®TSME44DC: 600 MHz, R&S®TSMS53DC: 1 GHz). A standard setup (setup 1) consists of one downconverter and one R&S®TSMx6 network scanner. For broadband 5G NR carriers, additional scanners can be used for high-performance measurements with increased system speed and dynamic range (setup 3). Other future use cases for multiple 5G NR scanner measurements include advanced demodulation and channel detection tasks.

New 5G NR measurement features via software updates

Rohde&Schwarz network scanners are in-field software upgradeable. The R&S®TSMx6 5G NR measurements will be extended by adding different features with every new release. New features are enabled via a simple software upgrade on the R&S®TSMx, R&S®TSME44DC and R&S®TSMS53DC.

Setup 3: Multiple measurements with multiple¹⁾ network scanners for increased dynamic range



MECHANICALLY COMPATIBLE WITH CLICK-IN SYSTEM

R&S®TSMA6B, R&S®TSME6, R&S®TSME44DC, R&S®TSMS53DC and R&S®TSMA6B-BP are mechanically compatible. All these devices feature the click-in system to create a vibration-safe stack. This makes it possible to quickly arrange different measurement setups based on the measurement task.



Two R&S®TSME6 with R&S®TSMA6B-BP battery pack and a downconverter on top

OPTIMIZED FOR BACKPACK OPERATION AND WALK TESTING

Low power consumption, small form factor, low weight

5G NR using mmWave spectrum will mainly be deployed for small cell applications. It is expected that cell sizes will range from 20 m to 200 m with highly directive antennas. Consequently, 5G NR mmWave measurements will mainly be performed during walk tests.

During walk test campaigns, the handling of the T&M equipment directly affects the time needed for the campaigns. Hardware with a small form factor and low weight is mandatory for efficient walk testing.

Walk test equipment typically runs on a battery, making low power consumption imperative for the entire measurement system, even including the extra hardware for mmWave measurements. Recharging interrupts the measurement campaign and significantly increases the costs. The combination of the R&S®TSME6 and a downconverter is optimized for maximum performance and low power consumption in total (R&S®TSME44DC: approx. 16 W, R&S®TSMS53DC: approx. 21 W).

Large portfolio of accessories for easy operation

All advantages of low weight, small form factor and low power consumption are used efficiently during backpack operation. The large portfolio of accessories includes a backpack solution that accommodates all types of measurement setups (standard and high performance), including the required cables, antennas and batteries. The location of the mmWave antenna is critical during walk testing. Near-field objects significantly affect the measurement result. Therefore, the backpack solution includes a special antenna holder to carry the antenna above the head of the person using the backpack.



Rear view of the setup above with interfaces. The battery pack can be used as a rechargeable power source for the two R&S®TSME6 devices and one downconverter.

SPECIFICATIONS

R&S®TSME44DC, R&S®TSMS53DC ultracompact downconverters

RF characteristics

Frequency range downconverter	input 1	
	R&S®TSME44DC	24 GHz to 44 GHz
	R&S®TSMS53DC	17 GHz to 53 GHz
Frequency range RF bypass input		350 MHz to 6 GHz
IF (downconverted spectrum frequency range)	R&S®TSME44DC	3.0 GHz to 3.6 GHz
	R&S®TSMS53DC	3.0 GHz to 6.0 GHz
Level measurement uncertainty	R&S®TSME44DC	
	outputs IF1 to IF3	±1.5 dB
	outputs IF4 and IF5	-2 dB to +1 dB
	R&S®TSMS53DC	
	10 MHz to 17.0 GHz	±1.0 dB (bypass)
	17.0 GHz to 44.0 GHz	
	20°C to 30°C	±1.5 dB
	0°C to 20°C, 30°C to 50°C	±2.0 dB
	44.0 GHz to 53.0 GHz	
	20°C to 30°C	±2.0 dB
	0°C to 20°C, 30°C to 50°C	±2.5 dB
Bandwidth	R&S®TSME44DC	600 MHz
	R&S®TSMS53DC	1 GHz
Maximum operating measurement range input level	R&S®TSME44DC, R&S®TSMS53DC	-18 dBm (nom.)
Maximum safe permissible input level		0 dBm/0 V (DC)
Image rejection	R&S®TSME44DC	> 40 dBc (meas.)
	R&S®TSMS53DC	> 60 dBc (meas.)
Spurious responses at -30 dBm input level	R&S®TSME44DC	< -25 dBc (meas.)
	R&S®TSMS53DC	< -60 dBc (meas.)
Third order intercept (TOI)	R&S®TSME44DC	> -3 dBm (meas.)
	R&S®TSMS53DC	> -10 dBm (meas.)
Second order intercept (SOI)	R&S®TSME44DC	> 0 dBm (meas.)
	R&S®TSMS53DC	> 5 dBm (meas.)
Noise figure	R&S®TSME44DC	7 dB (meas.)
	R&S®TSMS53DC	
	17 GHz to 24 GHz	< 8 dB (meas.)
	24 GHz to 40 GHz	4 dB to 6 dB (meas.)
	40 GHz to 50 GHz	< 7 dB (meas.)
	50 GHz to 53 GHz	< 9 dB (meas.)
VSWR	input 1	
	R&S®TSME44DC	
	24 GHz to 27 GHz	< 2.4 (meas.)
	27 GHz to 44 GHz	< 1.6 (meas.)
	R&S®TSMS53DC (17 GHz to 53 GHz)	< 2.1 (meas.)
Switching time between frequencies		real-time during measurement
Connectors		
RF mmWave inputs	R&S®TSME44DC	1 × 2.92 mm connector, 50 Ω (female)
	R&S®TSMS53DC	1 × 1.85 mm connector, 50 Ω (female)
RF bypass input		1 × SMA connector, 50 Ω (female)
IF outputs	R&S®TSME44DC (IF1 to IF5)	5 × SMA connectors, 50 Ω (female)
	R&S®TSMS53DC	3 × SMA connectors, 50 Ω (female)
AUX control interface		6-pin Lemo connector
DC In		4-pin Lemo connector

R&S®TSME44DC, R&S®TSMS53DC ultracompact downconverters

General data

Environmental conditions

Temperature range	operating	0°C to +50°C
	storage	-40°C to +70°C
Damp heat		+25°C/+55°C, 95% relative humidity, cyclic, in line with EN 60068-2-30

Mechanical resistance

Vibration	sinusoidal	5 Hz to 55 Hz, 0.15 mm amplitude const., 55 Hz to 150 Hz, 0.5 g const., in line with EN 60068-2-6
	random	8 Hz to 500 Hz, acceleration 1.2 g RMS, in line with EN 60068-2-64
Shock		40 g shock spectrum, in line with MIL-STD-810E, method 516.4, procedure I

Power rating

Supply voltage (DC-In)	R&S®TSME44DC	10 V to 28 V DC
	R&S®TSMS53DC	9 V to 28 V DC
Power consumption during operation	R&S®TSME44DC	6 W (typ.)
	R&S®TSMS53DC	10.5 W (typ.)

Product conformity

Electromagnetic compatibility and electrical safety	EU: in line with Radio Equipment Directive 2014/53/EU UK: Radio Equipment Regulations 2017	applied harmonized standards: ETSI EN 301489-1, EN 55032, EN 50498, EN 300440, EN 305550, EN 61010-1
	Korea	KC mark
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS) UK: in line with electrical and electronic equipment regulation 2012	applied harmonized standard: EN IEC 63000
Calibration interval		24 months
Dimensions	W × H × D	155 mm × 36 mm × 85 mm (6.10 in × 1.42 in × 3.35 in)
Weight	R&S®TSME44DC	approx. 548 g (1.21 lb)
	R&S®TSMS53DC	approx. 602 g (1.33 lb)

R&S®TSME-Z1 AC power supply

Power rating		
Input voltage		100 V to 240 V AC ± 10%
Input frequency		47 Hz to 63 Hz
Input current	230 V to 100 V AC	0.4 A to 0.8 A
Efficiency		CEC V
Output voltage		12 V DC
Output current		2.5 A
Standard output cable length		180 cm (5.9 ft)
Temperature range	operating	0°C to +60°C
	derating	derated linearly from 40°C at 100% load to 60°C at 60% load
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU international	applied harmonized standards: EN 61204-3 (class A), EN 61000-3-2, EN 61000-3-3 CISPR/FCC (class A)
Electrical safety	international	UL 60950-1, PSE J60950-1
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN 50581
Dimensions and weight		
Dimensions	W × H × D	57.6 mm × 33.5 mm × 107.7 mm (2.27 in × 1.32 in × 4.23 in)
Weight		400 g (0.88 lb)

R&S®TSMA6-Z1 AC power supply (with R&S®TSMA6-Z174 adapter cable)

Power rating		
Input voltage	at +25°C (1.6 A charge/1.6 A discharge)	100 V to 240 V AC ± 10%
Input frequency		50/60 Hz ± 5%
Input current	230 V to 115 V AC	0.7 A to 1.4 A
Efficiency		CEC VI
Output voltage		15 V DC
Output current		7.0 A
Standard output cable length		120 cm (3.9 ft)
Temperature range	operating	-10°C to +70°C
	derating 230 V AC	derated linearly from +45°C at 100% load to +70°C at 50% load
	derating 110 V AC	derated linearly from +40°C at 100% load to +60°C at 50% load
Product conformity		
Electromagnetic compatibility	EU: in line with EMC Directive 2014/30/EU international	applied harmonized standards: EN 55032 (Class B), EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11 CISPR 32
Electrical safety	EU: in line with Low Voltage Directive 2014/53/EU international	applied harmonized standard: EN 60950 CCC GB4943.1, PSE J60950-1, KC K60950-1
Restriction of the use of hazardous substances	EU: in line with 2011/65/EU (RoHS)	applied harmonized standard: EN 50581
Dimensions and weight		
Dimensions	W × H × D	67 mm × 35 mm × 167 mm (2.64 in × 1.38 in × 6.57 in)
Weight		583 g (1.29 lb)

R&S®TSMS-OMN70 omnidirectional mmWave antenna (17 GHz to 53 GHz)

Frequency range	in-band	17 GHz to 53 GHz
	out-of-band	4.5 GHz to 70 GHz
Polarization		vertical
Input impedance		50 Ω
VSWR, return loss	in-band	< 2.0 dB, better than 10 dB
	out-of-band	< 2.6 dB, better than 7 dB
Gain	average gain	3 dBi to 5 dBi, in-band
	maximum gain	7.4 dBi, in-band
Connector		1.85 mm or 2.4 mm, female
Maximum input power	CW	33 dBm
Radiation pattern	azimuth plane	max. gain 30° to 40° above horizon
	horizontal plane	omnidirectional
Operating temperature range		-10°C to +55°C
Ingress protection		IP65
Maximum driving speed	with R&S®TSMS-OMAGM magnetic mount	130 km/h (68 mph)
Dimensions and weight		
Dimensions	H × Ø	50 mm × 50 mm (1.97 in × 1.97 in)
Weight		120 g (0.26 lb)

Measured values (meas.)

Characterize expected product performance by means of measurement results gained from individual samples.

Nominal values (nom.)

Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

ORDERING INFORMATION

Designation	Type	Order No.
Base unit (includes accessories such as power cable, manual)		
Ultracompact downconverter, 24 GHz to 44 GHz	R&S®TSME44DC	4901.2600.02
Ultracompact downconverter, 17 GHz to 53 GHz	R&S®TSMS53DC	4902.0001.02
Scope of delivery: Downconverter, synchronization cable for two devices, power splitter cable to power the R&S®TSMxxxDC from an R&S®TSME-Z1 power supply, tools for cabling the downconverter; R&S®TSME44DC: 4 matching resistors, 5 SMA cables for IF transmission (from downconverter to scanner), R&S®TSMS53DC: 2 matching resistors, 3 SMA cables for IF transmission (from downconverter to scanner)		
Compatible scanner hardware and battery pack		
Ultracompact drive test scanner	R&S®TSME6	4900.0004.02
Autonomous mobile network scanner	R&S®TSMA6	4900.8005.02
Autonomous mobile network scanner	R&S®TSMA6B	4900.8005.20
Battery pack for R&S®TSMA6, R&S®TSMA6B, R&S®TSME6, R&S®TSME44DC, R&S®TSMS53DC	R&S®TSMA6B-BP	4900.9001.20
Hardware and software options (for compatible R&S®TSMx6 scanner hardware)		
5G NR scanning for R&S®TSME6	R&S®TSME6-K50	4900.2436.02
5G NR scanning for R&S®TSME6 add-ons	R&S®TSME6-K51	4900.2488.02
5G NR scanning for R&S®TSMA6(B)	R&S®TSMA6-K50	4901.0966.02
5G NR scanning for R&S®TSMA6(B) add-ons	R&S®TSMA6-K51	4901.0250.02
Simultaneous measurement in all bands	R&S®TSME6-KAB	4900.2107.02
Simultaneous measurement in all bands	R&S®TSMA6-KAB	4901.0708.02
RF power scan for R&S®TSME6	R&S®TSME6-K27	4900.2120.02
RF power scan for R&S®TSMA6(B)	R&S®TSMA6-K27	4901.0720.02
CW scanning for R&S®TSME6	R&S®TSME6-K25	4900.2242.02
CW scanning for R&S®TSMA6(B)	R&S®TSMA6-K25	4901.0814.02
Downconverter hardware driver for ROMES (supports all downconverters mentioned above)	R&S®ROMES4T30D	4900.5293.02
Drive test software	ROMES	1117.6885.04
ViCom interface/API for R&S®TSMx scanner (contact your local Rohde & Schwarz sales office to apply for ViCom)	R&S®VICOM	4900.7309.02
External accessories		
Omnidirectional mmWave antenna (26 GHz to 40 GHz)	R&S®TSME-Z20	3636.7151.02
Omnidirectional mmWave antenna (17 GHz to 53 GHz)	R&S®TSMS-OMN70	4902.6000.02
Magnetic mount, for mounting of R&S®TSMS-OMN70 on a magnetic car roof	R&S®TSMS-OMAGM	4902.6100.02
Antenna holder incl. R&S®TSMS-OMN70 and R&S®TSME-ZQC cable	R&S®FR4-5G-A3	1900.6403.42
AC power supply	R&S®TSME-Z1	1514.7310.00
AC power supply	R&S®TSMA6-Z1	4901.0550.02
Adapter cable, for connection of R&S®TSMA6-Z1 with R&S®TSMxxxDC	R&S®TSMA6-Z174	4901.0120.02
Synchronization cable for two devices (part of scope of delivery)	R&S®TSME6-ZC2	4900.1800.02
Synchronization cable for two devices, length: 1 m; Y-cable for power supply, length: 1 m; RF SMA cable, length: 1 m	R&S®TSME6-ZC2L	4900.1600.02
Synchronization cable for up to four devices (R&S®TSMx6 and R&S®TSMxxxDC)	R&S®TSME6-ZC4	4900.1817.02
Synchronization cable for five scanners and one downconverter	R&S®TSME6-ZC6	4900.1830.02
Power cable for R&S®TSMA6B-BP battery pack	R&S®TSMA6-BPPT	4900.1730.02
R&S®TSME6/TSMxxxDC dual power cable for R&S®TSMA6B-BP battery pack	R&S®TSMA6-BP2T	4901.0566.02
K cable, 2.92 mm (K male to K male)	R&S®TSME-ZKC	3640.5350.02
Q cable, 2.4 mm (Q male to Q male)	R&S®TSME-ZQC	3712.0912.02
Adapter, 2.92 mm to 1.85 mm	R&S®TSMS-AKV	4902.1066.02
Port saver, 2.92 mm (K female to K male), for R&S®TSME44DC	R&S®TDC292JACK	3637.8397.02
Port saver, 1.85 mm (V male to V male), for R&S®TSMS53DC	R&S®TSMS-PS185	4902.1050.02

Designation	Type	Order No.
19" rack adapter, for four R&S®TSME6/TSMxxxDC	R&S®TSME6-Z2	4900.1030.02
Mounting kit	R&S®TSME6-Z4	4900.1100.02
Carrying box	R&S®TSME6-Z5	4900.1875.02
Freerider backpack system generation 4 (contact your local Rohde&Schwarz sales office for backpack configuration)	R&S®FR4-CORE	1900.6403.10

Warranty		
Base unit		3 years
All other items ¹⁾		1 year
Options		
Extended warranty, one year	R&S®WE1	Contact your local Rohde&Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	

¹⁾ For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

Your local Rohde&Schwarz expert will help find the best solution for you.
Contact your local Rohde&Schwarz sales office for more information: www.rohde-schwarz.com

Service at Rohde & Schwarz You're in great hands

- ▶ Worldwide
- ▶ Local and personalized
- ▶ Customized and flexible
- ▶ Uncompromising quality
- ▶ Long-term dependability

Rohde & Schwarz

The Rohde&Schwarz technology group is among the trail-blazers when it comes to paving the way for a safer and connected world with its leading solutions in test & measurement, technology systems and networks&cybersecurity. Founded 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

Mobile network testing

The company's broad and diverse product portfolio for mobile network testing addresses every test scenario in the network lifecycle – from base station installation to network acceptance and network benchmarking, from optimization and troubleshooting to interference hunting and spectrum analysis, from IP application awareness to QoS and QoE of voice, data, video and app based services.

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