Version
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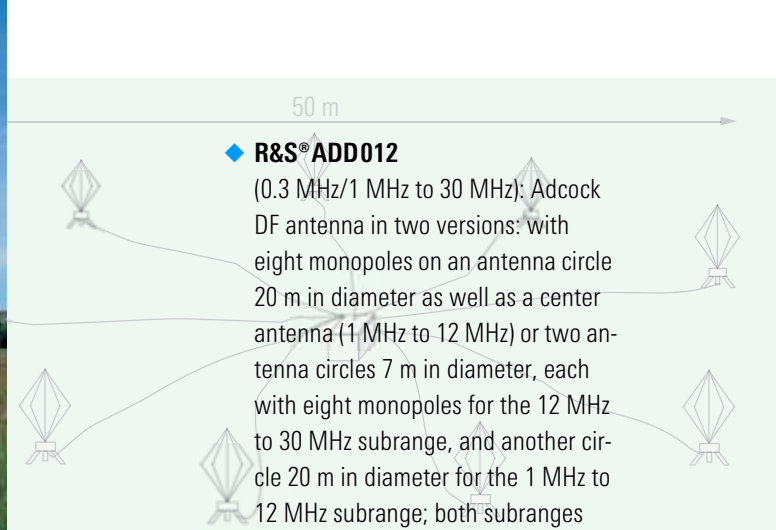
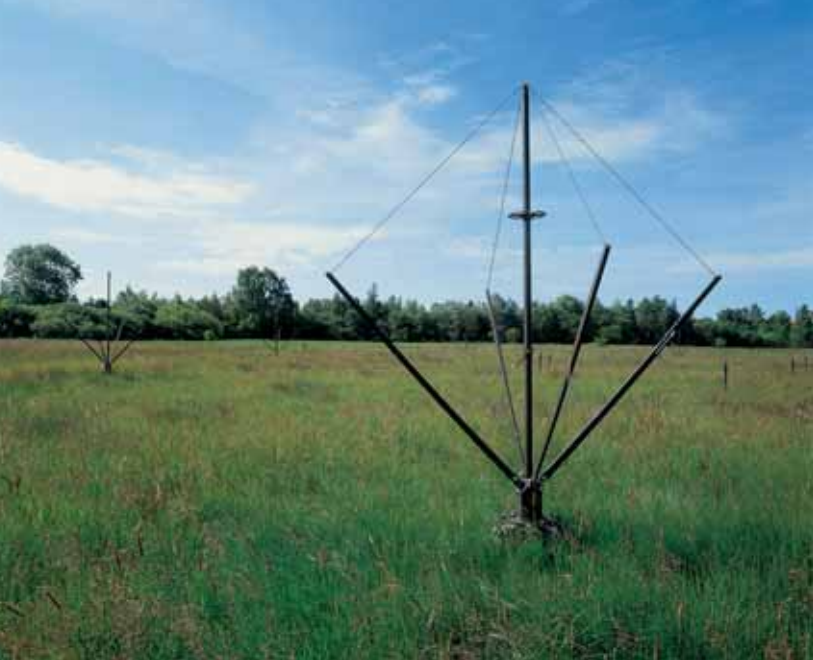
May 2005

HF/VHF/UHF DF Antennas R&S®ADDx

For the Digital HF/VHF/UHF Search Direction Finders R&S DDF® 0xA and the Digital HF/VHF/UHF Monitoring Direction Finders R&S DDF® 0xE from 300 kHz to 3 GHz

- ◆ Antennas for direction finding in accordance with the correlative interferometer principle or the Watson-Watt method
- ◆ Antennas for stationary and mobile use
- ◆ High DF accuracy and sensitivity
- ◆ Coverage of wide frequency ranges without splitting into subranges
- ◆ Direction-independent DF characteristics due to exclusive use of circular antenna arrays

**ROHDE & SCHWARZ**



R&S® ADD011/012

The accuracy and sensitivity of a direction finder is considerably influenced by the DF antenna used. Rohde&Schwarz offers a comprehensive scope of DF antennas for diverse applications to complement its direction finders of the R&S DDF® 0xA and R&S DDF® 0xE generation. Since these direction finders can be operated both as correlative interferometers and according to the Watson-Watt method, DF antennas suitable for both methods are provided.

HF range

Correlative interferometer

Two DF antennas are available for this DF method which, with sky wave reception, also determines the vertical angle of incidence (elevation) and stands out for its high accuracy of bearings and stable indication:

◆ R&S® ADD010

(0.3 MHz/1 MHz to 30 MHz): Nine R&S® HP010 monopole antenna elements are arranged on the circumference of a circle 50 m in diameter; they are suitable for frequent changes of location since only a minimum of space is required for transport; because of the vertical antenna radiation pattern of a monopole, they have

only limited suitability for sky waves with steep elevation angles

◆ R&S® ADD011

(0.3 MHz/1 MHz to 30 MHz): Nine antenna elements (R&S® HP011 crossed loop elements) are arranged on the circumference of a circle 50 m in diameter; they are ideally suited for receiving sky waves with steep elevation angles; the operator can select the sense of the usually circular or elliptical polarization to achieve optimum DF results; the antenna elements are also suitable for receiving (vertically polarized) ground waves

Watson-Watt

Two DF antennas are available for this classic DF method which does not permit elevation calculation, but requires only a short time to determine bearings:

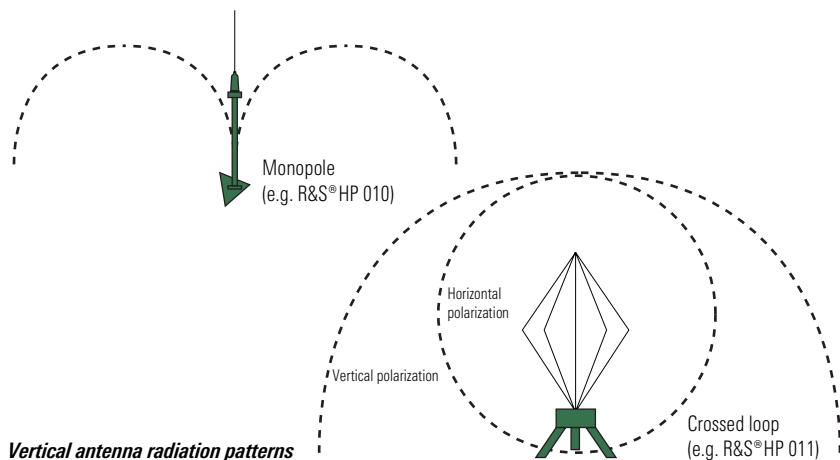
◆ R&S® ADD012

(0.3 MHz/1 MHz to 30 MHz): Adcock DF antenna in two versions: with eight monopoles on an antenna circle 20 m in diameter as well as a center antenna (1 MHz to 12 MHz) or two antenna circles 7 m in diameter, each with eight monopoles for the 12 MHz to 30 MHz subrange, and another circle 20 m in diameter for the 1 MHz to 12 MHz subrange; both subranges use a joint reference antenna that is placed in the center

◆ R&S® ADD119

(0.3 MHz/1 MHz to 30 MHz): Compact antenna for mobile use; primarily designed for ground wave direction finding; direction finding of sky waves is possible only to a limited extent

Users sometimes want to operate the R&S DDF® 01A or R&S DDF® 01E equipment when connected to an HF Adcock DF antenna from another manufacturer. This is possible by inserting the Antenna Interface R&S® GX060 between the DF antenna and the DF equipment. This interface provides the switchover facility that is usually required for switching between the two frequency subranges. Moreover, the calibration signal is applied via the R&S® GX060 since the connecting cables between DF antenna and DF equipment are also included in the calibration process. In addition, once the direction finder has been booted, it



switches automatically to the Watson-Watt method, which is subsequently required.

VHF/UHF range

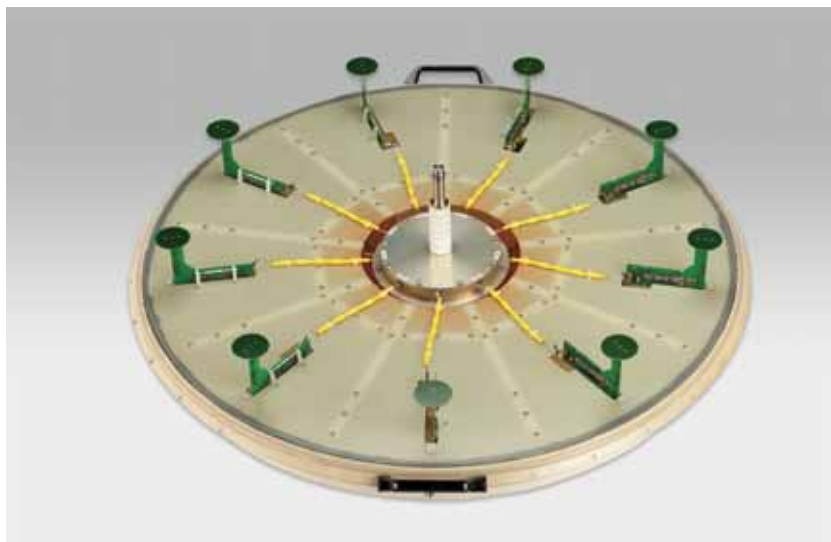
Correlative interferometer

For this DF method, a very extensive selection of different DF antennas is available:

- ◆ **R&S® ADD 153**
(20 MHz to 1300 MHz): Broad-band compact antenna for mobile and stationary use; nine active dipoles are arranged in a circle inside a radome 1.1 m in diameter
- ◆ **R&S® ADD 050**
(20 MHz to 200 MHz): Used to achieve optimum sensitivity – especially for stationary use – in the 20 MHz to 200 MHz range; nine dipoles are arranged on the circumference of a circle 3 m in diameter; the combination of the R&S® ADD 050 and the R&S® ADD 153 is referred to as the R&S® ADD 053



R&S® ADD 119 (on a tripod with adapter)



R&S® ADD 153 (without upper radome shell)



R&S® ADD 153 (top), R&S® ADD 050 (center), R&S® ADD 070 (bottom)

- ◆ **R&S® ADD 070**
(1300 MHz to 3000 MHz): Antenna in three versions: as a very sturdy model (.02), permitting the additional installation of the R&S® ADD 053 on its upper flange; as a more lightweight model (.12), allowing only the additional installation of the R&S® ADD 153; as the compact-design model R&S® ADD 070M, preferably used for vehicle installations, but not permitting the installation of a further DF antenna
- ◆ **R&S® ADD 170**
(800 MHz to 2000 MHz): Optimized for signal direction finding in the GSM850, GSM900, GSM1800 and GSM1900 mobile telephone networks



R&S® ADD070M

HF range

Type	Frequency range	Features	Method
R&S® ADD 119	0.3 MHz/1 MHz to 30 MHz	compact antenna	Watson-Watt
R&S® ADD 010	0.3/1 MHz to 30 MHz	9 monopoles	correlative interferometer
R&S® ADD 011	0.3/1 MHz to 30 MHz	9 crossed loops	correlative interferometer
R&S® ADD 012	0.3/1 MHz to 30 MHz	9/17 monopoles	Watson-Watt

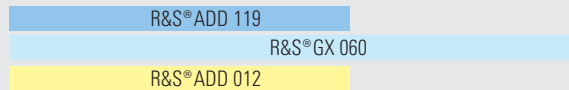
VHF/UHF range

Type	Frequency range	Features	Method
R&S® ADD 153	20 MHz to 1300 MHz		correlative interferometer
R&S® ADD 050	20 MHz to 200 MHz		correlative interferometer
R&S® ADD 053	= R&S® ADD 050 + R&S® ADD 153		
R&S® ADD 070(M)	1300 MHz to 3000 MHz		correlative interferometer
R&S® ADD 170	800 MHz to 2000 MHz		correlative interferometer

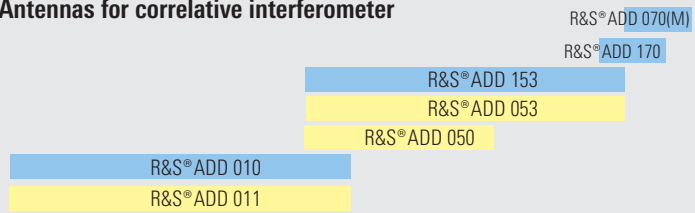
HF/VHF/UHF range

Type	Frequency range	Features	Method
R&S® GX 060	0.3 MHz to 650 MHz	antenna interface for non-R&S Adcock DF antennas	Watson-Watt

Antennas for Watson-Watt method

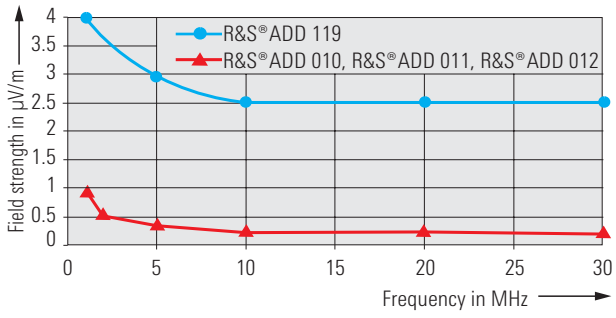


Antennas for correlative interferometer

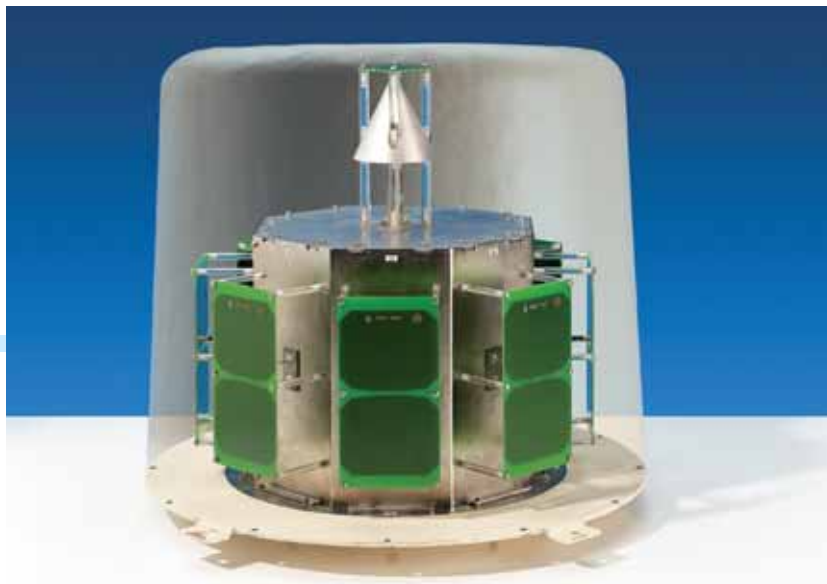
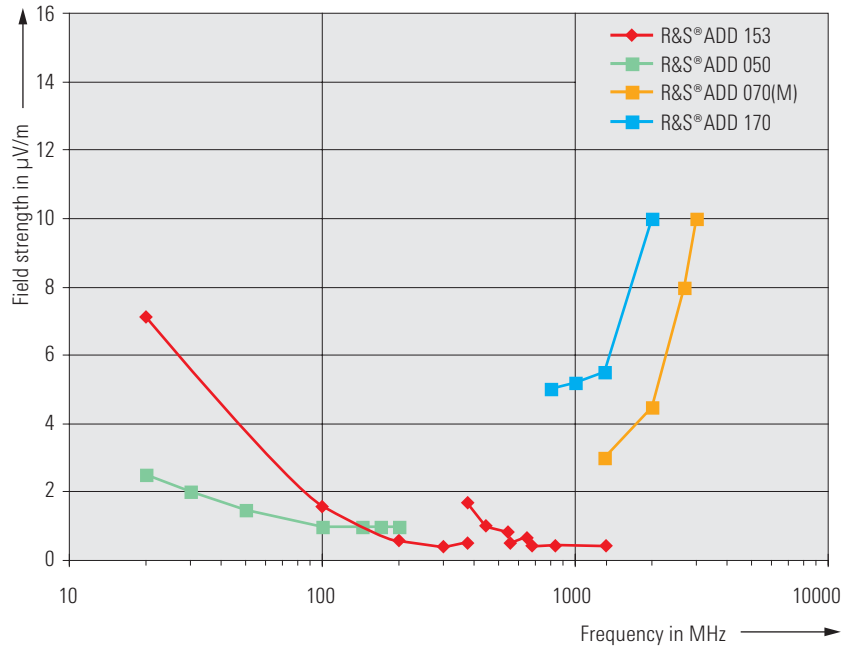


for mobile and stationary applications
 for stationary applications

0.3 1 3 10 30 100 200 650 1300 3000
Frequency in MHz



Typical sensitivity of DF antennas; 1 s averaging time, bearing fluctuation 2° RMS



R&S ADD170

Specifications – HF antennas

Type (Order No.)	R&S® ADD119 (4053.6509.02)	R&S® ADD010 (4045.0105.03)	R&S® ADD011 (4045.0005.13)	R&S® ADD012 (4051.1400.03)	R&S® ADD012 (4051.1400.13)
Colour	RAL 1015	RAL 6014	RAL 6014	RAL 6014	RAL 6014
Application	mobile, fast scanning for ground waves and sky waves with low elevation angle	semi-mobile and stationary, for signals with elevation angle $\leq 50^\circ$. SSL possible to a limited extent	stationary, for signals with elevation angle $\leq 85^\circ$, SSL possible	stationary, maximum scanning speed	semi-mobile and stationary, maximum scanning speed
Frequency range	(0.3) 1 MHz to 30 MHz, below 1 MHz with limited sensitivity and accuracy	active 9-element circular array of rod antennas	active 9-element circular array of crossed loops	U-Adcock, 1 x 8 elements of rod antennas, center antenna	U-Adcock, 2 x 8 elements of rod antennas, switchover at 12 MHz, center antenna
Antenna type	1 crossed loop and 1 active dipole				
DF method	Watson-Watt	correlation	vertical, horizontal, circular	Watson-Watt	
Polarization	vertical			vertical	
DF error ¹⁾	2° RMS	1° RMS		1° RMS: 1 MHz to 12 MHz (20 m dia), 12 MHz to 25 MHz (7 m dia) 2° RMS: 25 MHz to 30 MHz (7 m dia)	
Sensitivity	typ. 4 $\mu\text{V/m}$ to 2.5 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)	typ. 1 $\mu\text{V/m}$ to 0.2 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)		typ. 1 $\mu\text{V/m}$ to 0.2 $\mu\text{V/m}$ with operation in subranges 1 MHz to 12 MHz/12 MHz to 30 MHz (2° bearing fluctuation, 1 s averaging time)	typ. 1 $\mu\text{V/m}$ to 0.2 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)
Power supply	from DF equipment	from power supply built in as standard			
Dimensions (approx.)	1100 mm dia x 232 mm height	antenna circle: 50 m dia, height of rod antenna: 2 m	antenna circle: 50 m dia, height of crossed loop: 3.5 m incl. tripod	antenna circle: 7 m dia for 1 MHz to 30 MHz, 20 m dia for 1 MHz to 12 MHz, height of element: 2 m	antenna circle: 20 m dia and 7 m dia, height of element: 2 m
Weight (approx.)	25 kg	single element with base plate: 14 kg, network: 22 kg	single element incl. tripod: 32 kg, network: 22 kg		single element with base plate: 14 kg, network: 22 kg

Specifications – VHF/UHF antennas

Type (Order No.)	R&S® ADD153 (4063.0003.02)	R&S® ADD050 (4041.4006.02)	R&S® ADD053 (4062.8800.02)	R&S® ADD070 (4043.4003.02/12 ²⁾	R&S® ADD070M (4059.6000.02)	R&S® ADD170 (4055.7502.02/12 ³⁾)
Colour	RAL 1015					
Application	VHF/UHF, mobile and stationary	VHF, stationary, enhanced accuracy especially with multipath propagation	VHF/UHF, stationary, combination of R&S® ADD153 and R&S® ADD050	UHF, stationary, can be mounted below VHF/UHF antennas on same mast	mobile	mobile direction finding in GSM bands
Frequency range	20 MHz to 1300 MHz	20 MHz to 200 MHz	20 MHz to 1300 MHz	1300 MHz to 3000 MHz	1300 MHz to 3000 MHz	800 MHz to 2000 MHz
Antenna type	9 active antenna elements in radome	active 9-element circular array	2 x active 9-element circular array	8-element circular array	8-element circular array	8-element circular array with center antenna
DF method	correlation					
Polarization	vertical					
DF error ¹⁾	2° RMS (20 MHz to 200 MHz) 1° RMS (200 MHz to 1300 MHz)	1° RMS		2° RMS		
Sensitivity	typ. 8 $\mu\text{V/m}$ to 0.5 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)	typ. 2.5 $\mu\text{V/m}$ to 1 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)	for sensitivity, see R&S® ADD050 and R&S® ADD153	typ. 3 $\mu\text{V/m}$ to 10 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)	typ. 3 $\mu\text{V/m}$ to 10 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)	typ. 5 $\mu\text{V/m}$ to 10 $\mu\text{V/m}$ (2° bearing fluctuation, 1 s averaging time)
Wind load/center point of wind force						
Without ice deposit	at 188 km/h: 710 N/210 mm	at 188 km/h: 1700 N/380 mm	at 188 km/h: 2700 N/800 mm	at 180 km/h: 200 N/250 mm (model 1x) at 200 km/h: 530 N/620 mm (model 0x)	at 180 km/h: 199 N/170 mm	at 180 km/h: 350 N/180 mm
With 30 mm ice deposit	at 162 km/h: 770 N/270 mm	at 162 km/h: 2800 N/410 mm	at 162 km/h: 3700 N/690 mm	at 140 km/h: 210 N/260 mm (model 1x) at 176 km/h: 530 N/680 mm (model 0x)	at 140 km/h: 160 N/180 mm	at 140 km/h: 280 N/200 mm
Power supply	from DF equipment	from DF equipment, Power Supply R&S® IN 061 may be required for cables with a length >20 m (details upon request)	from DF equipment	from DF equipment		
Dimensions (approx.)	1100 mm dia x 297 mm height (height incl. lightning rod: 1327 mm)	antenna circle: 3 m dia, height: 800 mm, incl. lightning rod: 3 m	antenna circle: 340 mm dia x 1200 mm height (.02) 340 mm dia x 492 mm height (.12)	455 mm dia x 364 mm height	455 mm dia x 393 mm height	455 mm dia x 393 mm height
Weight (approx.)	30 kg	70 kg	114 kg	90 kg (.02), 11 kg (.12)	11 kg	11 kg

¹⁾ Measurement in reflection-free environment. The RMS error is calculated from the bearings of an evenly distributed azimuth and frequency sample.

²⁾ Model 12: lightweight model for mobile use.

³⁾ Model 02 for DDF0xM, model 12 for DDF0xA and DDF0xL.

General specifications

Mechanical design in line with production specifications	meets ISO 9000, AQAP 1, MIL-STD
Permissible wind speed in accordance with DIN 4131 Zone IV	
Stationary antennas on ground	
Without ice deposit	188 km/h
With 30 mm radial ice deposit	130 km/h
Stationary antennas on mast	
Without ice deposit	188 km/h; 200 km/h (survival)
With 30 mm radial ice deposit	162 km/h
Mobile antennas on vehicle	
Without ice deposit	180 km/h
With 30 mm radial ice deposit	140 km/h
Operating temperature range	-40 °C to +65 °C, meets MIL-STD-810E Meth. 502.3 and 501.3
Storage temperature range	-40 °C to +70 °C, meets MIL-STD-810E Meth. 502.3 and 501.3
Humidity	+25 °C/+55 °C, 95%, meets EN 60068-2-30
Type of protection against water permeation provided by housing	IPx5, meets EN 60529
Salt fog resistance	meets MIL-STD-810E Meth. 509.3
Resistance against direct lightning strokes in the mast/lightning rod ¹⁾	meets EN 61024-1-2 class of protection IV (I = 100 kA, di/dt = 100 kA/μs)
Vibration	
Sinusoidal (for stationary antennas in transport mode)	5 Hz to 55 Hz, 0.15 mm amplitude constant (total level: 1.8 g) 55 Hz to 150 Hz, 0.5 g constant, meets EN 60068-2-6, EN 61010-1, VG 95332-24-A2
Random (for stationary antennas in transport mode)	10 Hz to 300 Hz, 0.01 g ² /Hz 300 Hz to 500 Hz, 0.003 g ² /Hz (ca. 1.9 g rms), meets EN 60068-2-64
Random (for mobile antennas on commercial vehicles <7.5 t)	10 Hz to 500 Hz, 0.081 g ² /Hz to 0.00001 g ² /Hz (ca. 2.0 g rms), adapted to MIL-STD-810E Meth. 514.4 (measured data)
Shock	up to 2000 Hz, 6 dB/octave, crossover frequency 45 Hz, max. 40 g, meets MIL-STD-810E Meth. 516.4, Procedure I

¹⁾ Adequate grounding provided.

Accessories

Designation	Type	Order No.
Cable Sets	R&S DDF® 1xZ, R&S DDF® 5xZ, R&S DDF® 7xZ	various lengths
The use of the additional Power Supply R&S® IN 061 may be necessary with some antenna configurations and also if specific antenna cable lengths have been exceeded. Details upon request.		
Electronic Compass	R&S® GH 150	details upon request
Mast Adapter	R&S® ADD 150A	details upon request
Tripod with Adapter	R&S® ADD 1xTP	details upon request
Vehicle Adapter	R&S® AP 502Z1	details upon request



More information at
www.rohde-schwarz.com
(search term: ADDx)



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