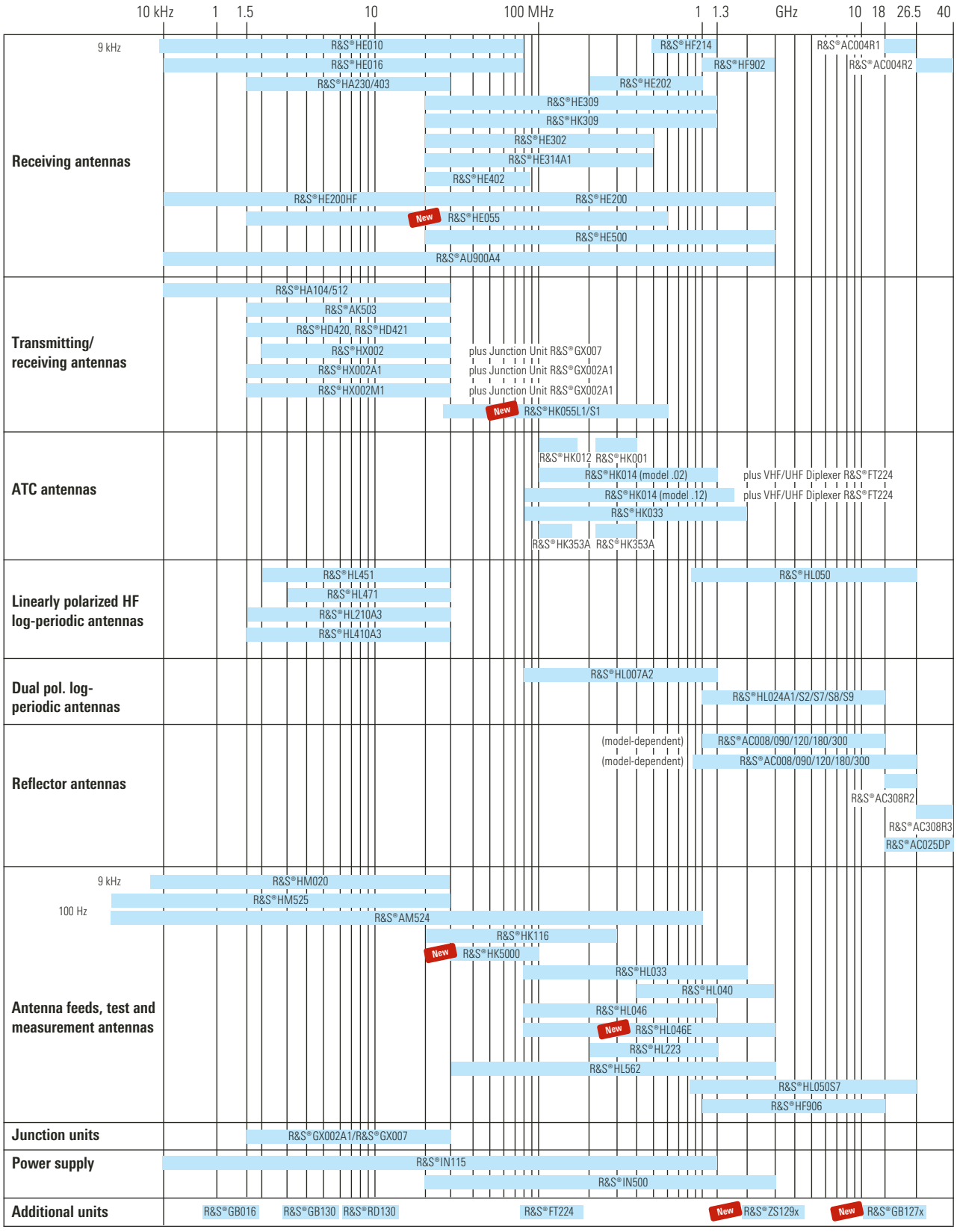
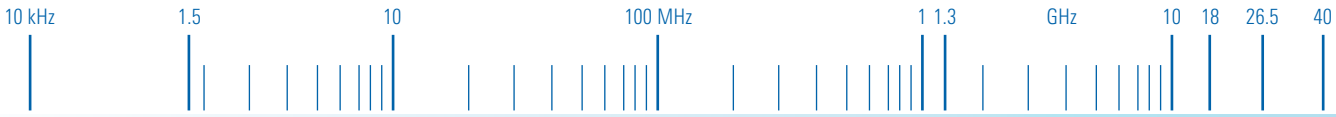
Antenna selection guide





HF Antennas

1

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Triple-Loop Antenna R&S®HM 020

9 kHz to 30 MHz

Fully automatic measurement of magnetic field strength

Chapter Overview

Type Index

Main Menu

Features

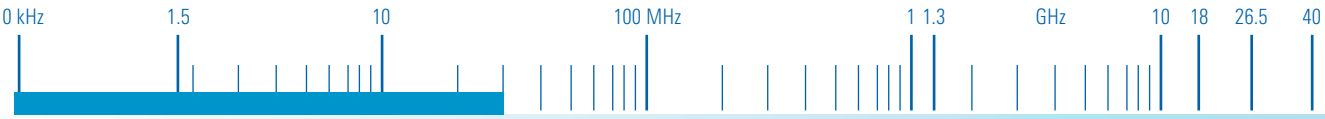
- Measurement method in line with CISPR/A (Secretariat) 103, 104, 105 and CISPR/F (Central Office) 66, 67
- More sensitive, faster and cheaper than previous methods in line with CISPR Publication 16
- Loop system mobile and foldable into one plane
- Wooden pedestal for 100 kg load available (permitting antenna loops to be freely moved)
- Calibration certificate supplied with antenna

Brief description

The R&S®HM 020 allows fully automatic measurements of the magnetic field strength in the X, Y and Z planes of a centrally placed EUT.

The antenna operates according to the van Veen/Bergervoet principle.

Measurements are fully automatic and controlled by a test receiver or controller.



Specifications

Frequency range	9 kHz to 30 MHz
Loop planes	switchable between X, Y and Z plane
Input impedance	50 Ω
Antenna factor of current probe	0 dB, referred to 1 S (in line with CISPR/A (Secretariat) 103, 104, 105)
RF connector	N female
Control connector	9-contact, D-Sub, female
Ground connector	terminal strip for copper foil
MTBF	>1 000 000 h
Operating temperature range	–10 °C to +55 °C

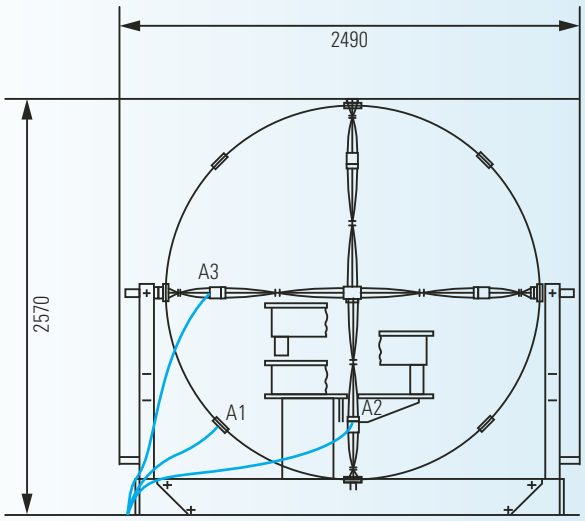
Dimensions (W × H × D)	
Loops set up	approx. 2.49 m × 2.57 m[1] × 2.07 m
Loops in transport crate	approx. 2.68 m × 2.32 m × 0.57 m
Basic pedestal (load capacity 100 kg)	approx. 0.9 m × 1.0 m × 0.9 m
Adapter pedestal (load capacity 100 kg)	approx. 0.9 m × 0.5 m (max.) × 0.9 m
Weight	
Loop system	approx. 45 kg
Basic pedestal	approx. 40 kg
Adapter pedestal	approx. 30 kg

[1] Height reduced to 2.09 m for operation in low-ceiling rooms.

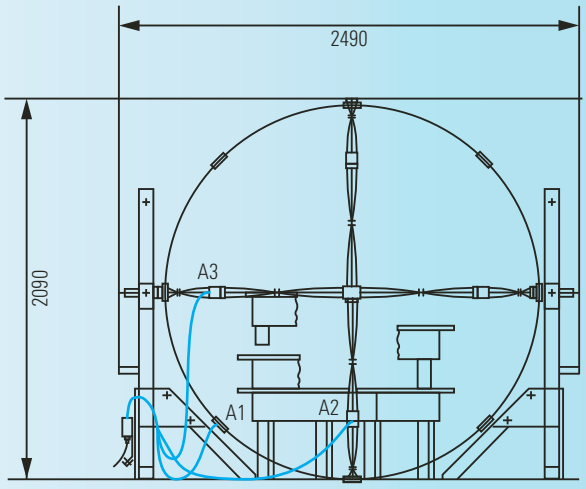
Ordering information

Triple-Loop Antenna	R&S®HM 020	4023.4508.02

Recommended extras		
Basic Pedestal	R&S®HM 020Z1	4023.5504.02
Adapter Pedestal	R&S®HM 020Z2	4023.5604.02
Calibration Dipole	R&S®HM 020Z3	4023.5704.02
Control Unit (only required for receivers without user port)	R&S®BG 020	4024.1002.02



Dimensions adjusted to upper measurement height



Dimensions adjusted to lower measurement height

Active H-Field Measurement Antenna R&S®HM 525

100 Hz to 30 MHz

Measurement of alternating magnetic fields with extremely high sensitivity

Chapter Overview

Type Index

Main Menu

Features

- Extremely high sensitivity
- Wide dynamic range
- Wide frequency range
- Compact design
- Selftest possible
- Remote-control capability (optional)
- Calibration certificate supplied with antenna

Brief description

The Measurement Antenna R&S®HM 525 is a loop antenna. The voltage at its output is proportional to the amplitude of the alternating magnetic field that is present.

Overview measurements are performed in the broadband mode, which covers the entire frequency range from 100 Hz to 30 MHz. To obtain maximum sensitivity, the antenna can be locally or remotely switched to the subrange mode. In this case the frequency range is divided into five subranges with different amplifier concepts in the active antenna part.

For a function check, the antenna can be operated in the test mode. The antenna is individually calibrated by comparison and comes with a calibration certificate.

Specifications

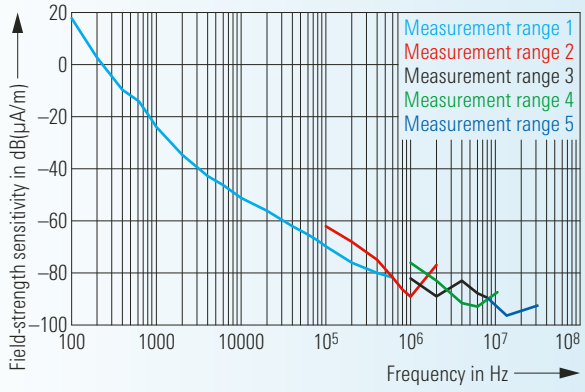
Frequency range	
Broadband mode	100 Hz to 30 MHz
Subrange mode	
Range 1	100 kHz to 600 kHz
Range 2	600 kHz to 1.2 MHz
Range 3	1.2 MHz to 2.6 MHz
Range 4	2.6 MHz to 8 MHz
Range 5	8 MHz to 30 MHz
Input impedance	50 Ω
Field-strength sensitivity	see diagram
Calibration	by comparison (as standard)

Power supply	18 V ±0.5 V DC (max. 0.7 A)
RF connector	N female
Test signal connector	N female
MTBF	>300 000 h
Operating	
temperature range	–10 °C to +55 °C
Dimensions (H × W × D)	approx. 730 mm × 640 mm × 400 mm
	(without support)
Weight	approx. 10 kg
Class of application	laboratory

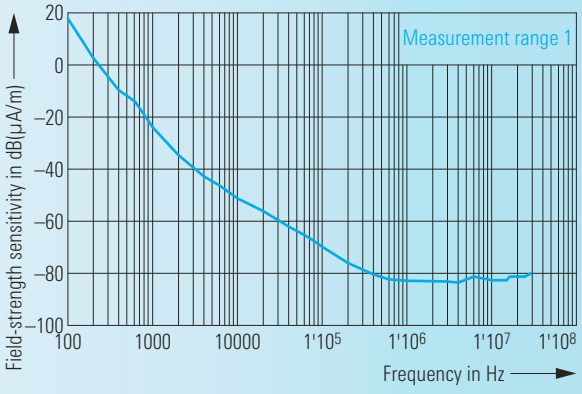
Ordering information

Active H-Field		
Measurement Antenna	R&S®HM 525	4031.0508.02

Recommended extras		
Pedestal	R&S®HM 525Z1	4036.1402.02
Control Unit	R&S®GS 525	4035.5004.02
Set of Fiber-Optic Cables	R&S®GS 525K1	4035.5604.02
Junction Unit	R&S®GX 525	4015.9256.02
Cabinet for Junction Unit	R&S®KK 524	4015.9004.02
Integration	R&S®AM 524-K	4015.7024.02



Field-strength sensitivity; bandwidth 1 Hz; S/N ratio 0 dB (measurement ranges 1 to 5 active)



Field-strength sensitivity in broadband mode

HF Antennas

Active Rod Antenna
R&S®HE 010

9 kHz to 80 MHz

Excellent receiving characteristics

Chapter Overview

Type Index

Main Menu

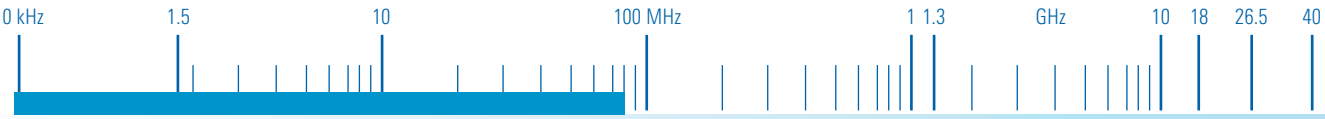
Features

- Wide frequency range
- Optimized for maximum dynamic range
- High sensitivity and excellent large-signal characteristic
- High immunity to lightning strokes in the vicinity
- Short length (1 m)

Brief description

The R&S®HE 010 with its low inherent noise can be used as a broadband test antenna.

The excellent characteristics of the active receiving antenna are the result of careful matching of the passive antenna structure to the active circuit. Active antennas are smaller than comparable passive structures and minimally coupled to their environment.



Specifications

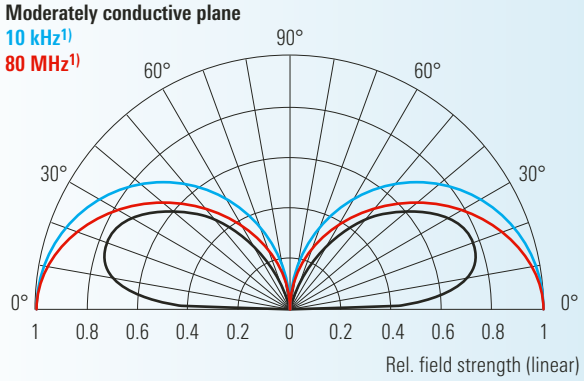
Frequency range	9 kHz to 80 MHz
Polarization	vertical
Input impedance	50 Ω
VSWR	
10 kHz to 50 kHz	<3
50 kHz to 80 MHz	<2
Antenna factor	
(antenna mounted on	
conductive plane)	typ. 17 dB
IP2	≥50 dBm (typ. 60 dBm)
IP3	≥30 dBm
Crossmodulation limit	12 V/m (up to 30 MHz)
	6 V/m (30 MHz to 80 MHz)

Power supply	21 V to 26 V DC (max. 170 mA)
Connector	N female
MTBF	>250 000 h
Operating	
temperature range	–40 °C to +65 °C
Protection class	IP 55 (in line with DIN EN 40050)
Max. wind speed	188 km/h (without ice deposit)
Dimensions	
Length × diameter (max)	approx. 1 m × 120 mm
Weight	approx. 0.9 kg

Ordering information

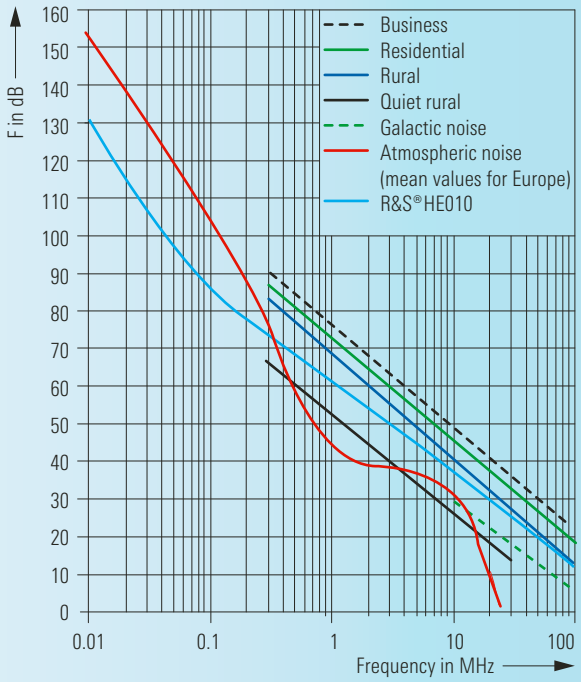
Active Rod Antenna	R&S®HE010	0523.1414.13

Recommended extras		
Power Supply Unit	R&S®IN 115	4004.1707.02



1) Valid for R&S®HE010 on perfectly conducting and infinetely large plane (practical dimensions >10 × λ).

Typical directional radiation pattern



Typical inherent noise compared with different standard noise environments

HF Antennas

Active Antenna System R&S®HE 016

10 kHz to 80 MHz (vertical)

600 kHz to 40 MHz (horizontal)

Omnidirectional reception of vertically and horizontally polarized signals

Chapter Overview

Type Index

Main Menu

Features

- Omnidirectional reception of horizontally and vertically polarized signals
- High linearity
- High immunity to lightning strokes in the vicinity
- Extremely small dimensions
- High sensitivity – comparable to that of passive antennas that are three times larger

Brief description

The Active Antenna System R&S®HE 016 is a combination of the Active Rod Antenna R&S®HE 010 and two crossed HF dipole antennas. The two horizontal dipole antennas are combined via a 90° coupler to produce an omnidirectional radiation pattern.

The high sensitivity of the antenna system is comparable to that of passive systems although the R&S®HE 016 requires less than one third of the antenna surface of a passive system.

Specifications

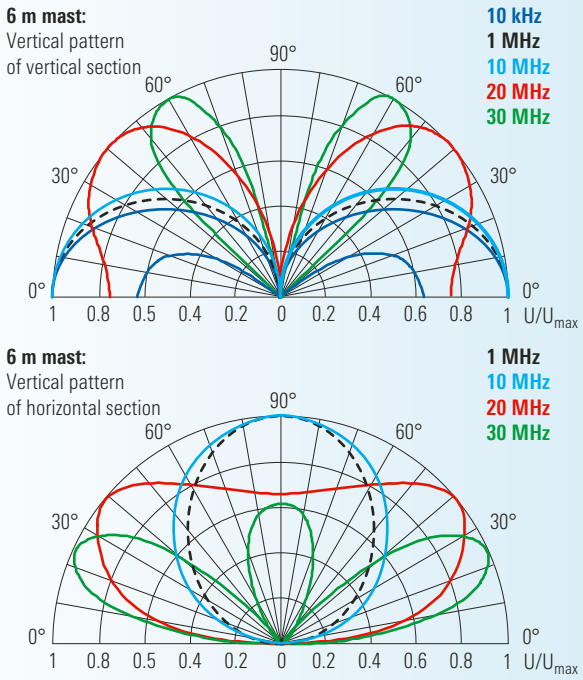
Frequency range	
Vertical polarization	10 kHz to 80 MHz
Horizontal polarization	600 kHz to 40 MHz
Input impedance	50 Ω
VSWR	
10 kHz to 20 kHz	<3
20 kHz to 80 MHz	<2
IP2	≥50 dBm (up to 30 MHz)
IP3	≥30 dBm (up to 30 MHz)
Power supply	21 V to 26 V DC (max. 500 mA)

Power consumption	
Vertical	approx. 160 mA at 24 V DC
Horizontal	approx. 340 mA at 24 V DC
Connector	2 × N female
MTBF	>25 000 h
Operating temperature range	–40 °C to +65 °C
Max. wind speed	188 km/h (without ice deposit)
Dimensions	
Height	approx. 1.4 m
Diameter	approx. 2.85 m
Weight	approx. 4.5 kg

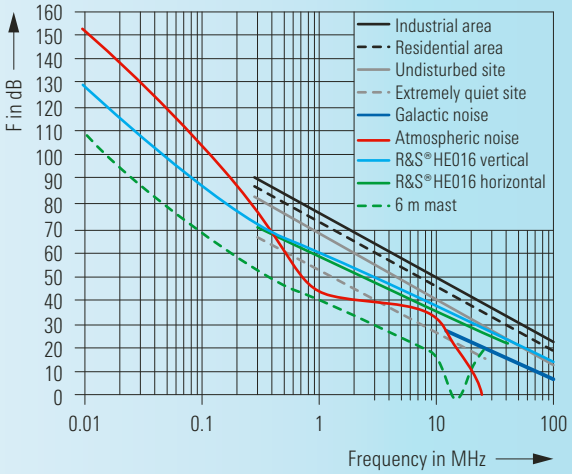
Ordering information

Active Antenna System	R&S®HE016	4051.8504.02

Recommended extras		
Power Supply Unit	R&S®IN115	4004.1707.02
Mast, 6 m, can be disassembled	R&S®KM011	0273.9116.02



Typical directional radiation pattern



Typical inherent noise compared with different standard noise environments

HF Whip Antenna
R&S®HA 104/512

10 kHz to 30 MHz (reception)

1.5 MHz to 30 MHz (transmission)

For ground waves and vertically polarized low-angle sky waves

Chapter Overview

Type Index

Main Menu

Features

- Sturdy construction
- Shock- and vibration-proof
- Optimal for mobile use
- Suitable ATU available

Brief description

The HF Whip Antenna R&S®HA 104/512 is suitable for ground waves and vertically polarized low-angle sky waves.

In conjunction with the Antenna Tuning Unit R&S®FK 2100, it can also be used for transmission.

The sturdy, shock- and vibration-proof construction makes the R&S®HA 104/512 ideal for mobile use.

For use on vehicles, the R&S®HA 104/512 can be tied down when the vehicle is in motion.

Specifications

Frequency range	
Reception	10 kHz to 30 MHz
Transmission (with ATU)	1.5 MHz to 30 MHz
Polarization	linear/vertical
Max. input power	150 W CW/150 W PEP
Horizontal radiation pattern	omnidirectional
Connector	clamp
MTBF	>150 000 h
MTTR	<20 min

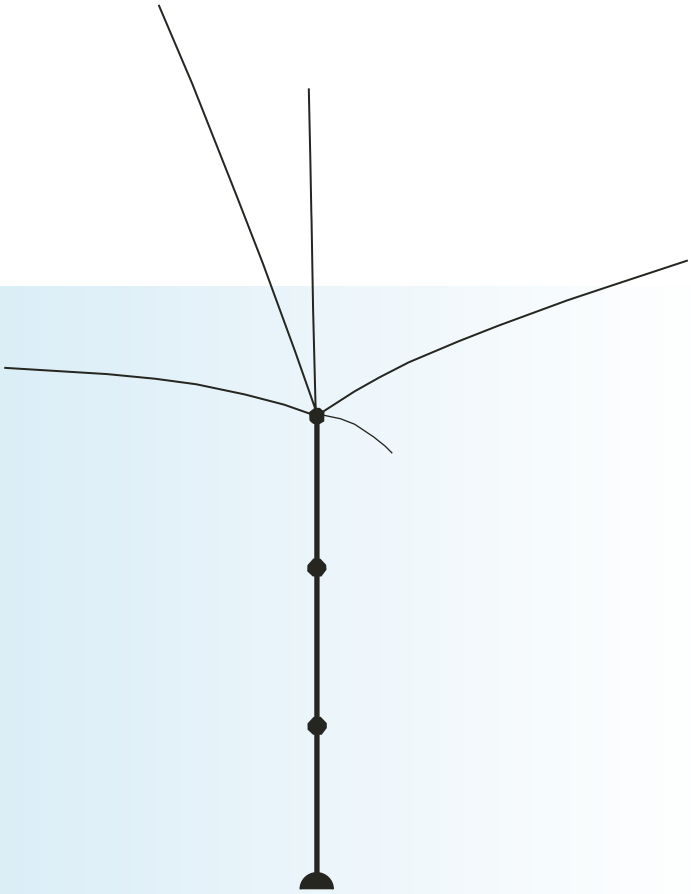
Operating temperature range	–30°C to +55°C
Max. wind speed	150 km/h (without ice deposit)
Height of antenna	approx. 5 m
Disassembly possible	yes
Weight	approx. 4 kg

Ordering information

HF Whip Antenna	R&S®HA 104/512	0156.2039.02

Recommended extras		
Antenna Tuning Unit	R&S®FK 2100	6046.8948.02

HF Receiving Antenna R&S®HA 230/403



1.5 MHz to 30 MHz

Also for polarization-diversity reception

Chapter Overview

Type Index

Main Menu

Features

- Radiators for horizontal reception
- Radiator for vertical reception
- Individual radiators decoupled from each other
- Suitable for polarization-diversity reception

Brief description

The HF Receiving Antenna R&S®HA 230/403 is a versatile shortwave antenna for both horizontally and vertically polarized waves.

The antenna consists of a mast head with a vertical monopole and two horizontal dipoles mounted at a 90° angle. The antenna is installed on a 6 m high mast.

Made up of electrically isolated and decoupled radiators, the antenna is particularly suitable for polarization-diversity reception.

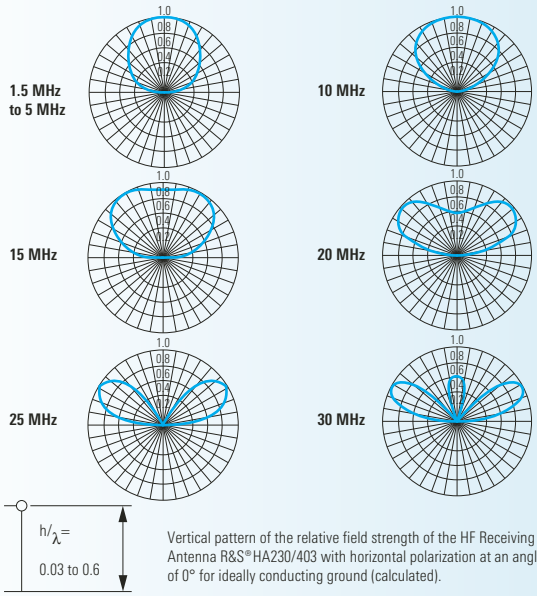
Specifications

Frequency range	1.5 MHz to 30 MHz
Polarization	horizontal and vertical
Input impedance	50 Ω
Connectors	3 × N female
MTBF	>100 000 h

Operating temperature range	–30 °C to +50 °C
Dimensions	
Length of radiators	approx. 5 m
Height	approx. 11 m
Weight (incl. mast)	approx. 85 kg
Max. wind speed	
Without ice deposit	160 km/h
With 30 mm radial ice deposit	135 km/h

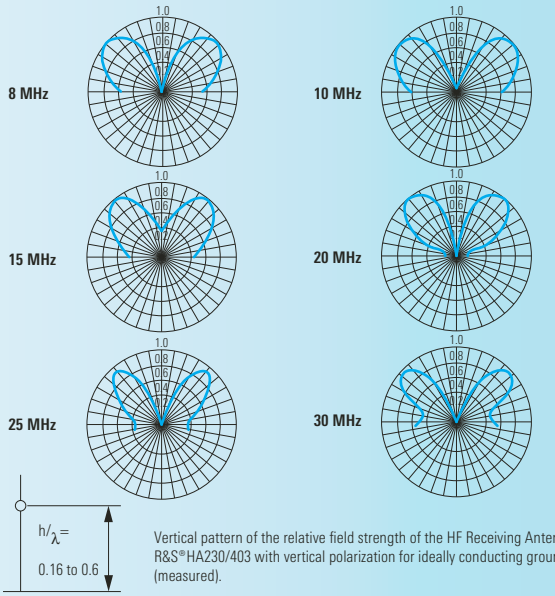
Ordering information

HF Receiving Antenna		
(stationary)	R&S®HA 230/403	0101.1176.02
Consisting of:		
Antenna Head	R&S®HA 230Z	0138.6313.00
Mast, 6 m	R&S®HA 230M	0138.6342.00



Vertical pattern of the relative field strength of the HF Receiving Antenna R&S®HA230/403 with horizontal polarization at an angle of 0° for ideally conducting ground (calculated).

Typical vertical radiation patterns for horizontal polarization



Vertical pattern of the relative field strength of the HF Receiving Antenna R&S®HA230/403 with vertical polarization for ideally conducting ground (measured).

Typical vertical radiation patterns for vertical polarization

Mobile HF Antenna
R&S®AK503

1.5 MHz to 30 MHz

Highly reliable HF antenna for mobile use

Features

- Coverage of all distance ranges
- No skip zone
- Omnidirectional coverage with high-angle radiation (NVIS)
- Omnidirectional coverage up to 1000 km due to null fill-in
- Installation time approx. 10 min

Brief description

The HF Antenna R&S®AK503 has been designed especially for mobile use. Short erection and disassembly times and low space requirements for installation and transportation have been combined with good electrical characteristics. Through optimized design with a focus on propagation conditions in the medium-wave and shortwave range, the antenna provides high reliability in radiocommunication.

The automatic Antenna Tuning Unit R&S®FK2100 ensures optimum antenna tuning in the entire operating frequency range.

Switchover between the three operating modes (optimized for specific frequency and distance ranges) is performed manually at the antenna head.

Chapter Overview

Type Index

Main Menu

Specifications

Frequency range	1.5 MHz to 30 MHz
Max. input power	150 W CW and PEP
Operation	
Mode 1	1.5 MHz to 30 MHz
Mode 2	6 MHz to 26 MHz (optimized)
Mode 3	for ground-wave communication and distances >2000 km
Connector	clamp
MTBF	>100 000 h
MTTR	<1 h

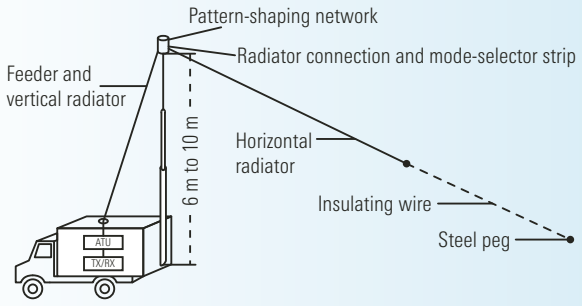
Operating temperature range	–40 °C to +55 °C
Max. wind speed	120 km/h (without ice deposit)
Length including guy rope	approx. 35 m
Height	approx. 7 m to 11 m[1]
Weight	approx. 6 kg

[1] Maximum configuration.

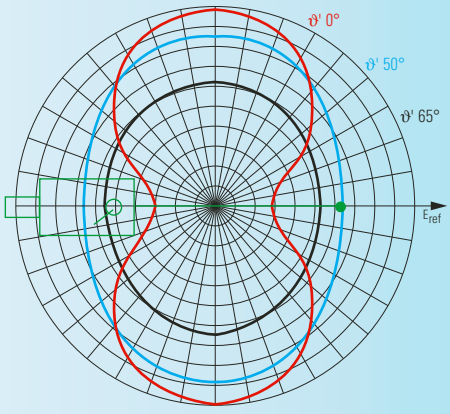
Ordering information

Mobile HF Antenna	R&S®AK 503	0448.3226.02

Recommended extras		
Antenna Tuning Unit	R&S®FK 2100	6046.8948.02
Mast, 6 m, can be disassembled	R&S®KM 011	0273.9116.02
Mast Adapter for R&S®AK 503 on R&S®KM 011	R&S®KM 011Z3	4021.7700.02



System overview with description of individual components



Azimuth patterns for various elevation angles ϑ' with high-angle radiation

HF Antennas

Mobile TFD Broadband Antennas R&S®HD 420/421

1.5 MHz to 30 MHz

Sky wave transmission over short, medium and global distances

Chapter Overview

Type Index

Main Menu

Features

- Coverage of any distance
- Omnidirectional coverage through high-angle radiation (NVIS)
- Broadband operation
- No tuning unit required
- Quick assembly/disassembly (approx. 30 min)
- Suitable for stationary use
- Extremely favorable price

Brief description

The Mobile TFD (terminated folded dipole) Broadband Antennas R&S®HD 420 and R&S®HD 421 operate as loop antennas on which travelling waves are generated by means of a termination. A tuning unit is not required to attain the specified VSWR.

Signals are fed in via a transformer at the highest point in the middle of the antenna. Corresponding to its geometry, the TFD antennas radiate horizontally polarized waves and are thus suitable for the transmission of sky waves over any distance.

Since the antennas are configured as an inverted V, only one antenna support is needed. Where space is limited, the length of the antenna can be considerably reduced through the use of two lateral 4 m masts.

Specifications

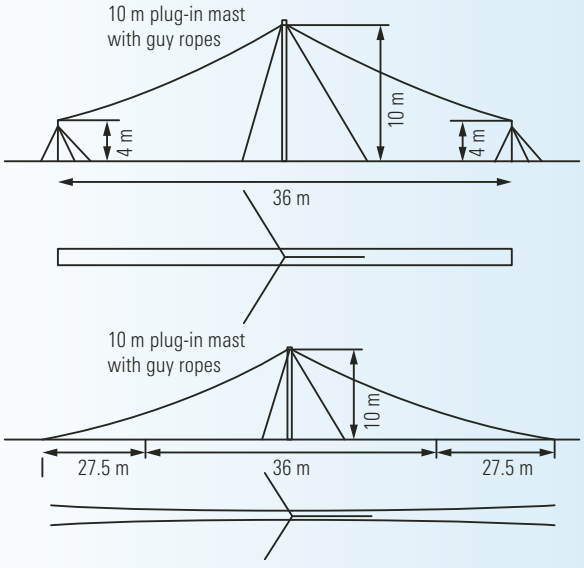
Frequency range	1.5 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	≤3
Max. input power	
R&S®HD 420	400 W
R&S®HD 421	1000 W
Connector	N female
MTBF	>100 000 h
Operating temperature range	–40 °C to +55 °C

Mechanical interface	for R&S®KM 420A1 and 10 m tower from Geroh
Max. wind speed	180 km/h (without ice deposit), with R&S®KM 420A1 and 2 × R&S®KM 420A2
Dimensions	
Length	approx. 30 m (with 2 × R&S®KM 420A2)
	approx. 90 m
Recommended height of feed point	approx. 10 m
Weight	
R&S®HD 420	approx. 13 kg
R&S®HD 421	approx. 17 kg

Ordering information

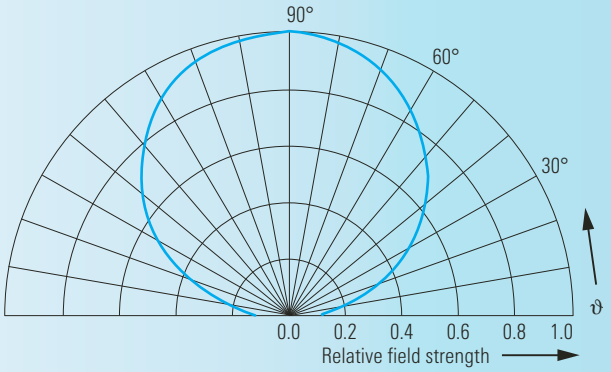
Mobile TFD Broadband Antenna		
	R&S®HD 420	4053.2503.02
	R&S®HD 421	4053.3500.02

Recommended extras		
Tiltable Mast, 10 m	R&S®KM 420A1	4054.1000.02
Tiltable Mast, 4 m (two pieces required)	R&S®KM 420A2	4054.1400.02

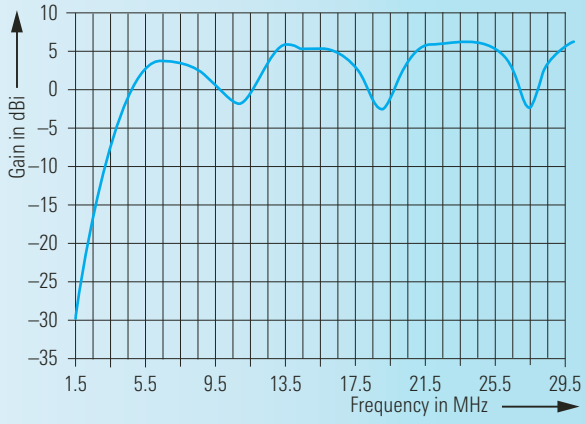


Installation options with guy ropes (bottom) and auxiliary masts for reducing the antenna length (top) (dimensions not to scale)

Typical elevation diagram for horizontal polarization

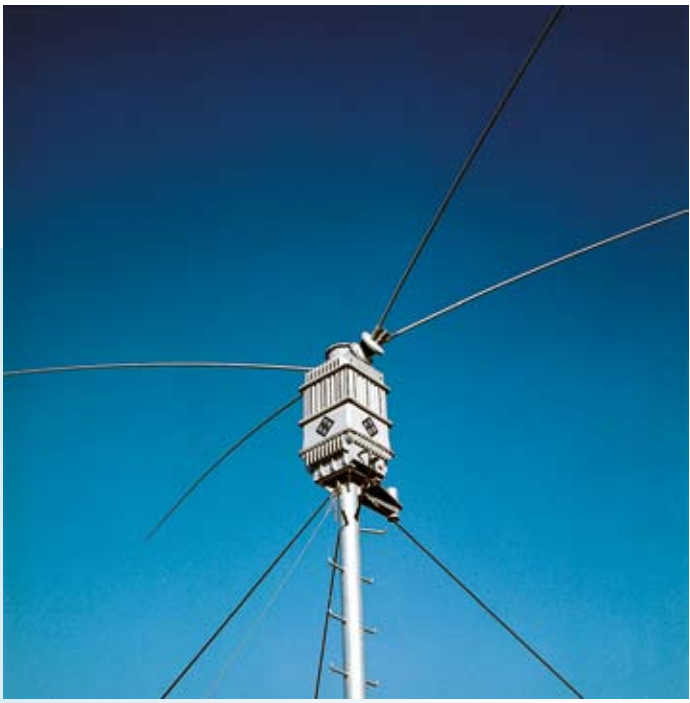


Coated wires, mast 10 m, ideal conductive ground



Typical gain

1 kW HF Dipole R&S®HX 002



2 MHz to 30 MHz

HF dipole with integrated antenna tuning unit for all distance ranges

Chapter Overview

Type Index

Main Menu

Features

- Omnidirectional coverage with high-angle radiation (NVIS)
- No skip zone
- Automatic adaptive operation
- Silent tuning possible
- Can be set up close to neighboring antennas

Brief description

The HF Dipole R&S®HX 002 ensures optimum coverage of all distance ranges and can be used for transmission and reception. The antenna can be directly connected to the HF Transceivers R&S®XK 2500 and R&S®XK 2900 (power supply and control signals via control cable of transceiver). For operation with other transmitters, the Junction Unit R&S®GX 007 is available to provide power supply and antenna control.

Taking into account the ambient conditions, the fully automatic ATU integrated in the antenna ensures optimum matching to the transceiver. This allows antennas to be set up close to neighboring antenna systems and on difficult terrain (e.g. built-on roofs). With the aid of an optional module, the lower frequency limit of 2 MHz can be reduced to 1.6 MHz.

Specifications

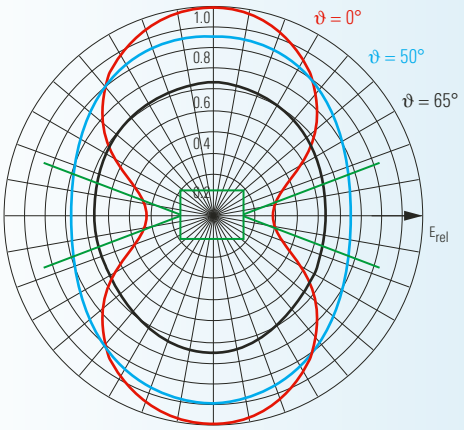
Frequency range	2 MHz to 30 MHz
With frequency extension	1.6 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	<1.5 (typ. <1.1)
Max. input power	1.15 kW CW/1.15 kW PEP
Tuning time	
Without retuning	70 ms to 500 ms
With retuning	typ. 2 s
Initial tuning	typ. <15 s
Silent tuning	<60 ms/typ. 56 ms
Tuning power	50 W to 300 W
Efficiency	
At 2 MHz	>20 %
From 5 MHz to 30 MHz	>75 %
Gain	–3.3 dBi to 7.8 dBi (typ.)

Power supply	21 V to 32 V DC (max. 6 A)
Average	28 V DC (2.5 A)
Power consumption	max. 165 VA
RF connector	N female
Control connector	26-contact, round, male
MTBF	>6500 h
MTTR	<0.9 h
Operating temperature range	–30 °C to +55 °C
Max. wind speed	
Without ice deposit	150 km/h
With 30 mm radial ice deposit	130 km/h
Dimensions	
Length × width (dipole)	approx. 10.3 m × 3.6 m
Height of ATU	approx. 1.10 m
Weight	approx. 103 kg

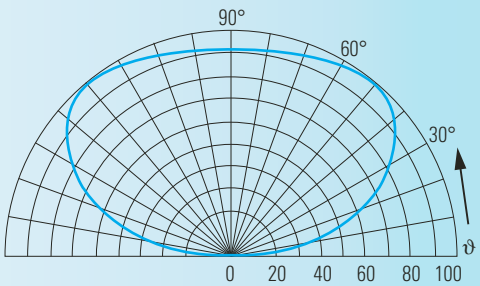
Ordering information

1 kW HF Dipole		
(with ATU)	R&S®HX002	0682.3010.24
Recommended extras		
Junction Unit	R&S®GX007	0682.6010.02
Frequency Extension, 1.6 MHz to 2 MHz	R&S®HX002F	4017.9053.02
Control Cable between R&S®GX007 and R&S®HX002/R&S®FK859	R&S®FK859K1	
Length 40 m		0669.8112.40
Length 60 m		0669.8112.60
Length 80 m		0669.8112.80

Tiltable Mast, 5 m, for roof mounting	R&S®HX002Z1	0506.4425.02
Auxiliary Mast for R&S®HX002Z1	R&S®HX002ZZ	0682.6961.02
Lattice Mast, 10 m	R&S®KM451B1	4028.3351.02
Lattice Mast, 15 m	R&S®KM451B2	4028.3400.02
Mast Adapter for 10 m or 15 m mast	R&S®KM451Z4	4032.2904.02



Typical horizontal radiation pattern for various elevation angles ϑ



Typical vertical radiation pattern (12 m above an ideal conductive plane)

150 W HF Dipole
R&S®HX002A1

1.5 MHz to 30 MHz
HF dipole with integrated antenna tuning unit for all distance ranges

Chapter Overview
Type Index
Main Menu

Features

- Omnidirectional coverage with high-angle radiation (NVIS)
- No skip zone
- Automatic adaptive operation
- Silent tuning
- No control line required
- Can be set up close to neighboring antennas

Brief description

The HF Dipole R&S®HX002A1 is highly suitable for setting up radio links over any distance range. The antenna design ensures high transmission reliability over short and medium distances. The antenna can easily be integrated in existing systems since no control lines are required. All control signals and the power for the ATU are fed via the coaxial cable. The HF Dipole R&S®HX002A1 can be directly connected to the HF Transceiver R&S®XK2100. For operation with other transmitters, the Junction Unit R&S®GX002A1 is available to provide power supply and antenna control.
The automatic adaptive behaviour of the integrated antenna tuning unit allows antennas to be set up close to neighboring antenna systems and on difficult terrain (e.g. built-on roofs).

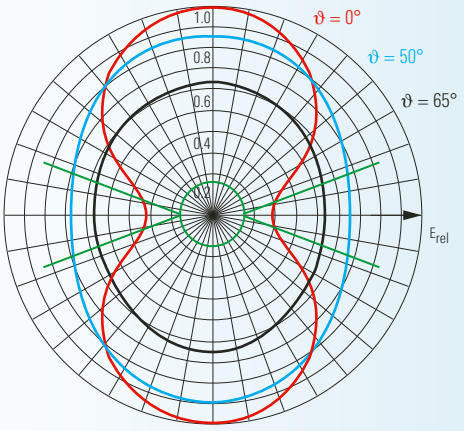
Specifications

Frequency range	1.5 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	<1.5 (typ. <1.3)
Max. input power	100 W CW/150 W PEP
Tuning time	
Without retuning	typ. 200 ms
Initial tuning	≤6 s (typ. 3 s)
Silent tuning	<30 ms
Tuning power	
With transmitters from	
Rohde&Schwarz	30 W to 100 W
With R&S®GX002A1	50 W to 100 W
Without R&S®GX002A1	30 W to 50 W
Efficiency	approx. 25% to 98%
Gain (6 m above perfectly conducting ground)	–12 dBi to 8 dBi (typ.)

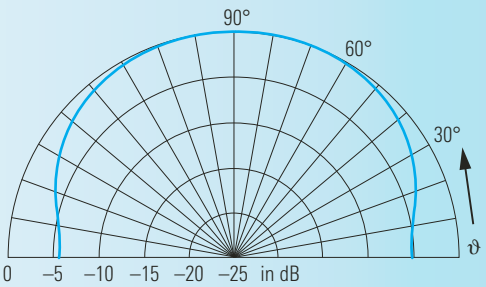
Power supply (via R&S®GX002A1)	
AC supply	100/120/230 V AC ±10%, 47 Hz to 63 Hz (100 VA)
Battery	22 V to 32 V DC (typ. 2.5 A at 24 V DC)
Connector	N female
MTBF	>8000 h
Operating temperature range	–25 °C to +55 °C
Max. wind speed	
Without ice deposit	188 km/h
With 30 mm radial ice deposit	130 km/h
Dimensions	
Length × width (dipole)	approx. 10.7 m × 4.4 m
Height of ATU	approx. 0.42 m
Weight	approx. 37.5 kg

Ordering information

150 W HF Dipole	R&S®HX002A1	4031.8009.02
Recommended extras		
Junction Unit	R&S®GX002A1	4031.9005.02
Cable Set for R&S®XK852 and R&S®GX002A1	R&S®GX002K1	4031.8909.03
Tiltable Mast, 5 m, for roof mounting	R&S®KM002A1	4035.7359.02
Lattice Mast, 10 m	R&S®KM451B1	4028.3351.02
Lattice Mast, 15 m	R&S®KM451B2	4028.3400.02
Mast Adapter for 10 m or 15 m mast	R&S®KM451Z4	4032.2904.02
Mast Adapter on R&S®KM451Z4	R&S®KM451Z5	4039.8308.02



Typical horizontal radiation pattern for various elevation angles ϑ



Typical vertical radiation pattern (relative field strength) on a 5 m mast above a large roof area

HF Antennas

150 W HF Dipole
R&S®HX002M1

1.5 MHz to 30 MHz
With integrated antenna tuning unit for all distance ranges – optimized for use on ships

Chapter Overview
Type Index
Main Menu

Features

- Omnidirectional coverage through high-angle radiation (NVIS)
- No skip zone
- Automatic adaptive operation
- Silent tuning
- No control line required
- Can be set up close to neighboring antennas
- Optimized for use on ships

Brief description

The HF Dipole R&S®HX002M1 provides good coverage over all distances. It is optimized for omnidirectional coverage and ensures high transmission reliability over short and medium distances. The antenna can easily be integrated into existing systems since no separate control lines are required. All control signals and the power for the ATU are fed via the coaxial cable. The HF Dipole R&S®HX002M1 can be directly connected to the HF Transceiver R&S®XK2100. For operation with other transmitters, the Junction Unit R&S®GX002A1 is available to provide power supply and antenna control.

The antenna with its small size and improved environmental data is particularly suitable for use on ships.

Specifications

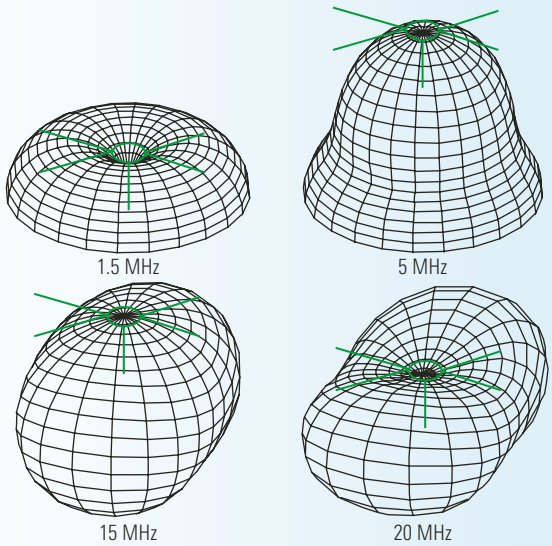
Frequency range	1.5 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	<1.5 (typ. <1.3)
Max. input power	100 W CW/150 W PEP
Tuning time	
Without retuning	typ. 200 ms
Initial tuning	≤6 s (typ. 3 s)
Silent tuning	<30 ms
Tuning power	
With R&S®GX002A1	50 W to 100 W
Without R&S®GX002A1	30 W to 50 W
Efficiency	
At 1.5 MHz to 7 MHz	approx. 70 % to 13 %
At 7 MHz to 30 MHz	approx. 13 % to 99 %

Power supply	21 V to 31 V DC (typ. 1 A)
Connector	N female
MTBF	>12000 h
Operating temperature range	–30 °C to +55 °C
Max. wind speed	
Without ice deposit	200 km/h
With 20 mm radial ice deposit	120 km/h
Length of dipole	approx. 5.2 m
Weight	approx. 34 kg
Protection class	IP 56

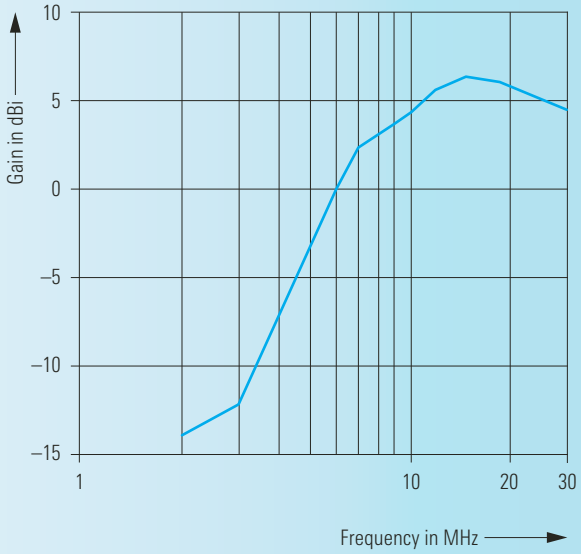
Ordering information

150 W HF Dipole	R&S®HX002M1	4021.6003.02

Recommended extras		
Junction Unit	R&S®GX002A1	4031.9005.02



Typical three-dimensional radiation patterns



Typical gain on a 6 m mast above perfectly conducting ground

Log-Periodic HF Antenna R&S®HL 451

2 MHz to 30 MHz

Transmission and reception of horizontally polarized waves over medium and long distances

Chapter Overview

Type Index

Main Menu

Features

- Reception from 2 MHz
- Transmission from 5 MHz
- Unshortened halfwave elements for high gain despite extremely small dimensions
- Easy and quick assembly
- Little maintenance required
- Suitable for roof mounting

Brief description

The compact, rotatable HF Antenna R&S®HL 451 can be used for transmission and reception of horizontally polarized waves.

Due to a transmission frequency range from 5 MHz to 30 MHz, the antenna is particularly suitable for communication over medium and long distances. Reception is possible from 2 MHz and thus covers all distances.

The antenna has been optimized for small size. Despite the low limit of its frequency range, the R&S®HL 451 is no larger than any comparable antenna covering a range from only 6.2 MHz to 30 MHz.

Specifications

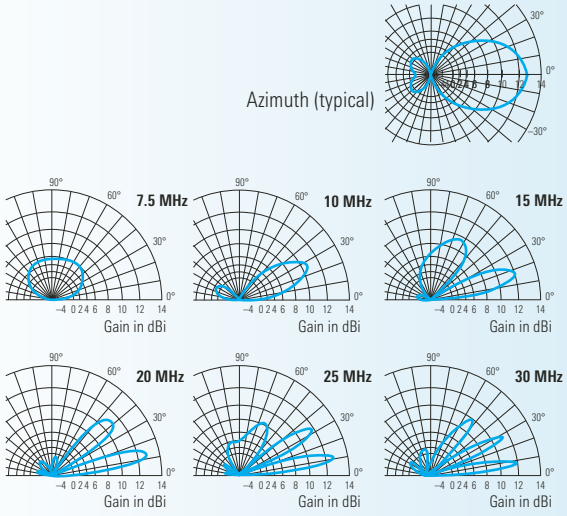
Frequency range	
Reception	2 MHz to 30 MHz
Transmission	5 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	≤2
Max. input power	1 kW CW/2 kW PEP
Gain (on 15 m mast)	6 dBi to 12.5 dBi

Max. wind speed	180 km/h (without ice deposit)
Connector	N male
MTBF	>100 000 h
Operating temperature range	–30 °C to +50 °C
Dimensions of antenna array	
Length	approx. 15 m
Width	approx. 16 m
Weight of antenna array	approx. 260 kg

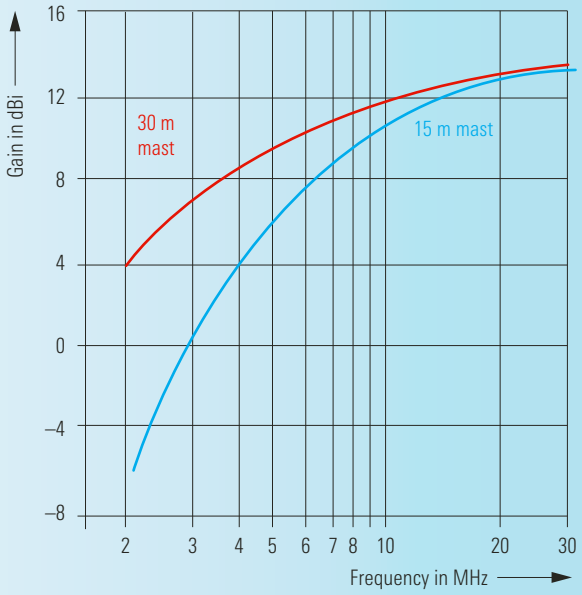
Ordering information

Log-Periodic HF Antenna	R&S®HL 451	0733.8507.02
Recommended extras		
Lattice Mast, 15 m (standard)	R&S®KM 451B2	4028.3400.02
Lattice Mast, 10 m (for roof mounting)	R&S®KM 451B1	4028.3351.02
Hazard Light	R&S®KM 451F1	4028.3500.02

Antenna Rotator	R&S®RD 130	4059.8503.02
Rotary Joint/Adaption Set	R&S®RD 008Z1	0720.6400.02
Control Unit	R&S®GB 130	4059.8755.02
Set of Cables (R&S®GB 130 ↔ R&S®RD 130, lengths: 50/80/120/200 m)	R&S®GK 130	4059.8855.0x (x = 2/3/4/5)
Other configurations on request.		



Typical radiation patterns on a 15 m mast



Typical gain

Log-Periodic HF Antenna R&S®HL 471

3 MHz to 30 MHz

Transmission and reception of horizontally polarized waves over long distances

Chapter Overview

Type Index

Main Menu

Features

- Reception from 3 MHz
- Transmission from 7 MHz
- Extremely small dimensions
- Low weight
- Easy and quick assembly
- Little maintenance required
- Suitable for roof mounting

Brief description

The compact, rotatable HF Antenna R&S®HL 471 can be used for transmission and reception of horizontally polarized waves.

Due to a transmission frequency range from 7 MHz to 30 MHz, the antenna is particularly suitable for communication over long distances. Reception is possible from 3 MHz so that all distances can be covered.

The antenna has been optimized for small dimensions, low weight and little maintenance.

Specifications

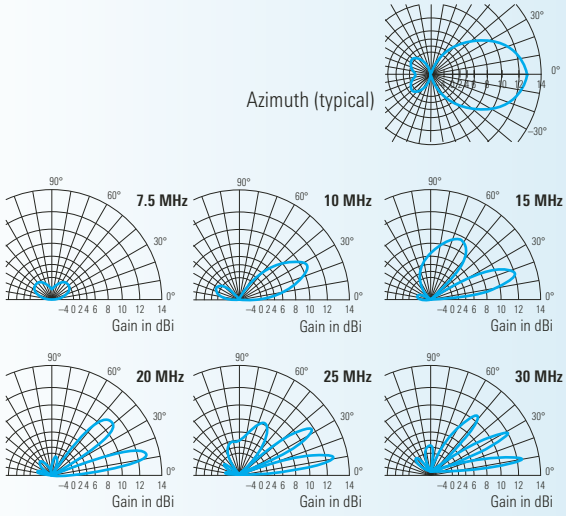
Frequency range	
Reception	3 MHz to 30 MHz
Transmission	7 MHz to 30 MHz
Polarization	linear/horizontal
Input impedance	50 Ω
VSWR	≤2
Max. input power	1 kW CW/2 kW PEP
Gain (on a 15 m mast)	
7 MHz to 8 MHz	0 dBi to 6 dBi
8 MHz to 30 MHz	6 dBi to 12.5 dBi

Max. wind speed	180 km/h (without ice deposit)
Connector	N male
MTBF	>100 000 h
Operating temperature range	–30 °C to +50 °C
Dimensions of antenna array	
Length	approx. 8.8 m
Width	approx. 11 m
Weight of antenna array	approx. 100 kg

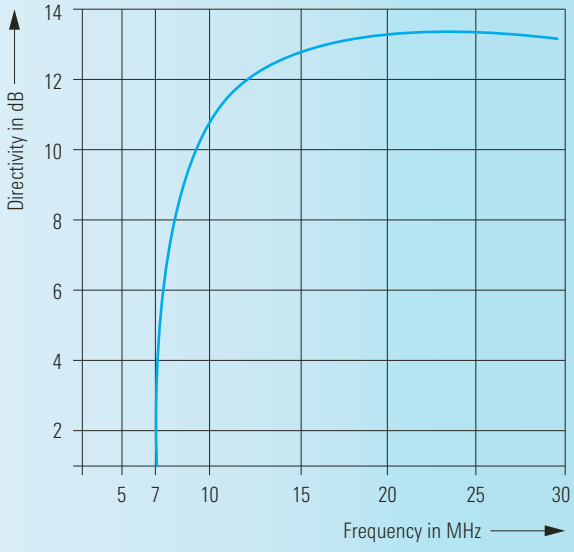
Ordering information

Log-Periodic HF Antenna	R&S®HL 471	0755.3008.02
Recommended extras		
Lattice Mast, 15 m (standard)	R&S®KM 451B2	4028.3400.02
Lattice Mast, 10 m (for roof mounting)	R&S®KM 451B1	4028.3351.02
Hazard Light	R&S®KM 451F1	4028.3500.02

Antenna Rotator	R&S®RD 130	4059.8503.02
Rotary Joint/Adaption Set	R&S®RD 008Z1	0720.6400.02
Control Unit	R&S®GB 130	4059.8755.02
Set of Cables (R&S®GB 130 ↔ R&S®RD 130, lengths: 50/80/120/200 m)	R&S®GK 130	4059.8855.0x (x = 2/3/4/5)
Other configurations on request.		

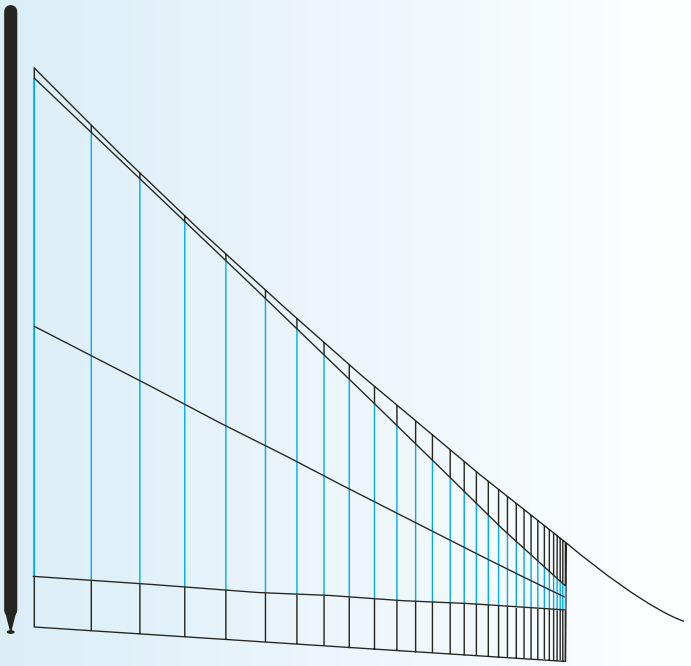


Typical radiation patterns on a 15 m mast



Typical directivity on a 15 m mast

Log-Periodic HF Antenna R&S®HL 210A3



1.5 MHz to 30 MHz

For high-sensitivity radiomonitoring through reception of ground waves and vertically polarized sky waves

Chapter Overview

Type Index

Main Menu

Features

- Extremely wide frequency range
- Very high efficiency through dipole structure
- Reception of even very weak signals
- High directivity
- Small antenna size for 1.5 MHz to 30 MHz range
- No ground net required
- Little maintenance required

Brief description

The R&S®HL 210A3 is suitable for the reception of ground waves as well as vertically polarized sky waves and allows even very weak signals to be detected.

According to the physical characteristics of vertically polarized waves, maximum sensitivity is obtained at low and medium elevation angles. The radiation pattern of the R&S®HL 210A3 is optimally suited for this purpose. The azimuth range of the R&S®HL 210A3 of about 120° can be enhanced up to 360° by adding two further antennas.

For additional reception of horizontally polarized waves and high-angle radiation (predominantly horizontally polarized), the antenna can be combined with the Log-Periodic HF Antenna R&S®HL 410A3.

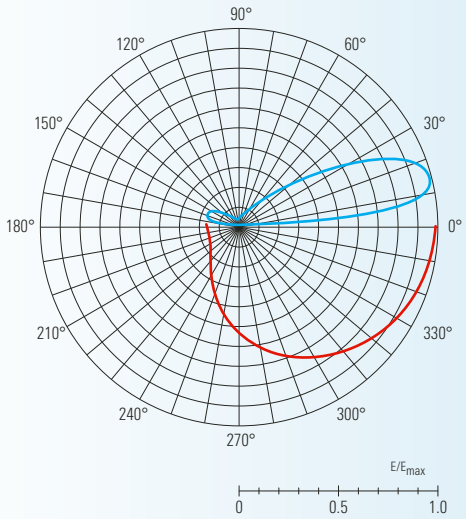
Specifications

Frequency range	1.5 MHz to 30 MHz
Polarization	linear/vertical
Input impedance	50 Ω
VSWR	
1.5 MHz to 2 MHz	<6
2 MHz to 30 MHz	<2.5, typ. <2.0
Directivity	
1.5 MHz to 2 MHz	8 dBi to 10.5 dBi
2 MHz to 30 MHz	10.5 dBi to 12 dBi
Efficiency	>90 %
Connector	N female
MTBF	≥100 000 h
Operating temperature range	–40 °C to +70 °C

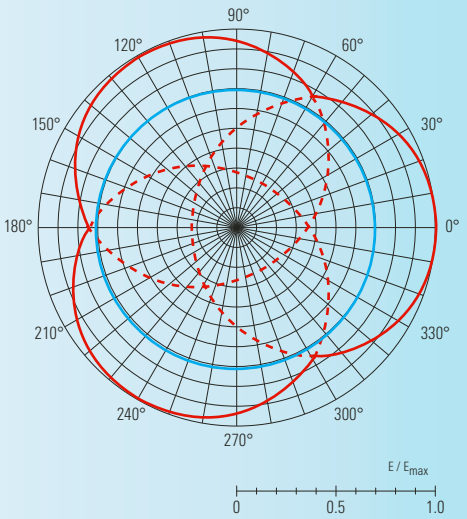
Max. wind speed	
Survival (operational with reduced data)	225 km/h (140 mph)
Operational with specified data	130 km/h (80 mph)
Permissible wind speed including ice deposit	135 km/h (84 mph)
Permissible ice deposit	
20 mm radial	on wires with diameter >7 mm
2 × diameter	on wires with diameter <7 mm
Dimensions	
Length of antenna array	approx. 97 m
Height of supporting mast	approx. 90 m

Ordering information

Log-Periodic HF Antenna	R&S®HL210A3	on request

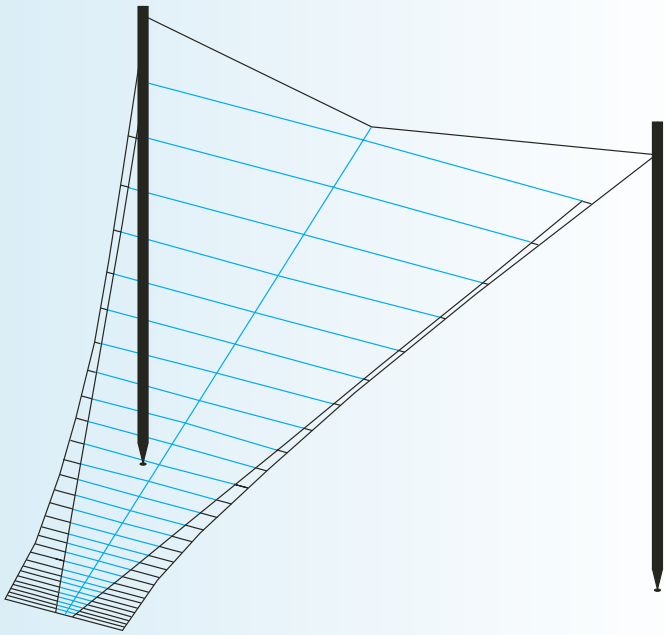


Typical vertical (blue) or horizontal (red, only half shown) radiation pattern



Typical horizontal omnidirectional reception characteristic (red = single patterns, blue = 3 dB reference) of a system comprising three R&S® HL210A3

Log-Periodic HF Antenna R&S®HL 410A3



1.5 MHz to 30 MHz

For radiomonitoring over short, medium and global distances with extremely high sensitivity

Features

- Extremely wide frequency range
- Very high efficiency through dipole structure
- Reception of even very weak signals
- High directivity
- No skip zone
- Small antenna size for 1.5 MHz to 30 MHz range
- Little maintenance required

Brief description

The R&S®HL 410A3 is suitable for the reception of horizontally polarized waves and allows even very weak signals to be detected.

The vertical pattern is shaped taking into account the transmission characteristics in the ionosphere. In conjunction with the extremely wide frequency range from 1.5 MHz to 30 MHz, the antenna thus allows reception over short, medium and global distances.

The half-power beamwidth of the horizontal radiation pattern of about 70° can be enhanced up to 360° by adding five further antennas. For the reception of vertically polarized waves, the antenna can be combined with the Log-Periodic HF Antenna R&S®HL 210A3.

Chapter Overview

Type Index

Main Menu

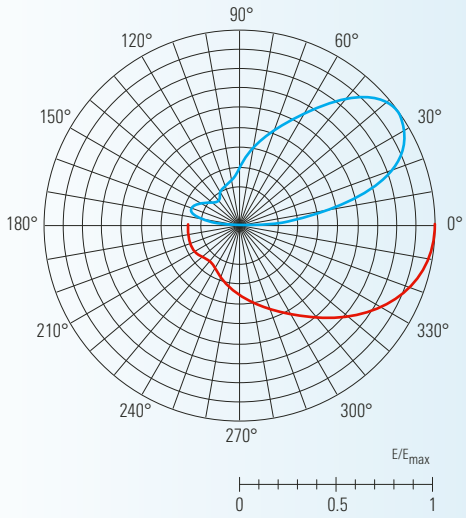
Specifications

Frequency range	1.5 MHz to 30 MHz
Polarization	linear/vertical
Input impedance	50 Ω
VSWR	
1.5 MHz to 2 MHz	<6
2 MHz to 30 MHz	<2.5, typ. <2.0
Directivity	
1.5 MHz	7.5 dBi
1.6 MHz to 30 MHz	8 dBi to 12 dBi
Efficiency	>90 %
Connector	N female
MTBF	≥100 000 h
Operating temperature range	–40 °C to +70 °C

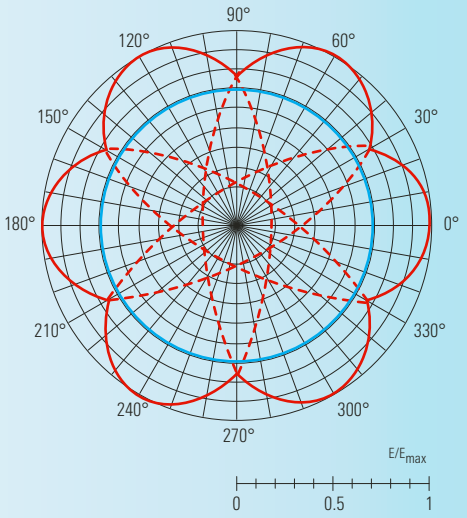
Max. wind speed	
Survival (operational with reduced data)	225 km/h (140 mph)
Operational with specified data	130 km/h (80 mph)
Permissible wind speed including ice deposit	135 km/h (84 mph)
Permissible ice deposit	
20 mm radial	on wires with diameter >7 mm
2 × diameter	on wires with diameter <7 mm
Dimensions	
Length of antenna array	approx. 94 m
Width of antenna array	approx. 88 m
Height of supporting mast	approx. 66 m

Ordering information

Log-Periodic HF Antenna	R&S®HL410A3	on request



Typical vertical (blue) or horizontal (red, only half shown) radiation pattern



Typical horizontal omnidirectional reception characteristic (red = single patterns, blue = 3 dB reference) of a system with six R&S®HL 410A3

Glossary

A

Absorption

1. In the transmission of electrical, electromagnetic, or acoustic signals, the conversion of the transmitted energy into another form, usually thermal.
→ Absorption is one cause of signal attenuation.
→ The conversion takes place as a result of interaction between the incident energy and the material medium, at the molecular or atomic level. (ANS T1.523.201)
2. The irreversible conversion of energy of an electromagnetic wave into another form of energy as a result of its interaction with matter. (IEEE)

ANSI

American National Standards Institute
The U.S. standards organization that establishes procedures for the development and coordination of voluntary American National Standards. (ANS T1.523.201)

Antenna

1. Any structure or device used to collect or radiate electromagnetic waves. (ANS T1.523.201)
2. A device that converts radio frequency electrical energy to radiated electromagnetic energy and vice versa. (ANS T1.523.201)

Antenna Aperture

see "Aperture"

Antenna Array

An assembly of antenna elements with dimensions, spacing, and illumination sequence such that the fields for the individual elements combine to produce a maximum intensity in a particular direction and minimum field intensities in other directions. (ANS T1.523.201)

Antenna Dissipative Loss

A power loss resulting from changes in the measurable impedance of a practical antenna from a value theoretically calculated for a perfect antenna. (ANS T1.523.201)

Antenna Effective Area

see "Effective Area"

Antenna Efficiency

The ratio of the total radiated power to the total input power.
→ The total radiated power is the total input power less antenna dissipative losses. (ANS T1.523.201)

Antenna Factor

1. The antenna factor K is the quotient of the electric field strength E and the voltage V present at 50 Ω (e.g. a matched receiver input).

$$K = \frac{\text{Electric field strength}}{\text{Antenna output voltage at } 50\Omega}$$

→ This factor includes the effects of antenna effective length or gain and mismatch and transmission line losses.
→ The factor for electric field strength is not necessarily the same as the factor for magnetic fieldstrength. (IEEE)

Antenna Gain

1. The ratio of the power required at the input of a loss-free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength at the same distance.
→ Antenna gain is usually expressed in dB.
→ Unless otherwise specified, the gain refers to the direction of maximum radiation. The gain may be considered for a specified polarization. Depending on the choice of the reference antenna, a distinction is made between:

- absolute or isotropic gain (Gi), when the reference antenna is an isotropic antenna isolated in space;
- gain relative to a half-wave dipole (Gd), when the reference antenna is a half-wave dipole isolated in space and with an equatorial plane that contains the given direction; (ANS T1.523.201)

2. The ratio of the radiation intensity, in a given direction, to the radiation intensity that would be obtained if the power accepted by the antenna were radiated isotropically.
→ Gain does not include losses arising from impedance and polarization mismatches.
→ If an antenna is without dissipative loss, then, in any given direction, its gain is equal to its directivity.
→ If the direction is not specified, the direction of the maximum radiation intensity is implied. (IEEE)

Antenna Gain-to-Noise-Temperature

see "G/T Ratio"

Antenna Lobe

see "Lobe"

Antenna Noise Temperature

The temperature of a hypothetical resistor at the input of an ideal noise-free receiver that would generate the same output noise power per unit bandwidth as that at the antenna output at a specified frequency.
→ The antenna noise temperature depends on antenna coupling to all noise sources in its environment as well as on noise generated within the antenna. (ANS T1.523.201)

Antenna Tuning Unit

see 'ATU'

Aperture

In a directional antenna, the portion of a plane surface very near the antenna normal to the direction of maximum radiant intensity, through which the major part of the radiation passes. (ANS T1.523.201)

Glossary

Atmospheric Duct
A horizontal layer in the lower atmosphere in which the vertical refractive index gradients are such that radio signals
(a) are guided or focused within the duct,
(b) tend to follow the curvature of the Earth, and
(c) experience less attenuation in the ducts than they would if the ducts were not present.
→ The reduced refractive index at the higher altitudes bends the signals back toward the Earth. Signals in a higher refractive index layer, i.e., duct, tend to remain in that layer because of the reflection and refraction encountered at the boundary with a lower refractive index material. (ANS T1.523.201)

Attenuation
1. A decrease in intensity of a signal, beam or wave as a result of absorption of energy and of scattering out of the path to the detector, but not including the reduction due to geometric spreading. (ANS T1.523.201)
2. A general term used to denote a decrease in signal magnitude in transmission from one point to another. Attenuation may be expressed as a scalar ratio of the input magnitude to the output magnitude or in decibels. (IEEE)

ATU
Antenna Tuning Unit
A device used to match the impedance of an antenna to the impedance of a transmitter or receiver frequency selective to provide maximum power transfer.

Azimuth
The angle between a horizontal reference direction (usually north) and the horizontal projection of the direction of interest, usually measured clockwise. (IEEE)

B

Bandwidth
The difference between the limiting frequencies within which performance of a device, in respect to some characteristic, falls within specified limits. (ANS T1.523.201)

Band
see "Electromagnetic Spectrum"

Beam
The main lobe of an antenna radiation pattern. (ANS T1.523.201)

Beamwidth
see "Half-power Beamwidth"

Bias Tee
A circuit which feeds a DC voltage to a RF path without affecting the RF parameters.

Boresight
The physical axis of a directional antenna. (ANS T1.523.201)

Boresight Error
1. The angular deviation of the electrical boresight of an antenna from its reference. (IEEE)
2. The deviation of the real main lobe direction to the theoretically available main lobe direction.

BW
see "Bandwidth"

C

c
see "Speed of Light"

Carrier
1. In a frequency stabilized system, the sinusoidal component of a modulated wave whose frequency is independent of the modulating wave; or the output of a transmitter when the modulating wave is made zero; or a wave generated at a point in the transmitting system and subsequently modulated by the signal; or a wave generated locally at the receiving terminal which when combined with the side bands in a suitable detector, produces the modulating wave. (ANS T1.523.201)
2. The sinusoidal output signal of a transmitter at a typical frequency without any modulations.

Carrier Power
The radio frequency power available at the antenna terminal when no modulating signal is present. (IEEE)

CCIR
Consultative Committee for International Radio
A predecessor organization of the ITU-R. (ANS T1.523.201)

CCITT
Consultative Committee for International Telegraph and Telephone
A predecessor organization of the ITU-T. (ANS T1.523.201)

CISPR
International Special Committee on Radio Interference
A committee that defines EMC measurement standards.

Clockwise Polarized Wave
see "Right-hand Polarized Wave"

Compromising Emanations
Unintentional signals that, if intercepted and analyzed, would disclose the information transmitted, received, handled, or otherwise processed by information systems equipment. (ANS T1.523.201)

Counterclockwise Polarized Wave
see "Left-hand Polarized Wave"

Glossary

D

dB see "decibel"

dBc dB relative to the carrier power (ANS T1.523.201)

dBd In the expression of antenna gain, the number of decibels of gain of an antenna referenced to the gain of a half-wave dipole.

$1\,dBd \triangleq 2.15\,dBi$

dBi In the expression of antenna gain, the number of decibels of gain of an antenna referenced to the zero dB gain of a free-space isotropic radiator. (ANS T1.523.201)

decibel 1. One tenth of the common logarithm of the ratio of relative powers, equal to 0.1 B (bel).
→ The ratio in dB is given by

$$dB = 10\log_{10}\left(\frac{P_1}{P_2}\right),$$

where P_1 and P_2 are the actual powers. Power ratios may be expressed in terms of voltage and impedance, E and Z, or current and impedance, I and Z, since

$$P = I^2 \cdot Z = \frac{E^2}{Z}.$$

Thus dB is also given by

$$dB = 10\log_{10}\left(\frac{E_1^2/Z_1}{E_2^2/Z_2}\right) = 10\log_{10}\left(\frac{I_1^2 \cdot Z_1}{I_2^2 \cdot Z_2}\right)$$

If $Z_1 = Z_2$, these become

$$dB = 20\log_{10}\left(\frac{E_1}{E_2}\right) = 20\log_{10}\left(\frac{I_1}{I_2}\right). \quad \text{(ANS T1.523.201)}$$

2. One tenth of a bel, the number of decibels denoting the ratio of the two amounts of power being ten times the logarithm to the base 10 of this ratio.
→ The abbreviation dB is commonly used for the term decibel. With P1 and P2 designating two amounts of power and n the number of decibel denoting their ratio,

$$n = 10\log_{10}\left(\frac{P_1}{P_2}\right) \text{ decibel,}$$

When the conditions are such that the ratios of currents or ratios of voltages (or analogous quantities in other fields) are the square roots of the corresponding power ratios, the number of decibels by which the corresponding powers differ is expressed by the following equations:

$$n = 20\log_{10}\left(\frac{I_1}{I_2}\right) \text{ decibel} \qquad n = 20\log_{10}\left(\frac{U_1}{U_2}\right) \text{ decibel}$$

Where I_1/I_2 and are the given current and voltage ratios, respectively. By extension, these relations between numbers of decibels and ratios of currents or voltages are sometimes applied were these ratios are not the square roots of the corresponding power ratios; to avoid confusion, such usage should be accompanied by a specific statement of this application. Such extensions of the term described should preferably be avoided. (IEEE)

Directive Gain see "Directivity"

Directivity The value of the directive gain in the direction of its maximum value. (IEEE)

E

Effective Area The functionally equivalent area from which an antenna directed toward the source of the received signal gathers or absorbs the energy of an incident electromagnetic wave.
→ Antenna effective area is usually expressed in square meters. (ANS T1.523.201)

Effective Aperture 1. In a given direction, the ratio of the available power at the terminals of a receiving antenna to the power flux density of a plane wave incident on the antenna from that direction, the wave being polarization matched to the antenna.
→ If the direction is not specified, the direction of maximum radiation intensity is implied. (IEEE)
2. A measure of the receive-power which an antenna can take out of the total incoming power of an certain electromagnetic power density. The effective aperture is normally smaller than the geometrical aperture.

Effective Height

1. The height of the center of radiation of an antenna above the effective ground level. (ANS T1.523.201)
2. In low-frequency applications involving loaded* or nonloaded vertical antennas, the moment of the current distribution in the vertical section divided by the input current.
→ For an antenna with symmetrical current distribution, the center of radiation is the center of distribution. For an antenna with asymmetrical current distribution, the center of radiation is the center of current moments when viewed from points near the direction of maximum radiation. (ANS T1.523.201)
*(Note: 'loaded antennas' means electrically short antennas)

Efficiency

The ratio of the useful power output to the total power input. (IEEE)

EIRP

Equivalent Isotropic Radiated Power
The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

Electrical Beam Tilt

The shaping of the radiation pattern in the vertical plane of a transmitting antenna by electrical means – so that maximum radiation occurs at an angle below (downtilt) or above (uptilt) the horizontal plane.

Electric Field

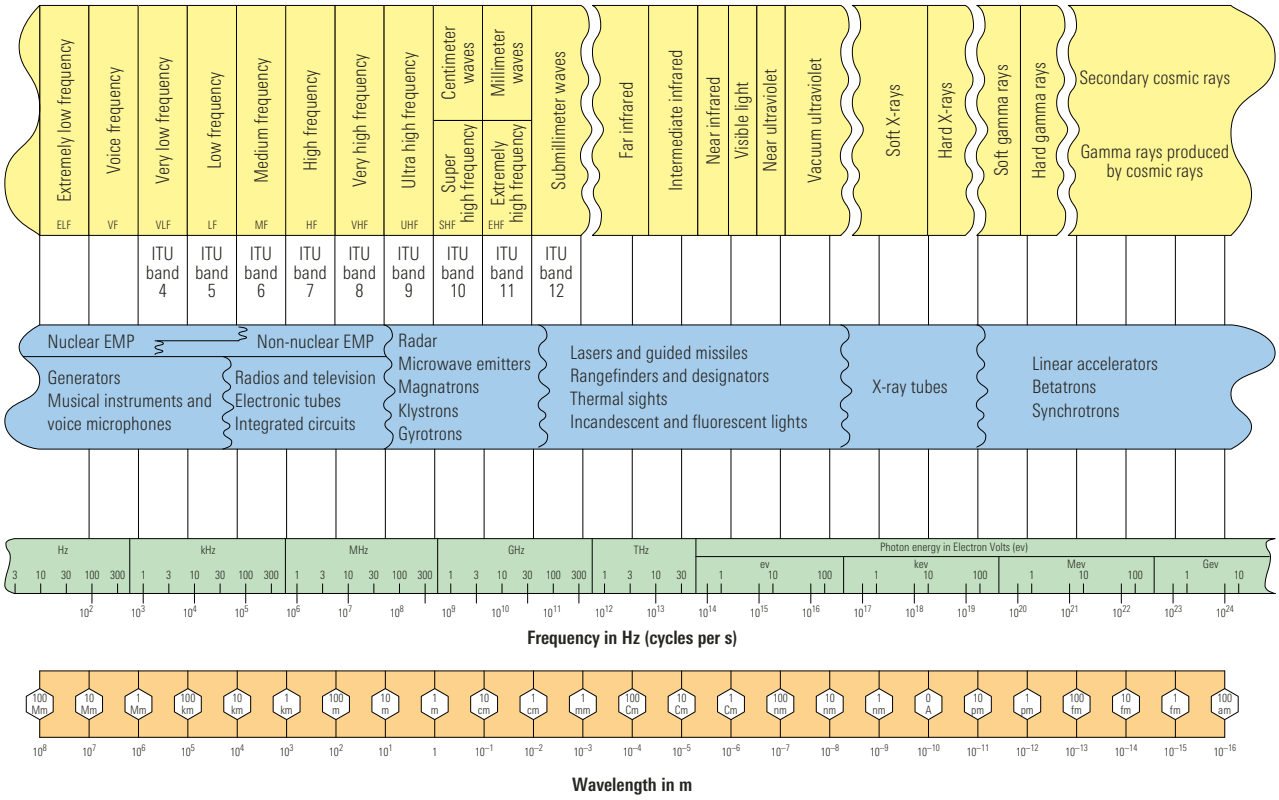
The effect produced by the existence of an electric charge, such as an electron, ion, or proton, in the volume of space or medium that surrounds it.
→ Each of a distribution of charges contributes to the whole field at a point on the basis of superposition. A charge placed in the volume of space or in the surrounding medium has a force exerted on it. (ANS T1.523.201)

Electric Field Strength

see "Field Strength"

Electromagnetic Spectrum

1. The range of frequencies of electromagnetic radiation from zero to infinity.
→ The electromagnetic spectrum was, by custom and practice, formerly divided into 26 alphabetically designated bands. This usage still prevails to some degree. However the ITU formally recognizes 12 bands, from 30 Hz to 3000 GHz. New bands, from 3 THz to 3000 THz, are under active consideration for recognition. Refer to the figure below. ((ANS T1.523.201)
2. The spectrum of electromagnetic radiation: in wavelengths, gamma ray, shorter than 0.006 nm; X-ray, 0.006 to 5 nm; ultraviolet, 5 nm to 0.4 mm; visible light, 0.4 to 0.7 µm; infrared, 0.7 µm to 1 mm; radio frequency, >1 mm. (IEEE)



Electromagnetic spectrum

Electromagnetic Wave

A wave produced by the interaction of time-varying electric and magnetic fields.
→ Electromagnetic waves are known as radio waves, heat rays, light rays, etc., depending on the frequency. (IEEE)

Elevation

The angle between the axis of a searchlight drum and the horizontal. For angles above the horizontal, elevation is positive, and below the horizontal negative. (IEEE)

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EMC
Electromagnetic Compatibility
1. Electromagnetic compatibility is the condition which prevails when telecommunications equipment is performing its individually designed function in a common electromagnetic environment without causing or suffering unacceptable degradation due to unintentional electromagnetic interference to or from other equipment in the same environment. (ANS T1.523.201)
2. A measure of equipment tolerance to external electromagnetic fields. (IEEE)

EMS
Electromagnetic Susceptibility
1. Of an electronic circuit or device, the degree to which it is subject to malfunction or failure under the influence of electromagnetic radiation. (ANS T1.523.201)
2. Electromagnetic Susceptibility includes all function tests to proof that a technical device is not disturbed by any occurring incoming electromagnetic radiation equal to the defined maximum limit-values.

EMI
Electromagnetic Interference
1. Any electromagnetic disturbance that interrupts, obstructs, or otherwise degrades or limits the effective performance of electronics/electrical equipment. It can be induced intentionally, as in some forms of electronic warfare, or unintentionally, as a result of spurious emissions and responses, intermodulation products, and the like. (ANS T1.523.201)
2. An engineering term used to designate interference in a piece of electronic equipment caused by another piece of electronic or other equipment. EMI sometimes refers to interference caused by nuclear explosion. (ANS T1.523.201)
3. Electromagnetic Interference includes all inspection measurements to prove that a technical device does not emit any electromagnetic radiation higher than the predefined limit-values.

Emission
Electromagnetic energy propagated from a source by radiation or conduction.
→ The emission may be either desired or undesired and may occur anywhere in the electromagnetic spectrum. (ANS T1.523.201)

E Plane
The plane containing the electric field vector and the direction of maximum radiation. (IEEE)

F

Feed (Element)
1. For continuos aperture antennas, the primary radiator, for example, a horn feeding a reflector. (IEEE)
2. For array antennas, that portion of the antenna which functions to produce the excitation coefficients. (IEEE)

Far-field
see "Far-field region"

Far-field region
The region where the angular field distribution is essentially independent of distance from the source.
→ If the source has a maximum overall dimension D that is large compared to the wavelength, the far-field region is commonly taken to exist at distances greater than $2D^2/\lambda$ from the source (λ being the wavelength). (ANS T1.523.201)

Field
The volume of influence of a physical phenomenon, expressed vectorially. (ANS T1.523.201)

Field Strength
The magnitude of an electric, magnetic, or electromagnetic field at a given point.
→ The field strength of an electromagnetic wave is usually expressed as the rms value of the electric field, in volts per meter. The field strength of a magnetic field is usually expressed in amperes per meter.
Synonym: radio field intensity (ANS T1.523.201)

Figure of Merit
see "G/T Ratio"

Flux
The rate of flow of energy through a surface. (IEEE)

Frequency
1. The number of cycles occurring per second of an electrical or electromagnetic wave; a number representing a specific point in the electromagnetic spectrum. (ANS T1.523.201)
2. The number of periods per unit time. (IEEE)

Front-to-Back Ratio
Of an antenna, the gain in a specified direction, i.e., azimuth, usually that of maximum gain, compared to the gain in a direction 180° from the specified azimuth.
→ Front-to-back ratio is usually expressed in dB. (ANS T1.523.201)

G

G/T ratio
Gain-to-Noise-Temperature, synonym: figure of merit
In the characterization of antenna performance, a figure of merit, where G is the antenna gain in decibels at the receive frequency, and T is the equivalent noise temperature* of the receiving system in kelvins. (ANS T1.523.201)
*(including antenna noise temperature)

Gain
see "Antenna Gain"

Ground Wave

1. In radio transmission, a surface wave that propagates close to the surface of the Earth.
The Earth has one refractive index and the atmosphere has another, thus constituting an interface that supports surface wave transmission. These refractive indices are subject to spatial and temporal changes. Ground waves do not include ionospheric and tropospheric waves. (ANS T1.523.201)
2. A radio wave that is propagated over the earth and is ordinarily affected by the presence of the ground and troposphere.
The ground wave is refracted because of variations in the dielectric constant of the troposphere including the condition known as surface duct. (IEEE)

H

Half-power Beamwidth

Of an antenna pattern, the angle between the half-power (3 dB) points of the main lobe, when referenced to the peak effective radiated power of the main lobe.
→ Beamwidth is usually expressed in degrees. (ANS T1.523.201)

Hertz

The SI unit of frequency, equal to one cycle per second.
→ A periodic phenomenon that has a period of one second has a frequency of one hertz. (ANS T1.523.201)

H Plane

The plane containing the magnetic field vector and the direction of maximum radiation.

HPBW

see "Half-power Beamwidth"

Hz

see "Hertz"

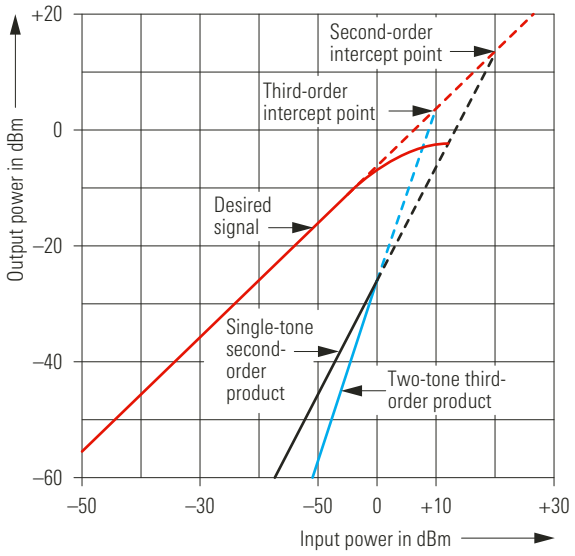
I

Impedance

The total passive opposition offered to the flow of electric current.
→ Impedance is determined by the particular combination of resistance, inductive reactance, and capacitive reactance in a given circuit.
→ Impedance is normally a function of frequency, except in the case of purely resistive networks. (ANS T1.523.201)

Intercept Point

1. Intermodulation products have an output-versus-input characteristic which, when graphically displayed, would theoretically intercept the plot of the desired output-versus-input if the nonlinear device continued to operate linearly without compression. The signal input level at which this theoretical point would occur is called the intercept point and is usually defined in dBm (decibel referred to one milliwatt). The figure below is a graphical representation of the intercept points for a single-tone second order and a two-tone third-order intermodulation product. (IEEE)



Intermodulation product intercept point

2. A point that is an extrapolated convergence – not directly measurable – of intermodulation distortion products in the desired output. That point indicates how well a receiver performs in the presence of strong nearby signals.

Intermodulation

The production, in a nonlinear element of a system, of frequencies corresponding to the sum and difference frequencies of the fundamentals and harmonics thereof that are transmitted through the element. (ANS T1.523.201)

Intermodulation Product

In the output of a nonlinear system, a frequency produced by intermodulation of harmonics of the frequencies present in the input signal. (ANS T1.523.201)

Ionosphere

That part of the atmosphere, extending from about 70 to 500 kilometers, in which ions and free electrons exist in sufficient quantities to reflect and/or refract electromagnetic waves. (ANS T1.523.201)

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Isotropic Antenna
A hypothetical antenna that radiates or receives equally in all directions.
→ Isotropic antennas do not exist physically but represent convenient reference antennas for expressing directional properties of physical antennas. (ANS T1.523.201)

Isotropic Radiator
see "Isotropic Antenna"

ITU
International Telecommunication Union
A civil international organization established to promote standardized telecommunications on a worldwide basis. The ITU-R and ITU-T are committees under the ITU. The ITU headquarters is located in Geneva, Switzerland. While older than the United Nations, it is recognized by the U.N. as the specialized agency for telecommunications. (ANS T1.523.201)

ITU-R
International Telecommunication Union - Radiocommunications Sector
The Radiocommunications Sector of the ITU; responsible for studying technical issues related to radiocommunications, and having some regulatory powers.
→ A predecessor organization was the CCIR. (ANS T1.523.201)

ITU-T
International Telecommunication Union - Telecommunication Standardization Sector
The Telecommunication Standardization Sector of the International Telecommunication Union (ITU).
→ ITU-T is responsible for studying technical, operating, and tariff questions and issuing recommendations on them, with the goal of standardizing telecommunications worldwide.
→ In principle, the ITU-T combines the standards-setting activities of the predecessor organizations formerly called the International Telegraph and Telephone Consultative Committee (CCITT) and the International Radio Consultative Committee (CCIR). (ANS T1.523.201)

K

K Factor
see "Antenna Factor"

L

Left-hand Polarized Wave
An elliptically or circularly polarized wave, in which the electric field vector, observed in the fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand or anticlockwise direction.
→ also called anticlockwise polarized wave (ANS T1.523.201)

Lobe
1. A lobe is a portion of the directional pattern bounded by one or two cones of nulls. (IEEE)
2. A three-dimensional section of the radiation pattern of a directional antenna, bounded by one or more cones of nulls or by regions of diminished irradiance. (ANS T1.523.201)

Loss
1. The diminution, usually expressed in dB, of signal level in a communications medium. (ANS T1.523.201)
2. The power, usually expressed in watts, consumed or dissipated by a circuit or component without accomplishing useful work or purpose; e.g., heating (hysteresis loss) that occurs in the core of a transformer. (ANS T1.523.201)
3. The attenuation of a signal level in a communications medium. (usually expressed in dB)

M

Main Beam
see "Main Lobe"

Main Lobe
or Major Lobe
Of an antenna radiation pattern, the lobe containing the maximum power (exhibiting the greatest field strength).
→ The width of the main lobe is usually specified as the angle encompassed between the points where the power has fallen 3 dB below the maximum value. (ANS T1.523.201)

Matched
Matched means that the impedance of e.g. an antenna is equal to the impedance of the RF cable as well as to the impedance of the connected device (e.g. transmitter or receiver). No reflections degrade the power transmission. A matched system offers the highest efficiency.

Mean Power
The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.
→ Normally, a time of 0.1 second, during which the mean power is greatest, will be selected. (ANS T1.523.201)

Medium
In telecommunications, the transmission path along which a signal propagates, such as a wire pair, coaxial cable, waveguide, optical fiber, or radio path. (ANS T1.523.201)

Modulation
The process, or result of the process, of varying a characteristic parameter of a carrier, in accordance with an information-bearing signal. (ANS T1.523.201)

MTBF
Mean Time Between Failure
An indicator of expected system reliability calculated on a statistical basis from the known failure rates of various components of the system. MTBF is usually expressed in hours. (ANS T1.523.201)

MTTR
Mean Time To Repair
The time interval (hours) that may be expected to return a failed equipment to proper operation. (IEEE)

N

Near Field
see "Near-field Region"

Near-field Region
The close-in region of an antenna wherein the angular field distribution is dependent upon the distance from the antenna. (ANS T1.523.201)

Near Zone
see "Near-field Region"

NF
see "Noise Figure"

Noise
An undesired disturbance within the frequency band of interest; the summation of unwanted or disturbing energy introduced into a communications system from man-made and natural sources. (ANS T1.523.201)

Noise Factor
see "Noise Figure"

Noise Figure
1. Of an active device, over the bandwidth of interest, the contribution by the device itself to thermal noise at its output. The noise figure is usually expressed in decibels (dB), and is with respect to thermal noise power at the system impedance, at a standard noise temperature (usually 20 °C, 293 K) over the bandwidth of interest. It is determined by
(a) measuring (determining) the ratio, usually expressed in dB, of the thermal noise power at the output, to that at the input, and
(b) subtracting from that result, the gain, in dB, of the system. Typical noise figures range from 0.5 dB for very low noise devices, to 4 to 8 dB. In some systems, e.g., heterodyne systems, total output noise power includes noise from other than thermal sources, such as spurious contributions from image-frequency transformation, but noise from these sources is not considered in determining the noise figure. In this example, the noise figure is determined only with respect to that noise that appears in the output via the principal frequency transformation of the system, and excludes noise that appears via the image frequency transformation. (ANS T1.523.201)
2. At a selected input frequency the ratio of (A) the total noise power per unit bandwidth (at a corresponding output frequency) delivered by the system into an output termination to (B) the portion thereof engendered at the input frequency by the input termination, whose noise temperature is standard (290 K (Kelvins) at all frequencies). (IEEE)

Noise Temperature
At a pair of terminals, the temperature of a passive system having an available noise power per unit bandwidth at a specified frequency equal to that of the actual terminals of a network.
→ The noise temperature of a simple resistor is the actual temperature of that resistor. The noise temperature of a diode may be many times the actual temperature of the diode. (ANS T1.523.201)
→ Noise temperature of an antenna depends on its coupling to all noise sources in its environment as well as noise generated within the antenna. (IEEE)

NVIS
Near-vertical-incidence Skywave
In radio propagation, a wave that is reflected from the ionosphere at a nearly vertical angle and that is used in short-range communications to reduce the area of the skip zone and thereby improve reception beyond the limits of the ground wave. (ANS T1.523.201)

O

Omnidirectional Antenna
An antenna that has a radiation pattern that is nondirectional in azimuth.
→ The vertical radiation pattern may be of any shape. (ANS T1.523.201)

P

Peak Envelope Power
see "PEP"

PEP
Peak envelope power
The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions. (ANS T1.523.201)

Phantom Feeding
A DC supply voltage is fed into a RF cable via a bias tee circuit

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Polarization
Of an electromagnetic wave, the property that describes the orientation, i.e., time-varying direction and amplitude, of the electric field vector.
→ States of polarization are described in terms of the figures traced as a function of time by the projection of the extremity of a representation of the electric vector onto a fixed plane in space, which plane is perpendicular to the direction of propagation. In general, the figure, i.e., polarization, is elliptical and is traced in a clockwise or counterclockwise sense, as viewed in the direction of propagation. If the major and minor axes of the ellipse are equal, the polarization is said to be circular. If the minor axis of the ellipse is zero, the polarization is said to be linear. Rotation of the electric vector in a clockwise sense is designated right-hand polarization, and rotation in a counterclockwise sense is designated left-hand polarization. (ANS T1.523.201)

Polarization Decoupling
The attenuation between a signal with a certain polarization and a signal with the same frequency but a differing polarization, e.g. cross-polarization decoupling.

Polarization Diversity
Diversity transmission and reception wherein the same information signal is transmitted and received simultaneously on orthogonally polarized waves with fade-independent propagation characteristics. (ANS T1.523.201)

Power
The rate of transfer or absorption of energy per unit time in a system. (ANS T1.523.201)

Propagation
The motion of waves through or along a medium.
→ For electromagnetic waves, propagation may occur in a vacuum as well as in material media. (ANS T1.523.201)

Propagation Channel
The physical medium in which the electromagnetic wave propagation takes place. This channel includes everything that influences the propagation between two antennas.

Propagation Path
see "Propagation Channel"

R

Radiant Power
The rate of flow of electromagnetic energy, i.e., radiant energy.
→ Radiant power is usually expressed in watts, i.e., joules per second. (ANS T1.523.201)

Radiation
In radio communication, the emission of energy in the form of electromagnetic waves. The term is also used to describe the radiated energy. (IEEE)

Radio Frequency
see "RF"

Radio Path
In the medium air, the channel or path through which the propagation between two antennas takes place.

Radiation Pattern
The variation of the field intensity of an antenna as an angular function with respect to the antenna axis.
→ A radiation pattern is usually represented graphically for the far-field conditions in either horizontal or vertical plane. (ANS T1.523.201)

Reciprocity
For antennas, this means that the same antenna can be used either for receiving as well as for transmitting purposes.
→ One exception to this rule are the active antennas. These can generally be used for receiving only.

Reference Antenna
An antenna that may be real, virtual, or theoretical, and has a radiation pattern that can be used as a basis of comparison with other antenna radiation patterns.
→ Examples of reference antennas are unit dipoles, half-wave dipoles, and isotropic, i.e., omnidirectional antennas. (ANS T1.523.201)

RF
Of, or pertaining to, any frequency within the electromagnetic spectrum normally associated with radio wave propagation.
→ For designation of subdivisions, see 'Electromagnetic Spectrum' and its associated diagram. (ANS T1.523.201)

Right-hand Polarized Wave
An elliptically or circularly polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction.
Synonym: clockwise polarized wave. (ANS T1.523.201)

Rotary Joint
A device transmitting cable-bound RF signals via a mechanically rotating joint to a device which is rotated.
Slip rings at a rotary joint are used for feeding e.g. control signals through the mechanically rotating joint. They are not meant for RF signals.

S

Side Lobe
A radiation lobe in any direction other than that of the major lobe. (IEEE)

Side Lobe Suppression
1. Any process, action of adjustment to reduce the level of the side lobes or to reduce the degradation of the intended antenna system performance resulting from the presence of side lobes. (IEEE)
2. Also the value of the side lobe suppression.

Glossary

Silent Tuning

A feature of some ATUs.
→ After a first learning tuning cycle the ATU stores it's frequency-depending setting values in a built-in memory. The now available 'Silent Tuning' mode can set the ATU to the stored values without initiating a new tuning process.

Silent Zone

see "Skip Zone"

Skip Zone

An annular region within the transmission range of an antenna, within the signals from the transmitter are not received.
The skip zone is bounded by the locus of the farthest points at which the ground wave can be received and the nearest points at which reflected sky waves can be received.
Synonyms: silent zone, zone of silence. (ANS T1.523.201)

Sky Wave

A radio wave that travels upward from the antenna.
→ A sky wave may be reflected to Earth by the ionosphere. (ANS T1.523.201)

Speed of Light (c)

The speed of an electromagnetic wave in free space, precisely 299,792,458 m/s.
→ The speed of an electromagnetic wave, e.g. light, is equal to the product of wavelength and frequency.

$$c = \lambda \cdot f$$

→ In any physical medium, the velocity of propagation of light is lower than the speed of light in free space. Since the frequency is not changed, in any physical medium, the wavelength is also decreased. (ANS T1.523.201)

Spillover

In a (reflector) antenna, the part of the radiated energy from the feed that does not impinge on the reflectors. (ANS T1.523.201)

Surface Duct

An atmospheric duct for which the lower boundary is the surface bounding the atmosphere. (IEEE)

T

TEMPEST

Telecommunications Electronics Material Protected from Emitting Spurious Transmissions
1. Short name referring to investigation, study, and control of compromising emanations from information systems (IS) equipment. (ANS T1.523.201)
2. To shield against compromising emanation. (ANS T1.523.201)

Terminated Folded Dipole

see "TFD"

TFD

Terminated Folded Dipole
Type of an antenna built. The dipole radiators are folded backwards at its half length. Both radiator ends are terminated to 'burn' all power which was not emitted via the radiator. In either case the reflected power would negatively influence the radiation pattern of the antenna and decrease the usability.

Troposphere

1. The lower layers of atmosphere, in which the change of temperature with height is relatively large. It is the region where clouds form, convection is active, and mixing is continuous and more or less complete. (ANS T1.523.201)
2. That part of the earth's atmosphere in which temperature generally decreases with altitude, clouds form, and convection is active. Experiments indicate that the troposphere occupies the space above the earth's surface up to a height ranging from 6 km (kilometers) at the poles to about 18 km at the equator. (IEEE)

V

Voltage Standing Wave Ratio

see "VSWR"

VSWR

Voltage Standing Wave Ratio
In a transmission line, the ratio of maximum to minimum voltage in a standing wave pattern.
→ The VSWR is a measure of impedance mismatch between the transmission line and its load. The higher the VSWR, the greater the mismatch. The minimum VSWR, i.e., that which corresponds to a perfect impedance match, is unity.
(ANS T1.523.201)

W

Wavelength

The distance between points of corresponding phase of two consecutive cycles of a wave.
→ The wavelength, λ, is related to the propagation velocity, v, and the frequency, f, by λ = v /f. (ANS T1.523.201)
→ In air the propagation velocity v is equal to c, the speed of light.

Z

Zone of Silence

see "Skip Zone"

References:

ANS T1.523.201: **www.atis.org/tg2k/**
IEEE: **Standard Dictionary of Electrical and Electronics Terms**

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