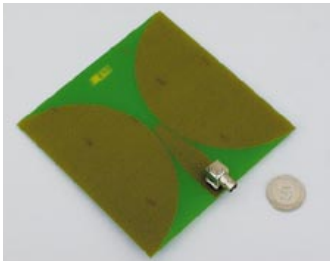
Fieldstrength-Test-Equipment 500 kHz to 60 MHz

Specified measuring ranges*

PWRM1	–70 dBm to +15 dBm
H-Field	0,32 mA/m to 5,6 A/m
E-Field	1 V/m to 3,16 kV/m
Accuracy of field strength measurements	better than ±3 dB
ABS-box outer dimensions	275 mm × 228 mm × 84 mm
Total weight (abovementioned parts included)	800 g only

PWRM1

HFS1



EFS1

Fixture, available on request

Complete test-set for measuring magnetic and electric field-strengths, comprising:

- Low-Level RF-Power-Meter PWRM1 and passive, non-isotropic probes for vector measurements
- HFS1 Magnetic Field Probe
- EFS1 Electric Field Probe

with BNC-Adapter and 9-V-battery-block stored in a small, handy ABS-box.

Comes, including individual calibration-certificate, 24 months warranty. Floppy disc with datasheets and reference frequency responses included.

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*) More detailed specs, see special datasheets!

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PWRM1
Low-Level RF-Power-Meter

General characteristics

Rated measuring range	–70 dBm to +15 dBm
Usuable range	–75 dBm to +20 dBm
Display steps	0,1 dB
Rated frequency range	100 kHz to 150 MHz
Bandwith (–3dB)[1]	50 kHz to 300 MHz
Accuracy[2,3]	better than ±2 dB; typ. ±1 dB
Input	
Impedance/Connector	50 Ohms / BNC, female
SWR	<1,2 ; typ. <1,1
max. total input power (summed RF + DC)	400 mW[4]
Dimensions W × H × D	93 mm × 39 mm × 33 mm
Weight, incl. battery	170 g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage[5]	–25 °C to 55 °C
Supply	9-V-block battery 6LR61
Operating time with alkaline battery	approx. 40 hours

Special feature

Multiple Input Signals („Level selective“ meter-action): Practical evaluation experienced, that in case of two sinewave RF-carriers, more than 250 Hz in frequency apart and same signal amplitude no increase of indicated value between one signal and the two-tone-signal occurred! Unlike common up-to-now RMS-meters, the PWRM1 does not indicate the average power-sum of a multiple-signal but indicates the power-level of the strongest signal only. This is due to inherent special properties of the level-meter's detector. This behaviour is very slightly influenced by the frequency-response and the input signal level, but within the –3-dB-frequency range a ratio Wanted Signal vs. Unwanted Interfering Signal of 3 dB is sufficient to give an unfalsified reading of the „dominating“ (wanted) signal. Filters for suppressing unwanted signals of a multiple-signal-input are therefore not needed unless the interfering signals are equal or stronger than the wanted signal.
The PWRM1 thus acts within its –3-dB-bandwith as broad-band, „level-selective“ RF-Power-Meter.

- Wide bandwith (50 kHz to 300 MHz)
- High dynamic range (>85 dB)
- Direct dBm-power-level reading
- Large, easy-to-read display
- Diecast box, handy and sturdy
- Acts „level-selective“
- For use in laboratories, HAM-Radio, EMR-measurements etc.

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Table: Correction factors for determining the RMS-Value of Non-Sine-Wave Signals measured with PWRM1. The signal-type relevant correction factor has to be added to the meter's reading.

Signal Type		Correction Factor
Sinewave	CW (unmodul. steady carrier, N0N)	0 dB
Sinewave	FM (F3E)	0 dB
Square wave	symmetrical (keying ratio 1:1)	– 3,0 dB
Triangular wave		+ 0,9 dB
GSM channel	all time slots on	+ 0,6 dB
CDMA (forw.)	9 channels on	+ 3,6 dB
PDC channel	all time slots on	+ 0,6 dB
Gaussian Noise		+ 2,5 dB

1 Ref. Typical frequency-response (calibration frequency is 10 MHz)
2 Measurements can be evaluated more exactly, if the typical frequency-response is taken into account.
3 If the input signal form differs from sine-wave, the meter reading has to be corrected by adding a factor, see table!
4 The meter's input presents a direct 52,5 Ohms DC-path to ground, loadable with 400 mW maximum. Max. DC-less RF input +26 dBm (max. RF-less DC input thus 4,6 V). – It is recommended to keep the input signal free of DC voltages!
5 battery removed

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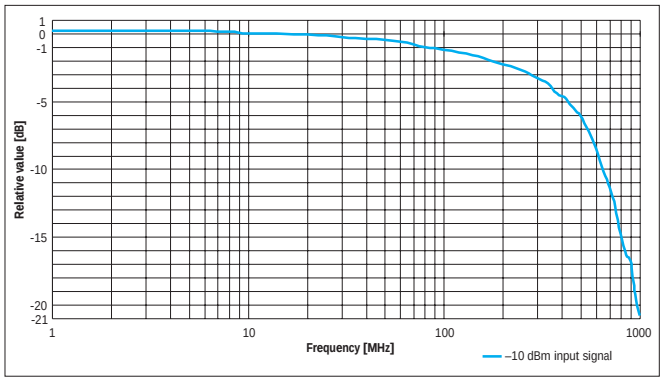


Typical frequency-response PWRM1

PWRM2
Low-Level UHF-Power-Meter

General characteristics

Rated measuring range	–60 dBm to –5 dBm
Usuable range	–62 dBm to –2 dBm
Display steps	0,1 dB
Rated frequency range[1]	30 MHz to 2,8 GHz
Accuracy 30 MHz–1 GHz[2,3]	better than ±3 dB
Accuracy 1 GHz–2,8 GHz[2,3]	better than ±8 dB
Input	
Impedance/Connector	50 Ohms / BNC, female
SWR	<2 ; typ. <1,5
max. RF-input	+19 dBm (approx. 80 mW)
max. DC-input	50 V
Dimensions W × H × D	93 mm × 39 mm × 33 mm
Weight, incl. battery	170 g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage[4]	–25 °C to 55 °C
Supply	9-V-block battery 6LR61
Operating time with alkaline battery	approx. 40 hours

Special application

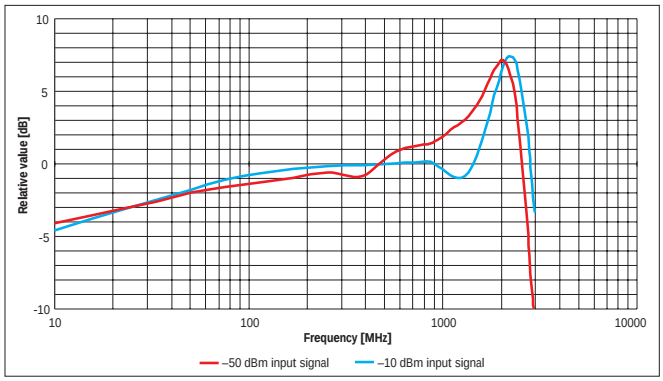
Multiple Input Signals („Level selective“ meter-action):
Unlike common up-to-now RMS-meters, the PWRM2 does not indicate the average-power-sum of a multiple-signal but indicates the power-level of the strongest signal only. This is due to inherent special properties of the level-meter's detector. A ratio Wanted Signal vs. Unwanted Interfering Signal of 3 dB would be sufficient to give an unfalsified reading of the „dominating“ (wanted) signal. The PWRM2 acts as broadband, „level-selective“ UHF-Power-Meter.
Depending on the frequencies of the signals involved, as well as their signal levels, the frequency-response must be taken into account. The unwanted signal could be emphazised relatively to the wanted signal, especially if considerably higher in frequency than the wanted one. Therefore, in critical cases, filters for suppressing unwanted signals of a multiple-signal-input are needed if the input level of an interfering signal is near or higher than that of the wanted signal.

- Wide bandwith (30 MHz to 2,8 GHz)
- High dynamic range (>55 dB)
- Direct dBm-power-level reading
- Large, easy-to-read display
- Diecast box, handy and sturdy
- Acts „level-selective“
- For use in laboratories, HAM-Radio etc.

CE

Tabelle: Correction Factors for determining the RMS-Value of Non-Sine-Wave Signals measured with PWRM2. The signal-type relevant correction factor has to be added to the meter's reading.

Signal Type		Correction Factor
Sinewave	CW (unmodul. steady carrier, N0N)	0 dB
Sinewave	FM (F3E)	0 dB
Square wave	symmetrical (keying ratio 1:1)	– 3,0 dB
Triangular wave		+ 0,9 dB
GSM channel	all time slots on	+ 0,6 dB
CDMA (forw.)	9 channels on	+ 3,6 dB
PDC channel	all time slots on	+ 0,6 dB
Gaussian Noise		+ 2,5 dB



Typical frequency-response PWRM2

1 Ref. Typical frequency-response
2 Measurements can be evaluated more exactly, if the typical frequency-response is taken into account.
3 If the input signal form differs from sine-wave, the meter reading has to be corrected by adding a factor, see table!
4 battery removed

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VM2
UHF-Microvoltmeter

General characteristics

Rated measuring range	47 dBµV to 102 dBµV
Usuable range	45 dBµV to 105 dBµV
Display steps	0,1dB
Rated frequency range[1]	30 MHz to 2,8 GHz
Accuracy 30 MHz–1 GHz[2,3]	better than ±3 dB
Accuracy 1 GHz–2,8 GHz[2,3]	better than ±8 dB
Input	
Impedance/Connector	75 Ohms / BNC, female
SWR	<2 ; typ. <1,5
max. RF input	126 dBµV (approx. 2 V)
max. DC-input	50 V
Dimensions W × H × D	93 mm × 39 mm × 33 mm
Weight, incl. battery	170g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage [4]	–25 °C to 55 °C
Supply	9-V-block battery 6LR61
Operating time with alkaline battery	approx. 40 hours

Special application

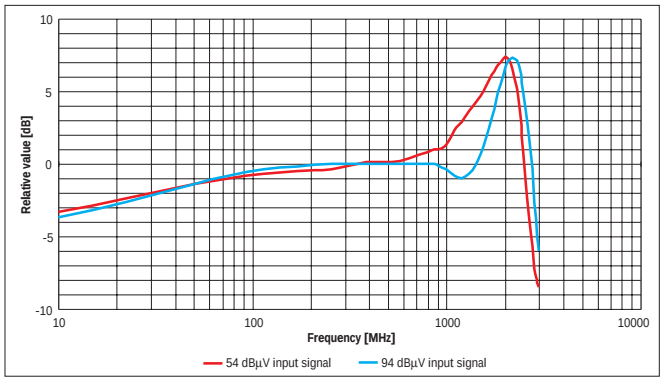
Multiple Input Signals („Level selective“ meter-action):
Unlike common up-to-now RMS-meters, the VM2 does not indicate the average voltage-sum of a multiple-signal but indicates the voltage-level of the strongest signal only. This is due to inherent special properties of the level-meter's detector. A ratio Wanted Signal vs. Unwanted Interfering Signal of 3 dB would be sufficient to give an unfalsified reading of the „dominating“ (wanted) signal. The VM2 acts as broadband, „level-selective“ UHF-Micro-Volt-Meter.
Depending on the frequencies of the signals involved, as well as their signal levels, the frequency-response must be taken into account. The unwanted signal could be emphazised relatively to the wanted signal, especially if considerably higher in frequency than the wanted one. Therefore, in critical cases, filters for suppressing unwanted signals of a multiple-signal-input are needed if the input level of an interfering signal is near or higher than that of the wanted signal.

- Wide bandwith (30 MHz to 2,8 GHz)
- High dynamic range (>55 dB)
- Direct dBµV reading
- Large, easy-to-read display
- Diecast box, handy and sturdy
- Acts „level-selective“
- For use in laboratories, CATV- and SAT-receiving-installations etc.

CE

Tabelle: Correction Factors for determining the RMS-Value of Non-Sine-Wave Signals measured with VM2. The signal-type relevant correction factor has to be added to the meter's reading.

Signal Type		Correction Factor
Sinewave	CW (unmodul. steady carrier, N0N)	0 dB
Sinewave	FM (F3E)	0 dB
Square wave	symmetrical (keying ratio 1:1)	– 3,0 dB
Triangular wave		+ 0,9 dB
GSM channel	all time slots on	+ 0,6 dB
CDMA (forw.)	9 channels on	+ 3,6 dB
PDC channel	all time slots on	+ 0,6 dB
Gaussian Noise		+ 2,5 dB



Typical frequency-response VM2

1 Ref. Typical frequency-response
2 Measurements can be evaluated more exactly, if the typical frequency-response is taken into account.
3 If the input signal form differs from sine-wave, the meter reading has to be corrected by adding a factor, see table!
4 battery removed

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HFS1
Magnetic Field Probe

General characteristics

Rated frequency range	500 kHz to 175 MHz
Usable frequency range[1]	250 kHz to 250 MHz
Termination needed	50 Ohms
Connector	BNC
Conversion factor	1 (0 dBA/m eq.: 0 dBm)
Conversion accuracy[2,3]	–1 dB / +1,5 dB
Measurement range[2]	–70 dBA/m to +15 dBA/m eq.: 0,32 mA/m to 5,6 A/m
Suppression of electric-field „antenna effect“[4]	>25 dB
Dimensions D × H	160 mm × 30 mm
Weight	52 g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage	–25 °C to 55 °C

H-Field-probe fundamentals: Short-circuited loop with double-shielded current transformer. Each individual probe is checked vs. reference-response at 10 MHz.[1]

- Passive H-Field-Probe for vector measurements of magnetic field components in electromagnetic fields
- Wide bandwith (500 kHz to 175 MHz)
- Special conversion factor in combination with a power-level-meter (like PWRM1) indicating dBm results in direct dBA/m reading with correct sign
- For use in laboratories, HAM-Radio, EMR-measurements etc.

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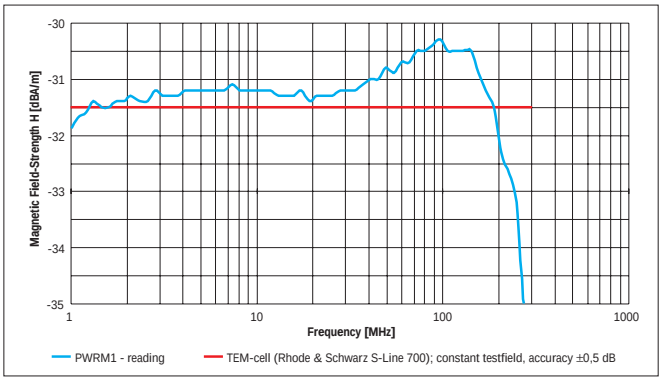

Figure 1: HFS1 Reference-Probe + PWRM1 combination: Over-all frequency response

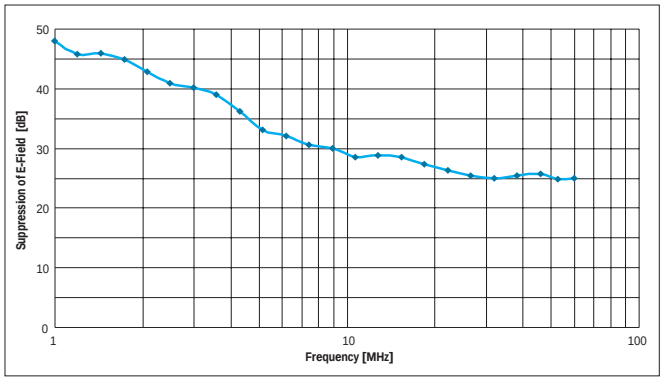

Figure 2: HFS1 Reference-Probe + PWRM1 combination: Minimum E-Field-Suppression

1 Ref. Fig.1: Over-all-frequency-response in combination with power-level-meter PWRM1
2 Valid only if the probe, by means of a BNC-adapter, is directly connected to a power-level-meter type PWRM1 for indication. – An interconnecting cable will impair the measurement!
3 Measurements can be evaluated more exactly, if the over-all-frequency-response Fig.1 is taken into account.
4 Ref. Fig.2: Minimum suppression of electric-field „antenna effect“

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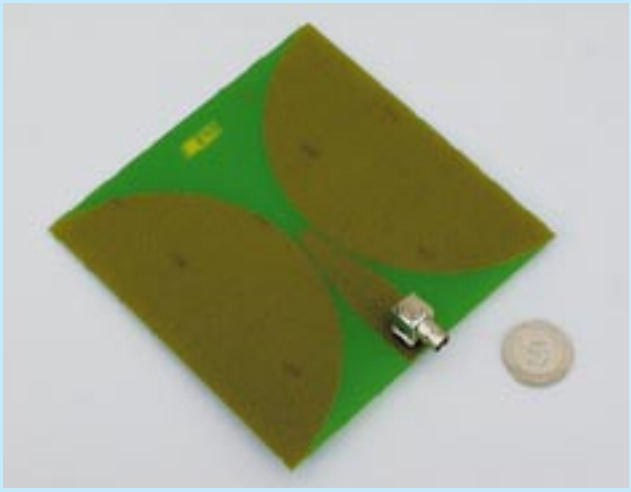
EFS1
Electric Field Probe

General characteristics

Rated frequency range	1 MHz to 60 MHz
Usable frequency range[1]	500 kHz to 80 MHz
Termination needed	50 Ohms
Connector	BNC
Conversion factor	0,0003162 (0 dBV/m eq. –70 dBm)
Conversion accuracy[2,3]	–1 dB / +1,5 dB
Measurement range[2]	0 dBV/m to +70 dBV/m eq.: 1 V/m to 3,16 kV/m
Dimensions L × W × H	152 mm × 152 mm × 35 mm
Weight	52 g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage	–25 °C to 55 °C

E-Field-probe fundamentals: Short Dipol, shunted capacitively, balanced on high-impedance side. Each individual probe is checked vs. reference-response at 10 MHz.[1]



- Passive E-Field-Probe for vector measurements of electric field components in electromagnetic fields
- Wide bandwith (1 MHz to 60 MHz)
- Special conversion factor in combination with a power-level-meter (like PWRM1) indicating dBm. Adding 70 dB to the dBm-reading results in dBV/m with correct sign
- For use in laboratories, HAM-Radio, EMR-measurements etc.

CE

1 Ref. Over-all-frequency-response in combination with power-level-meter PWRM1
2 Valid only if the probe, by means of a BNC-adapter, is directly connected to a power-level-meter type PWRM1 for indication. – An interconnecting cable will impair the measurement!
3 Measurements can be evaluated more exactly, if the over-all-frequency-response is taken into account.

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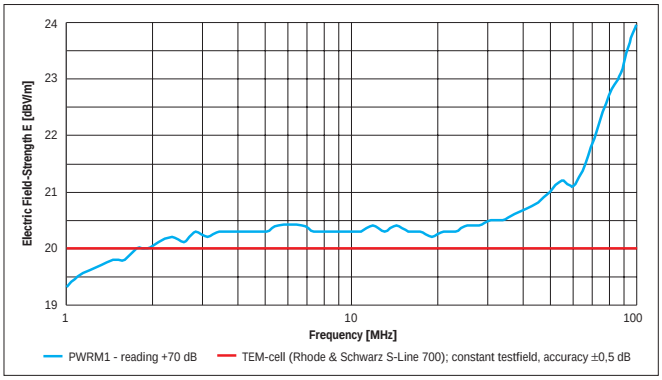

EFS1 Reference-Probe + PWRM1 combination: Over-all frequency response

SW1 RF-Current-Measuring-Transformer

General characteristics

Rated frequency range	100 kHz to 60 MHz
Bandwith (–3dB)	50 kHz to 100 MHz
Powermeter PWRM1 with dBm-reading:	
with 20-dB-attenuator	
Reading equals dBA	0-dBm-reading eq. 0 dBA = 1A
Rated range	–70 dBA to +6 dBA 0,32 mA to 2 A
without attenuator	
Reading –20dB eq. dBA	0-dBm-reading eq. –20 dBA = 100 mA
Rated range	–90 dBA to –5 dBA 0,032 mA to 562 mA
Power-meter with watts-reading;	
conv. formulas	(I in amperes, P in watts)
with 20-dB-attenuator	I = SQR (1000 × P × 1/Ohm) e.g.: 1 mW → 1 A
without attenuator	I = SQR (10 × P × 1/Ohm) e.g.: 1 mW → 0,1 A
Accuracy	better than 0,5 dB; typ. 0,2 dB
Nominal-/test voltage, measuring line vs. ground	1 kV/5 kV (2,4 mm O.D.-PTFE)
rf-current (t <30 sec)	3 A max.
Termination	50 Ohms
Connector	BNC
Dimensions W × H × D	23 mm × 47 mm × 20 mm
Weight	22 g
Ambient (relative humidity 25% to 80%)	
Rated performance	+23 °C ±5 °C
Operating	0 °C to 40 °C
Storage	–25 °C to 55 °C

Measuring transformer fundamentals: Screened current transformer with forced termination by 50 Ohms at the secondary side.
Remarks: An interconnecting cable between the SW1 and the PWRM1 is not allowed unless the supplied 20-dB-attenuator will be used as a coupling element directly terminating the SW1.

- Frequency range (100 kHz to 60 MHz)
- Wide range in combination with PWRM1 (0,032 mA to 2 A)
- With 20-dB-attenuator direct dBA-reading on PWRM1
- Formulas for calculating Watts-reading into current (amperes)
- For use in laboratories, HAM-Radio, EMR-measurements etc.

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Fieldstrenght-Test-Equipment 50 MHz to 2500 MHz

General characteristics

Maximum allowable level at PWRM-Imputs:	
PWRM1	max. +26 dBm
PWRM2	max. +19 dBm
Usuable ranges	s. Fig. 1
Antennafactors	s. Fig. 2
Typical accuracy (E-fieldstrenght) better than:	
50 MHz to 500 MHz	±3 dB with PWRM1 or PWRM2
500 MHz to 1000 MHz	±5 dB with PWRM2 only
1000 MHz to 2500 MHz	±7 dB with PWRM2 only
Dimensions of ABS-box W × H × D	275 mm × 84 mm × 228 mm
Weight, including all mentioned parts	740 g only

Additional technical data:
see special datasheets of BMA1, PWRM1, PWRM2

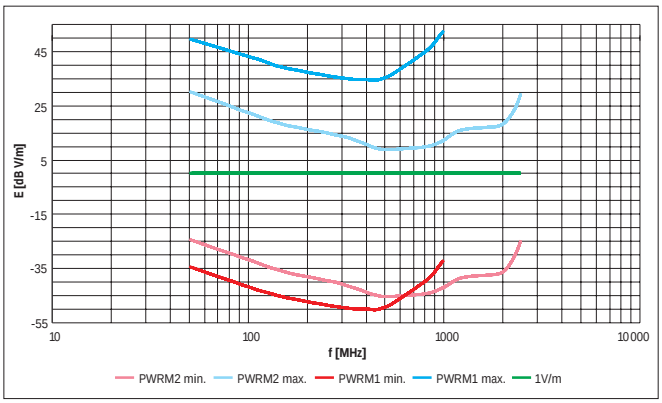

Fig. 1: Usuable measuring-limits (BMA1 connected with PWRM1 or PWRM2 by BNC-coupler directly). Values can be raised by use of an interconnecting attenuator.

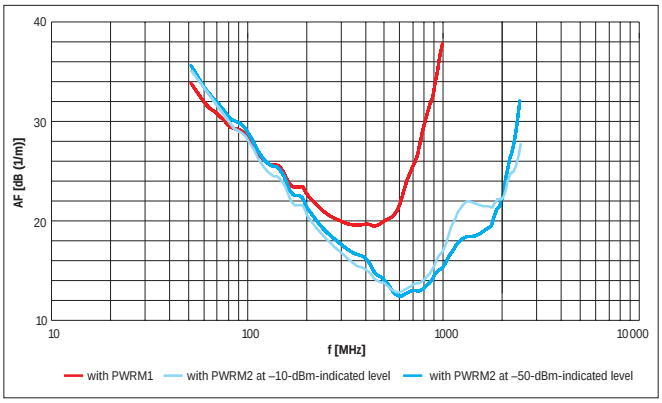

Fig. 2: Antennafactors for combinations BMA1 with PWRM1 or PWRM2

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Complete test-set for measuring electric field-strenghts, comprising:

- Low-level VHF-/UHF-Power-Meter PWRM2
- Biconical Broadband Dipol BMA1 with BNC-Adapter and 9-V-battery-block stored in a small, handy ABS box
- Comes, including individual calibration-certificate, 24 months warranty and documented frequency responses: gain (dBd) vs. $^1/_2\lambda$-dipol, antenna-factors
- From 50 MHz to 500 MHz the BMA1 may also be used in combination with PWRM1 (with higher sensitivity)

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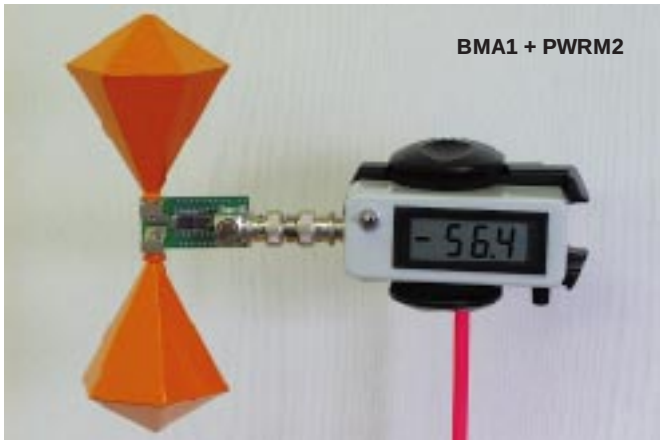
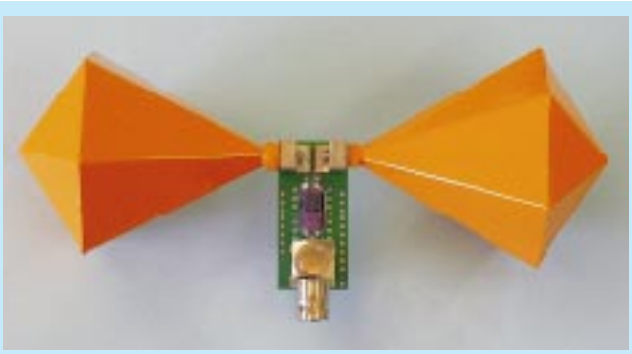


BMA1 – Measuring Antenna 50 MHz to 2500 MHz

General characteristics

Termination	BNC, 50 Ohm (forced termination essential!)
Dipol, dimensions L × D	178 mm × 68 mm
Weight	100 g
Material/surface	Brass/Cu-Ni-Zn-alloy (lacquer coated)
Ambient:	
Relative humidity	25 % to 80 %
Operating	0 °C to 40 °C
Storage	–25 °C to 55 °C



- Biconical Broadband Dipol (linear polarization)
- Documentated characteristics vs. frequency: gain (dBd) vs. $^1/_2\lambda$-dipol, antennafactors
- For use in laboratories, product evaluation, EMR-measurements, checking of mobile radio antenna radiation, HAM-radio etc.

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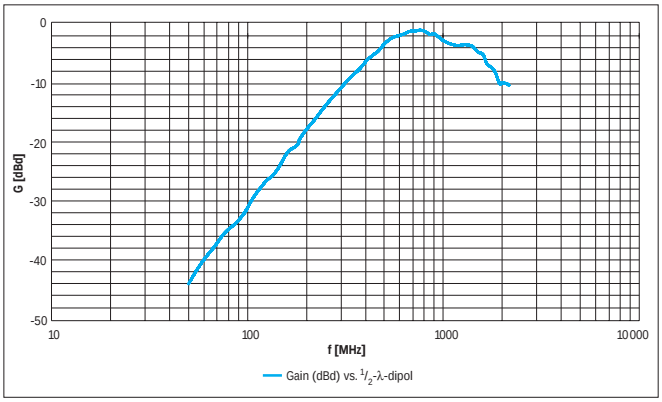

Fig. 1: Gain (dBd) vs. $^1/_2$-λ-dipol

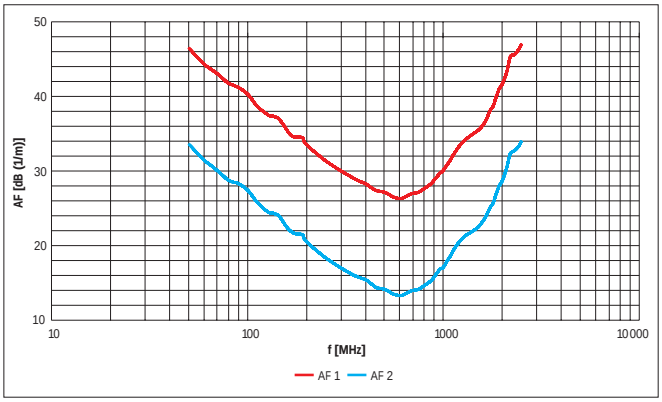

Fig. 2: Antennafactors for BMA1 combined with dBµV- or dBm-level-meters having frequency-flat characteristics (direct 50-Ohm-termination)
$E/[dB(\mu V/m)] = U_{Displ}/dB\mu V + AF1/[dB/(1/m)]$
$E/[dB(V/m)] = P_{Displ}/dBm + AF2/[dB/(1/m)]$

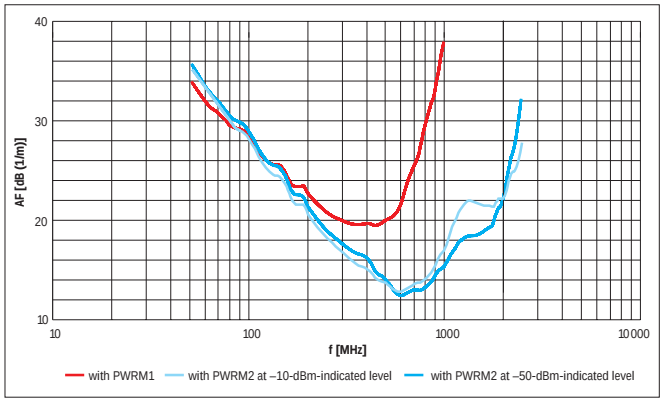

Fig. 3: Antennafactors for combinations BMA1 with PWRM1 or PWRM2
(BMA1 connected with PWRM1 or PWRM2 by BNC-coupler directly)
$E/[dB(V/m)] = P_{Displ}/dBm + AF/[dB/(1/m)]$

Attention: The occasional use of an interconnecting cable between BMA1 and level meter asks for:

1. Forced BMA1 termination: 50-ohms-attenuator à ≥ 3 dB
2. Adequate measures for keeping unbalanced rf-currents off the cables shield
3. Keeping the additional attenuations between BMA1 and level meter in mind

Issued: January 2001. Specifications subject to change without notice.

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