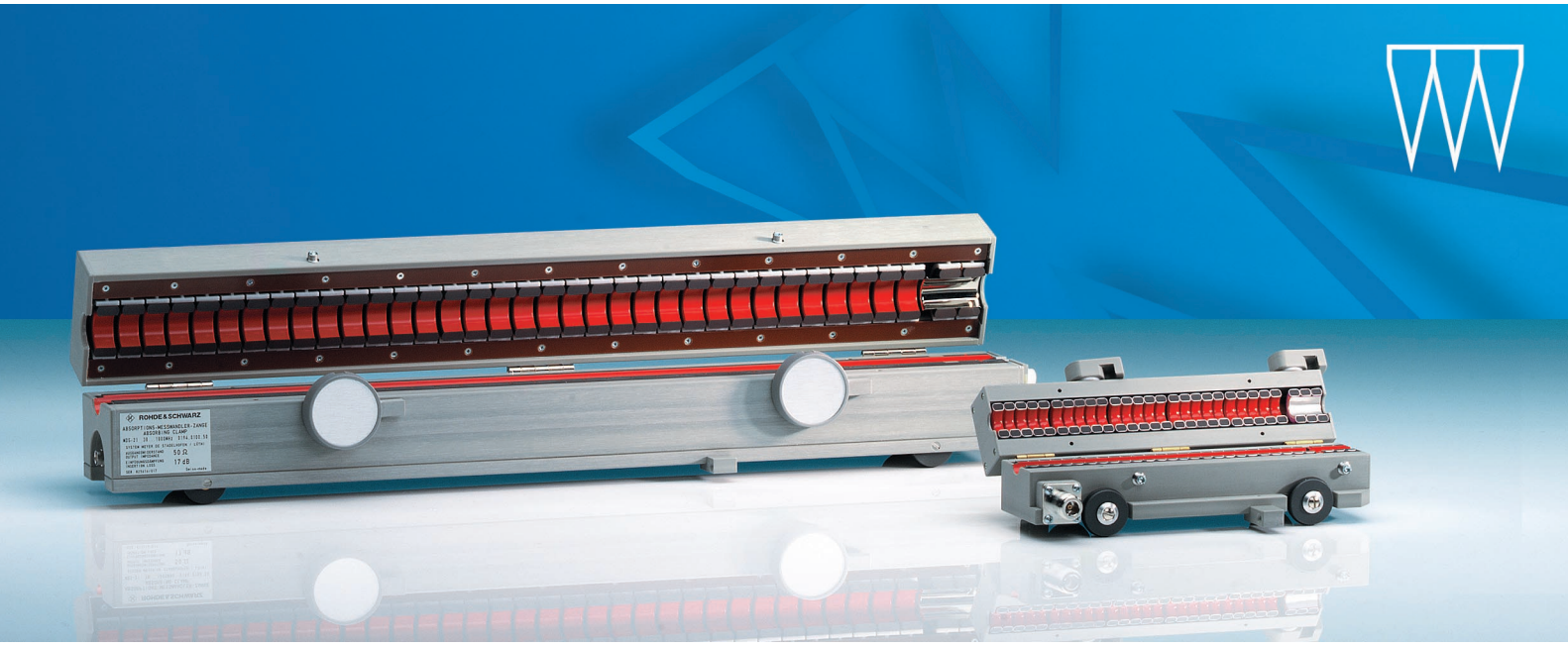
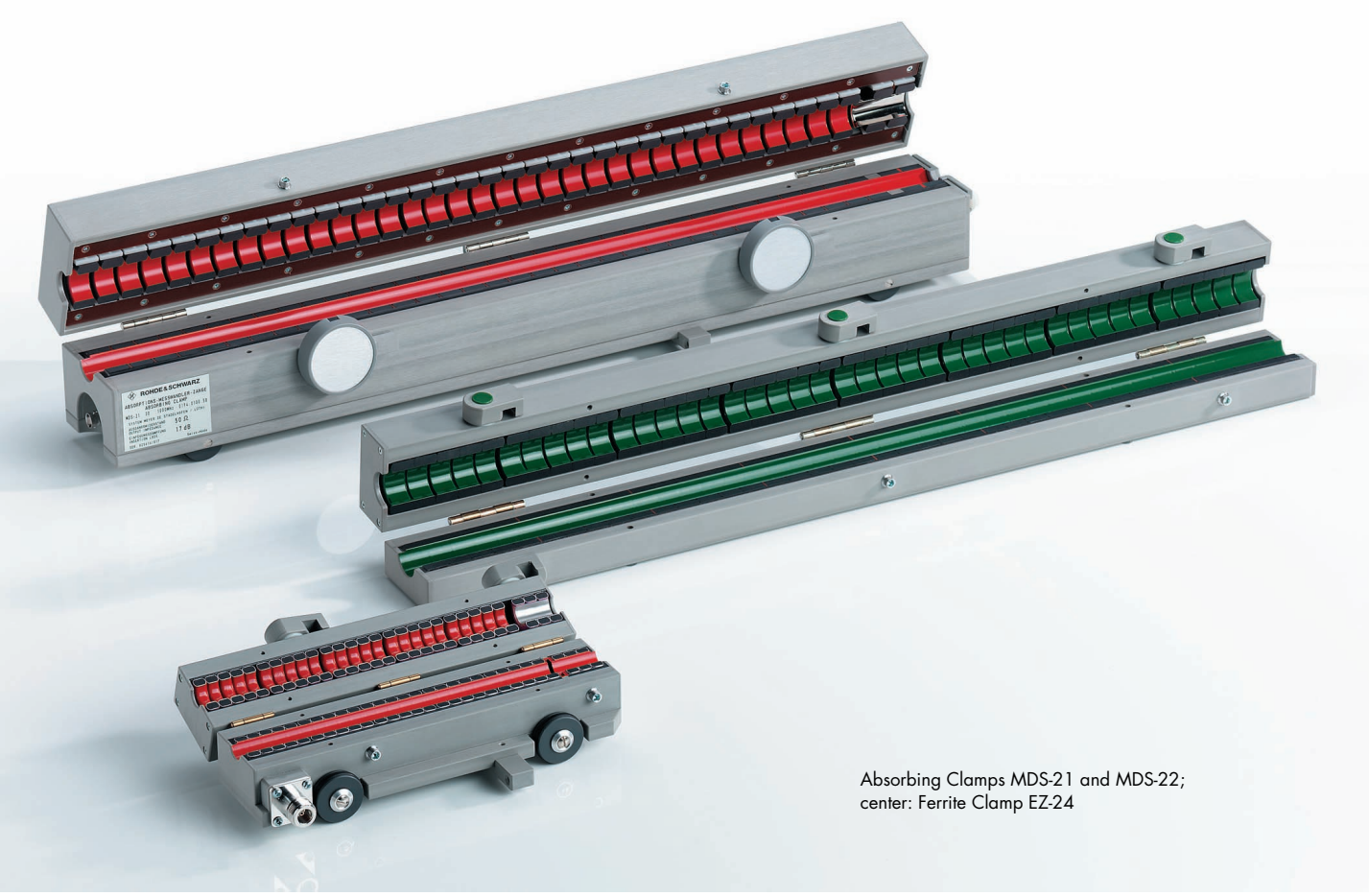


Absorbing Clamps MDS-21/-22, Ferrite Clamp EZ-24

RFI power and shielding effectiveness measurements on lines
Reproducible interference field-strength and power measurements

- MDS-21
  for 30 MHz to 1000 MHz
- MDS-22
  for 300 MHz to 2500 MHz
- Calibrated to CISPR Publ. 16-1
- Ball-bearing rollers for continuous use in automatic measurements
- EZ-24
  for 1 MHz to 1000 MHz
- For improved reproducibility of field-strength measurements
- Maximum line diameter
  20 mm for MDS-21
  12 mm for MDS-22
  22 mm for EZ-24
- All clamps can easily be opened to take up the line to be tested

ROHDE&SCHWARZ



Absorbing Clamps MDS-21 and MDS-22; center: Ferrite Clamp EZ-24

The RFI emission of electrical appliances, machinery and systems must be kept within the limits specified by regional and international standards. Absorbing Clamps MDS can be used in conjunction with EMI test receivers to measure RFI power on lines to CISPR 14-1, EN 55014-1, VDE 0875 Part 14 and EN 50083-2, and in conjunction with two-port measurement devices to measure the shielding effectiveness of lines to DIN 47250 Part 6, IEC 96-1, EN 50083-2 and DIN 0855 Part 200. MDS clamps are also used for testing the effectiveness of RFI suppression devices for high-voltage ignition systems in line with VDE 0879 Part 4 and CISPR 12 (4th edition). Draft documents for the measurement of radiated interference provide for the use of ferrite absorbers for line loading to improve the reproducibility of RFI field-strength measurements. Ferrite absorbers are also used to improve RFI power and shielding effectiveness measurements.

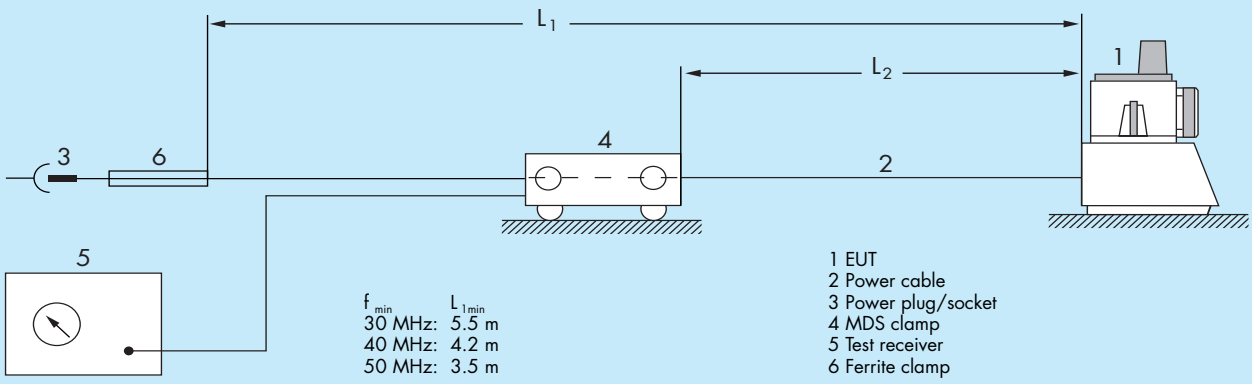
Interference measurements in the VHF/UHF range

In the frequency range below 30 MHz, where interference is mainly propagated via lines, this interference is determined as laid down in many regulations by measuring the RFI voltage produced by the EUT across the terminals of a line-impedance stabilization network.

In the VHF/UHF range, where radiated emission predominates, interference is defined in terms of the RFI field strength at a certain distance. Small EUTs emit interference mainly via the connecting cables such as power lines. For the above reasons as well as to avoid complex field-strength measurement, several regulations prescribe the use of an absorbing clamp for measurement of the RFI power.

Measurement principle and test setup

RFI power measurement A ferrite absorber inside the MDS clamp encircles the power cable and acts as a resistance to the RFI power. The current flowing into the absorber is measured at the absorber input with a current transducer and an EMI test receiver. Since in this test setup there is no matching between interference source, line and absorber, the MDS clamp is slid along the line for maximum current.



Test setup for RFI power measurement (with additional EZ-24)

By choosing a suitable absorber and conversion ratio of the current transducer, the dBµV readout of an EMI test receiver is approximately equivalent to a power indication in dBpW. Individual calibration curves are delivered with the MDS clamps.

Shielding effectiveness measurement
The shielding effectiveness of a cable is defined as the ratio of the RFI power of the surface wave of an unshielded line to that of the cable shield as measured with the MDS clamp. The shielded cable is terminated into its nominal impedance. Interfering effects caused by standing waves are reduced by the ferrite absorber of the MDS clamp and by an additional ferrite absorber. The relevant standards for measuring the shielding effectiveness, such as DIN 47250 Part 6, IEC 96-1 Amendment 1988 and EN 50083-2, differ in some details.

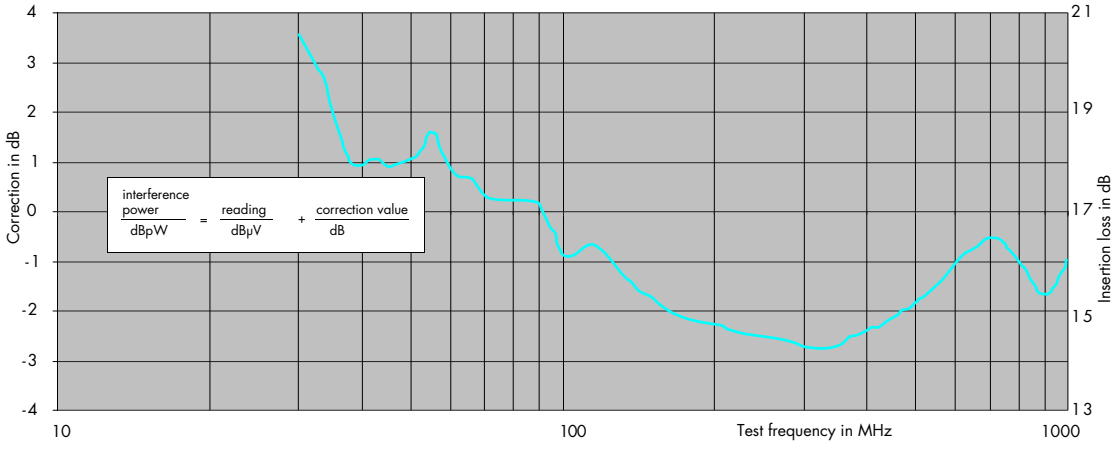
Design The MDS clamp consists of a number of ferrite rings arranged side by side and encircling the cable of the EUT. Some of these rings are part of the current transducer whose output voltage is taken to the test receiver via an internal RF cable which is also loaded by ferrite rings. With power cables, the measurement result is not affected by the magnitude of the current, since the currents in the forward and return leads compensate each other.

The absorbing clamp is accommodated in a plastic case made up of two hinged parts, each part containing a set of ferrite ring halves. The latter are held in spring-loaded plastic holders to form a channel for the EUT cable to be inserted. By closing the two parts of the case the magnetic loop around the cable is completed. Eccentric catches provide the necessary contact pressure.

The absorbing clamps are fitted with ball-bearing rollers designed for continuous use in automatic measurements to facilitate the determination of interference maxima.

Ferrite Clamp EZ-24 The characteristics of the absorber material used for Ferrite Clamp EZ-24 correspond to that of MDS-21. In a 50 Ω circuit the clamp produces a skin current loss of more than 15 dB in the range from 30 MHz to 1000 MHz. The ferrite clamp can be opened up to accept the cable to be loaded.

Typical calibration curve of Absorbing Clamp MDS-21



Test procedure

To measure the RFI power of an EUT, the latter is placed on a non-conductive surface (test table) so that it is at least 40 cm from a conductive floor or wall. The length of the cable is to be extended to λ/2 + 60 cm depending on the lowest frequency to be measured (30 MHz). The cable is then laid out horizontally so that the absorbing clamp encompassing the cable can easily be moved along the cable with the current transducer facing the EUT.

Test setup for RFI power measurement
The following example describes the test procedure (see illustration on page 3). After switching on the EUT, the test receiver must be set to a frequency of the interference spectrum. The MDS clamp is then moved away from the interference source until the meter on the test receiver shows a maximum. The operator should hold the MDS clamp at the end away from the EUT or move the clamp with the aid of a traction line.

Normally the maximum nearest to the interference source is measured. With frequencies above 150 MHz, this maximum may lie in the handle of the EUT; in this case the clamp must be moved to obtain the second maximum (distance L_2) provided that this position yields a higher reading than that with the clamp closest to the EUT. If the first maximum cannot be determined because of a power connector, the second maximum should be searched behind the connector and the interference level measured be corrected by +1 dB. Note: a power connector is not allowed in automatic measurements.

The interference level can now be read off the test receiver. The following holds true for readout in dBµV:

Interference power/dBpW =
reading/dBµV + correction value/dB

Modern test receivers allow the entry of a transducer factor.

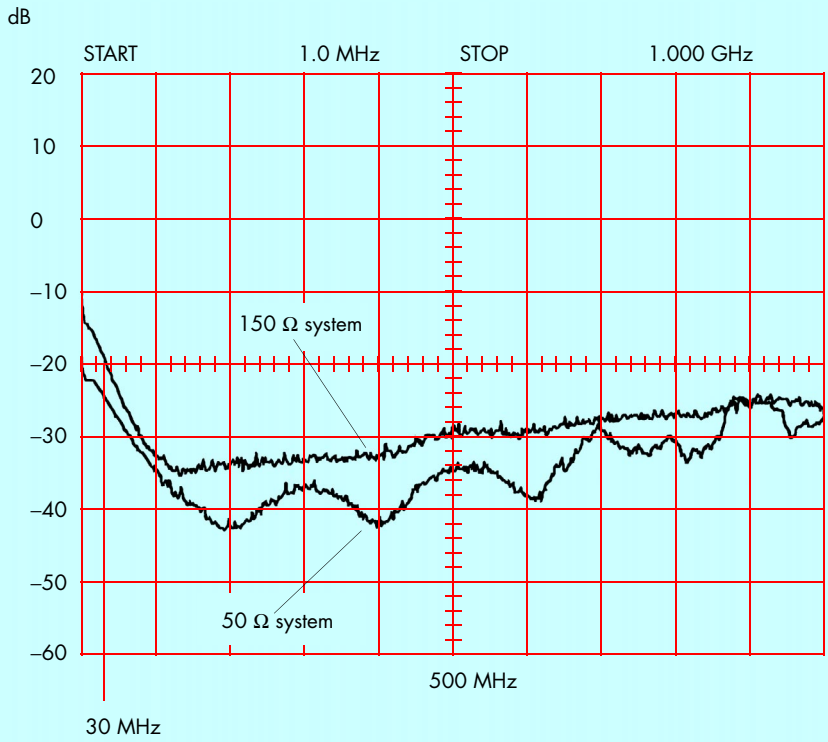
For automatic measurements, absorbing clamp slideways are to be used.

Further applications

In addition to measuring the interference emitted by small appliances and the shielding effectiveness of cables, Absorbing Clamp MDS-21 can also be used for testing the effectiveness of RFI suppression devices for high-voltage ignition systems according to VDE 0879 Part 4/Draft 9.89 and CISPR 12. High-energy pulses are coupled out and taken to the test receiver whose inputs are protected in a special way.

MDS clamps are also suitable for use as coupling clamps for testing the susceptibility of electronic devices.

Insertion loss characteristic of Ferrite Clamp EZ-24



Compact, cost-effective test set comprising EMI Test Receiver ESCS30, Absorbing Clamp MDS-21 and printer for semiautomatic measurement of RFI power

Specifications

	MDS-21	**MDS-22**
Frequency range	30 to 1000 MHz	300 to 2500 MHz
Insertion loss to CISPR 16-1, typ. (individual calibration report supplied with clamp)	17 ±4 dB	17 +6/–4 dB
Calibrated for receiver input impedance	50 Ω	50 Ω
Connector	N female 50 Ω	N female 50 Ω
Permissible DC current or peak value of AC current	30 A	50 A
Max. permissible RF input power for susceptibility measurement	5 W	5 W
Max. cable diameter	20 mm	12 mm
Insert sleeves supplied (diameter)	10 mm	3, 6, 9 mm
Rollers	ball bearing, dust-protected	ball bearing, dust-protected
Overall dimensions (W x H x D) in mm	610 x 115 x 80	230 x 70 x 70
Weight	6.3 kg	1.25 kg

	EZ-24
Frequency range	1 MHz to 1000 MHz
Skin current attenuation in range 30 to 1000 MHz in 50 Ω circuit	>15 dB (see typ. insertion loss)
Max. permissible skin current RF power	50 W
Overall dimensions (W x H x D) in mm	626 x 57 x 80
Weight	3.5 kg

Ordering information

Order designations

Absorbing Clamp	MDS-21	0194.0100.50
Absorbing Clamp	MDS-22	1052.3507.02
Ferrite Clamp	EZ-24	1107.2535.02

Accessories supplied

MDS-21	1 coaxial connecting cable (for connecting MDS-21 to EMI test receiver), 5 m long with 2 x N connector; 6 dB attenuator, 2 x N connector
MDS-22	1 calibration curve without cable insertion loss (insertion loss of connecting cable must be added)

CertifiedQualitySystem
ISO 9001
DQSREG.NO1954-04

Fax Reply (Absorbing Clamps MDS-21/-22, EZ-24)

❑ **Please send me an offer**

❑ **I would like a demo**

❑ **Please call me**

❑ **I would like to receive your free-of-charge CD-ROM catalogs**

Others: _____

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Name: _____

Company/Department: _____

Position: _____

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