R&S®ENY81
COUPLING NETWORK

For measurement of asymmetrical (common-mode) disturbance voltage

Product Brochure
Version 06.00

ROHDE&SCHWA

Make ideas real

AT A GLANCE

The R&S®ENY81 coupling network has been designed to measure the asymmetrical (common-mode) disturbance voltage of unshielded, symmetrical telecommunications ports of EUTs.

The radio disturbance measurements can be performed in the frequency range from 150 kHz to 30 MHz.
The coupling network complies with the following product standards:

- CISPR 22: 2008 and EN 55022:2010 (figure D.3)
- CISPR 32 and EN 55032 (figure G.3)

The R&S®ENY81 is tested and calibrated in line with CISPR 16-1-2. The calibration data supplied refers to a symmetrical impedance of 100 Ω.

Key facts

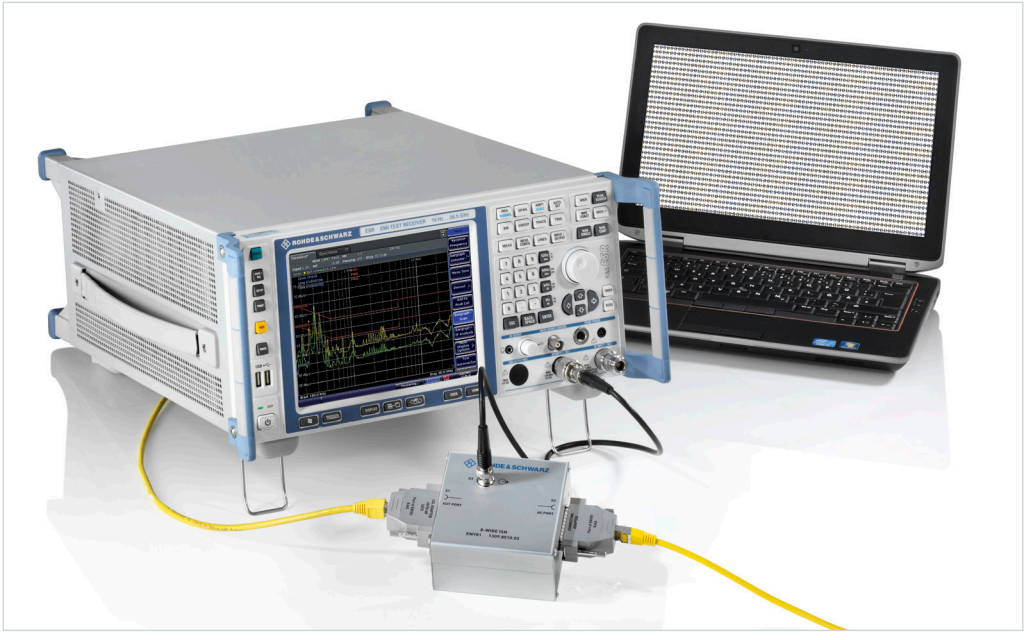
- Eight-wire network
- Radio disturbance measurements in line with CISPR 22: 2008 and EN 55022: 2010 or CISPR 32 and EN 55032 (150 kHz to 30 MHz)
- Compliance with CISPR 16-1-2
- Adapter sets to meet standardized LCL requirements (55 dB and 65 dB) and to accommodate various telecommunications interfaces
- High transmission bandwidth for wanted signal (100 MHz)

Test method

The R&S®ENY81 terminates the EUT's interface with 150 Ω (asymmetrical or common-mode impedance) and couples the EUT's asymmetrical disturbance signal to the test receiver with a voltage division factor of typ. 10 dB. The wanted symmetrical (differential-mode) signal passes through the network almost without attenuation up to a bandwidth of 100 MHz (valid for a symmetrical impedance of 100 Ω). At the same time, the coupling network decouples the test circuit from disturbance effects (disturbance voltage, impedance) at the associated equipment (AE) port.

In line with CISPR 22 and EN 55022 or CISPR 32 and EN 55032, an eight-wire ISN (R&S®ENY81 or R&S®ENY81-CA6) is used for disturbance voltage measurements on four unshielded symmetrical wire pairs. Thanks to the design, the R&S®ENY81 can also be used for measurements on two or four wire pairs.

CISPR 22 and EN 55022 as well as CISPR 32 and EN 55032 specify the following conformance test method: The measurement of the EUT should be performed with a suppression of the wanted symmetrical signal corresponding to the category of the connected cable (requirements for CAT 3, CAT 5 and CAT 6 cable categories are defined in the standard).



Compact test set consisting of the R&S®ESR EMI test receiver and the R&S®ENY81 coupling network for semi-automatic measurement of the asymmetrical disturbance voltage

In order to implement these test methods, the R&S®ENY81 consists of a high-symmetry basic network and a number of adapter sets for implementing the required longitudinal conversion losses (LCL). Each adapter set contains adapters for LCL values of 55 dB (for CAT 3 cable category) and 65 dB (for CAT 5 cable category). Due to the high longitudinal conversion loss, the CAT 6 cable category requires the use of a separate coupling network (R&S®ENY81-CA6).

Nomenclature

In the CISPR 22: 2008 and EN 55022: 2010 product standards, this type of coupling network is referred to as an impedance stabilization network (ISN).

In the CISPR 32 and EN 55032 product standards and the CISPR 16 basic standard, these networks are called asymmetrical artificial networks (AAN) and Y-networks. In the IEC 61000-4-6 basic standard, they are referred to as coupling/decoupling networks (CDN).

Adapters

The R&S®ENY81 eight-wire ISN comes with two adapter sets with RJ-45 connector and with connectors for user-selectable wiring (1 mm banana jack).

Functional testing

The R&S®ENY-FTS option in connection with a network analyzer allows the functional testing of the ISN. This functional testing includes the verification of the asymmetrical impedance and phase, voltage division factor, longitudinal conversion loss and decoupling attenuation.

Mechanical design

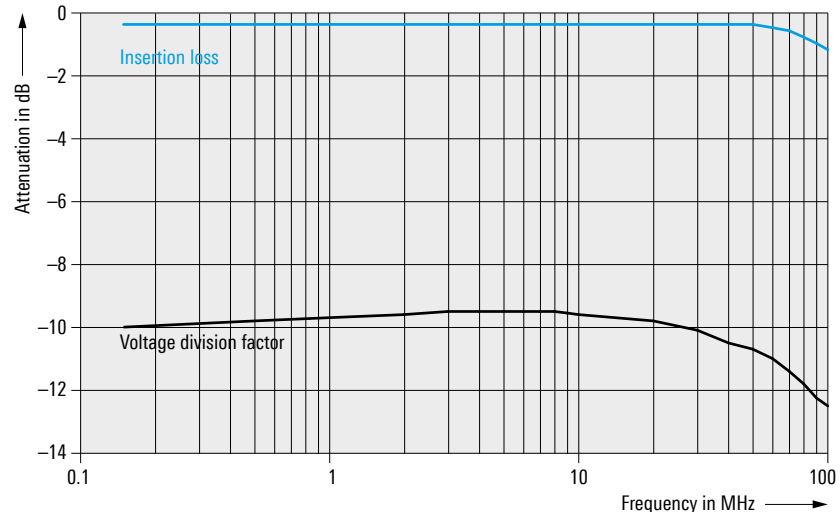
The R&S®ENY81 coupling network features bare threaded sockets for connecting them to a reference ground plane that is arranged either horizontally or vertically.

Overview of the adapter sets

Application	Pin assignment (in line with EIA/TIA T568B)				
	Connector	pair 1/pins 4, 5	pair 2/pins 1, 2	pair 3/pins 3, 6	pair 4/pins 7, 8
Ethernet (100BASE-T4, 1000BASE-T)	RJ-45	•	•	•	•
User-selectable pin assignment	RJ-11, RJ-45 and 1 mm				

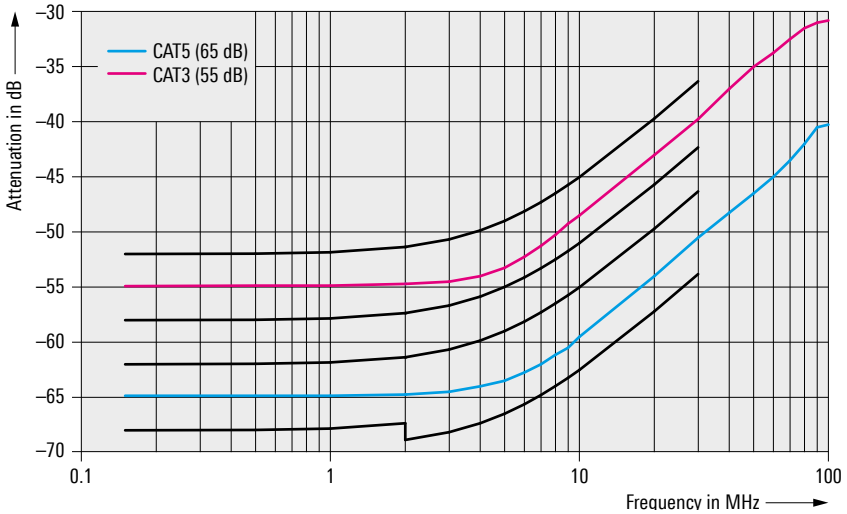
R&S®ENY81 with basic adapter sets

Insertion loss/voltage division factor



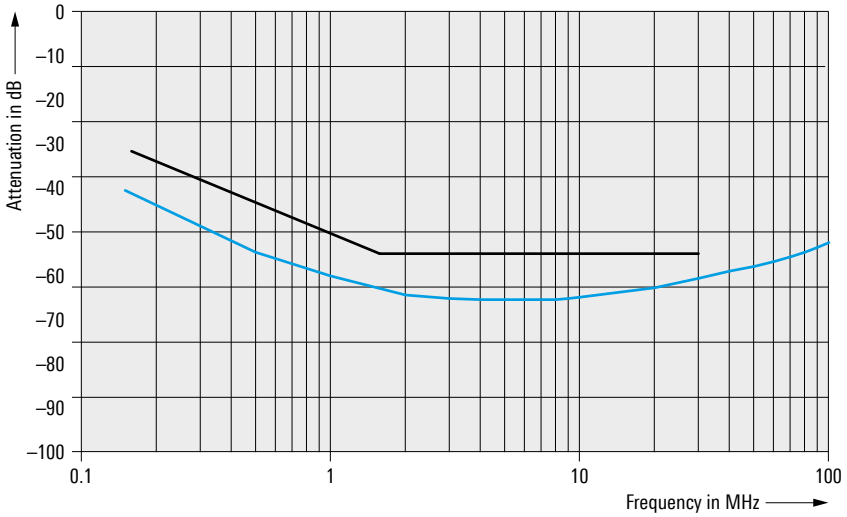
The typical insertion loss of the symmetrical circuit – measured with a line impedance of 100 Ω – determines the transmission bandwidth of the coupling network for the wanted signal; the typical voltage division factor (lower curve) is to be added to the measured voltage for the frequency range from 150 kHz to 30 MHz for comparison with the disturbance limit.

Longitudinal conversion loss (LCL)



Typical longitudinal conversion losses (LCL) as required by CISPR 22: 2008 and EN 55022: 2010 or CISPR 32 and EN 55032 for the CAT 3 and CAT 5 cable categories; all curves are valid for the frequency range from 150 kHz to 30 MHz but also have significance for immunity tests up to 80 MHz.

Decoupling attenuation



Typical decoupling attenuation between AE port and receiver port with EUT port short; the curves are valid for the frequency range from 150 kHz to 30 MHz but also have significance for immunity tests up to 80 MHz.

SPECIFICATIONS IN BRIEF

Specifications in brief		
Frequency range		
Radio disturbance measurements		150 kHz to 30 MHz
Asymmetrical impedance		
Impedance	0.15 MHz to 30 MHz	150 Ω ± 20 Ω
Phase angle	0.15 MHz to 30 MHz	0° ± 20°
Voltage division factor in asymmetrical circuit	150 kHz to 30 MHz	typ. 10 dB ± 1 dB (calibration data supplied [1])
	> 30 MHz to 80 MHz	typ. 10 dB ± 2 dB
Transmission bandwidth	3 dB	>100 MHz (for 100 Ω source and load impedances)
Longitudinal conversion loss (LCL)		
55 dB adapter	LCL (dB)	55 dB – 10 log (1 + (f/5)^2) dB
	tolerance	±3 dB, for 0.15 MHz ≤ f ≤ 30 MHz
65 dB adapter	LCL (dB)	65 dB – 10 log (1 + (f/5)^2) dB
	tolerance	±3 dB, for f < 2 MHz, –3/+4.5 dB, for 2 MHz ≤ f ≤ 30 MHz
Decoupling attenuation	150 kHz to 1.5 MHz	> 35 dB to 55 dB (increases linearly with logarithm of frequency)
	1.5 MHz to 30 MHz	> 55 dB
Crosstalk (PSELFEXT, EUT/AE)	1 MHz to 100 MHz	≥ 61 dB to ≥ 21 dB (increases linearly with logarithm of frequency)
Maximum values		
Max. permissible RF input voltage		< 15 V
Max. permissible DC voltage between line and ground		100 V
Max. permissible AC voltage between line and ground		63 V
Max. permissible DC current		600 mA (current on each individual wire of one pair or on different pairs)
Connectors		
Output to test receiver/input from signal generator		BNC female
Connectors for EUT and AE		adapter with 1 mm connectors and RJ-11 or RJ-45 connectors
General data		
Temperature range	operating temperature	+5 °C to +40 °C
	storage temperature	–20 °C to +70 °C
Overall dimensions (B × H × T)	base unit	105 mm × 65 mm × 110 mm (4.13 in × 2.56 in × 4.33 in)
	base unit with adapters	105 mm × 65 mm × 190 mm (4.13 in × 2.56 in × 7.48 in)
Weight	base unit with adapters	520 g (1.15 lb)
	case with basic adapter set	1640 g (3.62 lb)

ORDERING INFORMATION

Designation	Type	Order No.
Base unit		
Eight-wire ISN in line with CISPR 22: 2008 and CISPR 32	R&S®ENY81	1309.8503.03
Options		
Functional test set	R&S®ENY-FTS	1309.8703.13
Accessories supplied		
Plastic carrying case with foam material, calibration data [1]		

[1] The calibration data includes asymmetrical impedance and phase, voltage division factor, decoupling attenuation, longitudinal conversion loss (LCL), transmission bandwidth and crosstalk.