User-Manual

AN 200N100

Single line Artificial Network (AN) for Emission measurements in battery supply systems

The EM TEST single-line Artificial Networks, type AN 200N100 series, are used for the simulation of the impedance of the wiring harness particularly for testing the interference voltage in HF-VHF-area in the battery supply system (e.g. in the automotive, aerospace and military area).
They are designed to meet the specifications as per CISPR 25, ISO 11452-4 or ISO 7637-2 and CISPR 16-1-2

- ISO 7637 Part 2
- ISO 11452-4
- CISPR 25
- CISPR 16-1-2

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Contents

1. Safety remarks

The artificial network is to be used only for the limited purposes observing the accepted principles of electrical engineering. Prior to the application the user has to be familiar with the operation mode of artificial networks. The LISN may not be used with higher voltage and current than stated in the technical data. When using an operating voltage higher than 30V a protection earth has to be provided because generally with the artificial network it will be measured against touchable ground planes.

Important advice:

The artificial network has to be unconditionally connected **at first** with the ground potential on the GND prior to the connection of the mains. The ground potential on GND will be disconnected **at last!**

2. Control elements and operating

2.1. Control elements

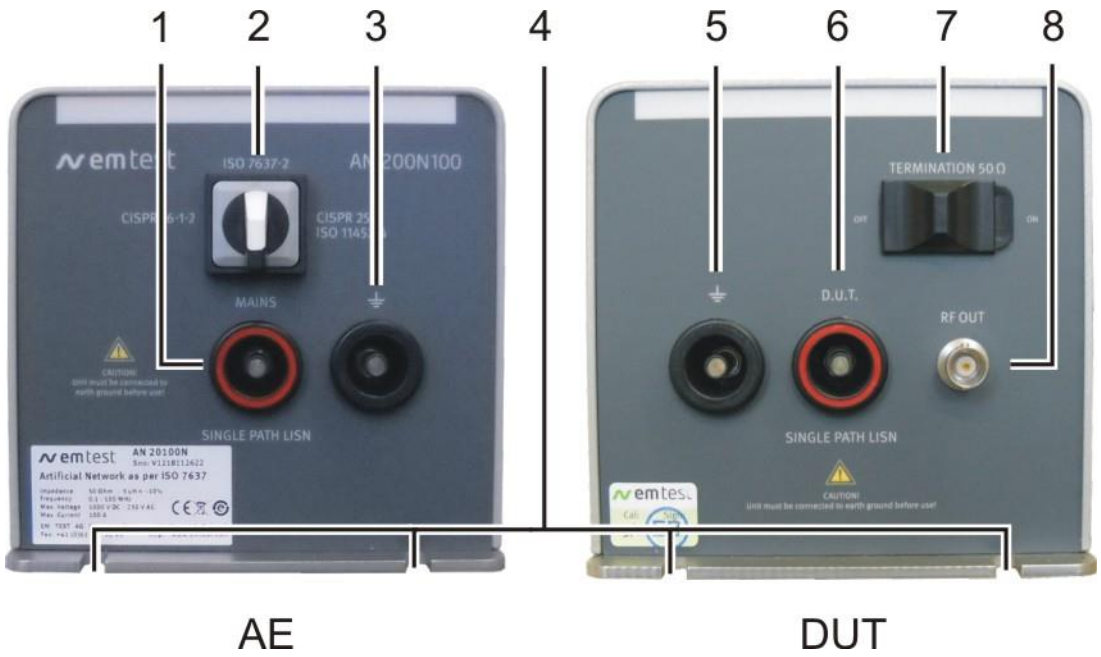


Figure 2.1 : BS 200N Top side

1	Mains, supply connection	**5**	DUT PE- or Ground connection
2	LISN selector	**6**	Mains to DUT
3	GND or return	**7**	Terminating switch 50Ω
4	Lugs for fastening to the ground reference	**8**	RF out BNC

1 Mains supply connection
Supply connection with 4mm or 6mm banana plugs

2 LISN selector
Selector switch for
- CISPR 16-1-2
- ISO 7637-2
- CISPR 25; ISO 11452-4

3 GND or return
Return connection with 4mm or 6mm banana plugs

4 Lugs for fastening to the ground reference
On each side of the bottom plate from AN 200N100 are two recesses for attach from AN 200N100 on the ground reference.

5 Output GND to DUT return
This input is internal connected to ground.

6 Output mains to DUT voltage supply
Power supply to DUT

7 Terminating Switch 50Ω
The 50Ω position terminates the RF out with 50Ω (5W), if no measuring equipment is connected.

8 RF out
Receiver Port (BNC) to measuring receiver, If the measuring receiver is not used, the termination 50Ω must be switched ON.

2.2. Schematic AN 200N100

Figure 2.2 shows the equivalent circuit diagram of the different artificial networks of AN200N100.

ISO 7637-2
Switch position: ISO 7637-2
For proper operation of the standard, the BNC output RFout plug has to terminate with a 50Ω resistor, or to activate the internal "**Termination 50Ω**" resistor with position "**ON**".

CISPR 25; ISO 11452-4
Switch position: CISPR 25; ISO 11452-4
For proper operation of the standard, the BNC output RFout plug has to terminate with a 50Ω resistor, or to activate the internal "**Termination 50Ω**" resistor with position "**ON**".

CISPR 16-1-2
Switch position: CISPR 16-1-2
For proper operation of the standard, the BNC output RFout plug has to terminate with a 50Ω resistor, or to activate the internal "**Termination 50Ω**" resistor with position "**ON**".

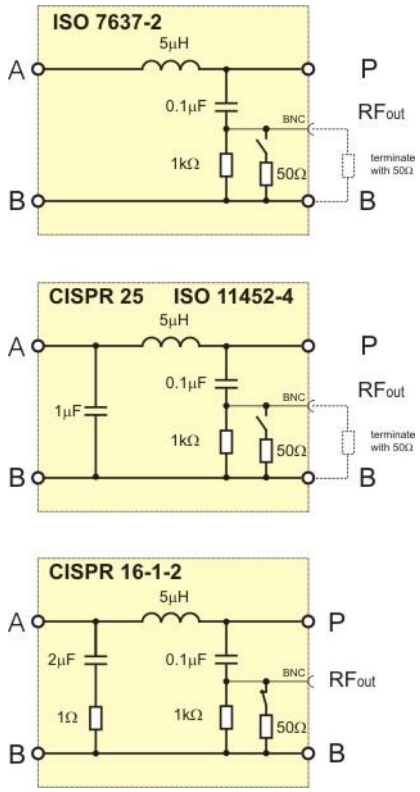


Figure 2.2 Schematics AN20100 for ISO 7637-2, CISPR 25, ISO 11452-4, and CISPR 16-1-2

3. Application

3.1. Test setup as per ISO 7637-2

The ISO 7637-2 standard describes the test setup.

Important

- The artificial network AN200N100 must connect directly to the ground reference plane.
- All wires between AN200N100 and the DUT shall be isolated from the ground plane by 50mm.
- Place the DUT on the ground plane as in real installation.
  - Directly grounded to the ground plane or
  - Use a 50 ± 5mm isolation from the ground plane
- The position of the instruments shall be as specified in the standard.

Switch as per ISO 7637-2:2011

For the measurement of the emission the ISO 7637-2: 2011 standard defines two different switches (electrical or mechanical) and switch positions. These are pending from the rise time of the voltage impulse. The switch position for slow impulses in the ms range is before the electrical switch see figure 3.1. For fast impulses, in µs and ns range, the switch is on the DUT side figure 3.2. During a test only one switch is allowed to operate.

For the emission measurement ISO 7637-2: 2011 defines the test setup below. For using AN200N100 and BS200N100 EM Test propose the test setup illustrated in figure 3.1, 3.2 and 3.3. The test setup with the mechanical switch BSM200N40 is similar. For a detailed test setup refer to the BS200N40 manual.

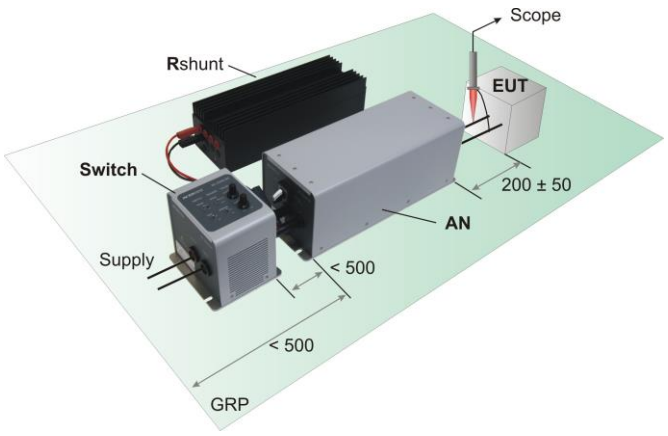


Figure 3.1. : Test setup for pulses in ms range

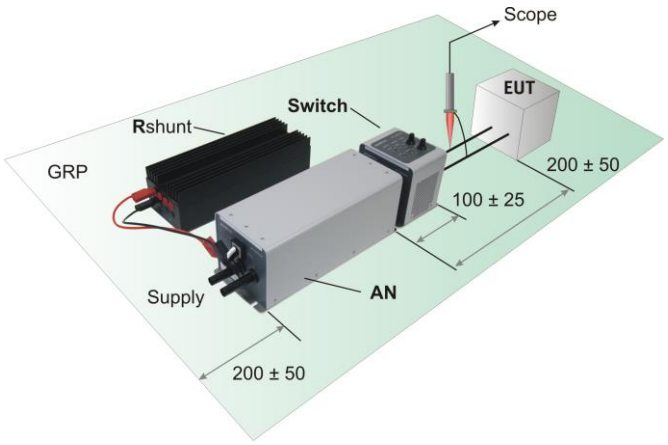


Figure 3.2. : Test setup for pulses in µs / ns range

Test setup for DUT with internal switch

ISO 7637-2:2011 Figure 3.3 includes a new test setup for measuring the transient emission for DUT with an internal switch.

This test setup is suitable for measuring transient emissions in the nanosecond and µs range. Since the original switch is built in the device under test, this test setup needed no BS200N80. The shunt resistor is in accordance with Section 5.2 of the ISO 7637-2 standard to choose.

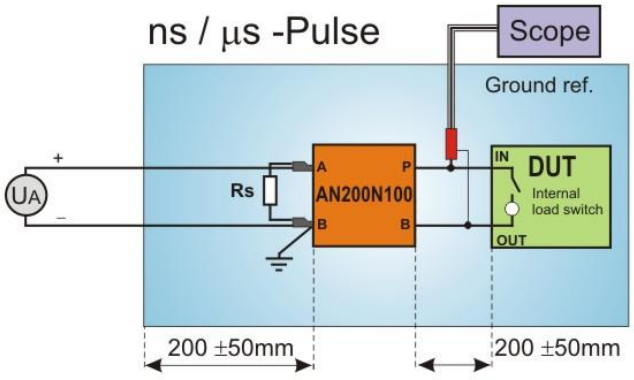


Figure 3.3. : Test setup for DUT with internal switch for devices with internal switch for pulses in µs / ns range

3.2. Test setup as per CISPR 25; ISO 11452-4

The CISPR 25 and ISO 11452-4 standard describes the test setup.

Setup with BCI configuration

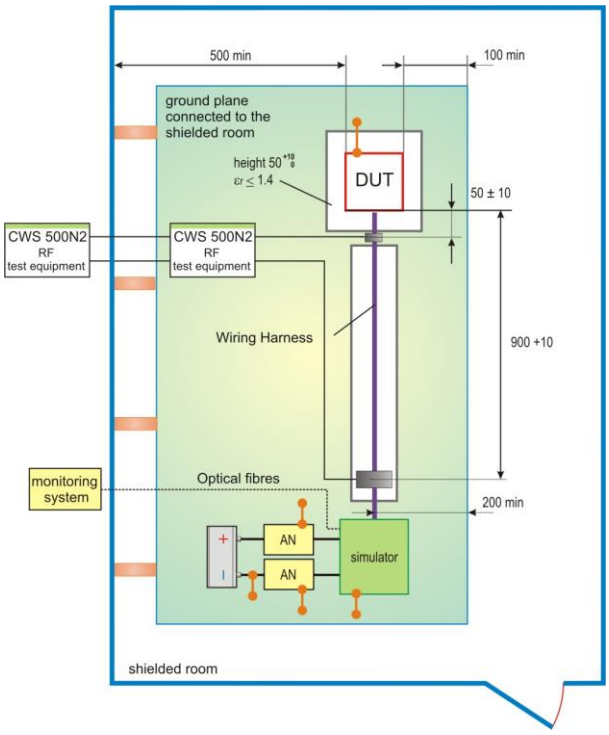


Figure 3.4: Setup for substitution method

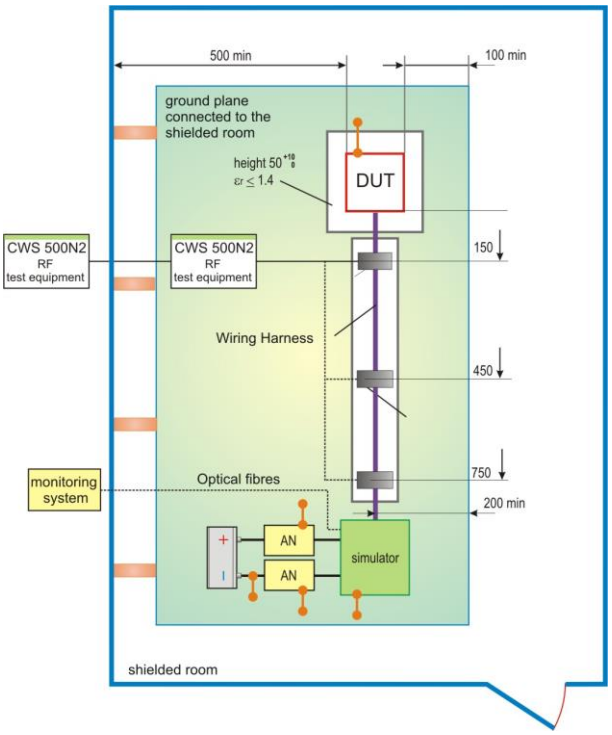


Figure 3.5: Setup for closed-loop method

Grounding configurations

The minus-pole connection to the ground plane illustrates in figure 3.6 as remotely grounded. The locally grounded minus pole is illustrated in Figure 3.7.

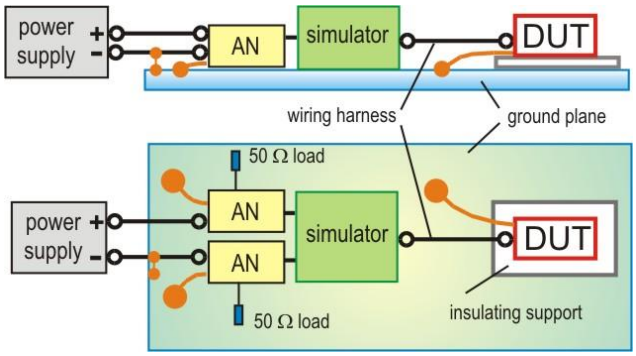


Figure 3.6: DUT remotely grounded

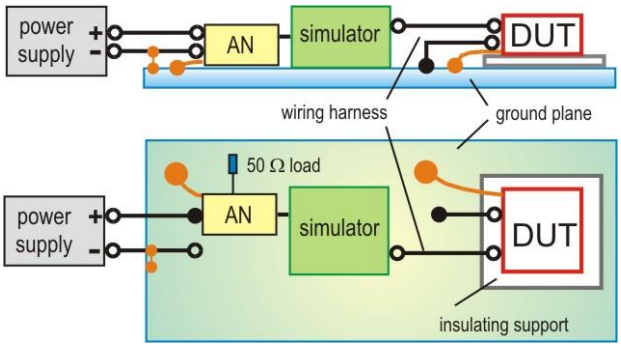


Figure 3.7: DUT locally grounded

Application of calibration data:

The included calibration data (correction data) must added to the measuring result of the corresponding frequency because these calibration data represent the insertion loss to this frequency.

Note: Save the correction, data on the measuring receiver (see the manual of the measuring receiver).

BCI Methode

The AN200N100 is for the decoupling of the load impulses to the power supply. The application of the AN200N100 is identical for substitution and closed loop method.

3.3. Test setup as per CISPR 16-1-2

The CISPR 16-1-2 standard describes in chapter 4 different network impedances. With switch, position to CISPR 16-1-2, the AN200N100 represents a 50 Ω/ (5 µH + 1 Ω) artificial mains V-network (for use in the frequency range 150 kHz to 100 MHz)

The network shall have the impedance versus frequency characteristic shown in figure 3.8 with a permitted tolerance of ±20 %.

Example for a CISPR 16-1-2 application with “Termination 50Ω” in OFF position.

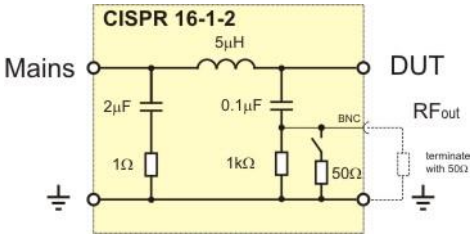
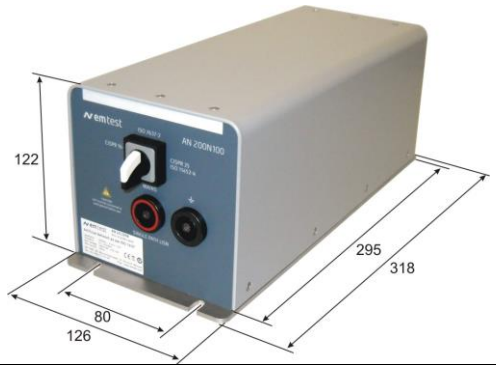


Bild 3.8: AN200N100 for CISPR 16-1-2 application

4. Technical Data

4.1. Technical data AN 200N100

DUT Supply	
Max operating voltage	1000V DC / 250V AC (up to 1kHz)
Max. operating current	100A continuous
Max. peak current	150A
Artificial Network	
Impedance	50 Ω ‖ 5 µH + 1 Ω +/- 10%
Frequency range	100 kHz ... 125 MHz
Inductance	5 µH (Air core)
Insertion loss	< 3 dB DUT to receiver output
Coupling capacitor	0,1 µF
Connector	
Connector	Multi Contact - 6mm High-current connector up to 100A - 4mm banana safety lab connector up tor 32A
BNC plug	for 50Ω terminating resistor or measuring device (in parallel with 22kΩ)
	50mm above GND Reference GND
General	
Temperature	0° to 45°C operating -25° to 45°C
Humidity	< 80% rel humitity non condensing
Dimensions	318mm x 126mm x 122mm (LxWxH);
	
Weight	2.80 kg

Important note:

The resistor (R) as illustrated in fig. 3 of ISO 7637-2:2011 Ed.3 represents the input resistance of the measuring receiver / oscilloscope. If oscilloscopes with high impedance measuring inputs were used, then a 50Ω matching resistor against reference ground (case) has to be connected on the BNC receiver port and measuring has to be done with a probe on the DUT connector.

5. Maintenance

5.1. General

The high current contacts will wear due to mechanical and electrical loads. These contacts are delivered lubricated. After approximately 500 pluggings the contacts should be lubricated again.

Appropriate lubricants e.g.:

- ***Synthesin PDL 250/1 (73.1050)***
- ***Kontasynth BA100 Spray (73.1051)***

After **1000** pluggings the complete set of high current contacts has to be replaced!
Dirtiness on the case should be cleaned with a dampish cloth without strong agents in a voltage-free state.

5.2. Calibration and Verification

5.2.1. Factory calibration

Every EM TEST generator is entirely checked and calibrated as per international standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.

The calibration certificate and the certificate of compliance (if available) show the date of calibration.

The EM Test equipment are calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.
The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label mark any due date for re-calibration.

Example: Calibration mark

5.2.2. Guideline to determine the calibration period of EM Test instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of EM TEST equipment.

EM TEST doesn't know each customer's Quality Assurance Policy nor do we know how often the equipment is used and what kind of tests is performed during the life cycle of test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.

In reply to all these questions we like to approach this issue as follows:
EM TEST make use of a solid state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence thereof a useful calibration period has to be defined based on two criteria:

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation has to be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment has to be taken into consideration.

- Based on the experience and observation collected over the years **EM TEST recommends a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered sufficient for rarely used test generators in order to assure proper performance and compliance to the standard specifications.

5.2.3. Calibration of Accessories made by passive components only

Passive components do not change their technical specification during storage. Consequently the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

5.2.4. Periodically In-house verification

Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, EM Test suggests refer to the waveshape and values of the original calibration certificate.

All calibrations and verifications are always done without mains supply voltage connected to the coupling network input.

5.2.5. Typical verification curves

Verification ISO 7637-2 : 2010

The internal resistance between A and P must be maximum 5 mΩ.

The measurement of the impedance is made between P and B while A and B terminals are short circuited.

Figure 5.3 illustrate a typical verification measurement

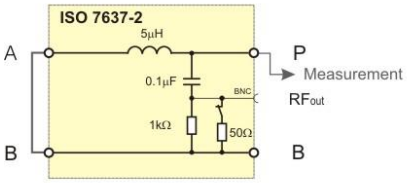


Fig. 5.1: Setup

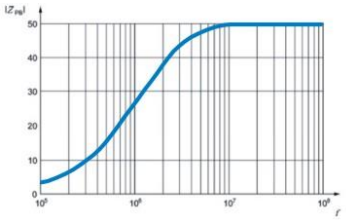


Fig 5.2: Ref Impedance

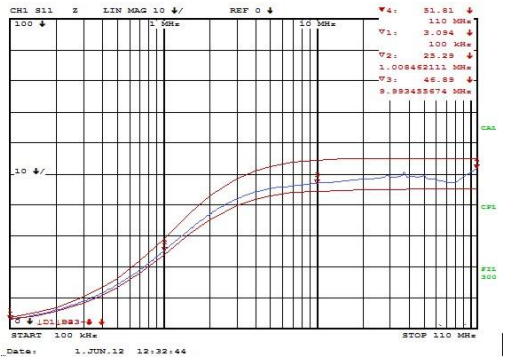


Fig 5.3: Typical measurement

Verification CISPR 25; ISO 11452-4

The measurement of the impedance is made between P and B while A and B terminals are short circuited.

Figure 5.6 illustrate a typical verification measurement

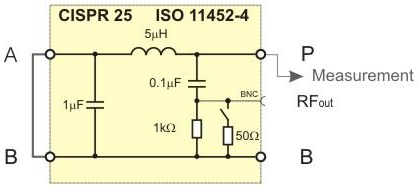


Fig. 5.4: Setup

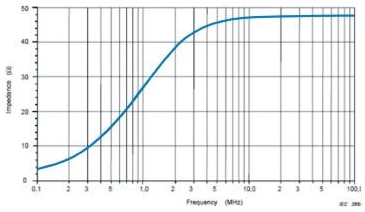


Fig 5.5: Ref Impedance

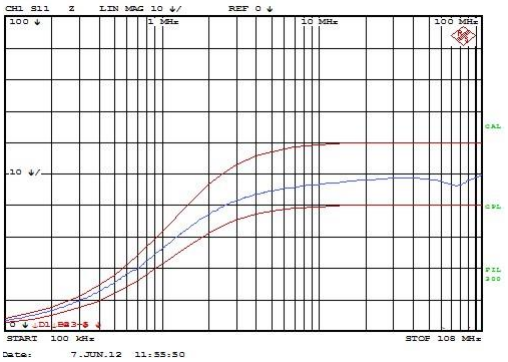


Fig. 5.6: Typical measurement

Verification CISPR 16-1-2

The measurement of the impedance is made between P and B while A and B terminals are short circuited.

Figure 5.9 illustrate a typical verification measurement

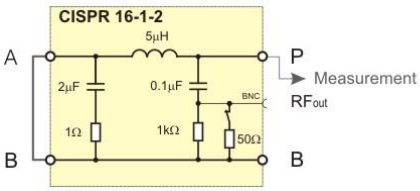


Fig. 5.7: Setup

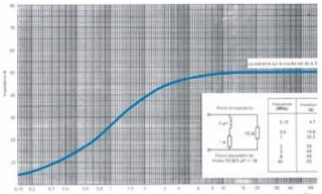


Fig 5.8: Ref Impedance

Fig. 5.9: Typical measurement

6. Delivery Group

6.1. Basic equipment

- Artificial network AN 200N100
- Manual on USB memory stick
- Calibration certificate
- Safety manual

Figure 6.1: AN200N100

6.2. Acessories

- 2 set connectors 100A red
- 2 set connectors 100A black
- 1 BNC cable 1m

Figure 6.2: Accessories AN200N100

Identical accessory parts are delivered only once if several devices are ordered. The delivered packing list is in each case valid for the delivery.

6.3. Options

- **Switch BS200N100**
  Electronic switch 60V 100A for measuring the transient emission as per ISO 7637-2

Figure 6.3: BS200N100

Shunt resistor Rs

Shuntresirtor for simulate the resistance of other vehicle devices which are connected in parallel to the DUT. The standard ISO 7637-2 defines the shuntresistor Rs.

RS-Box 10Ω, 20Ω, 40Ω, 120Ω max. 60V

Figure 6.4: RS-Box

7. Appendix

7.1. Declaration of CE-Conformity

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Artificial Network
Model Number(s)	AN 200N100

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1 : 2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1 : 2013	Electrical equipment for measurement, control and laboratory use Class A
EN 61000-3-2 : 2014	Limits for harmonic current emissions
EN 61000-3-3 : 2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
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Place	Kamen, Germany	Reinach BL, Switzerland
Date	20. December 2016	25. February 2016