

## EMI Test Accessories CISPR 14

Emissions from household appliances,  
electric tools and similar apparatus



Data Sheet

LISN

Absorbing Clamp

Voltage Probe

Switching Box

# CISPR 14 Test Accessories

## Overview

CISPR14-1 standard applies to the conduction and the radiation of radio frequency disturbances from appliances whose main functions are performed by motors and switching or regulating devices, unless RF energy is intentionally generated (EN55011) or intended for illumination (EN55015). It includes such equipment as: household electrical appliances, electric tools, regulating controls using semiconductor devices, motor driven electro-medical apparatus, electric toys, automatic dispensing machines as well as cine or slide projectors. Also included in this standard are: - separate parts of the above mentioned equipment such as motors, switching devices e.g. (power or protective) relays, however no emission requirements apply unless formulated in this standard.

CISPR 14 specifies the following tests:

### *Continuous Disturbance (mains and additional terminals)*

Commutator motors, as well as other devices incorporated in household appliances and similar electric apparatus may cause continuous disturbances, either broadband (i.e. switching devices and semiconductor regulators) or narrowband caused by electronic control devices such as  $\mu$ processor. The limits of terminal disturbance voltages are given in the frequency band 150kHz-30MHz. The signals from the LISN and from the voltage probe are analyzed into a CISPR 16-1 EMI receiver.

### *Discontinuous Disturbance*

For "clicks" - that is for interference emissions that exceed the recognized steady-state limits but for a very limited time - CISPR14-1 has been and is used as the *basic* standard for short-term emissions as well as a *product* standard. It is quoted as a basic reference in the generic standards IEC 61000-6-3 for residential and light industrial limits and IEC 61000-6-4 for industrial environments.

Likewise it is referenced in product standard EN55103 for professional audio/video equipment.

### *Disturbance Power*

The absorbing clamp method of measurement is accepted by European EMC Regulations as a standard method of measuring the interference power levels on cables connected to electronic and electrical devices. Measurement is normally made from 30MHz to 300MHz.

The signals from the absorbing clamp is analyzed into a CISPR 16-1 EMI receiver.

# LISN - artificial main network SWITCHING BOX

Conducted emission, both for continuous and discontinuous tests, use an artificial main network – LISN - as transducer between the main ports of the EUT and the measuring receiver. The LISN shall provide:

- defined RF impedances between EUT terminals;
- a  $50\Omega$  input impedance RF connector, to which the CISPR 16-1 measuring equipment shall be connected;
- a reference ground connecting point.

## General

The AFJ LISNs have been developed for measurement of line-bound interference's according to standards. It corresponds to CISPR-16-1 directives. The construction uses air coils in the current path in order to avoid saturation effects with high current strengths. Concerning the construction the LISN is a V-network because the position of the vectors of the interference voltage.

The continuous high current load-bearing capacity is ensured by the use of large wire cross-sections for the coils. For a short period (10 minutes), twice as high currents are admissible. The design of the stabilisation network is continuously low-impedance for minimum losses.

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The compact form of construction, despite the high current-bearing capacity, makes easy use of the AFJ LISNs for the measurement of high currents directly at the piece of use of the consumer possible. In this way, measurements of mains-borne interference's can be carried out under conditions corresponding to practice.

**AFJ LISNs include current variation counter (power meter) for EN55014-1 switching operation measurement;**

## Models

- **LS 16/C:** 16A single phase including current variation counter (power meter) for EN55014-1 (switching operation);
- **LT 32/C:** 32A single/three phase including current variation counter (power meter) for EN55014-1 (switching operation). Available also in single phase model.



# VOLTAGE PROBE

**Disturbance voltages on terminals which are not to be measured with LISN can be measured with a voltage probe.** Examples of such terminals are connecting jacks for antennas, control lines, signal lines and load lines. In general the voltage probe is used to measure the common mode disturbance voltage. The probe presents a high RF impedance between the terminal to be measured and the reference ground.



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The passive probes AFJ HVP1 and HVP1/1000 are designed to comply with CISPR 16-1 regulation and thus include a blocking capacitor to decouple the measured signal from any AC supply voltage that may be present on the line under test; they have a total internal resistance between line and earth of more than 1500  $\Omega$ .

Designed according to criteria of cheaply and compactness they can be used together with AFJ ER55C System for Conducted Interference measurement, or any other RF receiver/spectrum analysers.



# ABSORBING CLAMP

The “absorbing clamp” measurement method is accepted by CISPR as interference measuring power levels on cables connected to electronic devices. Clamp is equipped with rollers for either easily use in manual mode, or continuous use in automatic measurements;

## AFJ F-201 - 30 mm ABSORBING CLAMP

F201 absorbing Clamp has been designed for testing to CISPR 14-2 and CISPR 16-2.

Specially constructed to make simple and quick performing the disturbance power measurement, F201 is a rugged clamp up to 1000MHz.

Clamp is equipped with rollers for either easily use in manual mode, or continuous use in automatic measurements;

F 201 absorbing clamp consists of a ferrite current transformer calibrated for the frequency range of 30MHz to 1GHz and two groups of ferrite rings.

The ferrite rings act as absorbers of energy and impedance stabilizers. One group of ferrite rings surrounds the lead from the current transformer to the measuring device to minimize standing waves.

The second group of ferrite rings surround the mains lead connected to the apparatus under test. These rings act as impedance stabilizing the power mains and as an absorber of energy to isolate the device under test from the mains.

The mains lead to the apparatus under test is easily placed inside the aperture of the rings since the rings can be opened and closed. The current transformer is placed around the mains lead, and provides a voltage proportional to the resultant current.





## The Absorbing Clamp Method

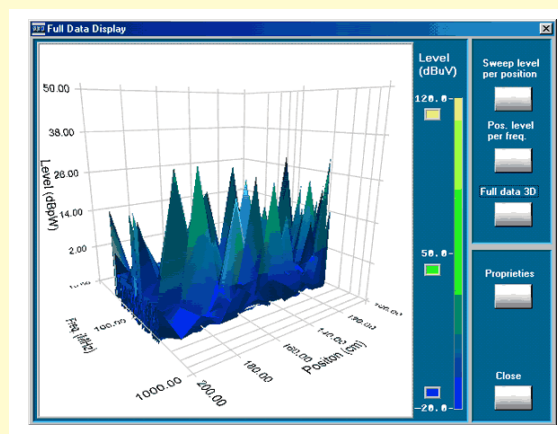
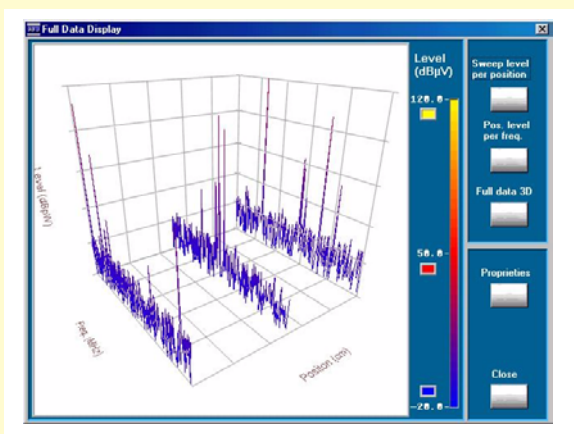
The **Absorbing Clamps** can be used in conjunction with **EMI test receivers** to measure RFI power on lines to CISPR 14-1.

The **EUT** is placed on a non-conductive test table, at least 40cm from a conductive floor or wall. The length of the cable is to be extended to  $\lambda/2 + 60\text{cm}$  depending on the lowest frequency to be measured (30MHz). The cable is then laid out horizontally on a **slide bar** so that the absorbing clamp encompassing the cable can easily be moved along the cable with the current transducer facing the EUT.

Automatic measurements;



- ▶ Absorbing clamp should be used in conjunction of **AFJ ER55 Receiver and KMS14 software option** for automatic power levels measurements.
- ▶ A **3D graph** will appear showing disturbance level against both frequency and Clamp Position on the slide bar, to assure measurement full reproducibility



## SLIDEBAR (for ABSORBING CLAMP)

The RSA Absorbing Clamp Slide bar is a device for the remotely-controlled positioning of an absorbing clamp along an electric cable. Measurement of the RFI power under CISPR, EN, ANSI, VCCI and VDE standards can be automated in this way.

The cable to be measured is attached to the ends of the Absorbing Clamp Slide bar by clips.

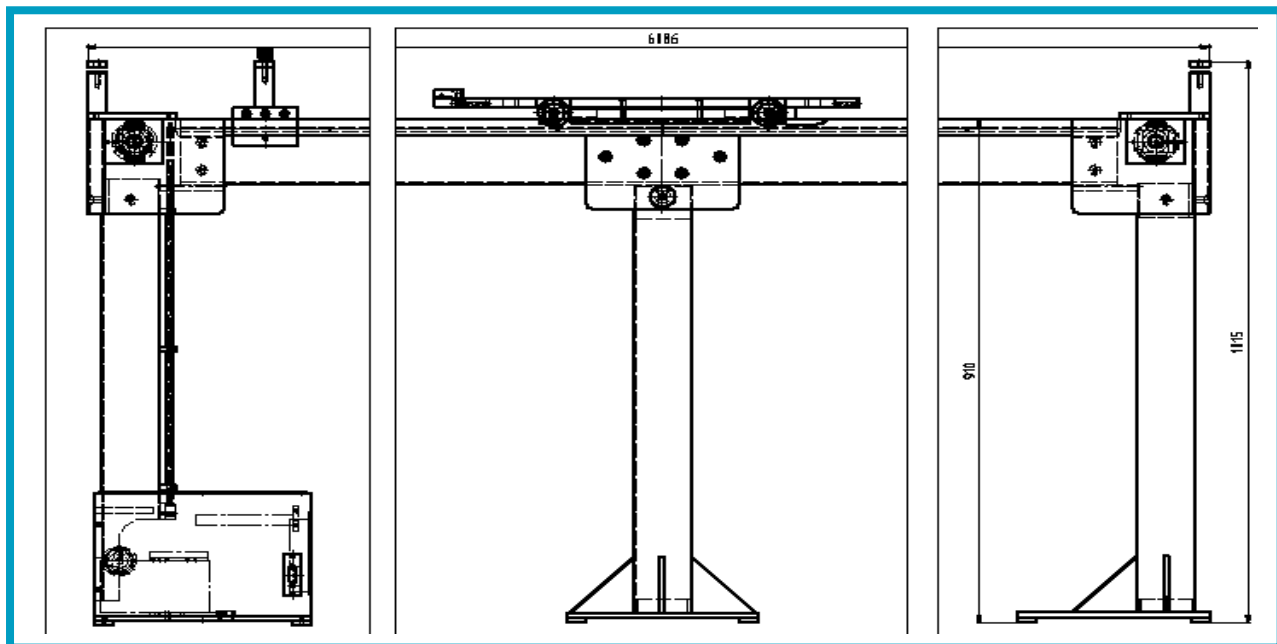
All the load-bearing parts of the slideway are made of strong glass-fibre reinforced epoxy material. The measurement clamp runs on a low-noise silicon section and is moved by a non-metallic, antistatic serrated belt. Thanks to the compact design of the sliding track around the point of origin, the absorbing clamp can be moved to 2 cm from the specimen.

A speed-controlled drive facilitates the high positional accuracy of 0.5 cm with smooth starting and deceleration. The high adjustment speed of 40 cm/s contributes to the rapidity of measurement.

The cable clips can be moved and the distance travelled shortened by software parameters for measurement at higher frequencies.

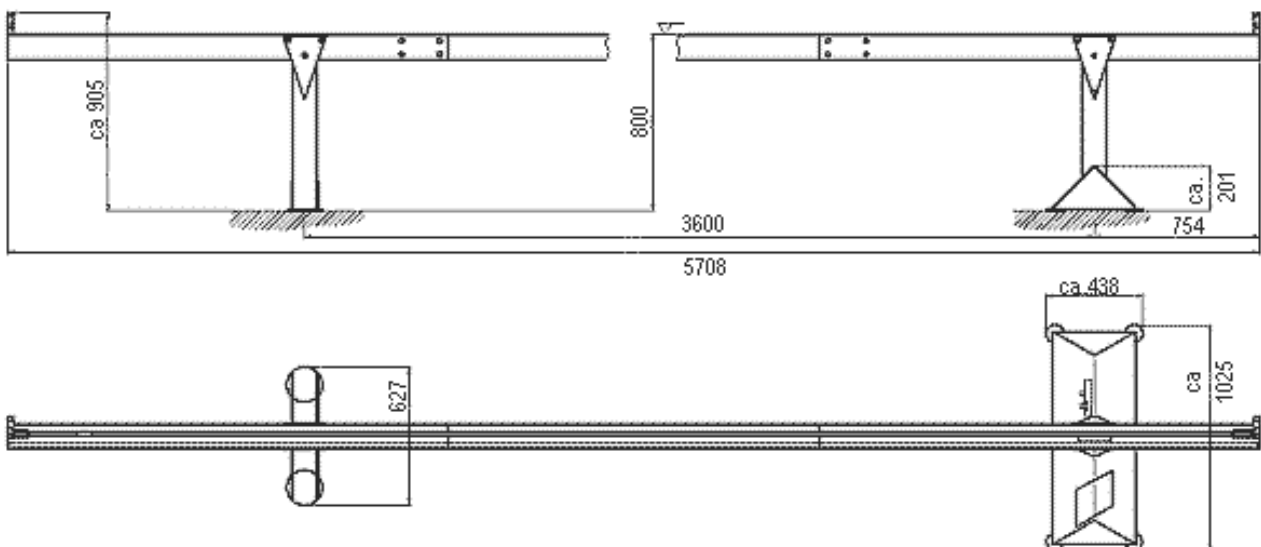
Control is by means of an RSC controller. Commands to the slideway and signals to the controller are transmitted exclusively by fibre-optic cable, which has the following advantages:

1. No filter is required when the control cable is introduced into the shielded room, unlike electrical cables.
2. The non-metallic structure prevents the control line from causing interference to measurement.



Maximum travel without measurement clamp	5500 mm
Non-linearity	< 10 mm
Reproducibility error	< 5 mm
Height of the track	80 cm above ground
Drive	Electronically-commutated permanent magnet motor with 1:15 speed control system
Transmission	Antistatic serrated belt
Positioning speed	3..40 cm/s in 9 stages
Remote control system	Fibre-optic cable with RS-232 protocol, Duplex operation
Material for load-bearing parts	Glass-fibre reinforced tube, 110 x 110 x 5 mm
Material for serrated belt	Chloroprene rubber with fibreglass cord
Weight	59 kg
Rated temperature	-10 ... +45°C
Storage temperature	-25 ... +70°C
Permissible humidity	90% constant at 45°C
Power supply	100 / 120 / 230 V +10/-15%, max 300 VA
Accessories included	Adapter for F201 absorbing clamp, power cable, manual
Accessories available	Adapter for other absorbing clamps on inquiry, fibre optic cable with various plugs and in various lengths, also for passing through chamber wall

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# Positioning Controller (for ABSORBING CLAMP)

The RSC 02 Positioning Controller controls such peripherals as Slid bar and Absorbing Clamp, antenna mast and turntable.

Movement is controlled by entering the position in digital form, as specific stages or, quasi-analogously, by using the arrow keys.

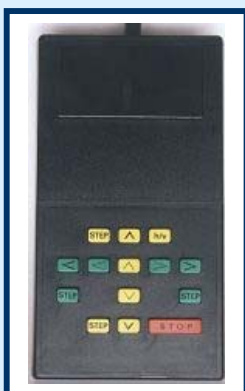


The controller provides a dedicated setting menu for each peripheral and also facilitates the automatic calibration of the Absorbing Clamp Slideway.

Command signals between the RSC Positioning Controller and the connected peripherals are transmitted through fibre optic cables as standard, with the following advantages:

- No filter is required when the control cable is introduced into the shielded room, unlike electrical cables;
- The non-metallic structure prevents the control line from interfering with measurement.

The remote control command set uses the modern IEC/IEEE interface protocol (SCPI compatible) with numerous commands. All the manual operating stages can be controlled remotely



The separate RSC-Z1 handset (optional extra) facilitates manual operation of all the connected units.

## Specs

<b>Positioning</b>	
Direct/interactive	by entering a number or quasi-analogously, by using four arrow keys on the RSC
interactive	quasi-analogously, by four movement keys per peripheral (slow, fast, forwards, backwards) with the RSC-Z1 handset (optional extra)
inching	in increments of 1-99 cm, using the RSC-Z1 control unit (optional extra)
speed	nine stages selectable for each peripheral
<b>Current position display</b>	Three characters on a 4x20 character LCD, resolution 1 cm/dg
<b>Connections and interfaces</b>	
Remote control system	in accordance with IEC 625-1/2 (IEEE 488-1/2), 24-pin Amphenol socket connector
Command sets	SCPI Version 1991.0
Peripheral control systems	Two optical fibre connections (RS-232 protocol, duplex operation), max. length 60 m
Fibre optic connector	Sprayproof pin terminal, diameter 29 mm; F-SMA on request
<b>General Data</b>	
Rated temperature	-10 ... +55°C
Storage temperature	-25 ... +70°C
Permissible humidity	90% constant at 45°C
EMI Suppression	CISPR 22, class B
Dimensions (WxHxD)	450 x 90 x 300 mm, 19"-standard casing
Power supply	120/240V +10/-15%, 47÷63Hz, 15VA, Safety class I IEC 348
<b>Order references</b>	
Positioning Controller	RSC-02
Accessories available	Separate RSC-Z1 handset, fibre optic cables with various plugs and in various lengths, also for passing through chamber walls.

# CISPR 14 Test Accessories

## Technical Specs

### LISN

	LS16C	LT32C	LT100
Frequency Range	9kHz-30MHz	9kHz-30MHz	150kHz-30MHz
Impedance (Accuracy)	$(50\mu\text{H}+5\Omega)//50\Omega (\pm 20\%)$	$(50\mu\text{H}+5\Omega)//50\Omega (\pm 20\%)$	$50\mu\text{H}//50\Omega \pm 20\%$
Number of Phases	1+N	3+N	3N
Rated Current	2x16A	4x32A	4x100 A
Max Current	2x32A	4x64A	4x200 A
Max AC Voltage	250 V rms	450 V rms	450Vrms
Artificial Hand	yes	yes	no
Operating Temperature	0÷45°C	0÷45°C	0÷45° C
Storage Temperature	-20÷70°C	-20÷70°C	-20÷70° C
Dimension (HxWxD)	342x177x436mm	450x266x436mm	450x266x436 for 2 units
Weight	12Kg	28Kg	35 Kg

### VOLTAGE PROBES

	HVP01	HVP01/1000
Frequency Range	9kHz-30MHz	9kHz-30MHz
Input Impedance	>1500Ω	>1500Ω
Input Capacity	<10pF	<10pF
Insertion loss	35dB typical	35dB typical
Max. permissible input operating voltage	300Vac	1000Vac
Operating Temperature	0÷45° C	0÷45° C
Storage Temperature	-25÷70° C	-25÷70° C
Connections: RF output	BNC male	BNC male
Weight	2Kg	2Kg

### ABSORBING CLAMP

Frequency Range	30MHz-1000MHz
Insertion loss	CISPR 16-1 (typ):
Number of Phases	3N
Permissible DC current	30A
Max. cable diameter	30mm
Input impedance	50Ω