EMI Test System
CISPR 15

Emissions from Luminaries and Ancillary Devices

Data Sheet

(DIN EN) ISO 9001: 2000
Certificate Registration n° 44 100 071100

Overview

Most lighting equipment is covered by the scope of CISPR 15, that applies to the emission of radio frequency disturbances from:

- all lighting equipment with a primary function of generating and/or distributing light intended for illumination purposes, and intended either for connection to the low voltage electricity supply or for battery operation;
- the lighting part of multi-function equipment where one of the primary functions of this is illumination;
- independent auxiliaries exclusively for use with lighting equipment;
- UV and IR radiation equipment;
- neon advertising signs;
- street/flood lighting intended for outdoor use;
- transport lighting (installed in buses and trains).

Excluded from the scope of this standard are:

- lighting equipment which utilize ISM frequencies for their operation (covered by CISPR 11);
- lighting equipment for aircraft and airports (covered by Civil Authority requirements)
- lighting which is not primarily intended for illumination purposes (such as photocopiers or slide projectors which are covered by CISPR 14 and display or indicator back lighting which are covered by the relevant product standard).

CISPR 15 specifies the following tests:

Insertion loss
Applicable to fluorescent lamp luminaries with switch type starter circuits. Measurement are made over the frequency range 150kHz to 1.605MHz using dummy lamps fitted in place of the fluorescent tubes.

Disturbance Voltage (mains and control terminals)
These tests are applicable to all other luminaries in the 9kHz÷30MHz frequency range. Conducted Emission back down the mains lead is measured preferably with a LISN (Line Impedance Stabilization Network).

Radiated Disturbance
This test is applicable to any luminaries which requires disturbance voltage tests and supplies the lamps at frequencies in excess of 100Hz. The test is performed within an enclosed loop antenna of 2m loop diameter. Antennas of this type are known as a Van Veen Loop and consist of three orthogonal loops enclosing a platform where the EUT is positioned. Frequency rang of measurement is 9kHz ÷30MHz.

The signals from the loop antenna, LISN are analyzed by through CISPR16-1-1 EMI receiver.

EMI Test Receiver

CISPR 16-1-1 compliance receivers in accordance with the requirements of CISPR & EN

The **ER55** is a family of microprocessor-controlled, super heterodyne-type automatic test receivers covering the frequency range from 9kHz to 1GHz (3GHz). These receivers are ideally suited for measurement of electromagnetic interference in accordance with the requirements of **CISPR & EN**.
Receivers can also be used as a selective RF voltmeter with a level range of 10dBµV to 127dBµV in 50Ω coaxial systems.

Optimized easy-to-use EMI measurement concept.

Fitted with the internal pre-selector/ preamplifier all AFJ ER55 models feature an excellent dynamic range and are, therefore, able to perform precise EMC tests.

Measurements to commercial EMI standards such as CISPR, EN 550xx, shall be carried out directly by comparing the EMI spectrum with the associated limit lines and switching on the appropriate detectors.

CISPR COMPLIANCE

The ER55 Receivers, fully complies with CISPR 16-1-1 and CISPR 16-2.
The response of ER55 Quasi-Peak Detector in terms of both absolute calibration and relative calibration lays between CISPR 16-1-1. the tolerances The pulse weighting conformity meet down to the minimum value of the Pulse Repetition Frequency (PRF) coming from the DUT, of 1Hz.

Accuracy and reproducibility are key parameters for AFJ ER55 receivers application.

MAIN FEATURES

- Peak, Quasi-Peak and AV detectors
- Quasi-Peak and AV simultaneous
- Correct pulse weighting to CISPR 16-1 from PRF of 1Hz
- High measurement speed and fast detection of critical frequencies (peak time down to 2msec)
- Spectrum analyzing mode
- EMI measurement bandwidths 200Hz, 9kHz, 120kHz (and 1MHz for 3GHz model)
- high sensitivity
- Correction values for cables loss, coupling networks and antenna k factors
- Overload indicator
- Built in AM/FM demodulation
- Built in tracking generator, also including automatic SW routine for the **Insertion Loss measurement according to CISPR 15**
- Powerful CPU with 1MByte Dynamic Memory: this allows to store all calibration files internally

LAN and USB Communications

- LAN (Intranet) and Internet Remote Control
- On line real time service (diagnosis from AFJ or AFJ Service Centre)
- Calibration On line
- Remote Firmware Upgrade
- file sharing (Shared Database)
- No installation drivers requested

New Open Software

- Universal Software for other devices
- Control of equipment other than ER55 Receivers
- The Software support ER55 Receivers in combination with Spectrum Analyser to fulfil CISPR 16-1 and MIL STD standards from f=10Hz÷40GHz
- Integrated Database Management (Local and Remote)
- Easier and faster management of equipment settings and results
- Data available online
- Download and Upload with different database
- Full Automation requirements such as turntables and antenna masts controls are also easily achieved.

PAT 20M Pulse Limiter

A **Pulse Limiter/Attenuator** is required to protect the RF input stages of sensitive equipment from unpredictable spikes generated during conducted emission testing of a DUT.
We recommend the utilization of our Pulse Limiter/Attenuator with all our EMI receivers, in particular whenever DUT are tested for the first time.
These Spikes with a high spectral density/Pulse energy can seriously damage all input stages such as, attenuators, pre-amplifier, preselector or mixer of our or other receivers as well as other RF sensitive equipment such as Spectrum Analysers.
PAT20M 20dB Attenuator is designed to stand Pulse Voltages up to 1Ws.

Technical specifications

Frequency Range	0Hz÷30MHz
Low pass filter up to	100MHz
Max continuous input power	1W
Max pulse input energy	1Ws (500µs)
Input / Output VSWR	1.05 / 1.15
Characteristic Impedance	50Ω
Insertion loss	20dB ± 0.3dB
In / Out RF connectors	BNC (f / m)
Dimensions	96x28x23mm
Weight	70g
Operating temperature	–10°C÷+45°C
Storage temperature range	–25°C÷+70°C

Technical specifications	ER55C	ER55CR
Frequency Range	9KHz÷30MHz	9KHz÷1000MHz
Frequency Settings	50Hz (9KHz÷150KHz) 1KHz (150KHz÷30MHz)	50Hz (9KHz÷150KHz) 1KHz (150KHz÷30MHz) 25KHz (30MHz÷3000MHz)
Setting Error	< $3x10^{-6}$	< $3x10^{-6}$
RF Input	BNC 50Ω (9KHz÷30MHz)	BNC 50Ω (9KHz÷30MHz) N 50Ω (30MHz÷1000MHz)
VSWR Input	< 2:1 < 1.5:1 with preamplifier <1.2:1 with attenuator	< 2:1 < 1.5:1 with preamplifier <1.2:1 with attenuator
Preselector 9KHz÷30MHz Fixed filters	9KHz÷150KHz 150KHz÷500KHz 500KHz÷2MHz 2MHz÷10MHz 10MHz÷30MHz	9KHz÷150KHz 150KHz÷500KHz 500KHz÷2MHz 2MHz÷10MHz 10MHz÷30MHz 30MHz÷62.5MHz 62.5MHz÷125MHz 125MHz÷250MHz 250MHz÷500MHz 500MHz÷750MHz 750MHz÷1000MHz
Max. Input	127dBµV	127dBµV
Intermediate Frequency	153.22MHz, 10.7MHz 455KHz	1554MHz, 480MHz, 153.22MHz, 10.7MHz, 455KHz
IF Bandwidth	200Hz, 9KHz, 120KHz	200Hz, 9KHz, 120KHz
Noise Floor Peak Quasi Peak Average	(IF 200Hz) (IF 9KHz) <-10dBµV <0dBµV <-13dBµV <-3dBµV <-20dBµV <-10dBµV	(IF 200Hz) (IF 9KHz) (IF 120KHz) <-10dBµV <0dBµV < 10dBµV <-13dBµV <-3dBµV < 7dBµV <-20dBµV <-10dBµV <3dBµV
Measuring error	±1.5dB max.	±1.5dB max. (9kHz - 30MHz) ±2dB max. (30MHz - 1GHz)
Demodulation	AM/FM	AM/FM
Display Measure Level	-20 to 120dBµV	-20 to 120dBµV
Pulse Spectral Density	90dbµV/MHz	90dbµV/MHz
Image Freq. Rejection	85dB Typ.	85dB Typ.
Intercept Point d3	|f2-f1| > 100kHz level f1, f2: -10dBm fin<2MHz: 8dBm typ fin>2MHz: 15dBm typ	|f2-f1| > 100kHz level f1, f2: -10dBm fin<2MHz: 8dBm typ fin>2MHz: 15dBm typ
Delay Time	2ms to 60s	2ms to 60s
Display Units	dBµV, dBµV /m, dBm, dBpW, dBµA/m	dBµV, dBµV/m, dBm, dBpW, dBµA/m
Interface	LAN 10/100 Mbit; USB 2.0	LAN 10/100 Mbit; USB 2.0
Power Supply	110/230Vac ± 10% f= f= f=50/60Hz	110/230Vac ± 10% f= 50/60Hz
Power Consumption	50VA	50VA
Operating Temperature	0° to 45°C	0° to 45°C
Storage Temperature	-20° to 70°C	-20° to 70°C
Size (WxHxD)	450x135x436mm	450x135x436mm
Weight	14kg	17kg

LISN

Artificial Main Network for conducted emission measurement

Electronic ballasted luminaires, semi-luminaires, self ballasted lamps, regulating controls, independent converters and uncommon varieties of transformer ballasted starter operated luminaires must undergo mains terminal disturbance emission measurements over the frequency range f=9kHz to 30MHz.

These measurements are performed using a 50Ω/50μH Line Impedance Stabilization Network (LISN), which provides a predefined and repeatable impedance between the luminaire and the mains network, and an RF coupling path to the line under test for the measuring receiver.

The AFJ AMNs have been developed for measurement of line-bound interference's according to CISPR 15 standard.

Concerning the construction, the AMN is a V-network because the position of the vectors of the interference voltage. The V-network is part of a EMC-test setup that also has been standardized in CISPR 16-2-1.

The LISN construction uses air coils in the current path in order to avoid saturation effects with high current strengths.

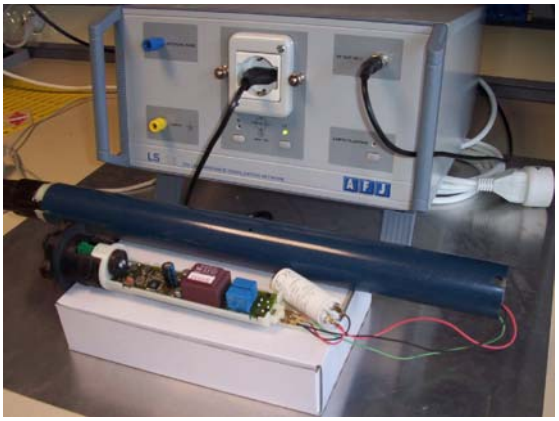
The design of the stabilization network is continuously low-impedance for minimum losses.

The continuous high current load-bearing capacity is ensured by the use of large wire cross-sections for the coils: for a short period (up to 10m), twice as high currents are admissible. In this way, measurements of mains-borne interference's can be carried out under conditions corresponding to practice.

Models:

LS 16C: 16A single phase, f=9kHz÷30MHz

LT 32C: 32A single/three phase, 9kHz÷30MHz



• LS16C connected to Dimmer

The AMN have the impedance (magnitude and phase) versus frequency characteristic as shown in Table 4 and Figure 1b of new CISPR 16-2-1 Amd.2. AFJ LISNs also include current variation counter (power meter) for EN55014-1 switching operation measurement.

LISN are remote controlled by AFJ receivers. TTL control inputs that can be driven by any should be provided.

Schuko 16A and Cekon 32A female plugs are provided. Various models with country-specific connector systems are available.

Technical specifications	LS 16C	LT 32C
Standards applied	CISPR 16-1-2	CISPR 16-1-2
Frequency Range	9kHz-30MHz	9kHz-30MHz
Impedance (Accuracy)	(50μH+5Ω)//50Ω (±20%)	(50μH+5Ω)//50Ω (±20%)
Number of Phases	1+N	3+N
Rated Current	2x16A	4x32A
Max Current	2x32A	4x64A
Max AC Voltage	$250V_{rms}$	$450V_{rms}$
Artificial Hand	yes	yes
Operating Temperature (Storage)	0÷45°C (-20÷70°C)	0÷45°C (-20÷70°C)
Dimension (HxWxD), Weight	342x177x436mm, 12Kg	450x266x436mm, 28Kg

Three Loop Antenna

Calibrated antenna for radiated magnetic field emission measurement

Independent converters and luminaries operating at a frequency in excess of 100Hz must also undergo radiated magnetic field emission measurements over the frequency range f=9kHz to 30MHz.
These measurements are performed in a two metre diameter Van Veen triple loop antenna (if the dimensions of the luminaries permit). The measurements are performed in each of three separate axes (X, Y and Z).

TLA-300 is a calibrated 2-metre large loop antenna manufactured to comply with product standard CISPR 15.
The calibrated frequency range of the TLA-300 is 9kHz to 30MHz and each antenna is supplied complete with antenna factor data so that it can be used with any EMC receiver or spectrum analyzer capable of antenna factor compensation.

TLA-300 is a compete 3-axis antenna with a switching unit to select each loop in turn.
The loops are 2m in diameter with the lowest point 0.5m above ground and are fitted with specially designed current transducers in fully screened housings.
Ambient interference is strongly suppressed in open area measurements.
TLA-300 is designed to be collapse down to sub unit of convenient size.
Calibration kit according to CISPR 15 standard is available

Design	Fully compliant with EN 55015
Frequency	9kHz to 30MHz
Loops	Triple independent loops, 2m diameter, switchable between X, Y, Z
Sensor	Matched inductively coupled
Selector	Loop selection by patch panel switch
Output:	50Ω BNC
Calibration	Each axis tested and correction data included with antenna
Antenna Factor	Matched to EN 55015, figure B4
Power req	None
Dimension	2.6mx2.1mx2.1m (height / width X / width Y)

Insertion Loss Measurement

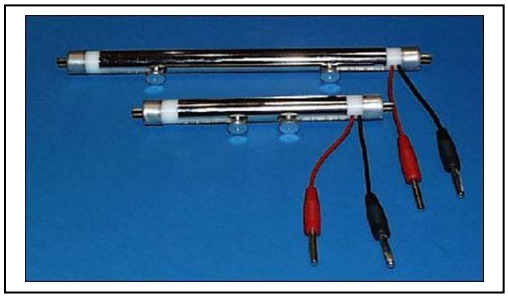
Insertion loss measurements over the frequency range f=150kHz÷1605kHz are to be performed on common varieties of transformer ballasted starter switch operated luminaries.
This test assumes that the luminaries creates low frequency conducted RF emissions, but as long as the transformer ballast has enough insertion loss, the overall interference will be reduced to an acceptable level.
Artificial lamps are installed into the luminaries during these tests to simulate the capacitive coupling between the actual lamp and the case of the EUT. Glow switch starters are also replaced with 5nF capacitors.
The insertion loss is obtained by comparing the voltage obtained by connecting the output terminals of the transformer to the terminals of the measuring network, with the voltage obtained when the transformer is connected to the measuring network through the luminaireto be measured.

Dummy Lamps

Sets of dummy lamps, which are used in the circuits of Insertion loss measurement. Dummy lamps simulate the RF properties of the fluorescent lamps.

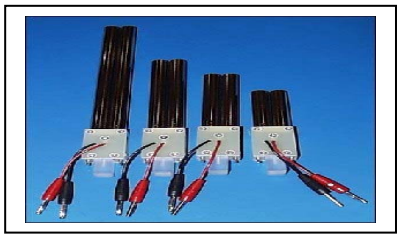
Linear Dummy Lamps

Linear Version	Watt	Length
Dummy Lamp with 38 mm Diameter	58 W	(1500 mm)
Dummy Lamp with 38 mm Diameter	36 W	(1200 mm)
Dummy Lamp with 38 mm Diameter	30 W	(895 mm)
Dummy Lamp with 38 mm Diameter	18 W	(590 mm)
Dummy Lamp with 25 mm Diameter	58 W	(1500 mm)
Dummy Lamp with 25 mm Diameter	36 W	(1200 mm)
Dummy Lamp with 25 mm Diameter	36 W	(970 mm)
Dummy Lamp with 25 mm Diameter	30 W	(895 mm)
Dummy Lamp with 25 mm Diameter	18 W	(590 mm)



Single Capped Dummy Lamps (diameter 15 mm) socket 2G7

Socket 2 G 7	Watt	Length
Dummy Lamp with 15 mm Diameter	11 W	(215 mm)
Dummy Lamp with 15 mm Diameter	9 W	(145 mm)
Dummy Lamp with 15 mm Diameter	7 W	(115 mm)
Dummy Lamp with 15 mm Diameter	5 W	(85 mm)



U Version Dummy Lamps

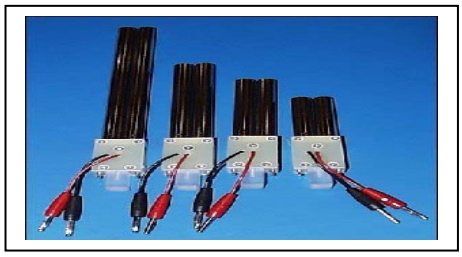
U Version	Watt	Length
Dummy Lamp with 38 mm Diameter	65 W	(765 mm)
Dummy Lamp with 38 mm Diameter	40 W	(607 mm)
Dummy Lamp with 38 mm Diameter	20 W	(310 mm)

Circular Version Dummy Lamps

Circular Version	Watt	Length
Dummy Lamp with 38 mm Diameter	40 W	(413 mm)
Dummy Lamp with 38 mm Diameter	32 W	(311 mm)
Dummy Lamp with 38 mm Diameter	22 W	(216 mm)

Single Capped Dummy Lamps (diameter 12 mm),socket G 23

Socket G 23	Watt	Length
Dummy Lamp with 12 mm Diameter	11 W	(214 mm)
Dummy Lamp with 12 mm Diameter	9 W	(144 mm)
Dummy Lamp with 12 mm Diameter	7 W	(114 mm)
Dummy Lamp with 12 mm Diameter	5 W	(85 mm)

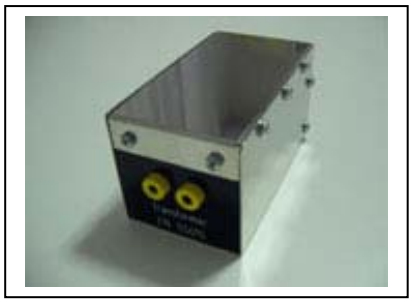


Single capped artificial lamps (diameter 12 mm) quad version

Socket G 24	Watt	Length
Dummy Lamp with 12 mm Diameter	26 W	(193 mm)
Dummy Lamp with 12 mm Diameter	18 W	(153 mm)
Dummy Lamp with 12 mm Diameter	13 W	(138 mm)
Dummy Lamp with 12 mm Diameter	10 W	(110 mm)

Transformer

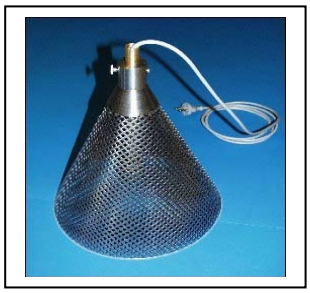
The low-capacitance balance-to-unbalance transformer is used to obtain a symmetrical voltage from the RF generator.
The output impedance of the transformer, when the input is terminated by 50Ω, is 150Ω ± 10%, with angle phase less than 10°.
The insulation of the transformer is checked as CISPR 15 requirement, in the f=150kHz÷1605kHz frequency range. The transfer characteristic is flat, ±0.5dB. The transformer is mounted in a metal box and the side where the output terminal are fixed, is constructed of insulating material.



Metal Housing

For the measurement of disturbance voltage, the self-ballasted lamps shall be adjusted to the highest position of the conical metal housing.

Conical Metal Housing for self-ballasted fluorescent Lamps		Type
Test Fixture	Socket	**E 27**
Test Fixture	Socket	**E 14**
Test Fixture	Socket	**Bajonet**



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