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NTC/SMT/TCI

**LVM CONCENTRATOR
DATASHEET AND TECHNICAL
CHARACTERISTICS**

DMIAB000289

Date 01/03/2021

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LOW VOLTAGE MANAGER DATASHEET AND TECHNICAL CHARACTERISTICS

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AMENDMENT REGISTER

Description of change	NAME	ISSUE	DATE
First issue	M.G.	I	11/03/2019
Added reference to DLMS support	M.G.	II	01/03/2021

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1. SCOPE

This document shows the main technical characteristics of Low Voltage Manager (LVM), overvoltage Category IV data concentrator. It is used for mass market electricity and/or GAS meter reading systems.

This device is designed for indoor installation (MV/LV substation). For outdoor or pole installation a suitable enclosure must be adopted. Each LVM concentrator communicates with the control server via public telecommunication networks (GSM, GPRS, PSTN, etc.) and by DLC communication with smart meters (for further information see section 4) . When it is used in GAS meter reading systems, LVM communicates with GAS meters through RF communications. An optical ZVEI port interface is provided for local connection with HHU terminals. The apparatus has to operate on both 400Vac@50Hz (3 x 230Vac) and 220Vac@50Hz (3 x 127Vac) electric power networks. The device includes a back up supply that allows a configurable emergency call in case of mains failure.

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2. Reference documents

Reference must be done to the most recent releases of the below listed standards and ENEL internal prescriptions, at the time of this publication.

- CEI EN 62056-21 Data exchange for meter reading, tariff and load control - Direct local data exchange
- IEC 62056 Set of standards for electricity metering data exchange (DLMS/COSEM)
- CEI EN 60529 Degrees of protection provided by enclosures (IP Code)
- CEI EN 50160 Characteristics of the voltage supplied by the public network power supply distribution
- CENELEC Documents associated with CEI EN 50160: Guide to standards application and Guide for electric quantity measurement.
- CEI EN 60950-1 Safety of Information Technology Equipment
- CEI EN 50065-1 Signaling on low voltage electrical installations in the frequency range 3kHz to 148,5 kHz – Part 1
- CEI EN 55022 Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
- CEI EN 55024 Information technology equipment. Immunity characteristics. Limits and methods of measurement
- CEI EN 62054 – 21 Particular requirements for time switches – Part 21
- CEI EN 50364: Limitation of human exposure to electromagnetic fields from devices operating in the frequency range 0 Hz to 300 GHz, used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications

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- ETSI EN 300 330 (v 2.1.1): Short Range Devices (SRD); Radio equipment in the frequency range 9 kHz to 25 MHz and inductive loop systems in the frequency range 9 kHz to 30 MHz; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
- ETSI EN 301 489-3: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
- European Directive 2014/30/EU (Electromagnetic Compatibility – EMC)
- European Directive 2014/35/EU (Low Voltage Directive – LVD)
- European Directive 2014/53/EU (Radio Equipment Directive – RED)

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3. Concentrator Kit

The equipment includes the following main parts:

- a) Plastic socket board/adapter for wall installation
- b) Dummy module or cable adapter
- c) GPRS/GSM modem (Optional)
- d) RF 169 MHz modem (Optional)
- e) Cable and tool for remote 169 MHz antenna (Optional)

4. Communication modem

The LVM concentrator can integrate a communication modem (Optional) able to operate on GPRS/GSM/UMTS (or public switched telephone network PSTN); it also provides a DC power supply for an external optional modem equipment. The connector of the GPRS / GSM / UMTS modem on the LVM is:

- 16 pin pitch 2,54 mm female;
- Modem interface includes:
 - o Serial interface connected to a serial port in the concentrator;
 - o 12 VDC output max 13W.

In case where an external modem is used a Dummy Module with its own adapter cable is supplied with the LVM. For further information see chapter section 6.

For the requirements and characteristics of both internal and external optional GPRS modems a specific e-distribuzione specification applies.

5. RF Module

The Optional RF module ensures bidirectional communication with other devices that support RF communication. This unit is designed for operating in 169 Mhz band with the Wireless M-Bus protocol (EN 13757 Mode N) embedded. It has to provide up to 27 dBm ERP level, with an RF sensitivity at least of -105 dBm.

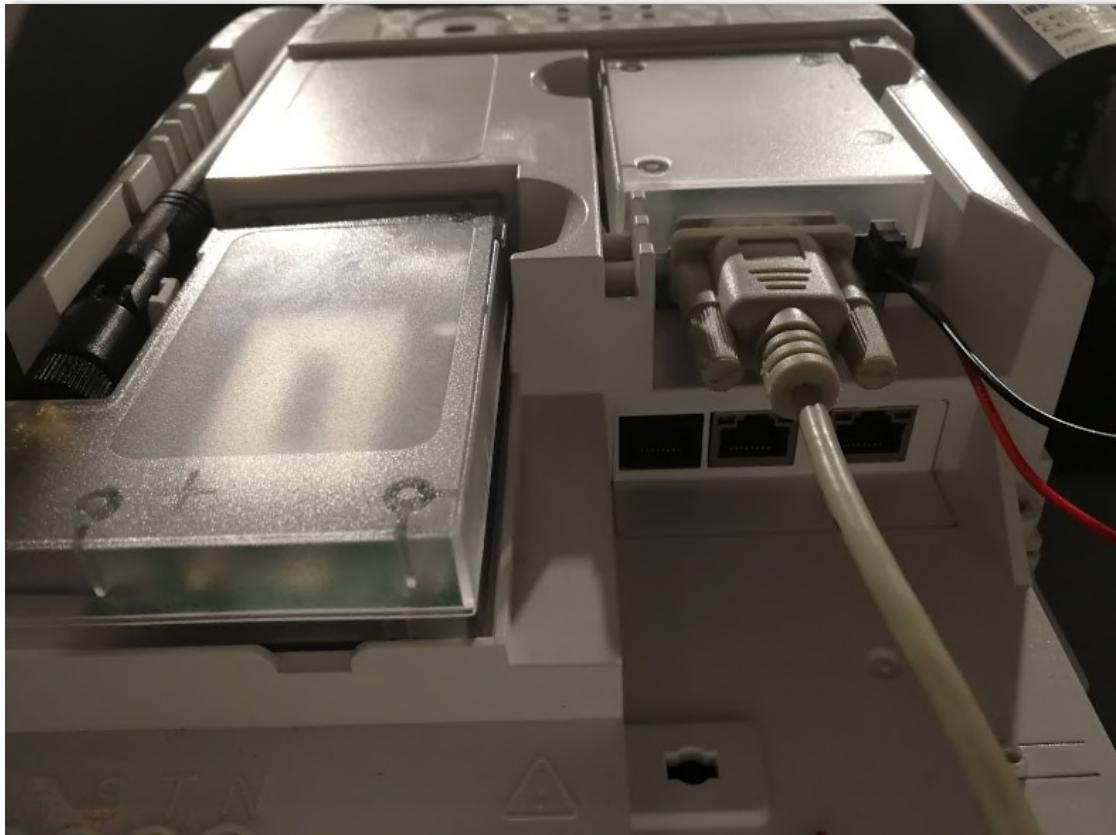
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The connector for the RF modem on the LVM is:

- 10 pin pitch 2,54 mm male;
- Apart from the signals for data exchanging, the connector includes the power supply:
 - 5 V_{DC} 5 W.

When this module is not mount on the LVM the following protections will be used, in order to maintain the characteristics of safety and IP protection of the LVM:

- Rubber plug over the connector for RF module;
- Plastic plug to close the antenna hole when the RF module is not mounted or used.



Picture of the LVM Concentrator with focus on the RF module and the Dummy module

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6. Dummy Module / adapter cable

The dummy module/adapter cable is used to allow, an external modem connection, the following signals are supported:

- RS232 port use for data communication;
- 12 V_{DC} 12 W for supplying external device.

The dummy box connector has the following characteristics:

- LVM side:
 - o 16 pin pitch 2,54 mm male.
- external device side:
 - o RS232 9-pin male connector;
 - o connector for power supply 4-pin female.

7. LVM Concentrator

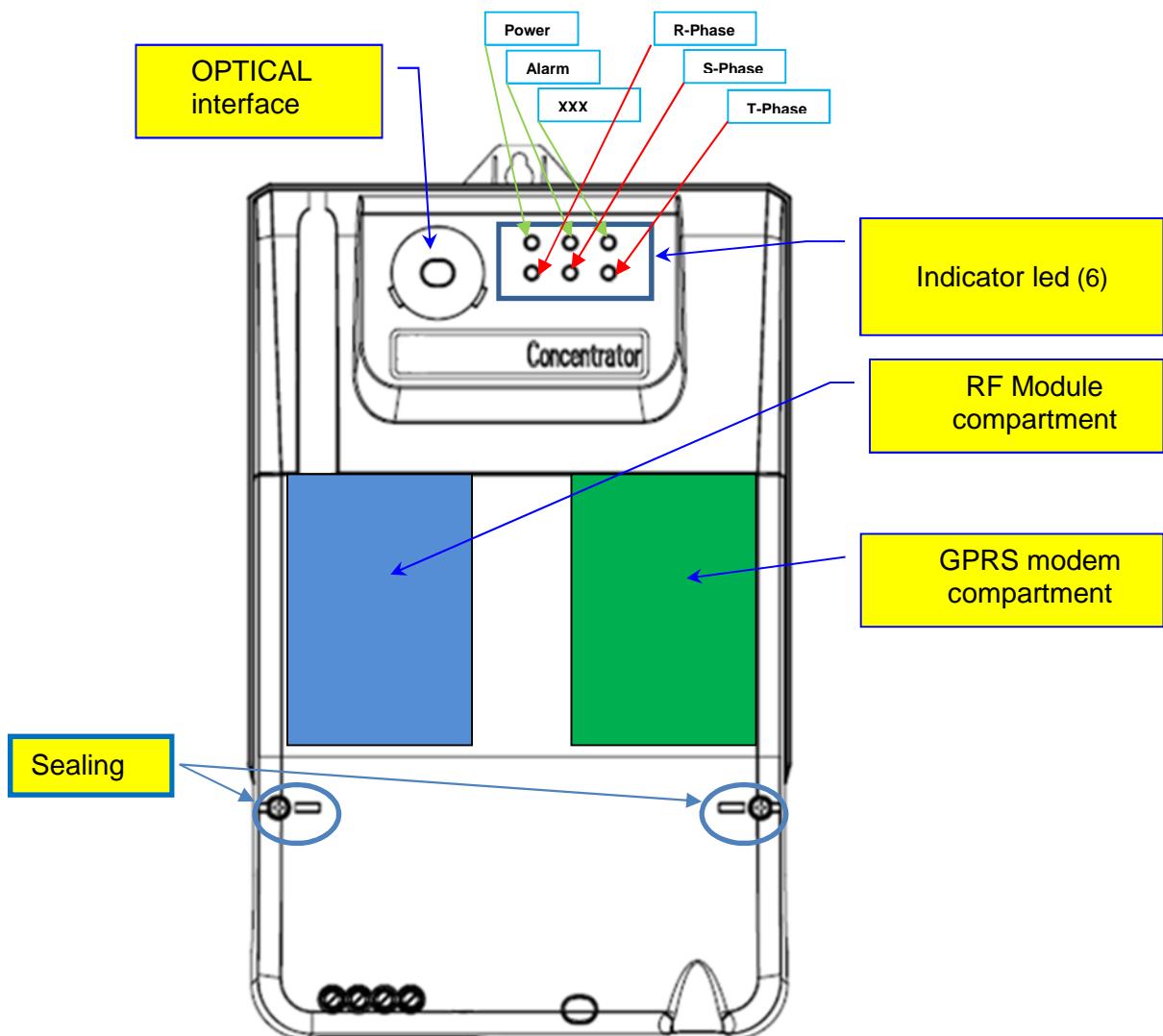
The concentrator is a unit of the AMI system for low voltage users.

It's the main node (gateway) for communications with the Smart Meters connected to the same network feed by the transformer powering the concentrator as well.

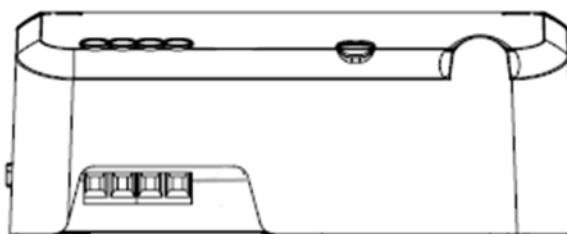
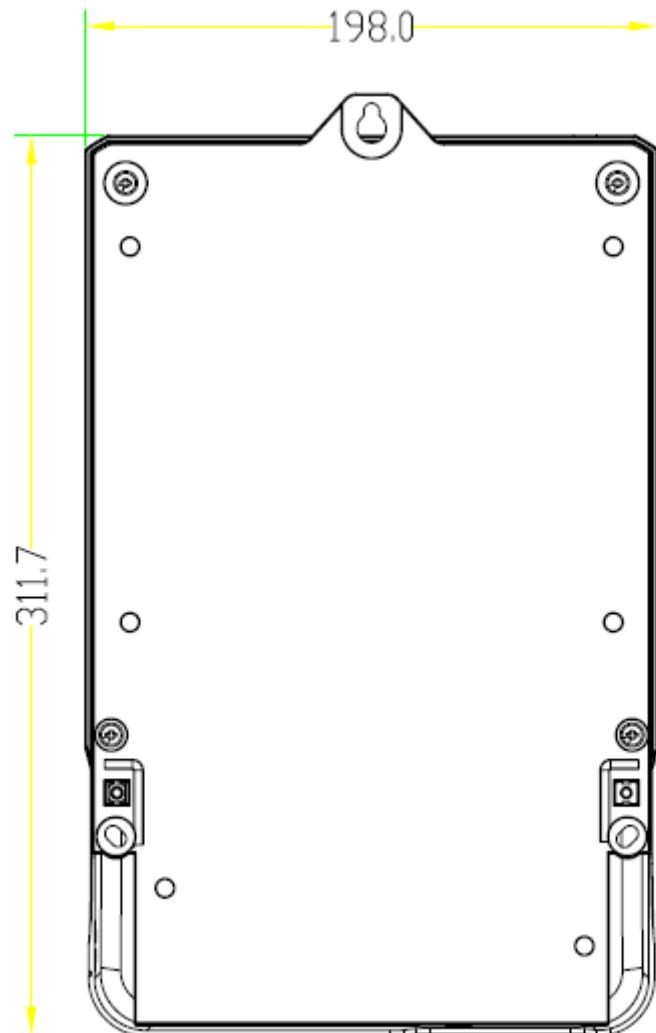
The LVM (see Figure 1) then carries out communication (to and from the LV nodes), which relate to the conveying and the management of the information, the management of the communication network and the AMI functions of remote nodes afferent to LV customers – carried out by the Central System (AMM) on Smart Meters that populate each “electricity island”.

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Concentrator dimensions



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The most relevant functionalities are summarized below:

- Clock-Calendar function for functional execution, consequently an RTC circuit with accuracy 0.5 s/day in standard condition (see CEI EN 62054-21)
- Battery back-up element is be coupled to the RTC block to keep the RTC working for at least 3 years when LVM is on the shelf
- Battery back-up allows logging anti-tampering events as well.
- The equipment has some local indicators (LEDs or equivalent) to show some status conditions and working information (the detail shall be defined in cooperation with the designer).
- The Optional GSM/GPRS/3G/4G module has some local indicators (LEDs or equivalents) to show some status conditions and working information (the detail shall be defined in cooperation with the designer).
- Optional RF Module used to communicate with other nodes RF (eg. Gas meter)
- Local Optical Interface (IEC 62056-21 mode E or IEC 61107)
- 2 Ethernet Ports (10M / 100M)
- Tampering: Detection of separation between terminal cover and case
- Diagnostic: Self-diagnostic of the main functions
- Other functionalities:
 - Automatic management of daylight saving time and leap year
 - Local and remote programming
 - Time zone
- Possibility to communicate on power line with different modulation, FSK and BPSK and different protocols, like Meters and More or DLMS/COSEM
- Handling of the nodes subtended to the low voltage network (optionally through RF as backup channel)

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8. Power supply

A.C. INPUT VOLTAGE

LVM is not provided with earth connection terminal

- | | |
|------------------------|-----------------------------------|
| • Nominal value | Vn = 400 Vac@50 Hz (3 x 230Vac) |
| • Voltage range | $\delta V = +/-15\% Vn$ |
| • Transitory variation | ($\geq 190\% Vn$) ≥ 5 sec. |
| • frequency range | $\delta f = \pm 5\%$ |

The HW is designed in order to support both connections to:

- 127/220V LV network
- 230/400V LV network

A galvanic insulation between the DC and the AC main sides is achieved in the Power Supply to guarantee the overvoltage category IV.

The power supply provides all the DC supply for internal circuits as well as the specific supply source for GPRS parts.

Particularly for the GSM/GPRS/3G/4G unit a DC isolated power supply (see below the characteristics), is available at the modem compartment.

- Output voltage: 12 Vdc.
- Output power: 12W (provided the appropriate capability to support inrush currents)
- Output protections: able to support a continuous short-circuit condition without damages.
- Possibility to switch off and on the GSM/GPRS/3G/4G module, by means of a dedicated switch (both electromechanical or solid state)

9. Connection to AC Mains

Each terminal allows screwing wires in the range of 1.5 to 6 mm².

All connections with the LVM concentrator shall be less than 3 m long.

A clear identification of all the connections is made visible for installation and maintenance operations.

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10. Protection degree

- Wiring compartment: **IP 20**;
- Circuitry compartment: **IP 41**.

11. Environmental characteristic and reliability

- | | |
|---|--|
| • Product Life: | More than 10 years |
| • Failure rate: | ≤ 0.3 % (percent) per year or better |
| • Operating Temperature: | -25 to +70°C |
| • Storage and transportation Temperature: | -40 to +85°C |
| • Operating Relative Humidity (non-condensing): | 25-90% RH @ 50°C (without condensation) |
| • Storage Relative Humidity (non-condensing): | 95% RH @ 50° C (without condensation) |
| • Self Consumption: | 3W (LVM Concentrator without GSM/GPRS/3G/4G modem, steady state) |

12. PLASTIC CASE MATERIAL

The concentrator plastic case has the following characteristics:

- made of plastic material (Polycarbonate and 10% glass fibre) suitable for recycling (related symbols are molded on bigger ports);
- color: LVM's base and case, white (RAL 9016); the characteristics of this color are not altered due to solar radiation according with EN 60068-2-5.
LVM's terminal cover, transparent;
- heat and flame resistant (class V0 in accordance with UL94);
- low emission of corrosive and toxic gases and smokes;
- the case shows no deformations, brittleness process or surface hardness reduction, in the temperature range from -25 to +100 °C, and is able to withstand up to - 40°C temperature.

All the materials comply with the European Directive 2014/35/EU dealing with the restriction of the use of certain hazardous substances in electrical and electronic equipment.

A suitable area for nameplate data is foreseen on the front side of the case in addition to the optional logo hard printed on the front panel.

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The external front case surface, not covered by the terminal cover, is provided with geometrical (rhombus shaped) "bas relieves"; the external lateral case surface, not covered by the terminal cover, is provided with "bas relieves" as well (vertical lines).

In order to increase the case security, the following further measures are provided:

- Hot blade welding of the concentrator case.
- Additional appendixes to both the LVM's base and cover at the top right part of the concentrator to add a seal (see picture below)



- The concentrator case is further secured by an RFID device with the following characteristics:
 - Allows concentrator secure identification
 - Is clearly readable from the outside of the case

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13. CABLING AND CONNECTIONS

Connection to AC Mains

Each terminal allows to screw wires in the range of 1.5 to 6 square mm.

The insulation level is:

- 5, 7 kVrms for 60 s.
- 10 kVp (impulse $t_{rise}=1.2 \mu s$ - $t_{fall} = 50 \mu s$) Category of isolation IV.

These values arise from the fact that this device is:

- Reinforced insulation
- Class IV overvoltage category

All connections with the LVM concentrator is less than 3m.

A clear identification of all the connections is made visible for installation and maintenance operations.

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LVM – Technical Datasheet

Identification data	Description	Low Voltage Manager
	Acronym	LVM
	e-distribuzione product number	510013
	e-distribuzione homologation number	920
	Dimensions	313 x 198 x 85 mm (height x width x depth)
	Unit	N°-
	Safety standard	CEI EN 60950-1
	Installation in MV/LV substation	Predisposition for Mounting on base socket
	Static meter interface	See Section 4
Nominal characteristics	Voltage V (three-phase and neutral, connection for power supply)	3N ~ 400/230 V 50 HZ + PE $\Delta V_{AC} = \pm 15\%$ $\Delta f = \pm 5\%$
	DLC transmission with Static Meter (CE)	CENELEC EN 50065-1
Terminals		
	Power supply DLC communication	4 outputs $\Phi = 1.5$ to 6 mm ² (cable jacket's thickness ≥ 0.4 mm)
	Transmission with control center (back office)	GSM/GPRS/UMTS Modem (or PSTN) (internal or external module) or via Ethernet
	Modem power supply	+12 V _{DC} , 12 W (provided the appropriate capability to support inrush currents)
	Connector for internal or external GPRS module	16 pin strip pitch 2.54 mm adapter (female)
	Connector for internal RF module	10 pin strip pitch 2.54 mm adapter (male)

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Modem Interface	Serial interface connected to a serial port in the concentrator
Specified Operating Temperature range	- 25 / +70 °C
Limit temperature range for storage and transportation	- 40 / +85 °C
Operating Relative humidity	25, 90 % RH @ 50°C (without condensation)
Relative humidity for Storage	95% RH @ 50 °C (without condensation)
Local optical interface	CEI EN 62056-21 mode E or CEI EN 61107
Self consumption	3 W Only LVM no TLC modem no RF module (steady state)
Life time	>10 years
Failure Rate	≤ 0,3%/year
Tampering	Detection of separation between terminal cover and case
Diagnostic	Self-diagnostic of the main functions
Other functionalities	Automatic management of daylight saving time and leap year. Local and remote programming. Time zone
CE mark	Compliant with European directive 2002/95/EC, 2006/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment
Conformity with the provisions of the following EC directive (including all applicable amendments)	European Directive 2004/108/EC (Electromagnetic Compatibility – EMC)
References of harmonized standards	EN 55022: Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement EN 55024: Information technology equipment - Immunity characteristics - Limits and methods of measurement

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