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Safety requirements for radio transmitting equipment – General requirements and terminology

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Exigences de sécurité applicables aux matériels d'émission radioélectrique – Exigences générales et terminologie

IEC 60215:2016
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and terminology**

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**Exigences de sécurité applicables aux matériels d'émission radioélectrique –
Exigences générales et terminologie**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
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INTERNATIONALE

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**SAFETY REQUIREMENTS FOR RADIO TRANSMITTING EQUIPMENT –
GENERAL REQUIREMENTS AND TERMINOLOGY**

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International Standard IEC 60215 has been prepared by IEC technical committee 103: Transmitting equipment for radiocommunication.

This bilingual version (2017-01) corresponds to the monolingual English version, published in 2016-04.

This fourth edition cancels and replaces the third edition, published in 1987, Amendment 1:1989 and Amendment 2:1993. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- The test methods in this standard are similar to those given in IEC 60215:1987 and continue to apply only to radio transmitting equipment and equipment defined in Clause 1, operating under the responsibility of SKILLED persons.
- Reorganization and revision of the content are summarized in Annex F.

Words printed in SMALL CAPITALS are terms that are defined in Clause 3.

The text of this standard is based on the following documents:

FDIS	Report on voting
103/143/FDIS	103/146/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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SAFETY REQUIREMENTS FOR RADIO TRANSMITTING EQUIPMENT – GENERAL REQUIREMENTS AND TERMINOLOGY

1 Scope

This International Standard applies to radio transmitting equipment, operating under the responsibility of SKILLED persons. It also applies to auxiliary equipment and ancillary apparatus, including combining units and matching networks and cooling systems where these form an integral part of the transmitter system.

The requirements of IEC 60215 may also be used to meet safety requirements for cognate equipment. Examples of equipment that could be within the scope of this International Standard are shown in Table 1.

Table 1 – Examples of equipment

Generic product type	Specific example of generic type
RF amplifiers	High power RF amplifiers used for industrial, medical or scientific applications
High-voltage power supplies (HVPS)	DC HVPS based on PSM technology or any cognate technology

Table 1 is not intended to be comprehensive, and equipment that is not listed is not necessarily excluded.

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When the equipment is to be manufactured and/or installed in territories that have safety standards covering the scope of this International Standard that are more stringent, then those standards apply.

Antenna systems, associated feeder lines and matching networks, not forming an integral part of the transmitter, are excluded.

This International Standard does not apply to transmitters of safety-insulated construction using DOUBLE INSULATION or REINFORCED INSULATION and without provision for protective earthing. This type of equipment is designated CLASS II EQUIPMENT and is usually marked with a symbol as shown in 3.2.2 b).

This International Standard does not apply to battery powered transmitters or to radio base stations and fixed terminal stations for wireless telecommunication, as this equipment is covered by other standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60244-6, *Methods of measurement for radio transmitters – Part 6: Cabinet radiation at frequencies between 130 kHz and 1 GHz*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-1-10, *Fire hazard testing – Part 1-10: Guidance for assessing the fire hazard of electrotechnical products – General guidelines*

IEC 60695-1-11, *Fire hazard testing – Part 1-11: Guidance for assessing the fire hazard of electrotechnical products – Fire hazard assessment*

IEC 60825-12, *Safety of laser products – Part 12: Safety of free space optical communication systems used for transmission of information*

IEC 62232, *Determination of RF field strength and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure*

IEC 62311, *Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)*

ISO 1999, *Acoustics – Estimation of noise-induced hearing loss*

Directive 2011/65/EU of the European Parliament and the Council of 8 June 2011 on the restriction of the use of hazardous substances in electrical and electronic equipment

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3 Terms, definitions and symbols

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For the purposes of this document, the following terms, definitions and symbols apply.

<http://document.iteh.ai/info/giving/term/3-definition-bb079-34408a50707b/iec-60215-2016>

3.1 Terms and definitions

3.1.1 skilled

having the necessary knowledge and practical experience of electrical and radio engineering to appreciate the various hazards that can arise from working on radio transmitters including auxiliaries, and to take appropriate precautions to ensure the safety of personnel

Note 1 to entry: Guidance on assessing the competence of personnel for designation as SKILLED is given in Annex B.

Note 2 to entry: The above definition and the guidance in Annex B detail the minimum requirements for a SKILLED PERSON. In some countries more stringent requirements for qualifications, training and experience are stipulated, with formal certification.

3.1.2 unskilled

not SKILLED

3.1.3 operator

operating company and operating personnel

3.1.4 operator area

area in which the ICNIRP occupational exposure limits apply

3.1.5**electrically safe**

unable to cause a harmful electric shock or radio-frequency skin burn

3.1.6**creepage distance**

shortest distance measured in air, over the surface of the insulation, between two conductive parts, or between a conductive part and the chassis of the equipment

3.1.7**clearance**

shortest distance, measured in air, between two conductive parts, or between a conductive part and the chassis of the equipment

3.1.8**by hand**

without the use of a tool, coin or any other object

3.1.9**accessible part**

part which can be touched by either of the standard test fingers described in IEC 60529, when applied in any direction with a force not exceeding 30 N

Note 1 to entry: In addition to guarding against flashover, any part carrying a voltage is regarded as an ACCESSIBLE PART if its distance to the test finger is less than the CLEARANCE given in Annex A.

3.1.10**enclosure**

space in which items of the equipment that might be dangerous are located, and access to which is prevented, for example, with locked doors or with cover plates which cannot be removed without using a tool

3.1.11**safety device**

part or component provided for the purpose of protecting personnel from possible injury

3.1.12**Class II equipment**

equipment in which protection against electric shock does not rely on BASIC INSULATION only, but in which additional safety precautions, such as DOUBLE INSULATION or REINFORCED INSULATION are provided, there being no reliance on protective earthing

3.1.13**basic insulation**

insulation that provides basic protection against electric shock

3.1.14**double insulation**

insulation comprising both BASIC INSULATION and an independent insulation in order to reduce the risk of electric shock in the event of a failure of the BASIC INSULATION








3.1.15**reinforced insulation**

single insulation system that provides a degree of protection against electric shock equivalent to DOUBLE INSULATION






3.2 Symbols

As far as practicable, the symbols given below conform to those given in IEC 60417.

3.2.1 General symbols

a) AC supply		IEC 60417-5032 (2002-10)
b) DC supply		IEC 60417-5031 (2002-10)
c) AC and DC supply		IEC 60417-5033 (2002-10)
d) Three-phase AC supply		IEC 60417-5032-1 (2002-10)
e) Earth		IEC 60417-5017 (2006-08)
f) Aerial; antenna		IEC 60417-5039 (2006-08)
g) Special disposal restrictions apply		

3.2.2 Symbols relating to safety

a) Safety earth		IEC 60417-5019 (2006-08)
b) Equipment of safety insulated construction (CLASS II EQUIPMENT)		IEC 60417-5172 (2003-02)
c) Dangerous voltage		IEC 60417-5036 (2002-10)
d) Ionizing radiation		ISO 7000-0907 (2004-01)
e) High temperature		IEC 60417-5041 (2002-10)

3.2.3 Symbols relating to degree of protection against moisture

IP codes (International Protection Marking) are used to indicate the degree of protection against the intrusion of solid particles or water. The first digit of the code indicates the protection against solid particles and the second digit the protection against ingress of water. Where no protection is specified for solid particles, this digit is replaced with the letter X.

The the following IP codes apply for ingress of water:

IPX0	Non-protected
IPX1	Protected against vertically falling water drops
IPX2	Protected against vertically falling water drops when enclosure tilted up to 15°
IPX3	Protected against spraying water
IPX4	Protected against splashing water
IPX5	Protected against water jets
IPX6	Protected against powerful water jets
IPX7	Protected against the effects of temporary immersion in water
IPX8	Protected against the effects of continuous immersion in water
IPX9	Protected against high pressure and temperature water jets

4 Principle of safety

4.1 General principles

It is essential that designers understand the underlying principles of safety requirements in order that they can engineer safe equipment.

Designers shall take into account not only normal operating conditions of the equipment but also fault conditions, foreseeable misuse and external influences such as temperature, altitude, pollution, moisture and overvoltages on the mains supply. Dimensioning of insulation spacing should take account of possible reductions by manufacturing tolerances, or where deformation could occur due to handling, shock ageing and vibration likely to be encountered during manufacture, transport and normal use.

There are two types of person whose safety needs to be considered, SKILLED persons and UNSKILLED persons.

Requirements for protection should assume that UNSKILLED persons are not trained to identify hazards, but will not intentionally create a hazardous situation. Consequently, the requirements provide protection for cleaners and casual visitors and all other UNSKILLED persons. In general, UNSKILLED persons should not have access to hazardous parts, whether or not such parts are marked or barriered.

4.2 Object

This International Standard specifies requirements intended to reduce risks of

- electric shock,
- skin burns,
- high temperature and fire,
- injury from harmful radiation, and
- mechanical or any other hazard,

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for the persons who may come into contact with the equipment covered by this International Standard.

This International Standard is intended to reduce such risks with respect to installed equipment, whether it consists of a system of interconnected units or independent units, subject to installing, operating and maintaining the equipment in the manner prescribed by the manufacturer.

Design and construction requirements and, where appropriate, test methods are specified covering the following:

- a) the safety of SKILLED personnel when operating, carrying out routine adjustments, and as far as practicable, during fault finding and repairing the equipment;
- b) the safety of personnel, including UNSKILLED personnel directed by SKILLED personnel, when the equipment is operating normally, and also when operating under certain specific fault conditions which may arise in normal use;
- c) the prevention of fire and its spread.

These requirements do not necessarily ensure the safety of UNSKILLED personnel working on the equipment when it is not in normal operation.

Tests are specified, where appropriate, for checking that the equipment meets the safety requirements of this International Standard when operating normally and also under the specified fault conditions. The tests should be carried out on a representative

set of equipment in order to determine whether the design meets the requirements of this International Standard. The tests are neither mandatory nor limiting and may be modified by agreement between manufacturer and purchaser.

The use of this International Standard is not, however, intended to be restricted to type tests. It may also be used for acceptance tests after installation of the equipment, for tests after modifications to parts of the equipment, and for tests at appropriate intervals to ensure the continuing safety of the equipment throughout its life.

5 Operating conditions

5.1 General

Clause 5 sets out the range of conditions of normal use and the fault conditions under which the equipment may operate without danger to personnel, including UNSKILLED personnel directed by SKILLED personnel. The equipment shall meet the safety requirements of this International Standard when operating under the conditions of normal use given in 5.2 and also when any of the initial fault conditions detailed in 5.3 have been applied.

5.2 Conditions of normal use

The conditions of normal use are as follows.

- a) The temperature and humidity conditions shall be compliant with the material specification as well as within conditions agreed between manufacturer and purchaser.
- b) Temperature and humidity shall never be such as to cause condensation on the equipment.
- c) Where no specific environmental condition exists, the atmospheric conditions shall be within the following range:
 - temperature: +5 °C to +45 °C;
 - relative humidity: 45 % to 75 %, without condensation;
 - air pressure: 86 kPa to 106 kPa (860 mbar to 1 060 mbar).
- d) The supply voltage and frequency shall be within the range for which the equipment has been designed.
- e) For AC equipment, the waveform of the supply voltage shall be substantially sinusoidal.
- f) For equipment which may be operated from AC or DC, either supply shall be applied separately.
- g) The safety earth terminals or contacts, if any, (see 7.2.1) and any other earth terminal shall be connected to earth, unless they are designed to be tightened BY HAND, in which case they shall be left unconnected.
- h) The access doors and cover plates or other protective covers, if any, shall be closed or fixed in position unless they are designed to be opened or removed BY HAND, in which case they may be left open or removed.
- i) The equipment shall operate in any position for which it has been designed to be used.
- j) The equipment shall be controllable at any operating state.
- k) The equipment shall operate with any input signal condition and output load given in the equipment specification.

5.3 Fault conditions

Operating under fault conditions denotes that, with the equipment operating under the conditions of normal use given in 5.2, one of the faults a) to i) listed below is present, together with any associated consequential faults arising. The initial faults shall be applied separately, in turn, in any convenient order.

The faults are as follows:

- a) short circuits across CREEPAGE DISTANCES, if they are less than the values given in Annex A, unless the insulation materials are resistant to tracking and non-flammable (for details see 7.6);
- b) short circuits across CLEARANCES, if they are less than the values given in Annex A;
- c) a potentially dangerous failure of any component as determined from inspecting the equipment and studying the circuit diagram, unless the component is known to comply with an IEC test recommendation appropriate to the conditions of use in the equipment;
- d) connection of any unfavourable impedance to the radio-frequency output connection, including open circuits and short circuits;
- e) failure of any cooling system;
- f) continuous operation of motors, intended for intermittent operation, unless protection against this is included in the equipment;
- g) locking of moving parts in rotating or linear operating devices, if these parts can be jammed by mechanical failure;
- h) the loss of one or more phases on a three-phase supply;
- i) the loss of the neutral conductor on a three-phases, four wire supply.

5.4 General conditions for tests

General conditions for tests shall comply with the international standards which define the methods of measurement of the equipment concerned.

Partial deviated test conditions might be mutually agreed between purchaser and supplier.

6 Components and construction IEC 60215:2016 <https://standards.iteh.ai/catalog/standards/sist/4349ef3f-f81-4bb5-b7b6-34408a50707b/iec-60215-2016>

6.1 Introductory remark

The purpose of Clause 6 is to ensure that the equipment is designed and constructed to ensure safety of the personnel throughout the life of the equipment, starting from the development through the operation of entire systems and the disposal of disused equipment.

Where no test method is given, compliance shall be checked by visual inspection and where appropriate by functional test.

6.2 Components

6.2.1 General requirements

Components shall not be loaded in excess of their ratings under normal conditions nor, as far as practicable, under fault conditions. Normal and fault conditions are described in 5.2 and 5.3

Components which are known to comply with an IEC test recommendation appropriate to the conditions of use in the equipment need not be tested.

When this is not so, the components may be tested either in the equipment or externally under conditions equivalent to those applying in the equipment. The number of components to be tested shall be agreed between manufacturer and purchaser.