Technical Article

IEC 62311: Demonstrating conformance in the low frequency range

Standards, methods, and limit values

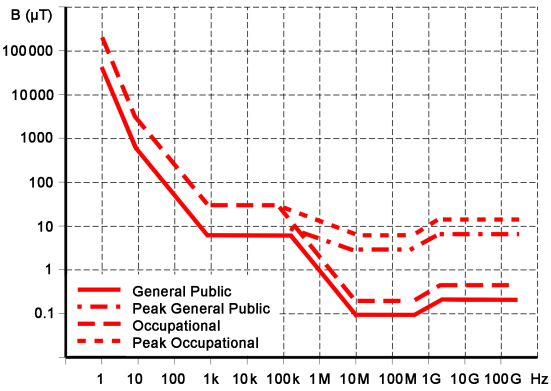
The international standard IEC 62311 entitled “Assessment of electronic and electrical equipment related to human exposure restrictions for electro-magnetic fields (0 Hz – 300 GHz)” [1] came into force in 2007. IEC 62311 applies to all devices not covered by the domestic appliance standard IEC 62233 [4] or other product group specific standards.

The equivalent European standard, EN 62311 [2] followed in 2008. It is harmonized with the international IEC standard and is already incorporated into national standards (the next lower level). The standard in the UK, for example, is BS EN 62311 [3].

IEC 62311 defines measurement procedures, not limit values. These procedures are *normative*, whereas the limit values are *informative*. According to Recommendation 1999/519/EC [5] the limit values to be applied in countries belonging to the European Community are those defined by ICNIRP, the International Commission for Non-ionizing Radiation Protection [6]. The limit values defined for “General Public” should be used in this case. In contrast, the limit values specified by IEEE [7, 8] may be applied in the USA.

Exposure to the magnetic field often preponderates in the low frequency range. For this reason, the magnetic flux density B in Tesla (T) is usually measured (1 T = 1 Vs/m^2). The magnetic flux density B and magnetic field strength H (in A/m) are related through the permeability μ of free space and can be converted one to the other using the relationship B = μ H.

IEC 62311 fundamentally allows two methods to be used to determine the field exposure level: Frequency domain assessment and time domain assessment. Frequency domain assessment can provide additional information about the sources of field exposure and their individual contributions. In contrast, time domain assessment is simpler and gives results more quickly.



ICNIRP limit value curves for magnetic flux density

The test equipment

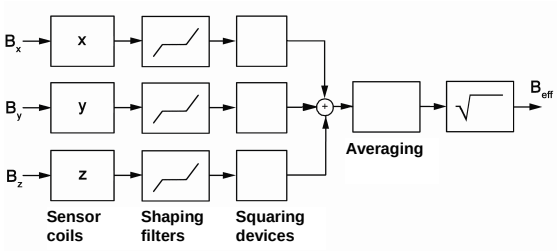
The Exposure Level Tester ELT-400 from Narda Safety Test Solutions is suitable for measurements in the low frequency range. It measures magnetic flux density B in the frequency range 1 Hz to 400 kHz. An isotropic (non-directional) standard-compliant probe with a cross-sectional area of 100 cm^2 is included with the device.

The ELT-400 uses time domain assessment. Using the so-called "shaped time domain" method, the device evaluates the measurement results in the time domain by simulating the inverse of the frequency dependent ICNIRP General Public limit value curves as a transfer function (see block circuit diagram).

The isotropic probe is equipped with three mutually perpendicular sensor coils. The three-channel layout of the test set means that all three spatial axes are continuously measured and the power sum formed. The device can also detect peak values instead of the average or mean value. The result is shown directly as a percentage of the permitted limit value.

ELT-400

- *Frequency range 1 Hz – 400 kHz*
- *Standard-compliant measurement with evaluation to ICNIRP*
- *Evaluation uses the fast STD (shaped time domain) method*
- *Standard-compliant 100 cm^2 probe*
- *Standard-compliant 3 m^2 probe for determining coupling factors*



Block circuit diagram of ELT-400 with isotropic probe: The sensor coils detect the field in all three spatial directions simultaneously. Filters then shape the measured values according to frequency to correspond to the ICNIRP limit value curves. Squaring devices produce the power sum, which is then averaged and the square root taken to give the weighted flux density.

The advantages

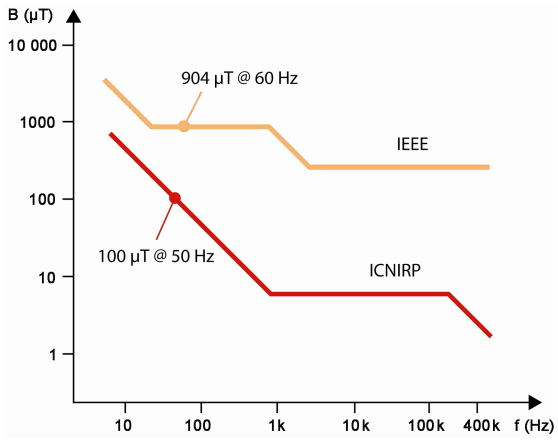
"Shaped time domain" method gives correct, reproducible results even in multi-frequency environments

When several field components from different sources with different frequencies overlap, evaluation using frequency domain assessment using, say, a spectrum analyzer would be time-consuming and complex; the results for each frequency would have to be assessed individually and then the overall result computed. The "shaped time domain" method used by the ELT-400 automatically evaluates all frequencies correctly and the result is available immediately.

Isotropic probes deliver correct results regardless of spatial orientation

Isotropic probes are equally sensitive in all directions. The orientation of the probe with respect to the source is therefore unimportant when measuring with isotropic probes. This would otherwise be a problem in the case of multiple sources. Both the 100 cm^2 probe and the 3 cm^2 probe for the ELT-400 from Narda Safety Test Solutions are isotropic.

The ELT-400 is therefore the instrument of choice for demonstrating compliance with IEC 62311 in the frequency range from 1 Hz to 400 kHz.



The ELT-400 from Narda Safety Test Solutions evaluates the magnetic flux density according to ICNIRP General Public. The IEEE limit value curves (yellow) are generally above the ICNIRP values (red) in the low frequency range. Devices that comply with ICNIRP will therefore also conform to the IEEE standard.

Standards and regulations

[1] IEC 62311 – Ed. 1.0 (2007)
Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)

[2] EN 62311:2008
Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz) (IEC62311:2007, modified)

[3] BS EN 62311:2008
Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz) (EN 62311:2008 Identical, IEC 62311:2007 Modified)

[4] IEC 62233 – Ed. 1.0 (2005)
Measurement methods for electromagnetic fields of household appliances and similar apparatus with regard to human exposure

[5] Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC).
Official Journal of the European Communities L 199/59, 30.7.1999

[6] ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz).
Health Phys., 1998, vol. 41, no. 4, pp. 449-522

[7] IEEE C95.6:2002
IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0 – 3 kHz

[8] IEEE Std C95.1:2005
IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

Narda
Safety Test Solutions GmbH
Sandwiesenstrasse 7
72793 Pfullingen, Germany
Phone: +49 (0) 7121-97 32-777
Fax: +49 (0) 7121-97 32-790
E-Mail: support@narda-sts.de
Internet: www.narda-sts.de

Narda
Safety Test Solutions
435 Moreland Road
Hauppauge, NY 11788 USA
Phone: +1 631 231-1700
Fax: +1 631 231-1711
E-Mail: NardaSTS@L-3COM.com
Internet: www.narda-sts.us

Narda
Safety Test Solutions Srl
Via Leonardo da Vinci, 21/23
20090 Segrate (Milano) - ITALY
Phone.: +39 02 269987-1
Fax: +39 02 269987-00
E-Mail: support@narda-sts.it
Internet: www.narda-sts.it