

IEC/EN 61000-3-2 - At a glance

Emission limits for harmonic currents of electronic devices up to 16A nominal current

The relating standards:

IEC/EN 61000-3-2:2005

- A1:2008, A2:2009

IEC/EN 61000-4-7

This standard is applicable for electric and electronic devices up to and including 16A per phase and intended to be connected to the public low-voltage distribution systems.

It defines limits of harmonic currents up to the 40th harmonic caused by equipment tested under the specifications under normal operating conditions or if specified according to the definitions under Annex C of this standard.

The number of devices with a non-linear load characteristic connected to the public network is increasing rapidly. Typical devices are for example the power supplies of personal computers, TV sets, printers, photocopying machines and audio equipment. In summation these devices cause an increasing harmonic content of the supply voltage.

A non-sinusoidal (and therefore harmonic afflicted) current consumption causes voltage drops at the mains impedance. These drops are the reason for a deviation of the voltage waveshape away from ideal sinewave.

Fully compliant and traceable measurement of harmonic currents require an ideal clean supply voltage (the IEC/EN 61000-3-2 defines limits of the harmonic voltage components of the supply source). The Spitzenberger & Spies power amplifier PAS meets all testing source requirements (voltage and frequency stability, low harmonic distortion, nearly ideal internal resistance). Using the PAS guarantees, that only the harmonic currents of the EUT are measured.

For equipment not mentioned in Annex C the EUT shall operate in a mode where the maximum total harmonic current under normal operating conditions will be expected. See also the operating definitions of the manufacturer

*Source requirements according
IEC/EN 61000-3-2, Annex A2:*

- Voltage accuracy $\pm 2,0\%$
- Frequency accuracy $\pm 0,5\%$
- Phase angle stability $\pm 1,5^\circ$
- $U_{peak} = 1,4 - 1,42 U_{rms}$ and between 87° and 93° after the first zero-crossing

maximum harmonic components for

3. harmonic	0,9%
5. harmonic	0,4%
7. harmonic	0,3%
9. harmonic	0,2%
for even harmonics of order 2. - 10.	0,2%
for harmonics of order 11. - 40.	0,1%

For each harmonic order the rms value of the relating harmonic current (smoothed with a time constant of 1,5 s) is measured during the test cycle in each time window of the discrete Fourier transformation (DFT). These measured values must be below 150% of the applicable harmonic limits. The next step calculates the arithmetic average of all DFT values during the observation period. The average values must be below the applicable harmonic limits.

The repeatability of the average value for the individual harmonic currents over the entire test observation period shall be better than ± 5 of the applicable limit.



For the purpose of harmonic current limitation, equipment is classified into 4 classes as follows

Class A:

Refers to balanced three-phase equipment, household equipment (excluding EUT's identified as class D), tools (excluding portable tools), dimmers and audio equipment. The applicable limits are shown in table 1.

Class B:

Refers to portable tools and arc welding equipment which is not professional equipment. The applicable limits for class B are defined in table 1 and must be multiplied with a factor of 1,5.

Class C:

Refers to lighting equipment. The applicable limits are shown in table 2.

Class D:

Refers to personal computers and personal computer monitors and television receivers having a rated input current less than or equal to 600W. The applicable limits are shown in table 3.

Observation periods for four different types of equipment behaviour are considered and described in table 4:

Table 1: Limits for class A EUT

Odd harmonics	
n (order)	Max. $I_{harm}(A)$
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq n \leq 39$	$0,15 \times 15/n$

Even harmonics	
n (order)	Max. $I_{harm}(A)$
2	1,08
4	0,43
6	0,30
$8 \leq n \leq 40$	$0,23 \times 8/n$

Table 2: Limits for class C EUT

Odd harmonics only	
n (order)	Max. $I_{harm}(\%I_{fund})$
2	2
3	$30 \times \lambda^*$
5	10
7	7
9	5
$11 \leq n \leq 39$	3

* λ is the circuit power factor

Table 4: Observation periods T_{obs}

Quasi-stationary	T_{obs} of sufficient duration to meet the requirements for repeatability
Short cyclic ($T_{cycle} \leq 2,5\text{min}$)	$T_{obs} \geq 10$ cycles (reference method) or T_{obs} of sufficient duration to meet the requirements for repeatability
Random	T_{obs} of sufficient duration to meet the requirements for repeatability
Long cyclic ($T_{cycle} \geq 2,5\text{min}$)	Full equipment program cycle (reference method) or a representative 2,5min period considered by the manufacturer as the operating period with the highest THC

Table 3: Limits for class D EUT

Odd harmonics only		
n (order)	Max. $I_{harm}(mA/W)$	Max. $I_{harm}(A)$
3	3,4	2,30
5	1,9	1,14
7	1,0	0,77
9	0,5	0,40
11	0,35	0,33
$13 \leq n \leq 39$	$3,85/n$	$0,15 \times 15/n$

Annex C defines specific test conditions for television receivers, audio amplifiers, lighting equipment, independent and built-in incandescent lamp dimmers, vacuum cleaners, washing machines, microwave ovens, information technology equipment, induction hobs, air conditioners, kitchen machines and arc welding equipment.

The test report shall include all relevant information for the test conditions, the test observation period and the active power or fundamental current and power factor.

