Requirements of the generic and product immunity standards

EN	EN 61000-6-1: 2001	EN 61000-6-2: 2001	EN 301 489-1: v1.4.1	EN 55014-2: 1997 + A1	EN 55020: 2002 + A1 + A2	EN 55024: 1998 + A1 + A2	EN 50130-4: 1995 + A1 + A2	EN 61326-1: 2006	EN 61547: 1995 + A1
Related IEC	IEC 61000-6-1	IEC 61000-6-2	-	CISPR 14-2	CISPR 20	CISPR 24	-	IEC 61326-1	IEC 61547
Scope	Residential, commercial, light industry generic	Industrial generic	Radio comms equipment: common requirements	Household appliances, electric tools and similar	Broadcast receivers and associated equipment	Information technology equipment	Fire, intruder and social alarm system components	Equipment for measurement, control and laboratory use	Equipment for general lighting purposes
Test	Requirements								
Radiated RF	3 V/m 80% AM 80-1000 MHz to EN 61000-4-3	10 V/m 80% AM 80-1000 MHz to IEC 61000-4-3, except broadcast bands where level is 3 V/m (2005 version adds tests up to 2.7 GHz)	3 V/m 80% AM 80- 1000 MHz to EN 61000-4-3, with exclusion band, disre- garding narrowband responses	3 V/m 80% AM 80- 1000 MHz to EN 61000-4-3, only category IV appara- tus, and ride on toys with electronics in category III	125 dBmV/m (1.78 V/m) 80% AM 0.15-150 MHz in open stripline, reductions at some frequencies for receivers and VTRs; plus 900 MHz 3 V/m 200 Hz keyed carrier	3 V/m 80% AM ≤80-1000 MHz to EN 61000-4-3, extra spot frequency functional test for TTE	10 V/m 80% 1 kHz AM 80-2000 MHz to EN 61000-4-3, extra 1 Hz pulse modula- tion required; exclu- sion bands as in EN 301489 for radio link components	Part 1 gives general requirements: 3V/m 80% AM to EN 61000-4-3 over 80–1000 MHz and 1.4–2.0 GHz, 1 V/m from 2 to 2.7 GHz, Part 2 gives particular requirements	3 V/m 80% 1 kHz AM 80-1000 MHz to IEC 61000-4-3, only for electronic lighting equipment
Conducted RF	3 V rms 80% AM 0.15- 80 MHz to EN 61000-4-6 on AC power and func- tional earth ports, and all signal, control and DC power ports > 3m	10 V rms 80% AM 0.15-80 MHz to ENV 50141, except 47-68 MHz where level is 3 V rms: all ports except signal lines < 3 m	3 V rms 80% AM 0.15- 80 MHz to EN 61000-4-6 on AC power, and sig- nal, telecomm, control and DC power ports > 3 m, with exclusion band, disregarding nar- rowband responses	3 V rms 80% AM 0.15- 80 MHz to EN 61000- 4-6 on AC power ports, 1 V rms on DC and signal ports > 3 m, category IV; extending to 230 MHz for cats. II and III	RF common mode 126 dBmV emf 26-30 MHz, antenna terminal; induced voltages at mains and audio terminals, 0.15- 150 MHz 80% AM up to 130 dBmV emf	3 V rms 80% AM 0.15-80 MHz to EN 61000-4-6 on power and all signal cable ports > 3 m, extra spot frequency functional test for TTE	10 V (140 dBmV) rms 80% 1 kHz AM 0.15- 100 MHz to EN61000- 4-6, extra 1 Hz pulse modulation required; test not required for ca- ble ports \leq 3 m, except AC mains supply	Part 1 gives general requirements, 3 V rms 80% AM to EN 61000-4-6 over 0.15–80MHz except signal/control lines < 3 m; Part 2 gives particular requirements	3 V rms 80% AM 0.15- 80 MHz to IEC 61000-4-6 on power and all signal cable ports > 1 m, only for electronic lighting equipment
LF magnetic field	3 A/m to EN 61000-4-8, susceptible devices only	30 A/m to EN 61000-4-8, susceptible devices only	Not applicable	Not applicable	Not applicable	1 A/m to EN 61000- 4-8, susceptible devices only	Not applicable	30 A/m to EN 61000- 4-8, susceptible devices in industrial locations only	3 A/m to EN 61000-4-8, susceptible devices only

Field uniformity

IEC 61000-4-3: 2006 Edition 3 field uniformity and level calibration



Magnetic field immunity

IEC 61000-4-8:2001 Power frequency magnetic field **Requirement** EUT immersed in a magnetic field of 50 or 60 Hz sinusoidal (< 8% distortion) generated by an Magnetic fields induction loop surrounding it, in three orthogonal orientations Gauss = 100µTesla = 79.55 Amps/metre Severity levels of 1, 3, 10, 30 and 100 A/m continuous, 300 and 1000 A/m short duration (1 - 3 seconds) A/m mG **Test volumes** Single square loop, 1 m side: 0.6 x 0.6 x 0.5 m high 1 12.57 1.257 Double square loops, 1 m side, 0.6 m spaced: 0.6 x 0.6 x 1 m high (0.8 m spacing gives 1.2 m height) Single rectangular loop, 1 x 2.6 m: 0.6 x 0.6 x 2 m high 3 37.71 3.77 These figures give an acceptable variation of ±3 dB within the stated volume Loop factor (H/I, magnetic field/current injected) is calibrated at the centre of the loop 10 126 12.57 30 377 37.71 G 100 1.257 126 Induction loops 300 3.771 377 loop moved in steps (standard 1 x 2.6 m 1000 12.57 1257 of 50% of shortest testing in three side to test whole orthogonal EUT volume orientations) to test current Table-top set up generator (> 3 m) _Floo Induction loops standing (standard 1 x 1 m, set up testing in three orthogonal orientat EUT 10 cm insulating suppor to test current generator (> 3 m) to safety earth table-top ground plane 10 cm insulating support $(\min 1 \times 1 \text{ m})$ NB the vertical loop may alternatively enclose the EUT and ground plane assembly, with the EUT at its centre www.teseq.com E & OE: Whilst great care has been taken in preparing this data, Teseq AG cannot be responsible in any way for any errors or omissions. standards are subject to change and it is strongly recommended that before any tests are carried out, the latest issue of the standard is obtained from the relevant standards body. Tesea AG Nordstrasse 11F 4542 Luterbach Switzerland Tel: +41 (0)32 681 40 40 Fax: +41 (0)32 681 40 48 © 2009 Teseq Specifications subject to change without notice. All trademarks recognised. 691-004B

Coupling/decoupling networks (CDNs)





power amplifier

6 dB attenuator

Alternative 50 Ω level setting for current injection probe



Conducted LF immunity



Electromagnetic spectrum - LF and RF immunity



(n = no. of lines)

ground reference plane or

common earth terminal,

connections < 1 m length



Pulse Freq 50 Hz Duty Cycle: 50

Run Stop



Antenna VSWRs - 20 to 80 MHz



The near field transition

The near field/far field transition

There are two definitions for the transition between near and far field: The <u>Rayleigh</u> criterion: determined by the maximum dimension D of the radiating structure (antenna or EUT), allowing the approximation of a point source in the far field

The <u>Maxwell</u> criterion: determined by the transition from the induction region to the plane wave region, giving differences in electromagnetic wave properties



Radiated RF immunity

IEC 61000-4-3:2006 Edition 3 – Radiated RF test method

Levels

Levels

Requirement Radiated RF field generated by an antenna in a shielded anechoic enclosure over a pre-calibrated uniform field area, swept from 80 to 1000 MHz with a step size not exceeding 1% of preceding frequency value; dwell time per step sufficient to allow the EUT to respond, minimum 0.5 s The antenna faces each of the four sides of the EUT in each polarization (and top and bottom). if EUT can be used in any orientation), hence 8 or 12 tests in all. Tests are also included from 800-960 MHz and 1.4-6 GHz (though not necessarily the whole of this frequency range) for protection against digital mobile phones. * Partial illumination, in which multiple sweeps are performed with the antenna or EUT in different relative positions, is acceptable for EUTs larger than the uniform field area; both this and use of independent smaller (0.5 x 0.5 m) windows is acceptable for frequencies above 1 GHz. Other test facilities, in particular TEM/GTEM cells and reverberation chambers, are not now covered by this standard; see IEC 61000-4-20 and -21. Severity levels of 1, 3, 10 or 30 V/m unmodulated, pre-calibrated field level; actual applied signal is modulated to 80% with a 1 kHz

sinewave and the forward power, not the applied field strength, is controlled during the test.



Conducted RF immunity

IEC 61000-4-6:2006 Edition 2 – Conducted RF test method

- Requirement RF voltage swept with a step size not exceeding 1% of preceding frequency value; dwell time per step sufficient to allow the EUT to respond, minimum 0.5 s, over the frequency range 150 kHz to 80 or 230 MHz. The range 80 to 230 MHz overlaps with IEC 61000-4-3 and these tests may be used instead of the radiated tests, depending on the EUT dimensions. The signal is applied via coupling/decoupling networks (CDNs) to cable ports of the EUT. When CDNs are not suitable. the alternative methods of EM-clamp or current injection probe can be used. Cables leaving the EUT in close proximity or in conduit
 - are treated as one cable. One CDN is connected to the port to be tested and one CDN with 50 Ω termination is connected to another port, either at the EUT's earth terminal, or closest to the injection point or at the mains supply. All other ports with attached cables are isolated using decoupling networks, so that there is only one loop terminated with 150 Ω at each end. When using clamp injection, the AE set-up must present the 150 Ω common mode impedance as closely as possible, typically by using a combination of decoupling networks and a terminated CDN. If this can't be achieved, the actual CM impedance must be
 - less than the EUT's CM impedance and the applied stress current must be monitored and limited to $U_{_0}/150$. Severity levels of 1, 3 or 10 V emf unmodulated; actual applied signal is modulated to 80% with a 1 kHz sinewave



				80 MHz	230 MH	iz	1 G	Hz 1.4 - 6 GHz	
		coverage of	IEC 61000-4-3	i →	F			- F	
	HF			VHF				UHF	
ero, maritime & land mobile an	d fixed	29.7 M	47.04	Band III yhf/fm	maritime milit	ary aero & satellite	GSM/analogue cellul 890-960	Ar phones PCN + UMTS cellular M radar 1.72-1.88 G 1.92-2.	^r phone .17 G
	wave broadcasting	CB 27-28 M	and mobile (PMR)	broadcast 108 M	136 M 230 ro 156 M 165 M lar	M 400 M rada	r 0 M	aero 1.53 G land mo	bile
amateur =	ISM 13.56 M	28-29.7 N 27.12 M	amateu – amateu	r — 87.5 M	= amateur DAB 144-146 M	amateur — 430-440 M	Bands IV/V TV broadcast ^{853 M} 960	DME fixed M 1.215 G links ^{1.7 G}	ISM
6 M 8 M	I0 MHz	20 M 30 M	40 M 60 M	1 80 M 100 MHz	200 M	300 M 400 M	600 M 800 M 1	GHz 2 G	
6 4	2	10 m	8 6	4	2	1 m 8	6 4	2	

USB

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% n	nod	pow	er				
V po	ower						_
% mod power							
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				-			
				-		-	
							7



near field

re Ce	ferred e for radiated ty tests
	Rayleigh
	D = 0.3 m
	Rayleigh
	D = 1 m
	Rayleigh
	D = 3 m



must be provided with decoupling networks

