

产品---系列标准概述

Harmonic	EN 61000-3-2 ($\leq 16A$)
Flicker	EN 61000-3-3 ($\leq 16A$)
Radiated Emission (RE)	EN 61000-6-4
Conducted Emission (CE)	EN 61000-6-4
Electrostatic Discharge (ESD)	IEC 61000-4-2
RF electromagnetic field (RS)	IEC 61000-4-3
Fast transients (Burst/EFT)	IEC 61000-4-4
Surge	IEC 61000-4-5
Injected currents (CS)	IEC 61000-4-6
Power frequency magnetic field	IEC 61000-4-8
Voltage Dip and Interruptions	IEC 61000-4-11



1. Emission

1.谐波测试 Harmonic

Standard:EN61000-3-2

Scope

- ❑ 规定向公共电网发射的谐波电流的限值。
- ❑ 指定由在特定环境下被测设备产生的输入电流的谐波成分的限值。
- ❑ 适用于输入电流小于或等于16A的接入公共低电压网络的电子电气设备。

Classification of equipment

- ❑ **Class A:** -平衡的三相设备;
 - 家用电器;
 - 除手持工具外的工具;
 - 白炽灯调光器;
 - 音频设备;
 - 其他设备.
- ❑ **Class B:** - 手持工具;
- ❑ **Class C:** - 照明设备.
- ❑ **Class D:** - 个人电脑及监视器;
 - 电视接收机.



1. Emission

谐波测试主要是检验低压供电网络中的谐波可能对这些频率敏感的设备所产生的影响。

谐波实验原理：由于电子设备的工作模式、非线性元件和各种干扰噪声等原因，导致其输入电流不是完全的正弦波，往往含有丰富的高次谐波成分对电网造成污染。

电力系统中的谐波指的是那些频率为供电系统额定频率整数倍的正弦电压或正弦电流。

公共输电系统出现谐波电流会引起以下问题：

- 损失更多电能，每一个谐波都有无功功率部分、有功功率部分，（其中有功功率会令导线发热，导致导线要采用更大面积）；
- 电子部件使用寿命缩短；
- 电压失真导致电机效率降低；



1. Emission

谐波电压是由叠加在电源电压上的一个或多个连续正炫波的组合波构成。

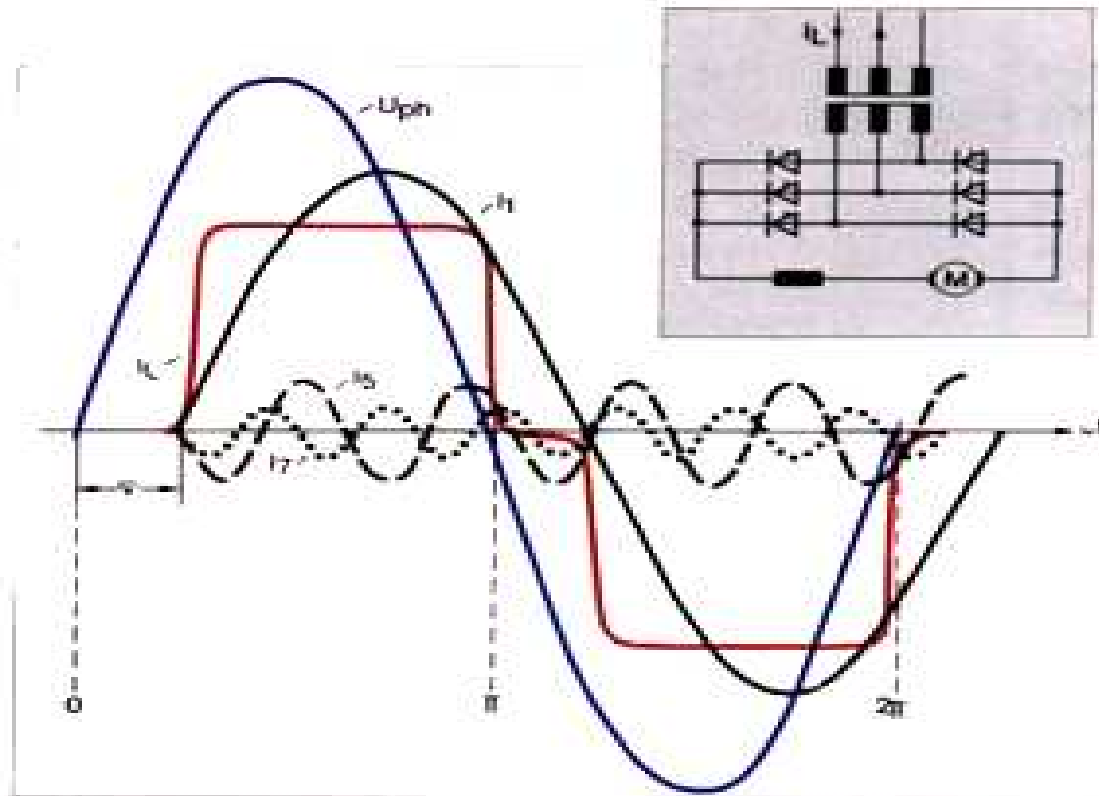
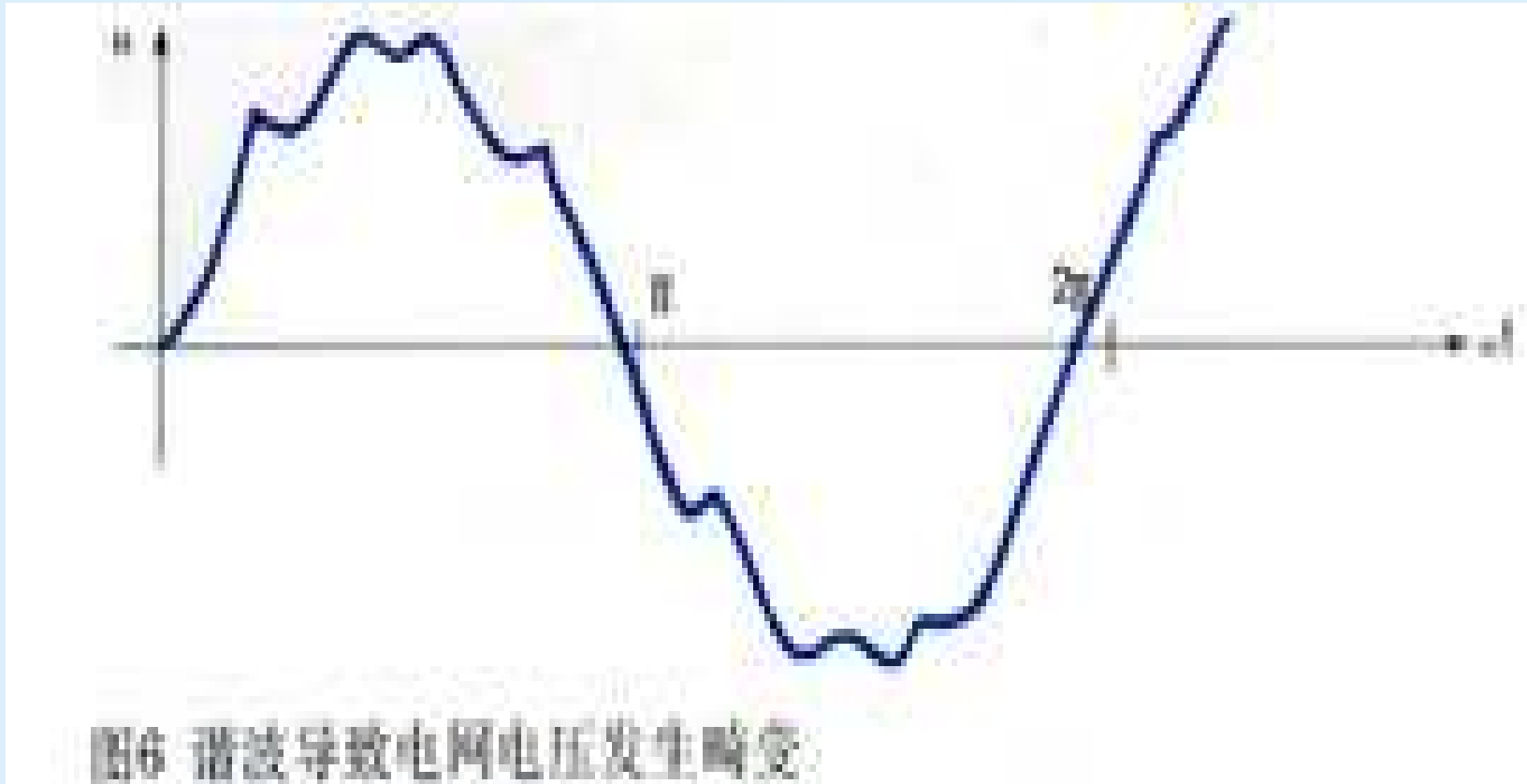


图 5 变流器网侧电流分解为基波和谐波

1. Emission

谐波



1. Emission

测试数据:

测试上限为基频的**40**次谐波频率

$$\text{Total harmonic current} = \sqrt{\sum_{n=2}^{40} I_n^2}$$

EUT: EHU305
 Test category: Class-A per A-14 (European limits)
 Test date: 05-6-23
 Test duration (min): 10
 Comment:
 Customer:
 Tested by:
 Test Margin: 100
 End time: 14:21:17
 Data file name: CTSMXL_H-000449.cts_data

Test Result: Pass
 THC(A): 1.172 I-THD(pk%): 295.763
 Highest parameter values during test:
 V_RMS (Volts): 229.85
 I_Peak (Amps): 3.024
 I_Fund (Amps): 2.127
 Power (Watts): 449
 Source qualification: Normal
 POHC(A): N/A POHC Limit(A): N/A
 I_RMS (Amps): 1.965
 Crest Factor: 1.575
 Power Factor: 1.000

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.049	1.080	4.6	0.062	1.620	6.69	Pass
3	0.546	2.300	23.7	0.816	3.450	25.18	Pass
4	0.038	0.430	8.8	0.051	0.645	12.33	Pass
5	0.426	1.140	37.4	0.587	1.710	38.42	Pass
6	0.025	0.300	8.3	0.036	0.450	11.79	Pass
7	0.256	0.770	33.2	0.348	1.155	32.09	Pass
8	0.015	0.230	6.4	0.024	0.345	10.16	Pass
9	0.124	0.400	30.9	0.159	0.600	27.18	Pass
10	0.011	0.184	6.1	0.018	0.276	9.63	Pass
11	0.053	0.330	16.0	0.058	0.495	14.90	Pass
12	0.009	0.153	6.1	0.014	0.230	9.00	Pass
13	0.041	0.210	19.7	0.049	0.315	19.79	Pass
14	0.006	0.131	4.8	0.009	0.197	6.72	Pass
15	0.038	0.150	25.7	0.048	0.225	24.89	Pass
16	0.004	0.115	3.6	0.006	0.173	5.36	Pass
17	0.029	0.132	21.7	0.035	0.199	19.56	Pass
18	0.004	0.102	3.9	0.006	0.153	5.85	Pass
19	0.018	0.118	14.9	0.020	0.178	15.00	Pass
20	0.005	0.092	5.0	0.006	0.138	6.90	Pass
21	0.015	0.107	13.9	0.020	0.161	16.29	Pass
22	0.005	0.084	5.5	0.006	0.125	7.39	Pass
23	0.015	0.098	15.8	0.022	0.147	16.69	Pass
24	0.007	0.077	8.5	0.008	0.115	10.19	Pass
25	0.012	0.090	13.7	0.017	0.135	13.83	Pass
26	0.004	0.071	5.6	0.006	0.106	8.58	Pass
27	0.008	0.083	10.0	0.009	0.125	11.33	Pass
28	0.003	0.066	5.3	0.005	0.099	8.10	Pass
29	0.008	0.078	9.8	0.009	0.116	11.64	Pass
30	0.003	0.061	4.9	0.005	0.092	7.59	Pass
31	0.007	0.073	9.6	0.009	0.109	11.70	Pass
32	0.003	0.058	4.9	0.004	0.086	7.99	Pass
33	0.006	0.068	8.1	0.006	0.102	9.09	Pass
34	0.003	0.054	5.3	0.003	0.081	7.64	Pass
35	0.005	0.064	7.8	0.006	0.096	8.40	Pass
36	0.002	0.051	4.4	0.003	0.077	6.52	Pass
37	0.005	0.061	8.0	0.006	0.091	9.19	Pass
38	0.002	0.048	4.5	0.003	0.073	6.28	Pass
39	0.004	0.058	7.7	0.006	0.087	8.62	Pass
40	0.002	0.046	4.8	0.004	0.069	7.00	Pass



1. Emission

A 类限值

Table 1 – Limits for Class A equipment

Harmonic order n	Maximum permissible harmonic current A
Odd harmonics	
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq n \leq 39$	$0,15 \frac{15}{n}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \leq n \leq 40$	$0,23 \frac{8}{n}$

1. Emission

2. 电压波动和闪烁 Flicker

Standard: EN 61000-3-3

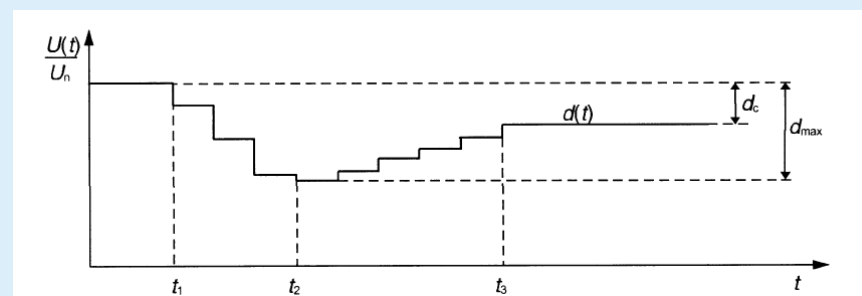
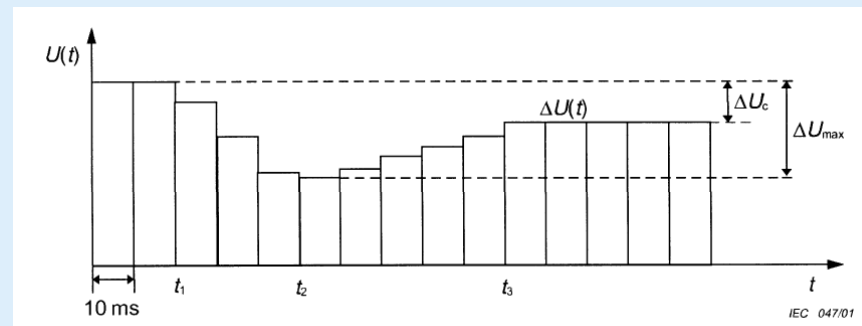
Scope

- ❑ 对定电压波动和闪烁对公共电网的影响的限值。
- ❑ 指定在特定的条件下被测样机产生的电压变化限值和评估方法的指导。
- ❑ 适用于每相输入电流小于或等于16A的接入公共低电压网络的220V到250V，50Hz的电子电气设备。

1. Emission

该标准的目的是为了保证产品不对与其连接在一起的照明设备造成过度的闪烁影响(灯光闪烁)。

下表对于各相对电压变化值允许的分钟变化率或变化时间。可以理解为电压变化幅度越大，允许的变化速度就越小，或者说是要要求变化的时间也越大。



1. Emission

限值:

- the value of P_{st} shall not be greater than 1,0;
- the value of P_{lt} shall not be greater than 0,65;
- the value of $d(t)$ during a voltage change shall not exceed 3,3 % for more than 500 ms;
- the relative steady-state voltage change, d_c , shall not exceed 3,3 %;
- the maximum relative voltage change d_{max} , shall not exceed



1. Emission

3.传导骚扰 CE (0.15-30MHz)

Standard:EN61000-6-4

Scope

- 电子电气测量测试设备
- 电子电气控制设备
- 电子电气实验室设备

Classification of equipment

Class A: equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. 非家用

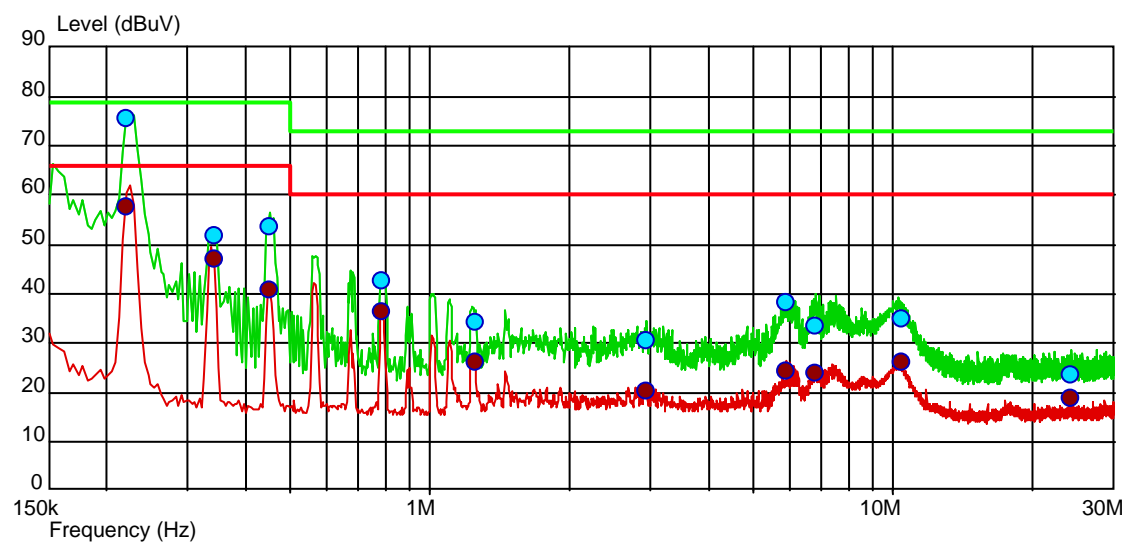
Class B: equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. 家用



1. Emission

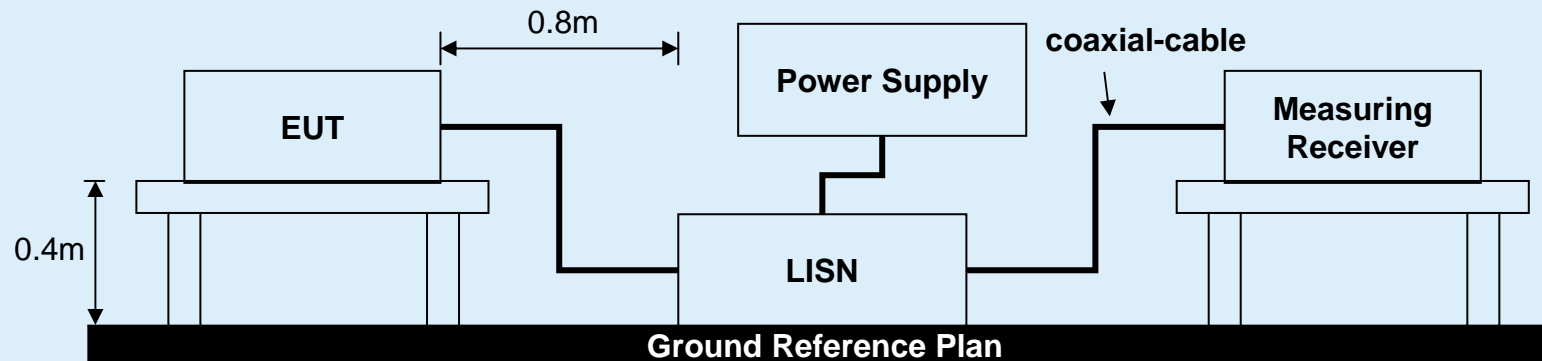
A类限值

Frequency band MHz	Quasi-peak dB μ V	Average dB μ V
0.15 - 0.50	79	66
0.50 - 5	79	66
5 - 30	73	60



1. Emission

Test setup

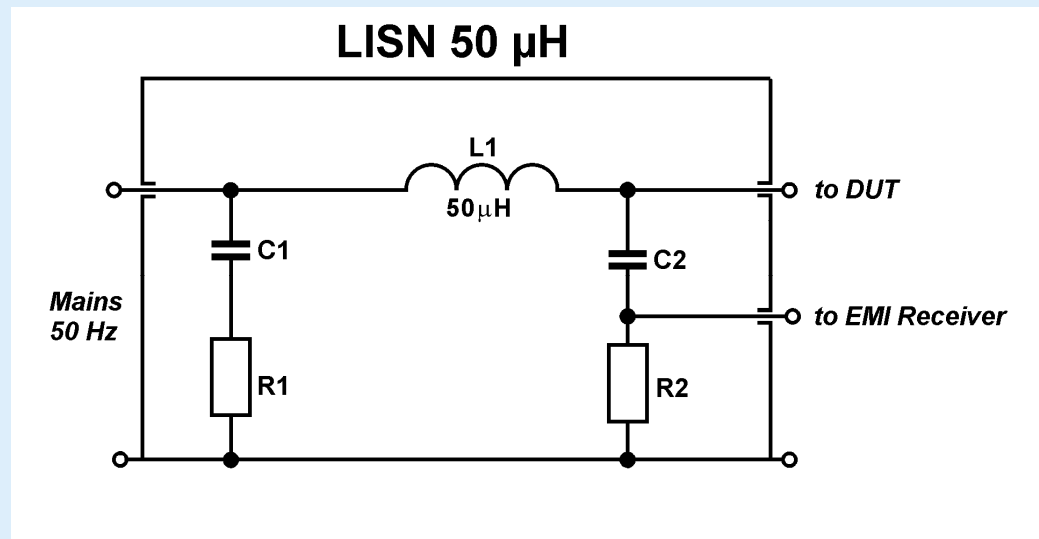


%EUT : Equipment Under Test

%LISN: Line Impedance Stabilization Network

传导骚扰实验原理:

当电子设备干扰噪声的频率小于**30MHz**, 主要干扰音频频段, 电子设备的电缆对于这类电磁波的波长来说, 还不足一个波的波长(**30MHz**的波长为**10m**), 向空中辐射的效率很低, 这样若能测得电缆上感应的噪声电压, 就能衡量这一频段的电磁噪声干扰程度, 这类噪声就是传导噪声。



LISN的作用:

- 1.在EUT及供电电源之间起高频隔离作用，避免来自供电电源的噪声进入EUT，影响测量结果。
- 2.模拟实际的供电电源阻抗，为EUT的电源端子间提供规定的阻抗，以使测量结果统一化。
- 3.保持测试频段内的阻抗稳定为50欧，以实现与测量接收机/频谱分析仪的输入阻抗匹配。

1. Emission

4. 辐射骚扰 RE (30-1000MHz)

Standard: EN61000-6-4

Scope

- ❑ 电子电气测量测试设备
- ❑ 电子电气控制设备
- ❑ 电子电气实验室设备

Classification of equipment

❑ **Class A:** equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. 非家用

❑ **Class B:** equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. 家用

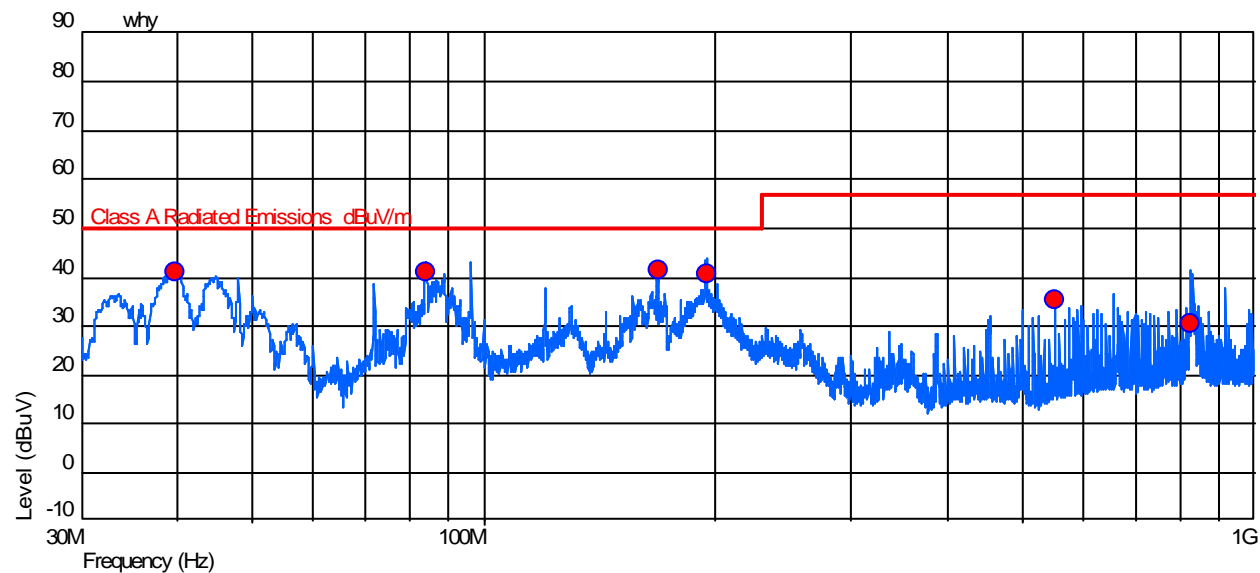


1. Emission

A类限值

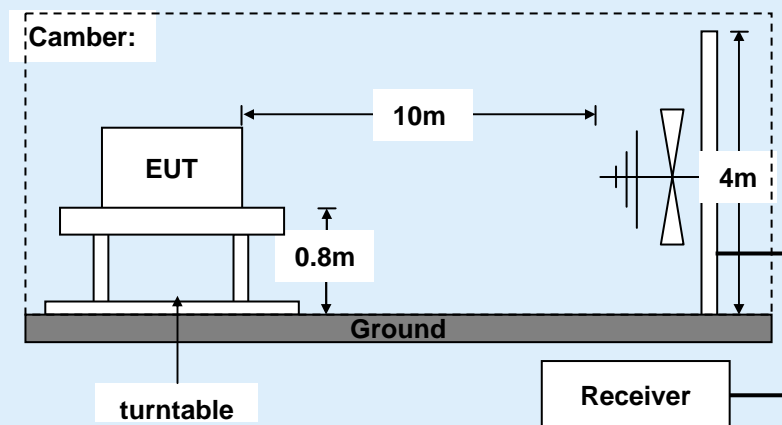
Frequency band MHz	Quasi-peak 10m dB μ V/m	Quasi-peak 3m dB μ V/m
30-230	40	50
230-1000	47	57

$$L(a)-L(b)=20\log(b/a)$$



1. Emission

Test setup



辐射骚扰实验原理：

当天线的总长度大于信号波长 λ 的 $1/20$ ，会向空间产生有效的辐射发射，当天线的长度为 $\lambda/2$ 的整数倍时，辐射的能量最大。当噪声频率大于 30MHz 时，电子设备的电缆，开孔、缝隙都容易满足上述条件，形成辐射发射。

EN 61000-6-2

对产品的抗扰度 (Immunity)

性能指标要求

Performance criteria

The general principles (performance criteria) for the evaluation of the immunity test results are the following.

Performance criterion A

During testing, normal performance within the specification limits.

Performance criterion B

During testing, temporary degradation, or loss of function or performance which is self-recovering.

Performance criterion C

During testing, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.



2. Immunity

1. 静电放电 ESD

Standard: IEC 61000-4-2 Criteria B

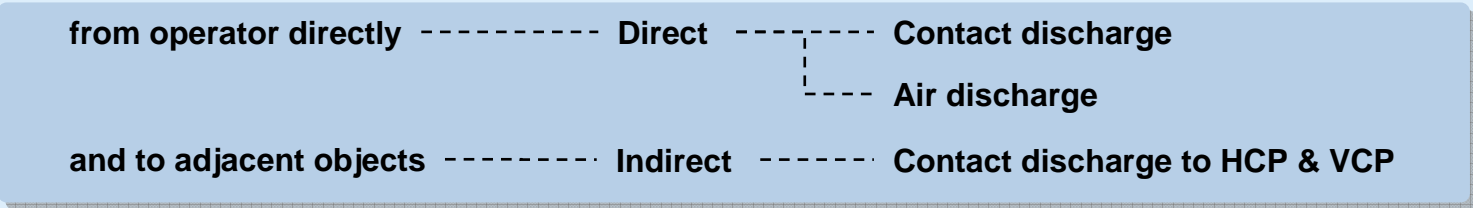
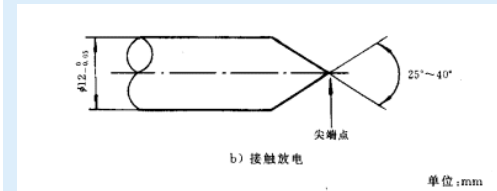
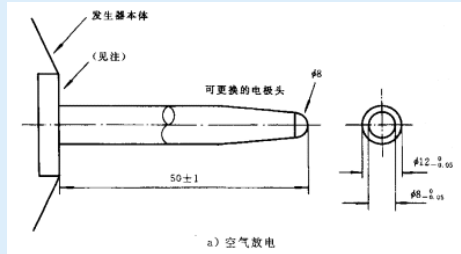
目的是检验单个设备或系统抗静电泄放干扰的能力。

实验原理：**ESD**实验是模拟人体、物体在接触设备时产生的静电放电或人体、物体对邻近物体的放电包括直接通过能量的交换，引起器件的损坏或放电所引起的近场(电场和磁场的变化)，造成设备的误动作。



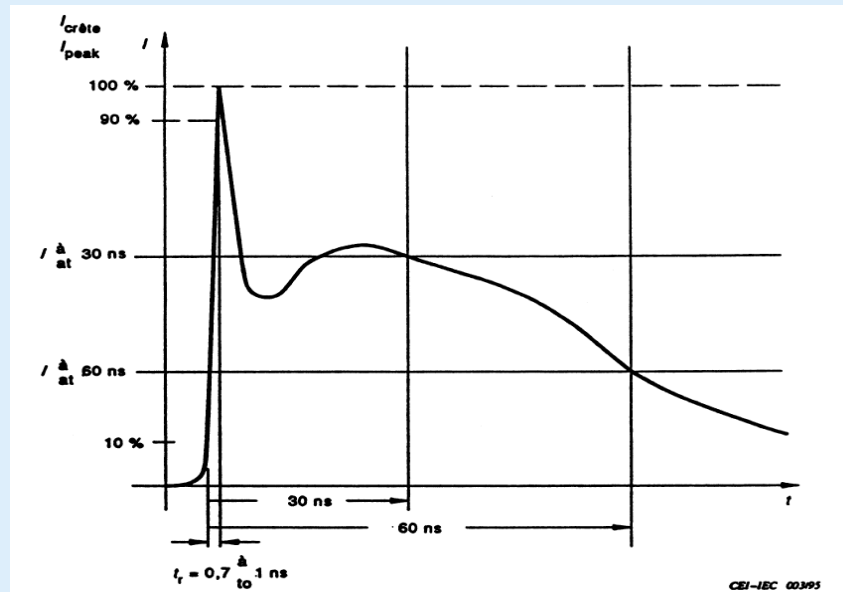
2. Immunity

General



Test Waveform

ESD Generator



Typical waveform of the output current of the ESD generator

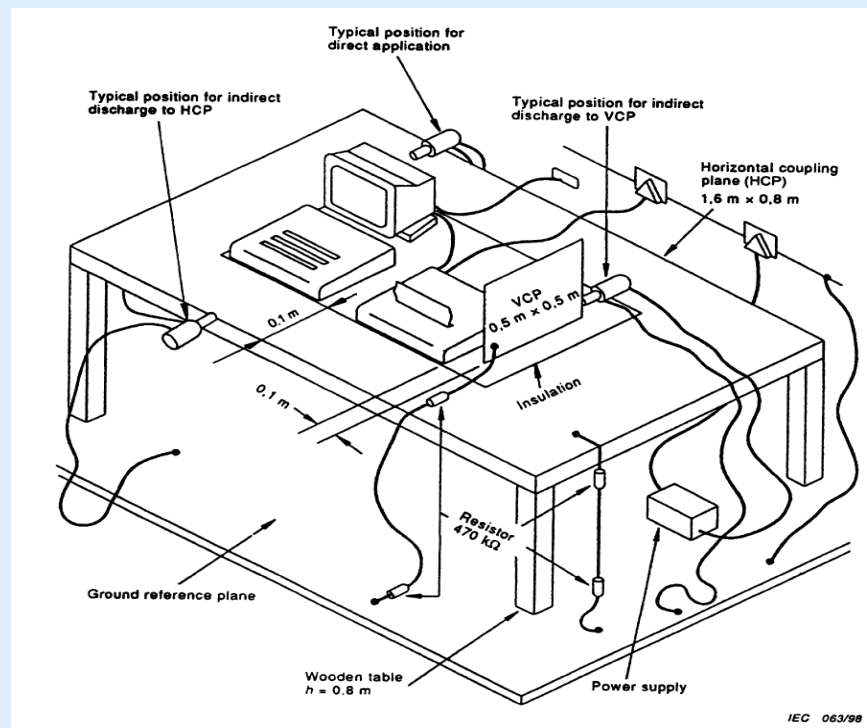


2. Immunity

● Test Level

Environmental phenomenon	IEC test specification
Electrostatic discharge	± 8 kV air discharge ± 4 kV contact discharge

● Test Setup



2. Immunity

2. 辐射抗扰度 RS

Standard: IEC 61000-4-3 Criteria A

目的是检验单个设备或系统抗电场干扰的能力。

Test Waveform

频率范围：80MHz-2.5GHz,
调制方式：80% AM, 1kHz sin-wave
频率步长：1%
驻留时间：3s

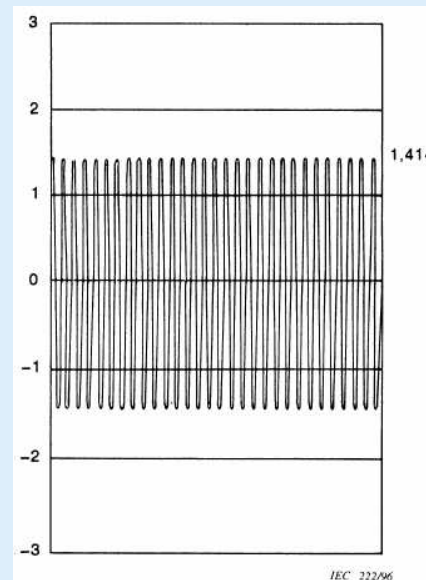


Figure 4a – Unmodulated RF signal
 $U_{pp} = 2,82 \text{ V}$, $U_{rms} = 1,00 \text{ V}$

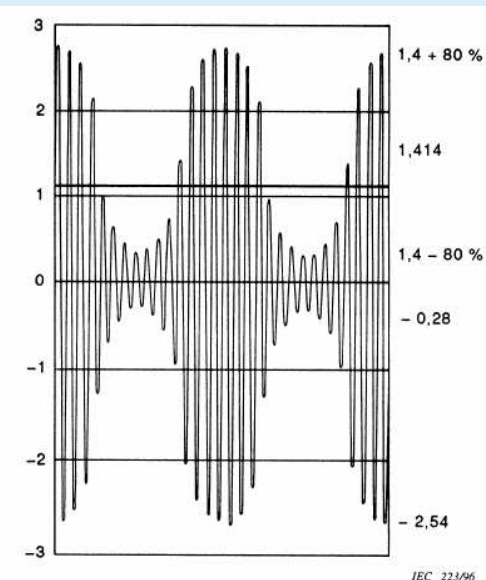


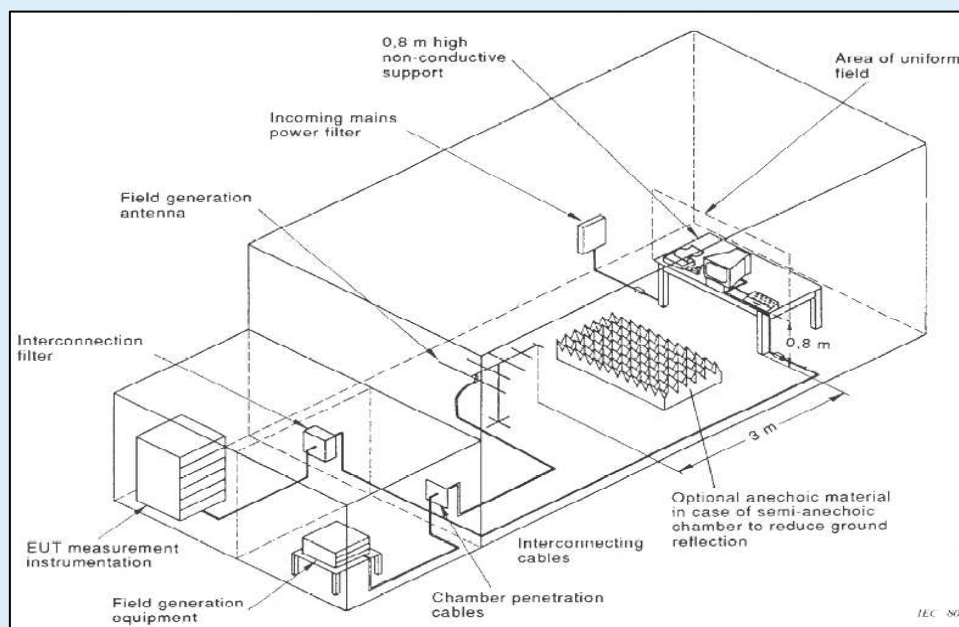
Figure 4b – Modulated RF signal 80 % AM
 $U_{pp} = 5,09 \text{ V}$, $U_{rms} = 1,12 \text{ V}$

2. Immunity

● Test Level

Frequency MHz	IEC test specification
80-1000	10V/m
1400-2000	3V/m
2000-2700	1V/m

● Test Setup



Example of suitable test facility

2. Immunity

3.快速脉冲群 EFT/Burst

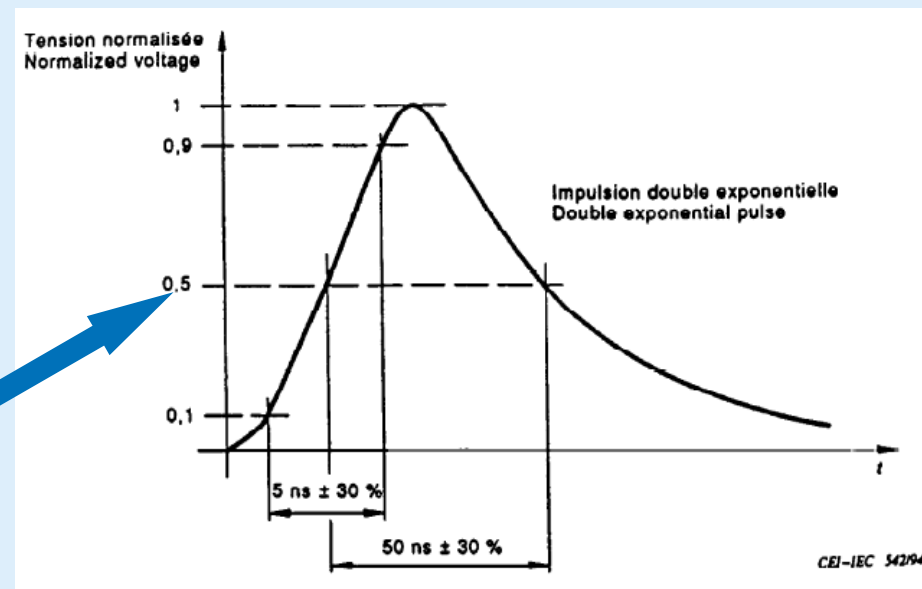
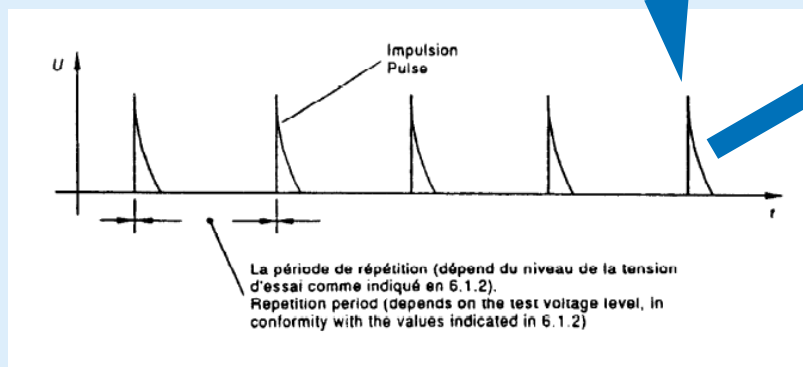
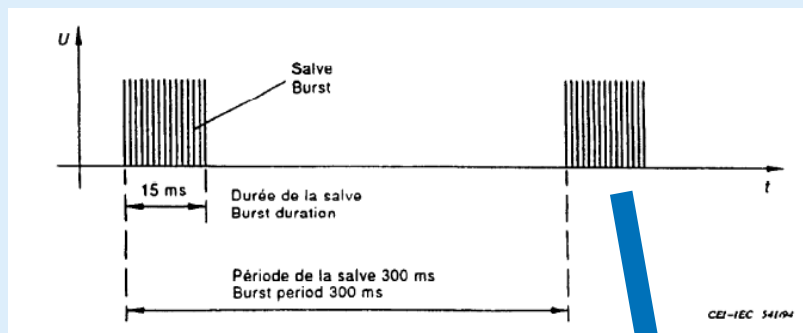
Standard: IEC 61000-4-4 Criteria B

实验目的是考察单个设备或系统抗快速瞬变干扰的能力，这些瞬变骚扰是由于感性负载的中断等瞬变动作，导致脉冲成群的出现，脉冲重复频率高，上升时间短，单个脉冲能量低等会导致设备误动作。



2. Immunity

Test Waveform



2. Immunity

4. 雷击浪涌 Surge

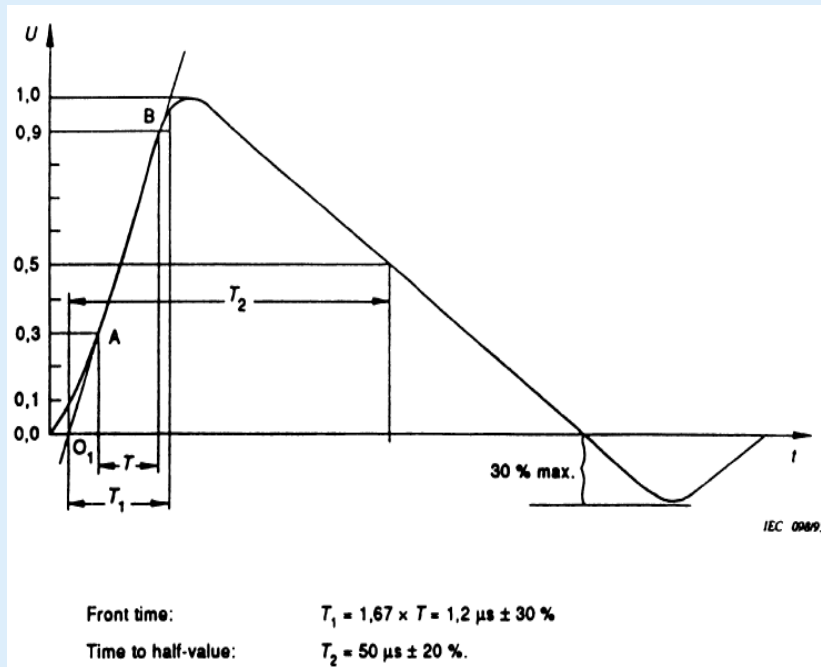
Standard: IEC 61000-4-5 Criteria B

实验目的是考察EUT抗浪涌干扰的能力，这些瞬变骚扰是由于其他设备的故障短路，主电源系统切换，间接雷击等产生的干扰。

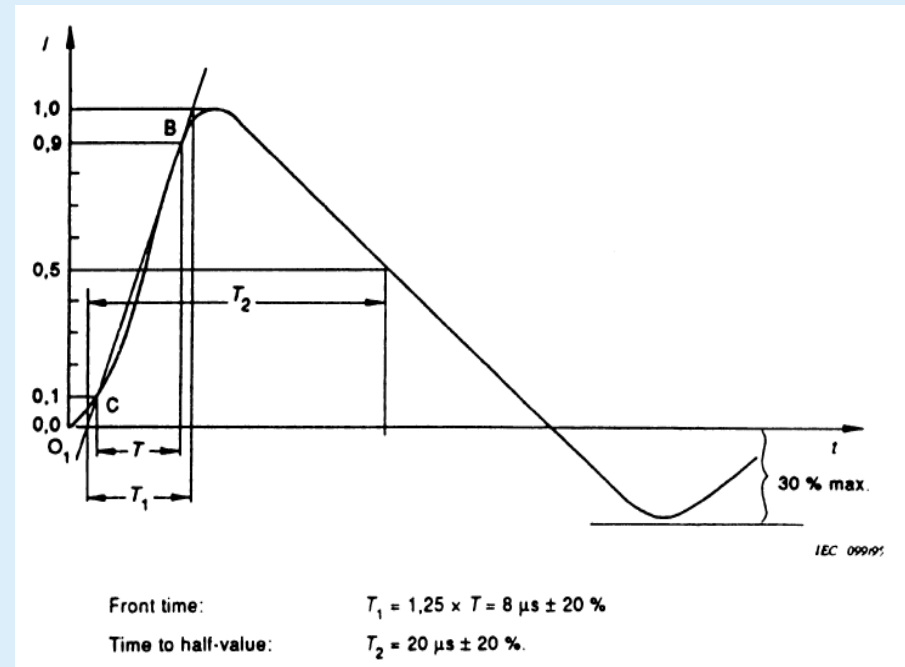


2. Immunity

Test Waveform



Waveform of open-circuit voltage (1.2/50 μs)



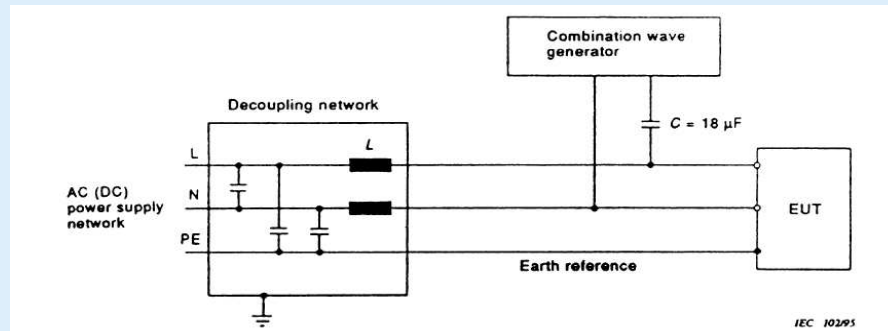
Waveform of short-circuit current (8/20 μs)

2. Immunity

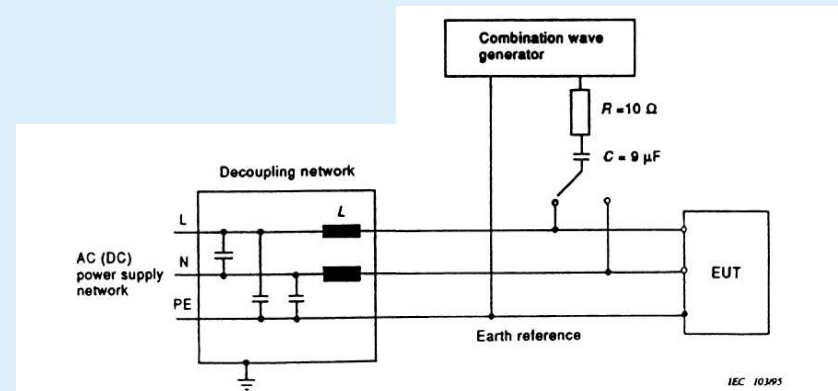
Test Level

Environmental phenomenon	IEC test specification
L-PE, N-PE	$\pm 2\text{kV}$
L-N	$\pm 1\text{kV}$

Test Setup



Test set-up for line-to-line coupling



Test set-up for line-to-earth coupling

2. Immunity

5. 传导射频干扰 CS

Standard: IEC 61000-4-6 Criteria A

实验目的是考察单个设备或系统抗传导骚扰的能力。

实验原理：主要考察外界从导线或电缆而引入的0.15MHz-80MHz的连续干扰电压时的抗扰性。

Test Waveform

频率范围：0.15MHz-80MHz

调制方式：80% AM, 1kHz sin-wave

频率步长：1%

驻留时间：3s

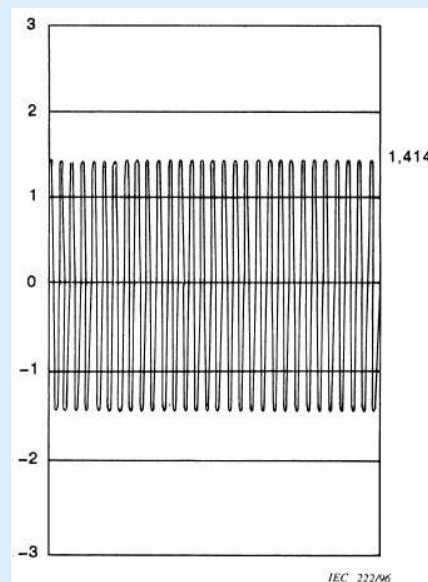


Figure 4a – Unmodulated RF signal

$U_{pp} = 2,82 \text{ V}$, $U_{rms} = 1,00 \text{ V}$

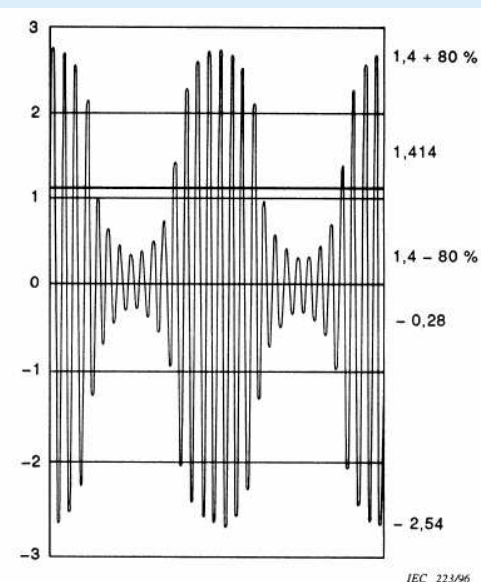


Figure 4b – Modulated RF signal 80 % AM

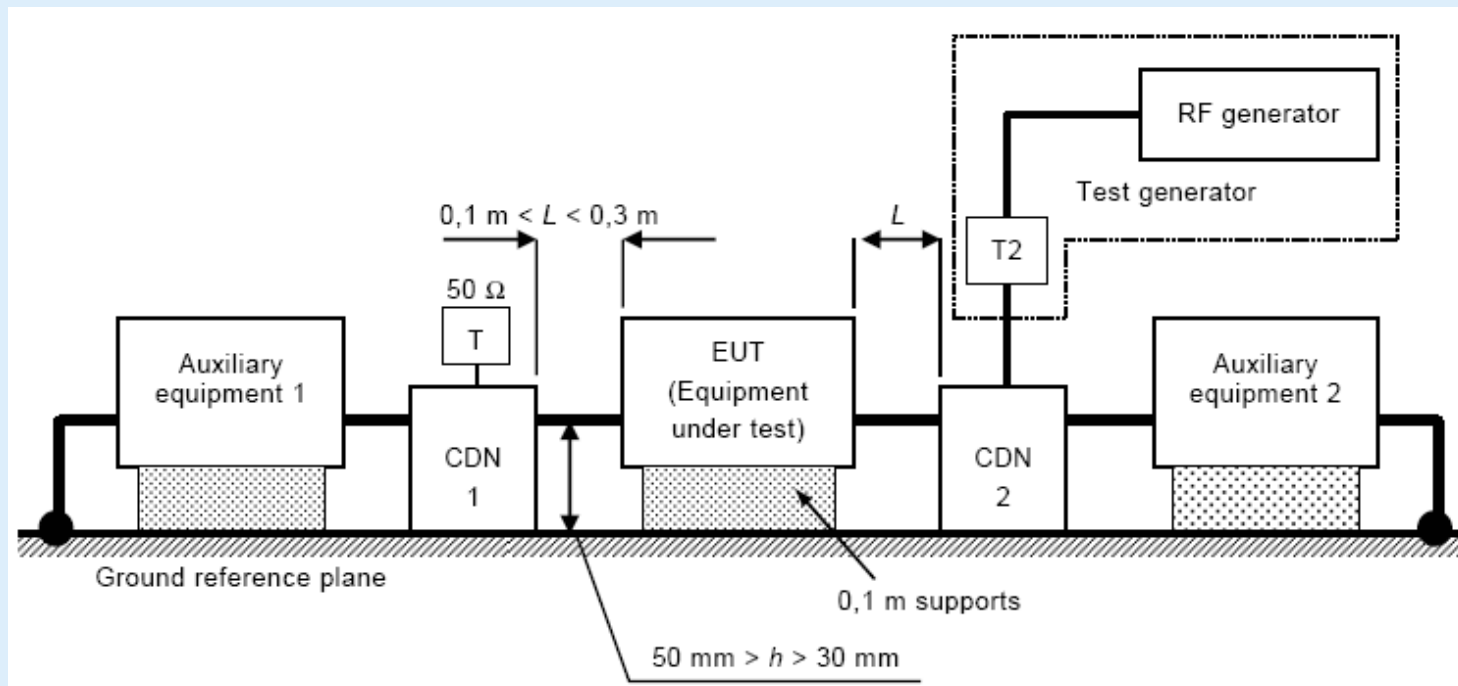
$U_{pp} = 5,09 \text{ V}$, $U_{rms} = 1,12 \text{ V}$

2. Immunity

Test Level

Frequency MHz	IEC test specification
0.15-80	10V

Test Setup



2. Immunity

6. 公频磁场 Rated power frequency magnetic field

Standard: IEC 61000-4-8 Criteria A

实验目的是考察EUT抗磁场干扰的能力。

*针对工业环境要求

*针对磁敏感设备，例如霍尔元件



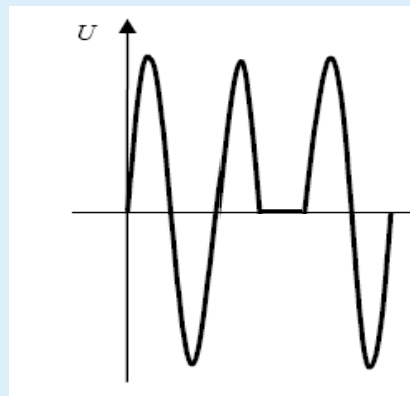
2. Immunity

7. 电压暂降和跌落 Dips

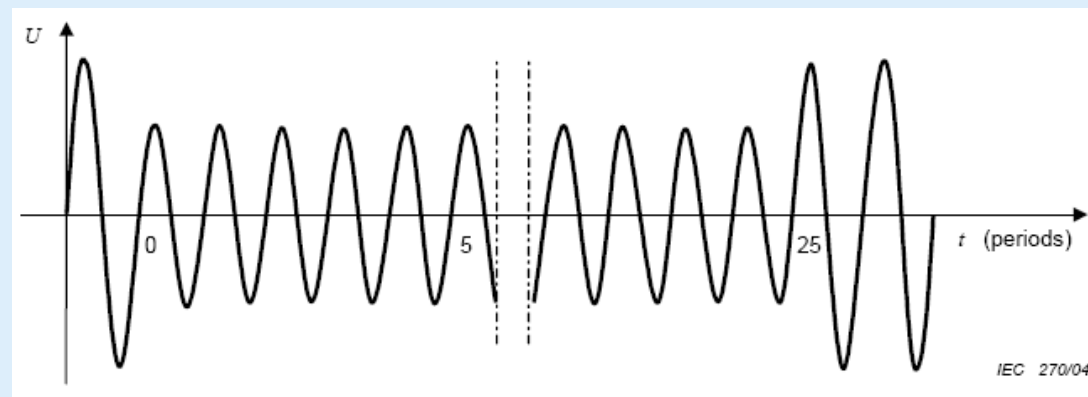
Standard: IEC 61000-4-11 Criteria B & C

实验目的是考察EUT抗电压跌落和暂降的能力。

Test Waveform



0%



70%

2. Immunity

Test Level

Environmental phenomenon	IEC test specification	Criteria
Voltage dip	0% 1 cycle	B
	40% 10 cycle	C
	70% 25 cycles	C
Short interruptions	0% 250 cycles	C

Test Setup

