

• CHENGYU assured EMC

常州市承钰屏蔽机房设备有限公司

产品教育培训课程

PART 1

CHAMBER

主 讲 人：邵逸峰

内容大纲

➤ What is CHAMBER ?

基本CHAMBER 型式介绍

基本CHAMBER 特性验证

➤ How to make use of the test data?

基本EMI测试要求

CHAMBER量测之注意事项及测试技巧

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What is CHAMBER?

- 从外层空间谈起!-----自由空间(Free space)



What is CHAMBER?

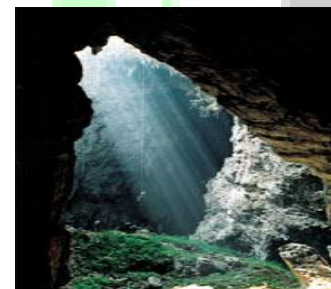
- 回到地球-----加块铁板吧!(Ground plane)



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What is CHAMBER?

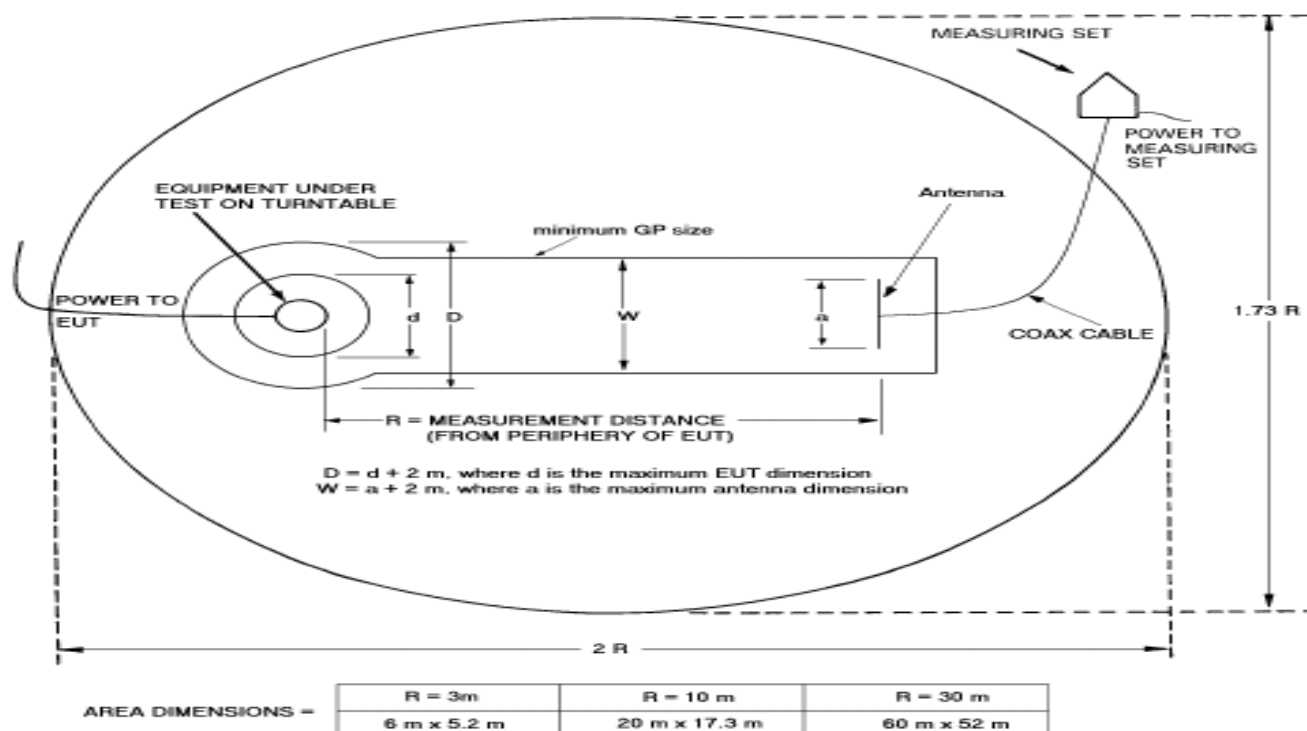
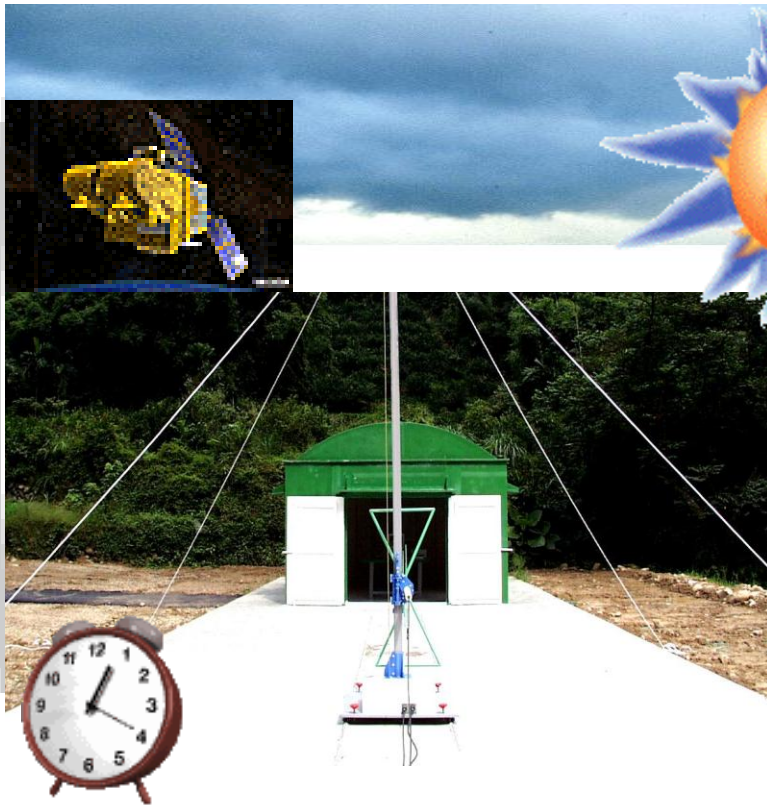


Figure 5—Radiated emissions measurements obstruction-free area and minimum size of groundplane for test site with a turntable

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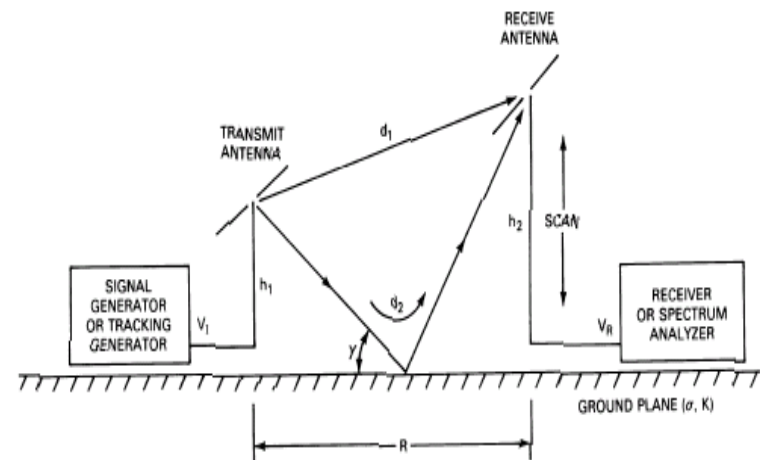
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What is CHAMBER?



ANSI
C63.5-1998

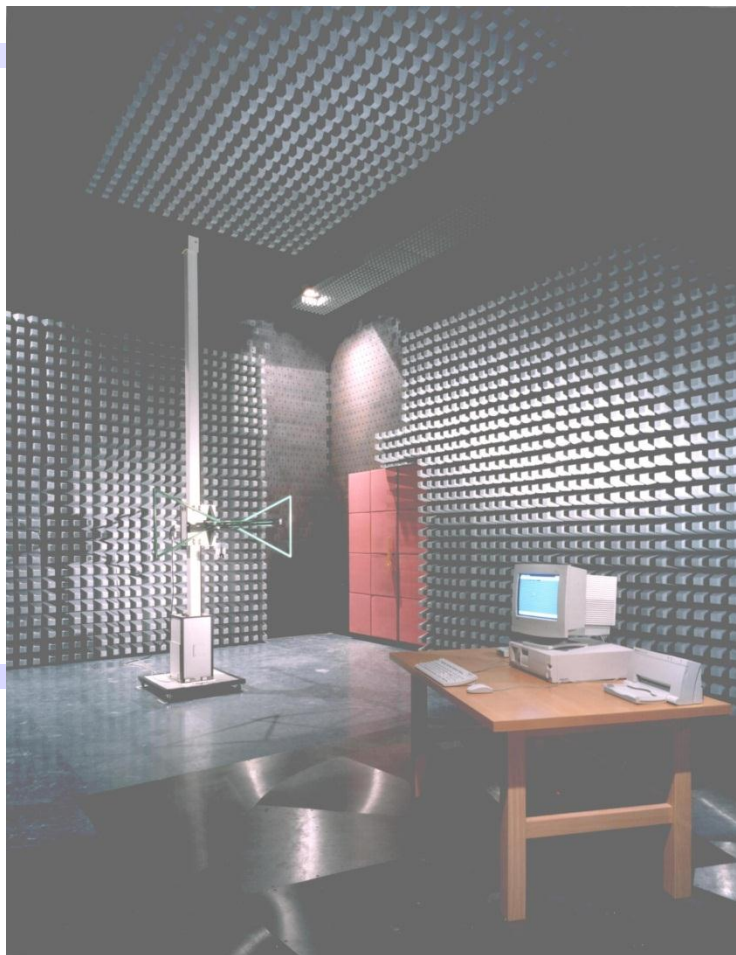
STANDARD FOR ELECTROMAGNETIC COMPATIBILITY – RADIATED EMISSION MEASUREMENTS



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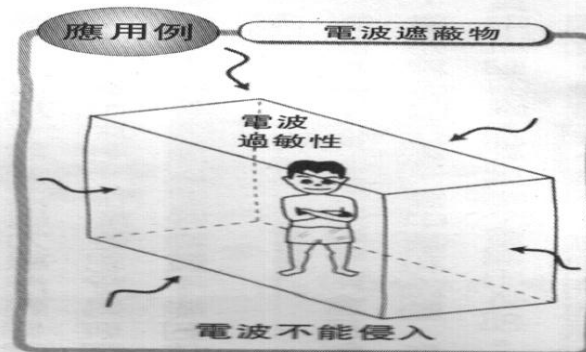
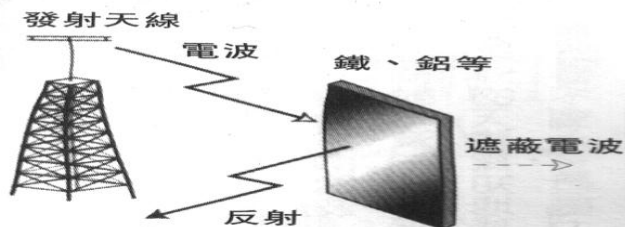
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What is CHAMBER?

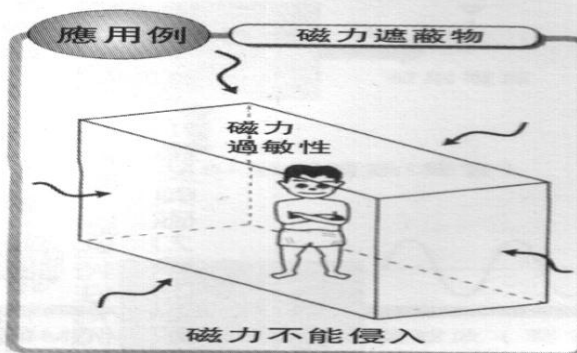
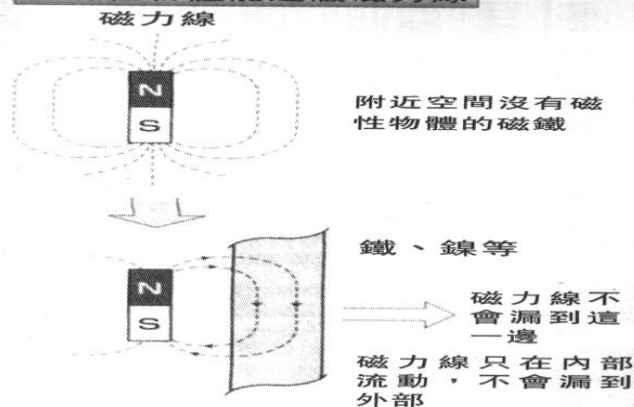


What is CHAMBER?

金屬可以遮蔽電波



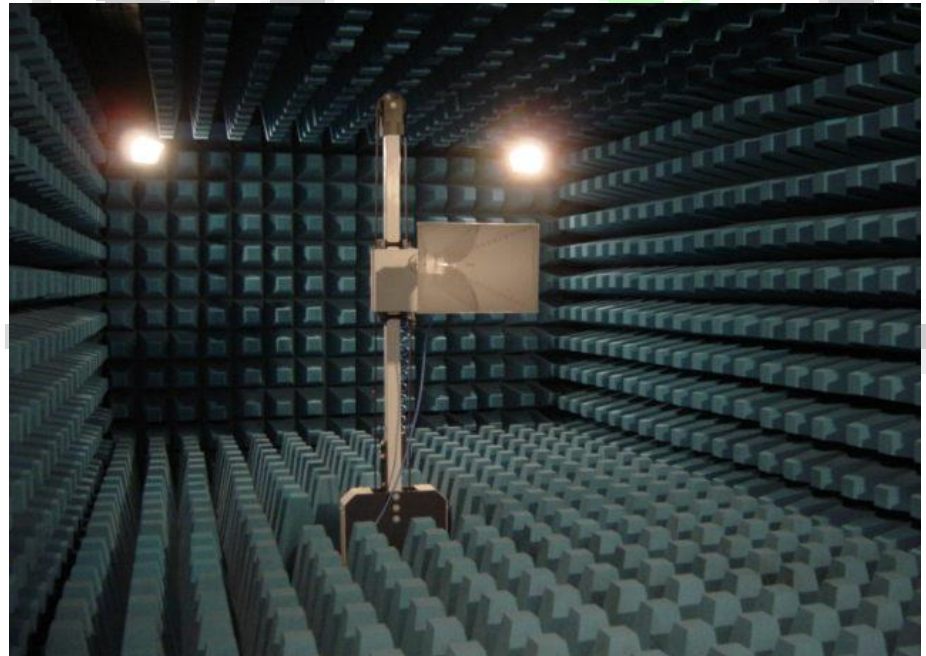
強磁性物體能遮蔽磁力線



What is CHAMBER?

基本CHAMBER型式介绍

- Fully Anechoic Chamber (FAC)
Silimar Free space



What is CHAMBER?

基本CHAMBER型式介绍

- Semi Anechoic Chamber (SAC)
Silimar Ground



What is CHAMBER?

基本CHAMBER特性验证

- Shielding effectiveness (SE)

MIL-STD-285

EN-50147-1

$$SE = P_o - P_s$$

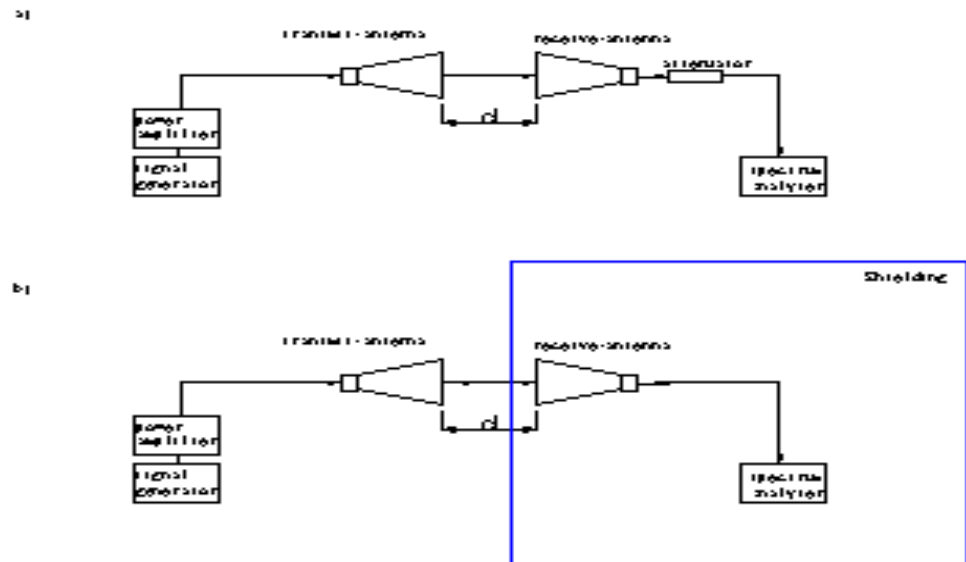
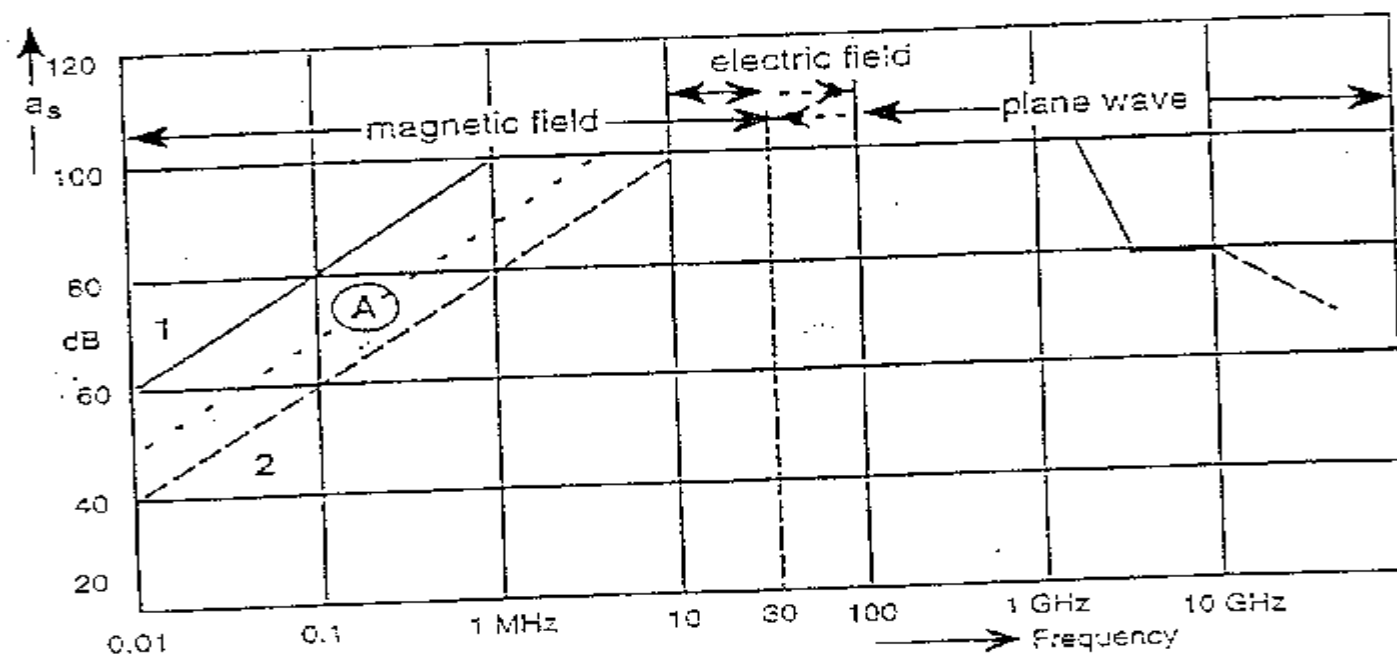


Figure 1: Schematic test setup for Shielding Effectiveness measurements

- a) Measurement of P_o without shielding
- b) Measurement of P_s with shielding

What is CHAMBER?

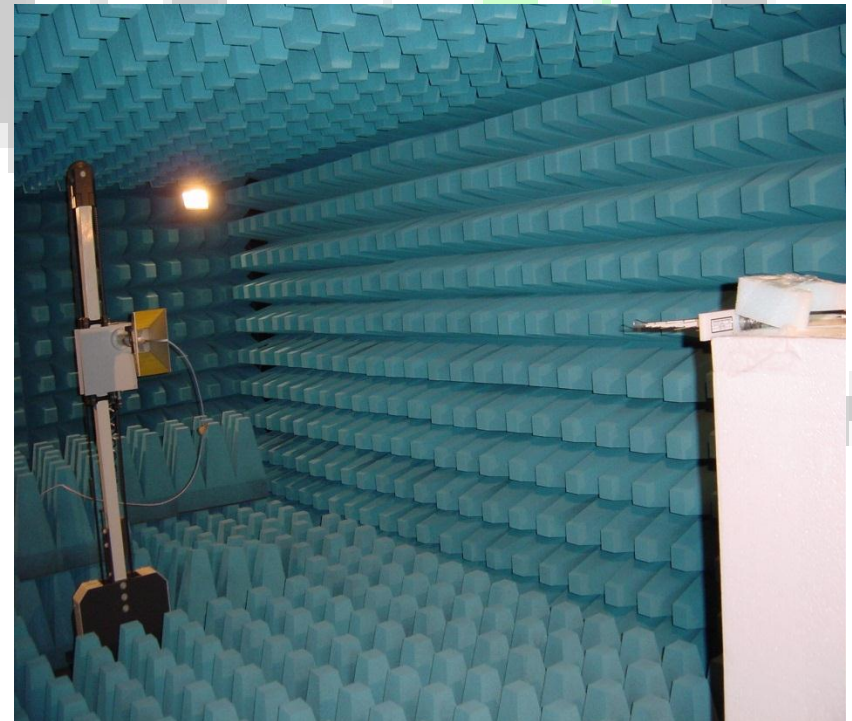
• EN-50147-1 标准



What is CHAMBER?

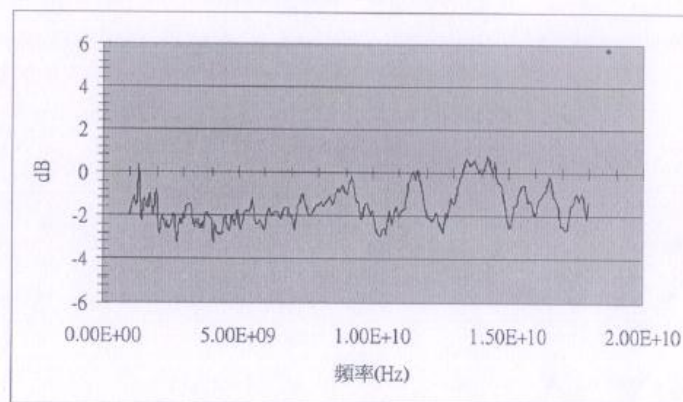
基本CHAMBER特性验证

- Transmission Loss (TL)(1-18G)
Similar EN 50147-2
Similar CISPR 16-1



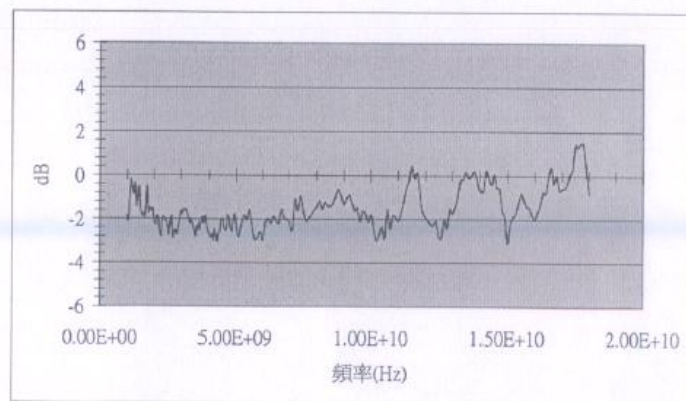
What is CHAMBER?

基本CHAMBER特性验证



3.1.2 電波傳播損失-水平極化

圖 3-2 垂直極化(Height=1.5m)-頻率範圍：1GHz~18GHz



What is CHAMBER?

基本CHAMBER特性验证

- Normalised Site Attenuation(NSA)

ANSI 63-4

CISPR 16-1

EN 50147-2

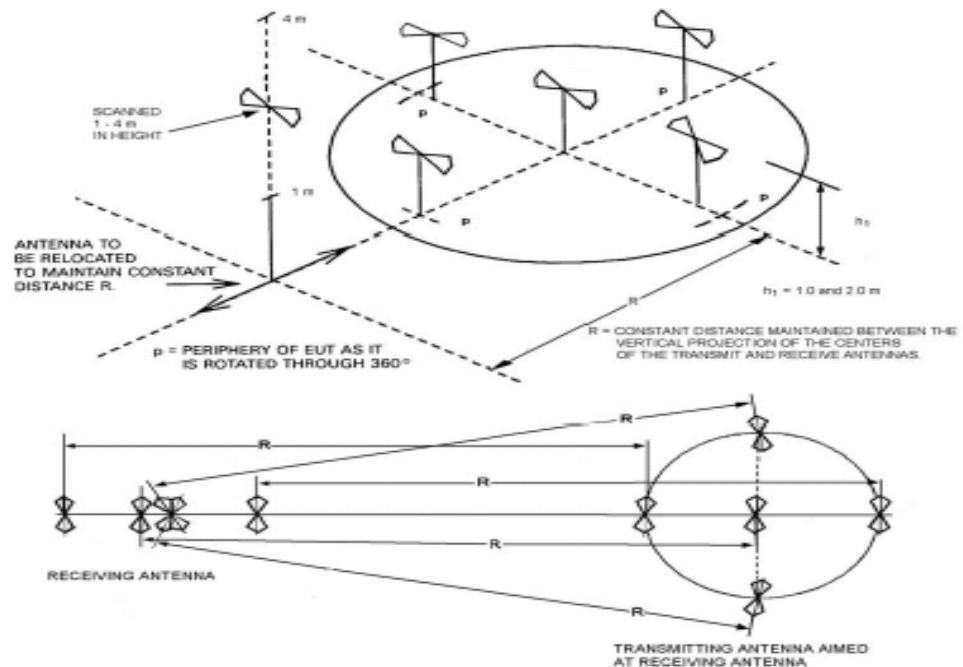


Figure 8b—Typical antenna positions for alternative test sites:
Horizontal polarization NSA measurements

What is CHAMBER?

基本CHAMBER特性验证

$$A_N = V_{\text{Direct}} - V_{\text{Site}} - AF_T - AF_R - \Delta AF_{TOT}$$

where

AF_T = Antenna factor of transmitting antenna (dB/m),

AF_R = Antenna factor of receiving antenna (dB/m),

AF_{TOT} = Mutual impedance correction factor (dB).

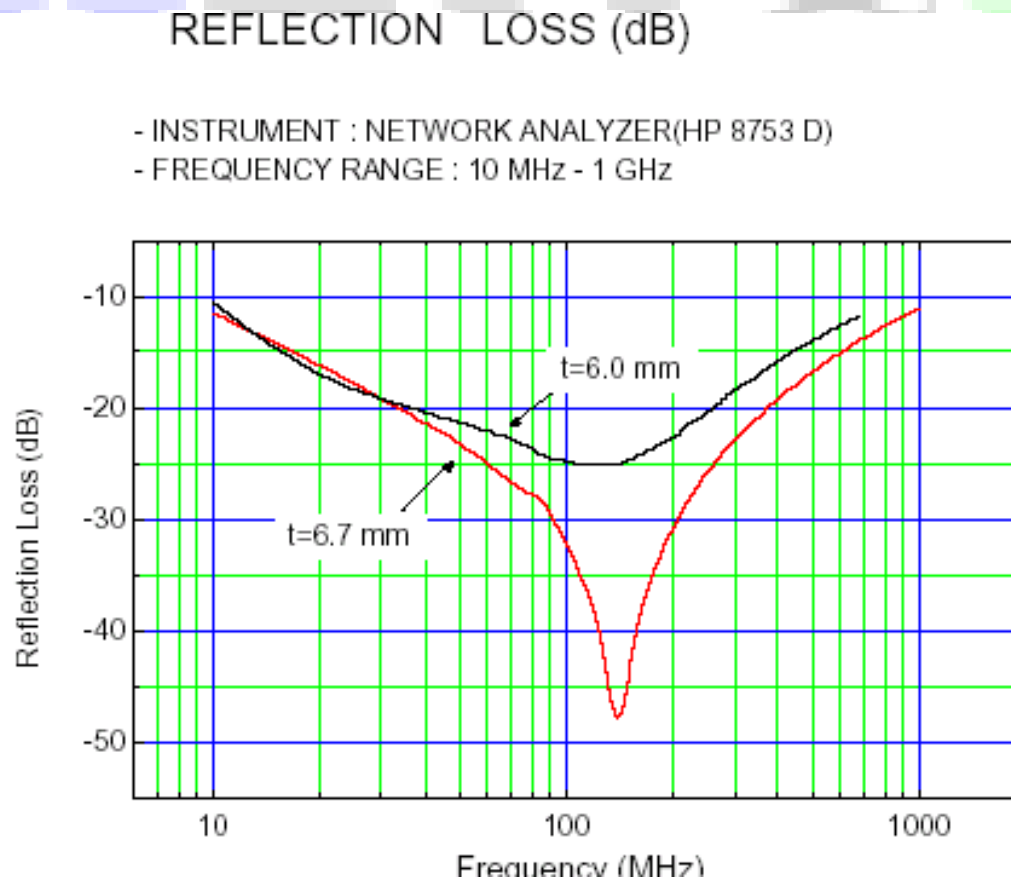
Table 1 – Theoretical normalized site attenuation for ideal site
(recommended geometries for broadband antennas)^a

Polarization <i>R</i> meters <i>h</i> ₁ meters <i>h</i> ₂ meters <i>f</i> _M (MHz)	Horizontal 3 1 1-4	Horizontal 10 1 1-4	Horizontal 30 1 1-4	Vertical 3 1 1-4	Vertical 3 1.5 1-4 <i>A</i> _X (dB)	Vertical 10 1 1-4	Vertical 10 1.5 1-4	Vertical 30 1 1-4	Vertical 30 1.5 1-4
30	15.8	29.8	47.7	8.2	9.3	16.7	16.9	26.0	26.0
35	13.4	27.1	45.0	6.9	8.0	15.4	15.5	24.7	24.7
40	11.3	24.9	42.7	5.8	7.0	14.2	14.4	23.5	23.5
45	9.4	22.9	40.7	4.9	6.1	13.2	13.4	22.5	22.5
50	7.8	21.1	38.8	4.0	5.4	12.3	12.5	21.6	21.6
60	5.0	18.0	35.7	2.6	4.1	10.7	11.0	20.0	20.0
70	2.8	15.5	33.0	1.5	3.2	9.4	9.7	18.7	18.7
80	0.9	13.3	30.7	0.6	2.6	8.3	8.6	17.5	17.5
90	-0.7	11.4	28.7	-0.1	2.1	7.3	7.6	16.5	16.5
100	-2.0	9.7	26.9	-0.7	1.9	6.4	6.8	15.6	15.6
120	-4.2	7.0	23.8	-1.5	1.3	4.9	5.4	14.0	14.0
140	-6.0	4.8	21.1	-1.8	-1.5	3.7	4.3	12.7	12.7
160	-7.4	3.0	18.9	-1.7	-3.7	2.6	3.4	11.5	11.6
180	-8.6	1.7	16.9	-1.3	-5.3	1.7	2.7	10.5	10.6
200	-9.6	0.6	15.2	-3.6	-6.7	1.0	2.1	9.6	9.7
250	-11.7	-1.6	11.6	-7.7	-9.1	-0.5	0.3	7.7	7.9
300	-12.8	-3.3	8.7	-10.5	-10.9	-1.5	-1.9	6.2	6.5
400	-14.8	-5.9	4.5	-14.0	-12.6	-4.1	-5.0	3.9	4.3
500	-17.3	-7.9	1.8	-16.4	-15.1	-6.7	-7.2	2.1	2.8
600	-19.1	-9.5	0.0	-16.3	-16.9	-8.7	-9.0	0.8	1.8
700	-20.6	-10.8	-1.3	-18.4	-18.4	-10.2	-10.4	-0.3	-0.9
800	-21.3	-12.0	-2.5	-20.0	-19.3	-11.5	-11.6	-1.1	-2.3
900	-22.5	-12.8	-3.5	-21.3	-20.5	-12.6	-12.7	-1.7	-3.4
1000	-23.5	-13.8	-4.5	-22.4	-21.4	-13.6	-13.6	-3.6	-4.3

^a These data apply to antennas that have at least 25 cm of ground plane clearance when the center of the antenna is 1 m above the groundplane in vertical polarization.

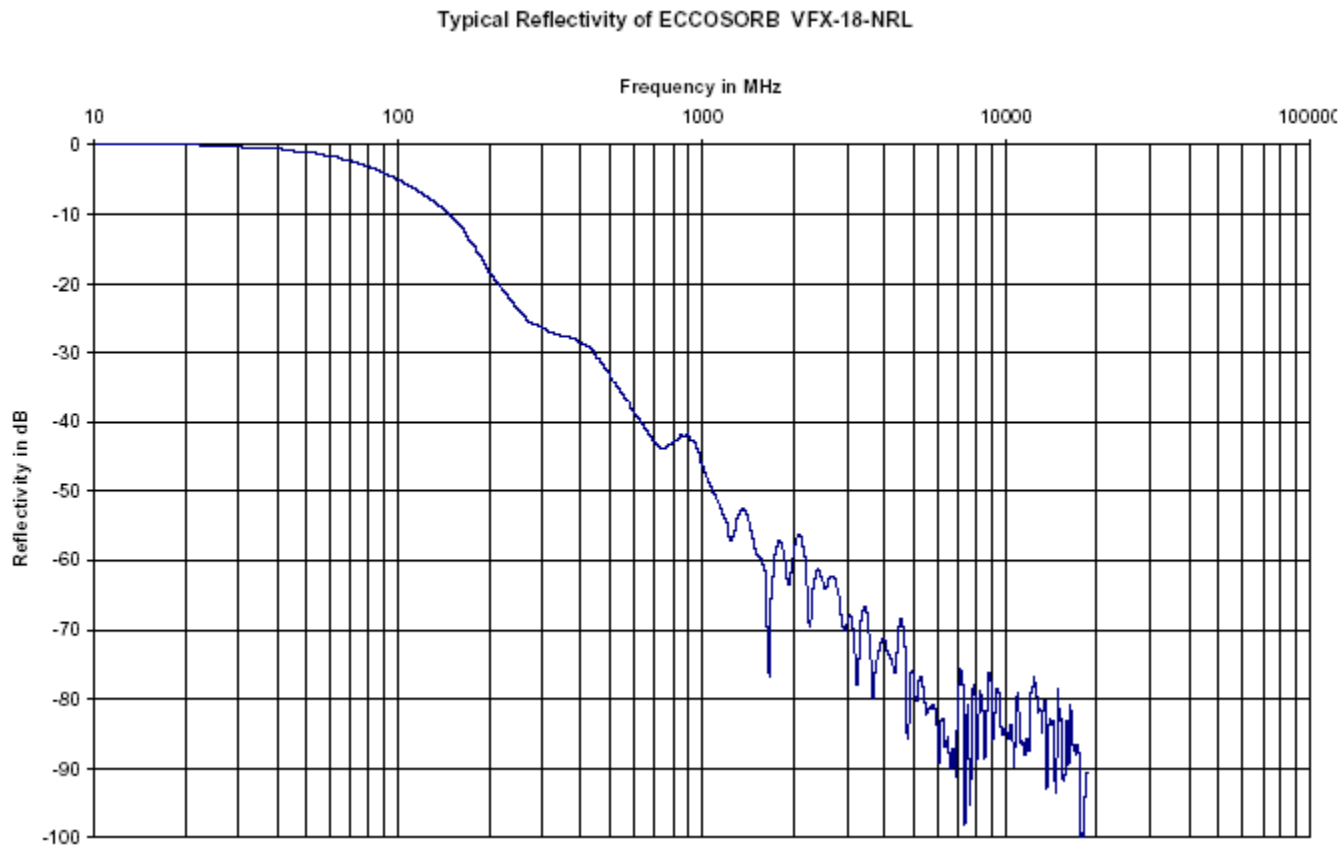
What is CHAMBER?

基本CHAMBER特性验证



What is CHAMBER?

基本CHAMBER特性验证



How to make use of the test data?

基本EMI测试要求

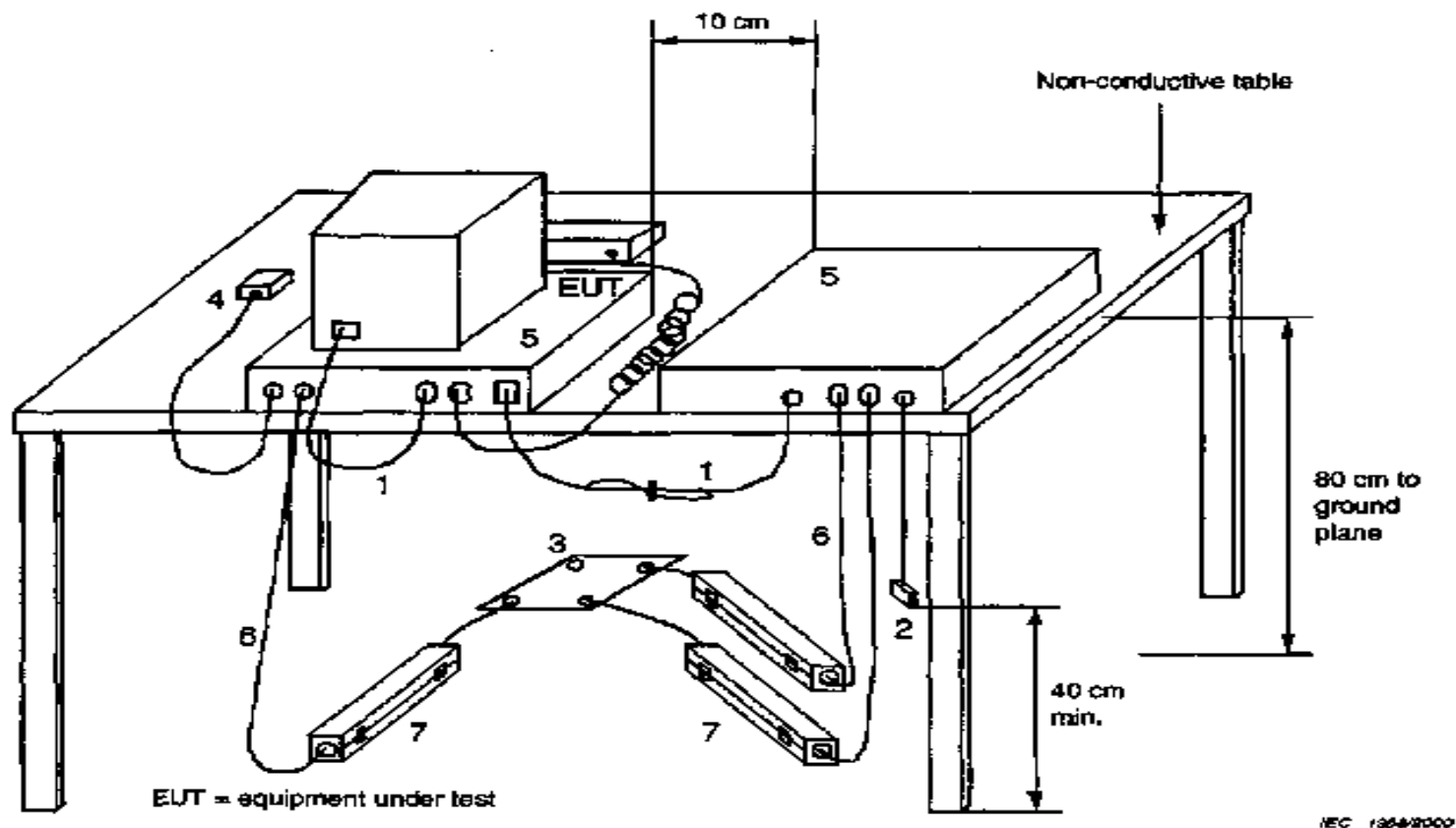
Table 1 lists the generic and product specifications that the company applies to its product range.

Table 1. Specifications that Start Spellman use for in-house EMC testing

Scope	Emission	Immunity
<i>Generic Specifications:</i>		
Residential, Commercial, and Light Industrial	EN 50081-1	EN 50082-1
Industrial	EN 50081-2	EN 50082-2
<i>Product Specifications:</i>		
Mains Signalling Apparatus	EN 50065-1	
Industrial, Scientific & Medical Apparatus	EN 55011	
Broadcast Receivers & Associated Equipment	EN 55013	EN 55020
Household Appliance, tools & similar equipment	EN 55014	EN 55014
Electrical Lighting & Similar Equipment	EN 55015	EN 61547
Information Technology Equipment	EN 55022	
Medical Electrical Equipment	EN 60601	EN 60601
Marine Navigational Equipment	EN 60945	EN 60945
Programmable Controllers	EN 61131-2	
Watt-Hour Meters	EN 60521, EN 60687, EN 61036	
LTV Switchgear & Control Gear	EN 60947-1	

How to make use of the test data?

基本EMI测试要求



How to make use of the test data?

CHAMBER量测之注意事项及测试技巧

- 3M/10M测试数据之比较
- 准峰值与峰值之比较
- 测试前之准备

背景资料重复性确认

测试设备正常运作确认

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CHENGYU
Q&A

附件(一)电磁波及其频率

電磁波及其頻率（波長）

頻 率	波 長	名 稱	特徵及用途
		× 光	
	10nm	紫外線 UV - C UV - B UV - A	化學性作用強
	380nm [400]	可視光	眼睛可見的電 磁波
	780nm	紅外線 IR	光通信、 雷射、雷達、 雷射加工
3THz (3000GHz)	100μm	次釐波	測距儀
300GHz	1mm	毫米波 EHF	太空通信、 無線航行
30GHz	1cm	微波 SHF	太空通信、航空氣 象用、船舶航行
3GHz (3000MHz)	10cm	極超短波 SHF	電視、太空通信、 行動電話
300MHz	1m	超短波 VHF	電視、計程車無線電、 FM 廣播、業餘無線電
30MHz	10m	短波 HF	短波廣播、國際通信、 標準電波、業餘無線電
3MHz (3000kHz)	100m	中波 MF	無線電廣播、交通資訊、電 波導航法援助系統 (LORAN)
300kHz	1km	長波 LF	船舶、電波導航法援 助系統 C、飛機航行用
30kHz	10km	超長波 VLF	亞米加 (OMEGA) 導航系統
3kHz	100km		

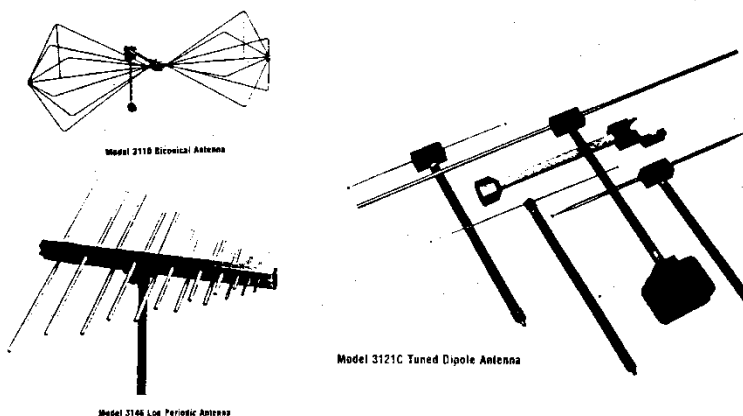
註：有境界不明確的情形

所有的電磁場都屬於電磁波

3THz 以下的電磁波都屬電磁波

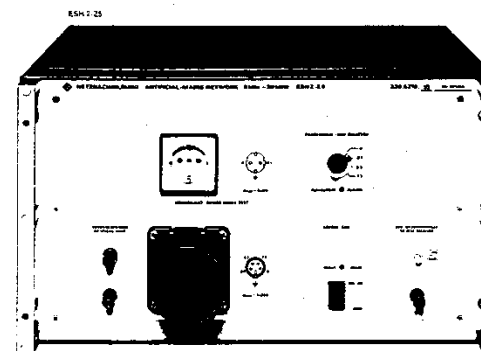
附件(二)EMC 常见的测试设备

測試接收天線(Antenna)



說明:主要作用為將產品輻射到空中上的干擾雜訊拾取,然後經儀器讀取各點的雜訊值。

電源阻抗模擬網路(Line-Impedance Stabilization Network)



說明:主要作用為將電源線上的雜訊拾取,然後經由儀器讀取各點的雜訊值。

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EMC 常见的测试设备



EN 61000-4-2 ESD



EN 61000-4-4 EFT/B

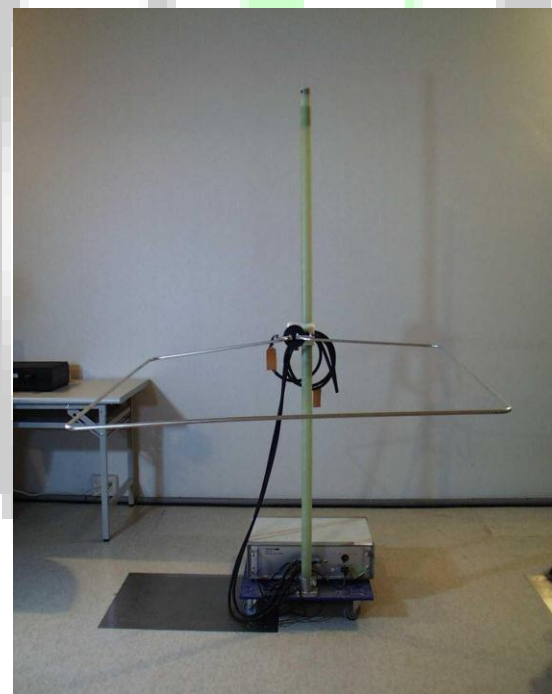
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EMC 常见的测试设备



EN 61000-4-5 SURGE

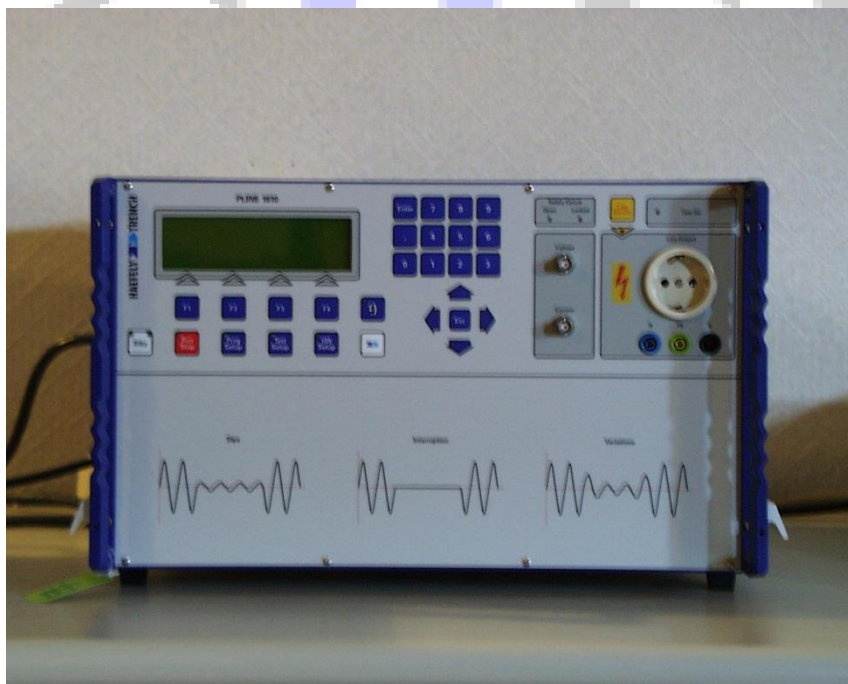


EN 61000-4-8 Power Magnetic

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EMC 常见的测试设备



EN 61000-4-11 Voltage Dips



EN 61000-4-6 CS (CDN)

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感谢您的聆赏

~若有任何指教，欢迎洽询~

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