



# Electromagnetic Compatibility ( *EMC* )

Introduction about Immunity Testing  
( IEC example )





# Agenda

- Electrostatic Discharge (ESD)
  - IEC 1000-4-2
- Radiated, radio-frequency electromagnetic field immunity (Susceptibility / immunity to Radiated Emission)
  - IEC 1000-4-3
- Electrical Fast Transient (EFT) / Burst Immunity
  - IEC 1000-4-4
- Lightning / Surge Immunity
  - IEC 1000-4-5
- Immunity to Conducted Disturbances included by radio-frequency fields above 9KHz
  - IEC 1000-4-6

RF Immunity





# System Immunity Test

## Radiated Immunity

### IEC 1000-4-3

- Test level
- Interference generator
- Test set-up
- Test procedure





# Radiated Immunity

## Test Level

### Frequency Range 80MHz to 1GHz

Test Level	Field Strength(V/m)	Product use environment
Class 1	1	Low level EMI, i.e. Radio/TV>2km distance
Class 2	3	Moderate level EMI i.e. Typical commercial environment
Class 3	10	Severe EMI environment i.e. Typical industrial environment
Class x	Special	Dedicated product standard

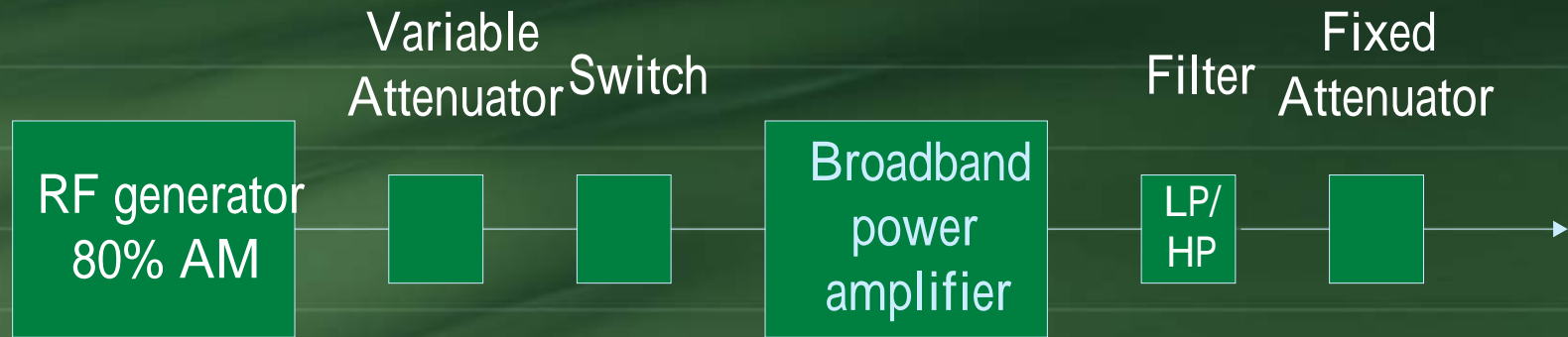
- Most manufactures test by 3V/m field strength from 80M to 1GHz
- Some test by 10V/m down to 26MHz
  - Test cost is very expensive





# Radiated Immunity

## Interference generator



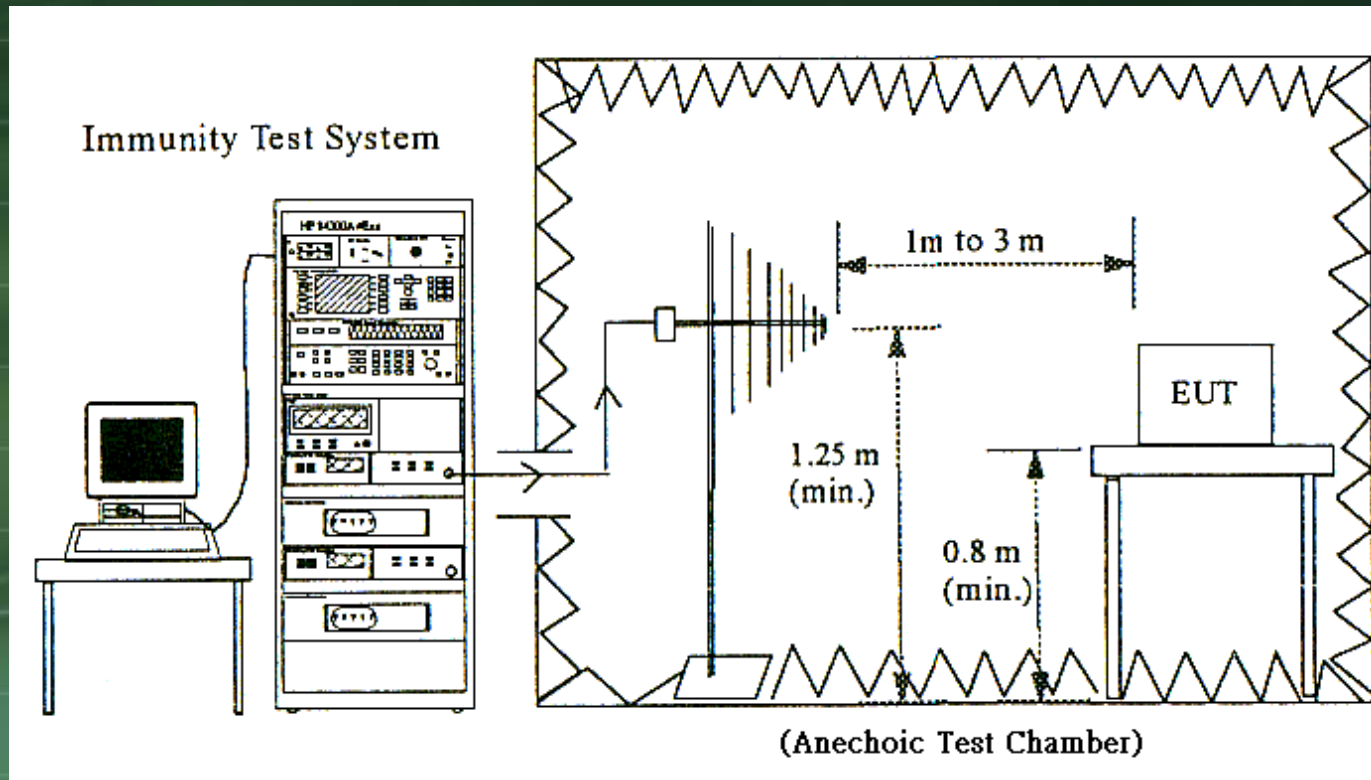
- 1KHz amplitude modulated(80% AM) electric field of 1~10 volts/meter over 80M~1GHz
- Frequency steps are not to exceed 1%





# Radiated Immunity

## Test set-up



- 3m test distance is required, but it can be reduced to 1m, if it is impossible to generate the required field strength at 3m.
- In Compact Full Anechoic Chamber or Semi-Anechoic Chamber with floor absorbers

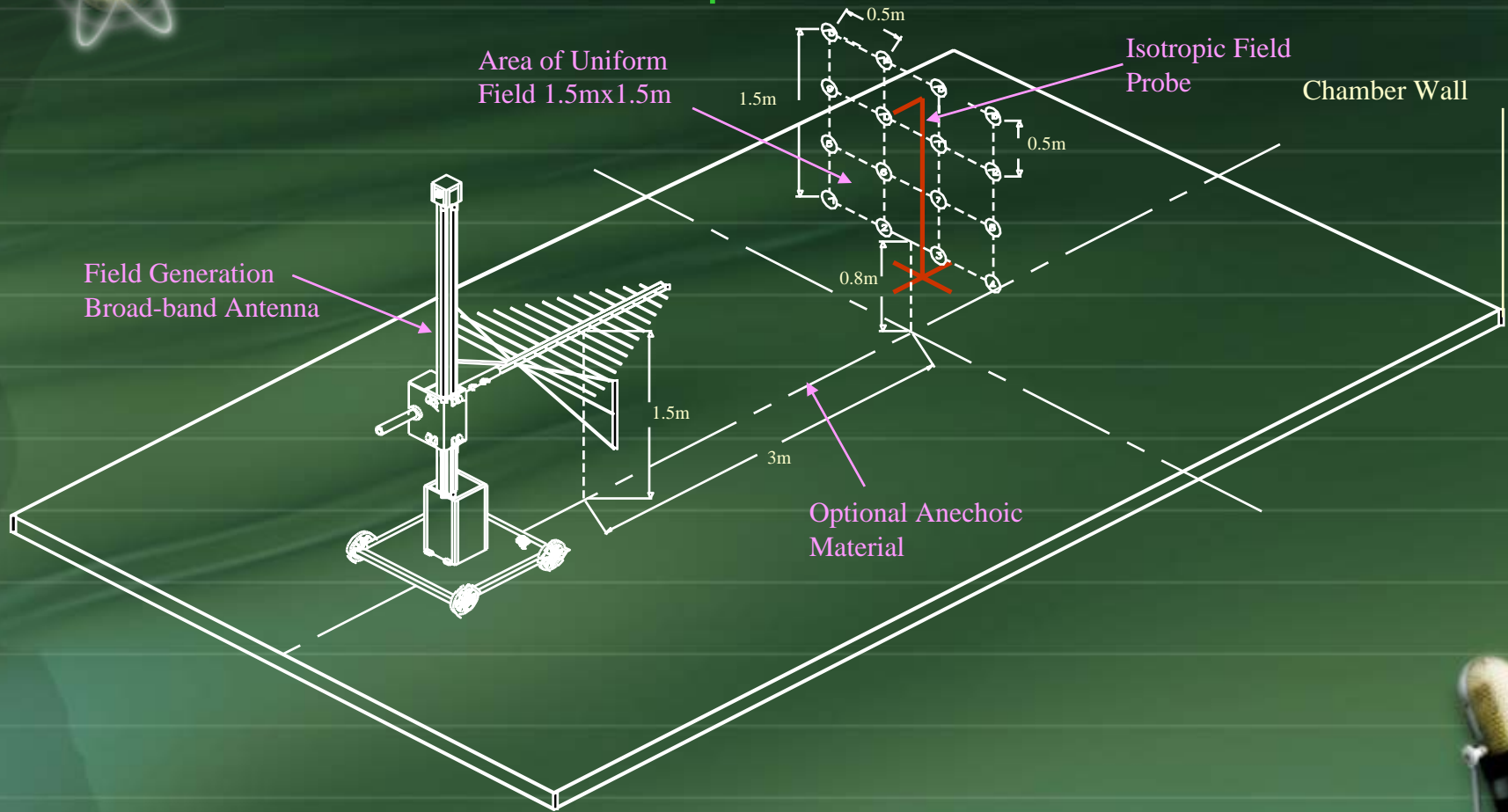






# Radiated Immunity

## Test procedure



- Before immunity test, it is necessary to establish a uniform, calibrated field strength level over 1.5meter square.
- EUT must withstand the immunity test level without performance degradation





# Agenda

- Electrostatic Discharge (ESD)
  - IEC 1000-4-2
- Radiated, radio-frequency electromagnetic field immunity (Susceptibility / immunity to Radiated Emission)
  - IEC 1000-4-3
- Electrical Fast Transient (EFT) / Burst Immunity
  - IEC 1000-4-4
- Lightning / Surge Immunity
  - IEC 1000-4-5
- Immunity to Conducted Disturbances included by radio-frequency fields above 9KHz
  - IEC 1000-4-6







# System Immunity Test

## Conducted Immunity

### IEC 1000-4-6

- Test level
- Interference generator
- Test set-up
- Test procedure





# Conducted Immunity

## Test Level

Frequency Range 150KHz to 80MHz			
Test Level	dB $\mu$ V	Voltage Level (V)	Product use environment
Class 1	120	1	Low level EMI,
Class 2	130	3	Moderate level EMI
Class 3	140	10	Severe EMI environment
Class x	Special	Special	Level Negotiated

- Most manufactures test from 150K to 80MHz
- Some case, like small sized battery operated equipment is tested up to 230MHz
  - Dimension  $< \frac{1}{4}$  at 80MHz





# Conducted Immunity

## Interference generator

- 1, 3, 10 volt carrier signal be coupled into the product power mains and interconnect cables over the frequency range of 150KHz up to 80MHz with 1KHz 80% AM.





# Conducted Immunity

## Test set-up

- A flow chart diagram in IEC 1000-4-6 helps you to select the suitable coupling methods.
- There are four coupling methods and transducers described
  - Coupling / Decoupling Networks (CDNs)
  - Injection (current) Clamps
  - EM Clamps
  - Direct Injection
    - Current clamps, EM and Injection are used for coupling to variety of shielded, unshielded, balanced and unbalanced lines; they require separate decoupling networks.





# Conducted Immunity

## Test set-up

