

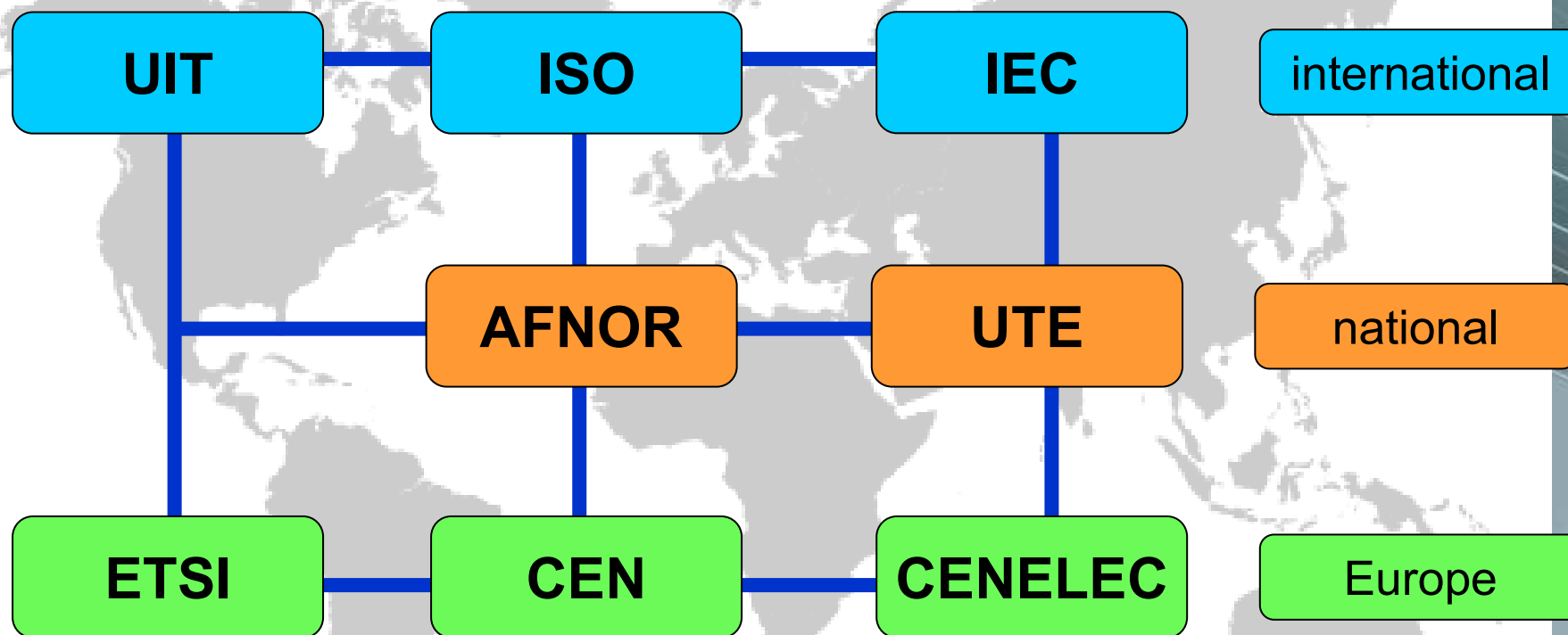


Integrated Circuit level

EMC Measurement method

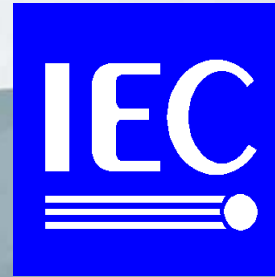
EME / EMI modeling

MAROT Christian
EMC Expert
EADS IW





**IEC SC 47A / WG 2, 2000
EMC MODELLING
Convenor : Japan, Mitani H,**



**IEC SC 47A / WG 9, 1996
EMC measurement methods
Convenor : France, Marot Ch**

**Prepare international standards for EMC measurement
and modeling at integrated circuits level
that are acceptable to the manufacturers and customers**

National mirror committee



France

US

UK

Japan

Nederland

Germany

Italy

Poland



UTE : SC 47A / WG EMC , 1996



SC 47A UTE Members



Animateur / UTE

EADS-IW : Christian Marot
UTE : Adel Guerini

IC manufacturers

ST : Philippe Dupre
ATMEL : Jean-Luc Levant
T.I. : Jean-Claude Perrin
Freescale : John Shepherd

IC users

Continental : Andre Durier
EADS – AIRBUS : Alain Sauvage
Valeo : Frederic Lafon
EADS-IW : Marc Meyer

University support

ESIGELEC : David Baudry
ESEO : Mohamed Ramdani
LESIA : Etienne Sicard



SC 47A IEC WG2 , WG9 Members



IC manufacturers / users

FR: Christian MAROT, EADS IW,
Jean Luc LEVANT, Atmel
Frederic LAFON, Valeo
John SHEPHERD, Freescale

NL : Boris TRAA, Philips Applied

CH : Christian TERRIER, EM Microelectronic

US : Ross CARLTON, NI

DE : Frank KLOTZ, Infineon
Guenther AUDERER, Freescale
Hans-Werner LUETJENS, NXP

JP: Atsushi NAKAMURA, Renesas Technology
Goichi YOKOMIZO, Renesas Technology y
Kouji ICHIKAWA, Denso
Norio MASUDA, NEC
Shinichiro MITANI, Hitachi
Yoshiyuki SAITO, Matsushita Electric Industrial

KR : Byoung Nam LEE , Soon Il YEO
Electronic, Telecom research inst

University support

IT : Francesco MUSOLINO, Politecnico di
Torino
Franco FIORI IT Politecnico di Torino

PL : Jerzy F. KOLODZIEJSKI, Institute of
Electron

JP : Osami WADA, Kyoto university



IEC 61967-1, Ed.1: Integrated circuits – Measurement of electromagnetic emissions, 150 kHz to 1 GHz -

- part 1 : General conditions and definitions → IS (International Standard)
- part 1-1: Near-Field Scan Data Exchange Format → TR (technical report)
- part 2 : TEM cell and wideband TEM cell method → IS
- part 3 : Surface scan method → TS (technical specification)
- part 4 : 1 Ω /150 Ω direct coupling method → IS
- part 4-1 : Application guidance to 1 Ω /150 Ω direct coupling method → TR
- part 5 : Workbench Faraday Cage method → IS
- part 6 : Mode Stirred Chamber method → IS
- part 7 : Mode Stirred Chamber method → DNP (draft new proposal)
- part 8 : IC Stripline method → CDV (committee draft for voting)

IEC 62132-1, Ed 1: Integrated circuits – Measurement of electromagnetic immunity, 150 kHz to 1 GHz

- part 1 : General conditions and definitions → IS (International Standard)
- part 2 : TEM cell and wideband TEM cell method → IS
- part 3 : Bulk Current Injection (BCI) method → IS
- part 4 : Direct RF Power Injection method → IS
- part 5 : Workbench Faraday Cage method → IS
- part 6 : Local Injection Horn Antenna (LIHA) method → NP
- part 7 : Mode Stirred Chamber method → DNP (draft new proposal)
- part 8 : IC Stripline method → CD (committee draft for voting)
- Part 9 : Near Field scan immunity method → DNP



IEC SC47A WG9



IEC 62228, Ed1: Integrated circuits – IC family specific requirements

part 1 : DPI on Can BUS → **TS**

IEC 62215,Ed1 : Integrated circuits – Measurement of impulse immunity

part 1 : General conditions and definitions → **NP**

part 2 : Synchronous Transient Injection → **TS**

part 3 : Non-Synchronous Transient Injection → **NP**

part 4 : Surge → **DNP**

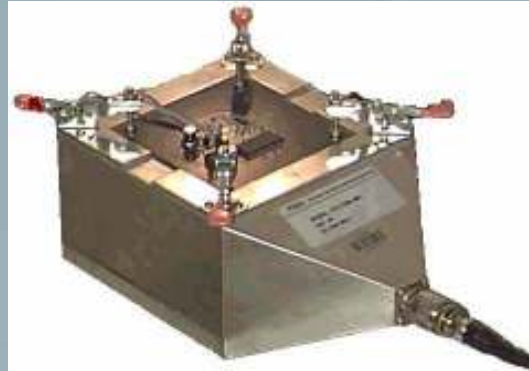
part 5 : Supply dips → **DNP**

part 6 : Near Field scan immunity method → **DNP**

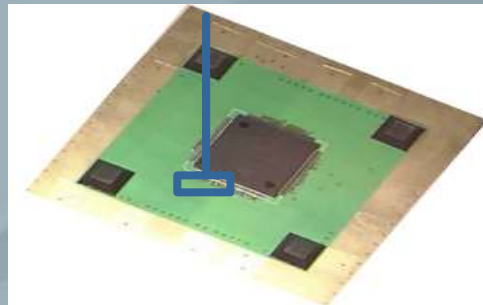
IEC 62433, Ed. 1
Models of Integrated Circuits for
EMI behavioural simulation

- part 1 : General modelling framework → CD
- part 2 : Integrated Circuit Emission Model, ICEM-CE → IS
- Part 2-1 : Theory of black box modelling for conducted emission → TS
- part 3 : Integrated Circuit Emission Model, ICEM-RE → DNP
- part 4 : Integrated Circuit Immunity Model, ICIM-CE → DNP
- part 5 : Integrated Circuit Immunity Model, ICIM-RE → DNP
- part 6 : Integrated Circuit Immunity Model, ICIM-PE → DNP

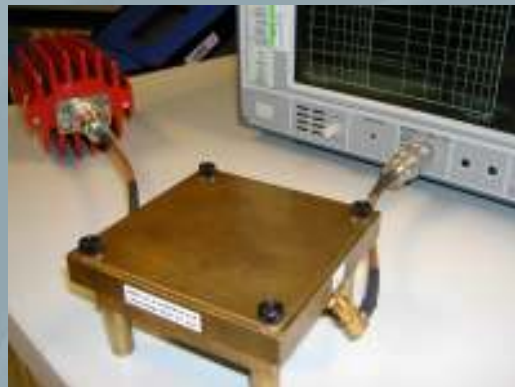
TEM cell



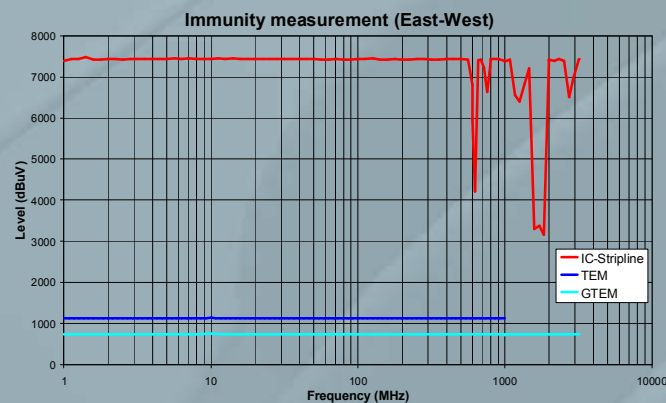
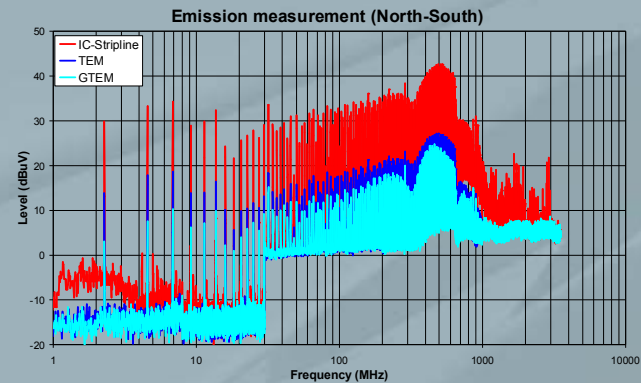
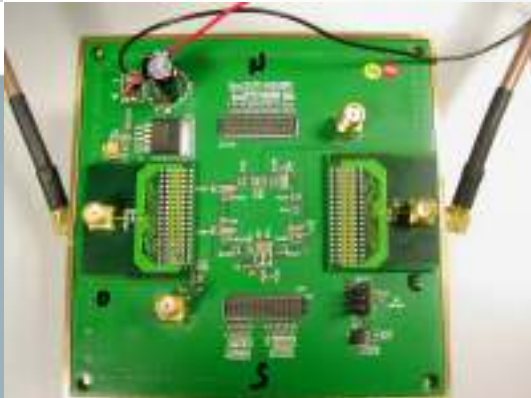
Near Field Scan



Stripline

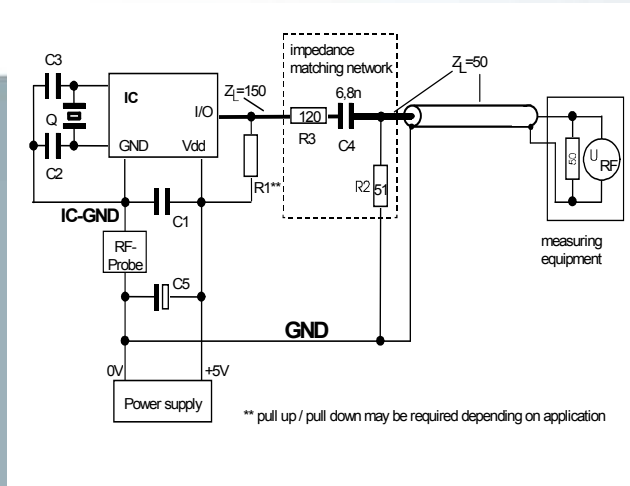


- Emission measurement with low sensibility
- Immunity tested up to 8kV/m
- Frequency range : 150kHz-3GHz
- Identification of hot spot in the IC design
- Need a specific test board
- Light test set-up



- No significant resonances
 - Usable up to 3.2GHz (and more)
- Improved sensitivity over TEM and GTEM
 - 16dB over TEM and 20dB over GTEM
- Considerably increased electric field
 - Up to 8000V/m
 - Detect previously TEM unseen defaults

1Ω /
150Ω



- Emission measurement on Power and I/O lines

- Low sensitivity with AS or RS

- BCI immunity tested up to 200mA

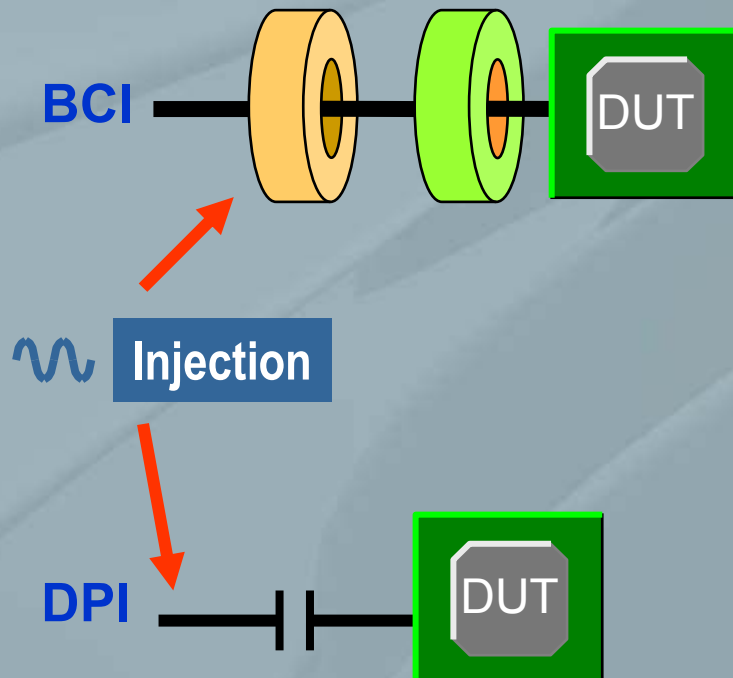
- DPI immunity tested up to 30dBm

- Frequency range :150kHz-3GHz

- Identification of internal crosstalk in the IC design

- Need a specific test board

- Heavy test set-up for multi IC I/O

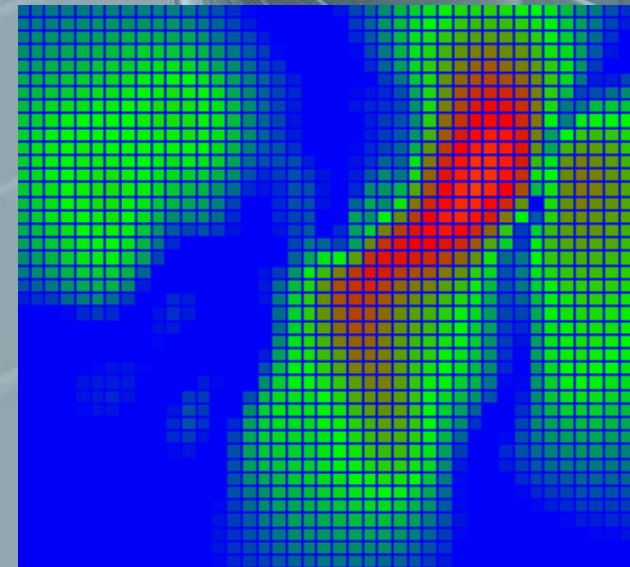




Format for Near Field scan data exchange



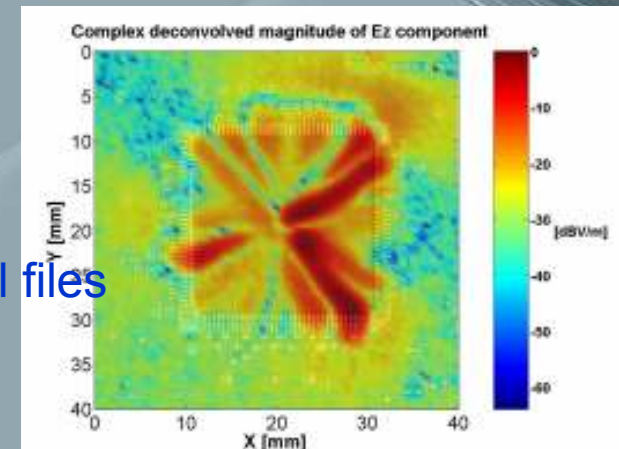
- Facilitate exchange and comparison of results between:
 - Industrials
 - Academics
 - Customers
- Avoid multiple file formats such as:
 - XML
 - Spreadsheets
 - Custom formats
- Flexible and evolutive:
 - Applicable to emission and immunity scans
 - Usable for scans and simulations
 - Easy addition of new functions
 - Adaptable to user requirements
 - Easily convertible to/from other formats



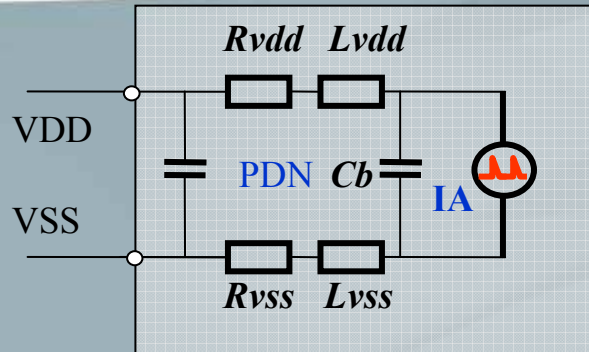
- Human and machine readable:
 - XML format
 - Simple keywords
 - Easily enhanced
 - Well structured
 - Easily parsable by viewers and post-processors

- Minimal constraints:
 - Most headers and keywords optional
 - Easily exportable, even between different operating systems
 - Simple file system structure
 - Information contained in a single file or several files
 - Applicable to emission and immunity scans
 - Not linked to a specific NFS setup
 - Scan table
 - Measurement equipment (Spectrum analyser, etc)

```
<?xml version="1.0" encoding="UTF-8"?>
<EmissionScan>
  <Nfs_ver>1</Nfs_ver>
  <Filename>scan_component_v7.xml</Filename>
  <File_ver>7</File_ver>
  <Date>9 October, 2008</Date>
  <Source>Freescale</Source>
  <Notes/>
  <Disclaimer>This file saves result of near field
  <Copyright>This document is the property of
  <Component>
    <Name>16-bit microcontroller</Name>
    <Manufacturer>Freescale SAS</Manufacturer>
    <Notes>Full speed mode</Notes>
    <Image>
      <Path>component_image.JPG</Path>
      <Unit>mm</Unit>
```



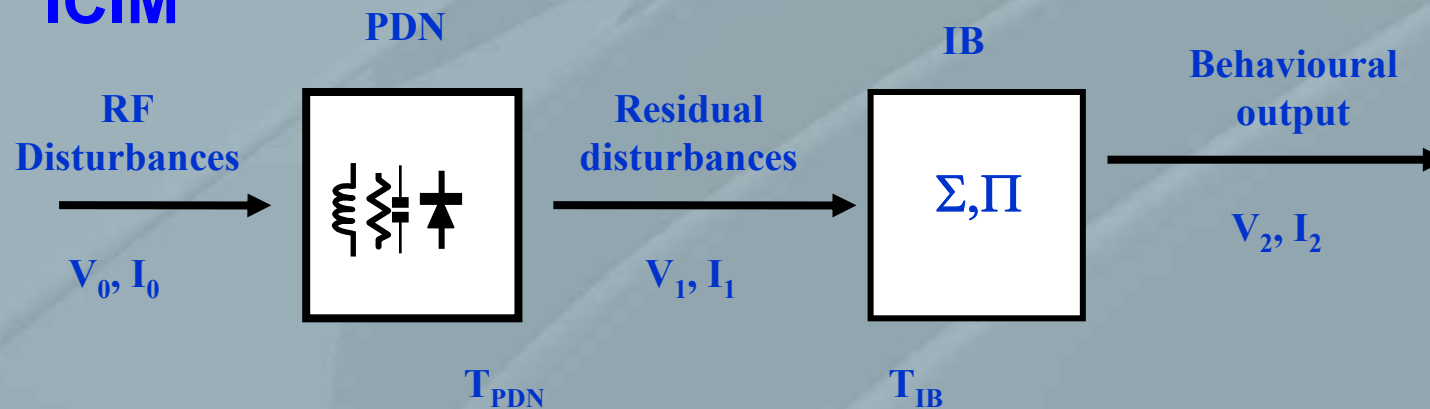
ICEM



Integrated Circuit Emission Model

- Evaluation of the decoupling network
- Filtering optimization
- Starting to be supported by IC manufacturers
- ICIM is still in definition

ICIM



Integrated Circuit Immunity Model

