

 **System Dependability and Compatibility Group**
Z'EMC attitude



IC-Emit

Comparing Simulated/Measured IC Emission Spectrum

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1. Context

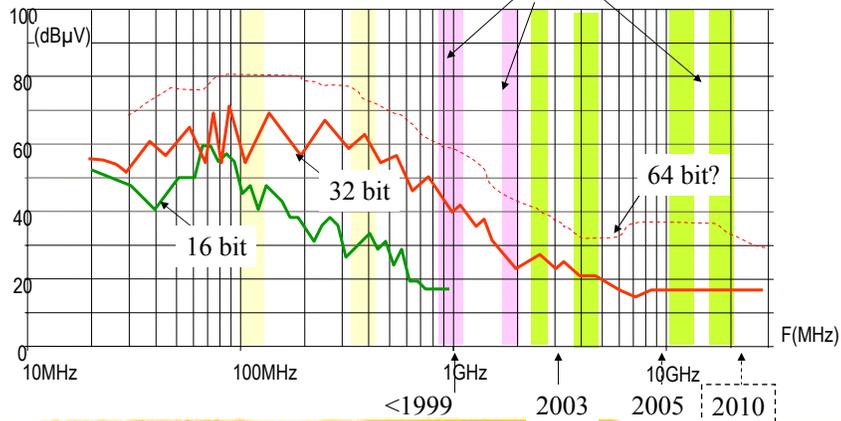
More Complex Embedded electronic systems



1. Context

Trend: investigate ever higher frequencies

Important frequency bands



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NSA EADS CCR

1. Context

Help to simulate IC Electromagnetic Emission before fabrication

The diagram illustrates the IC design process. It starts with 'Architectural Design' leading to 'Design Entry Design Architect'. 'EMC Guidelines' (in a blue oval) are integrated into the design process, with a red arrow pointing to the 'Design Entry' stage. Below 'Design Entry', there are 'Ibis model' and 'ICEM model' (represented as cylinders) and 'Tools' (in a blue oval). These feed into 'EMC Simulations Compliance?' (in a grey box), which has a red 'NO GO' button and a green 'GO' button. A red arrow loops back from the 'EMC Simulations' box to 'EMC Guidelines'. A green arrow points from the 'GO' button to 'IC FABRICATION', which includes 'EMC measurement' and a green 'GO' button.

13/02/2004 February 04 E. Sicard - EMC for ICs/EMC Issues DATE Ibis Summit, DIVA project 5/15

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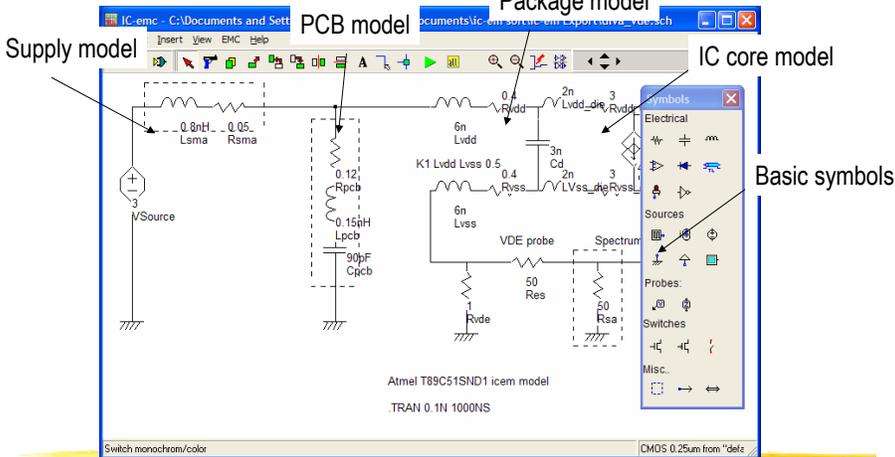
2. What is IC-Emit

- An electric circuit editor
- An IBIS to circuit translator
- An analog simulator
- A dB vs. frequency post processor
- A library of EMC/IC elements
- A data base of measured emission
- A simple tool to compared measured/Simulated emission
- A convenient way to investigate *what if* impact on emission

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3. Description

Electric circuit editor



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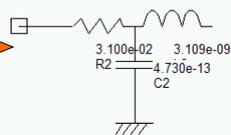
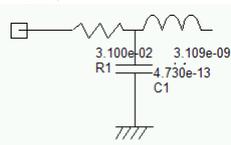
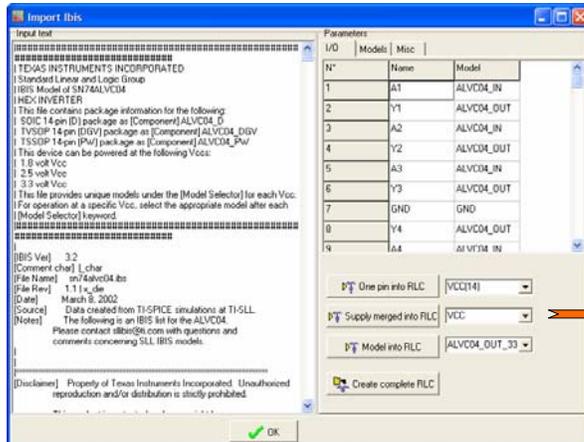
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3. Description

IBIS to Schema Translator

Equivalent R,L,C of supply networks



R/n, L/n, C*n

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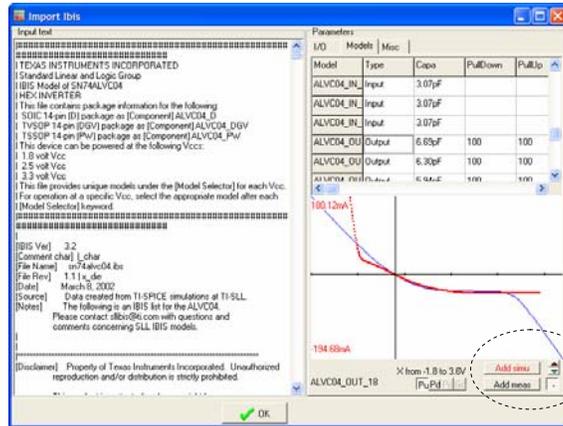
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3. Description

IBIS to Schema Translator

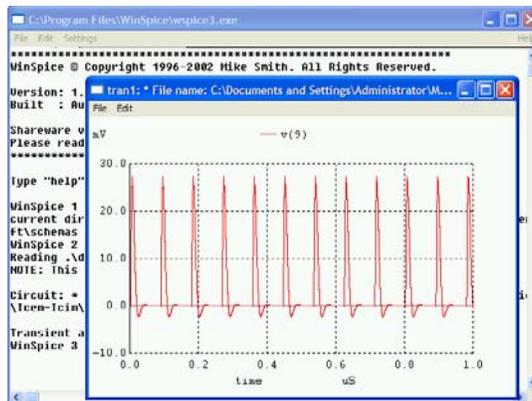
Simple comparison between simulated, measured and IBIS data



3. Description

Analog simulator: PC Spice freeware from www.winspice.com

- Simple, free PC tool
- Support from Mike Smith
- Simple clear manual
- Script-based
- Access to models
- Simple TRAN, AC, DC analysis
- ... Poor FFT



3. Description

dB vs frequency post processing

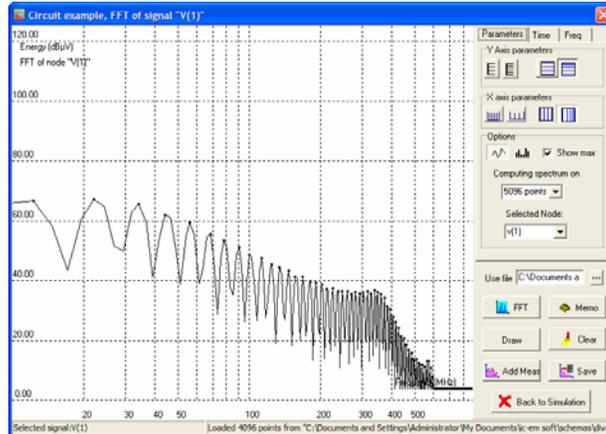
Log/Log, 10MHz-10GHz

Based on WinSpice text output

Access to FFT parameters, scale, lin

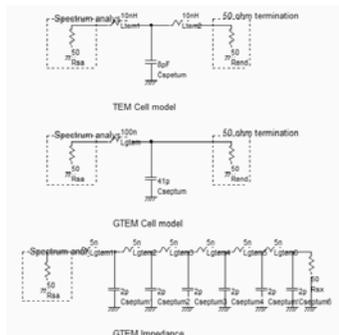
Can add measurements

Can save in simple format



4. Added value

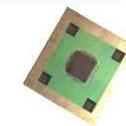
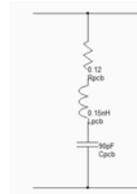
A library of EMC/IC elements



Tem model



GTem model



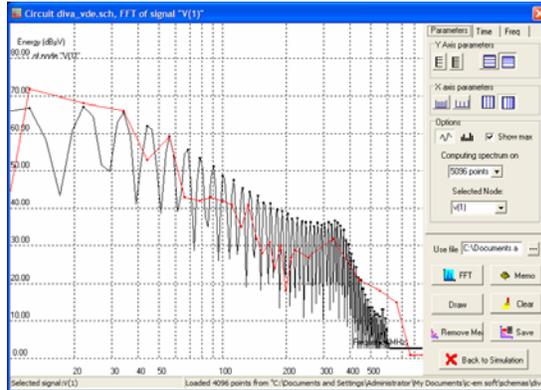
PCB board

4. Added value

A data base of measured emission spectrum

- 16 bit micro-controllers
- 32 bit micro-controller
- 0.18µm CMOS Test-chip

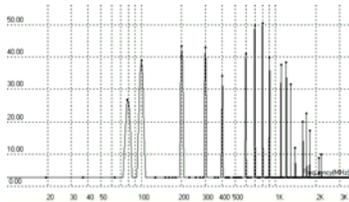
Full SPICE model given for immediate comparison with measurements



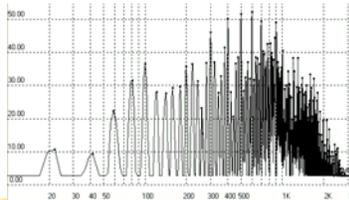
4. Added value

A convenient way to investigate *what if* impact on emission

16 bit micro-controller, core only



16 bit micro-controller, core and active I/O



Conclusion

- An environment for simple emission simulation has been developed
- The schematic editor interfaces with WinSpice
- A post processor has been setup for easy comparison between measured and simulated spectrum
- A library of models and measurements is available
- The package is online at www.ic-emc.org
- Demos at DATE'04, EmcCompo 04, IEEE EMC 2004 St Clara