

# A Concurrent Engineering Platform for Modeling IC emission and immunity

A. C. Ndoye<sup>1</sup>, A. Boyer<sup>1</sup>, E. Sicard<sup>1</sup>, S. Serpaud<sup>2</sup>, F. Lafon<sup>3</sup>, S. Rigour<sup>3</sup>

<sup>1</sup>INSA, LATTIS, 135 av. de Rangueil,  
31077 Toulouse cedex 04 France  
[amadou.ndoye@insa-toulouse.fr](mailto:amadou.ndoye@insa-toulouse.fr)

<sup>2</sup>NEXIO, 46 avenue du Général de Croutte  
31100 Toulouse France

<sup>3</sup>VALEO, 2 rue F. Pouillon  
94042 Créteil France

**Abstract**— The emergence of integrated circuits is increasingly more complex associated with the growth of the problems involved in the immunity and the emissions of these same components give the need for a model of susceptibility or emission. This model must be not only be used by the manufacturers of circuits to check if their components will pass EMC specifications, but also by the industries to evaluate the emission and the immunity of their products. The development of this model represents a true challenge since this one must be accurate enough, compatible with the simulation flow suggested by the most current tools and to include only non-confidential data. The LATTIS laboratory [1] of INSA Toulouse has implemented for a few years an Electromagnetic Compatibility (EMC) platform of the components which concentrates at the same time the means of EMC measurement of components and the means of modeling. The more innovating aspects concern the modeling part with, in particular, the development of an experimental platform IC-EMC [2] which capitalizes the knowledge, to make acquired in modeling of emission and immunity components. The platform is currently in the phase of validation and used in the EMC component research with industrial partnership.

The innovation or the promotion of the research project always has major problems for the industrial. The lack of resources, the time constraints and the limitation of technical means are often barriers to the development. The industry needs solutions and effective tools to be supported.

## I. HISTORY

Within the Aerospace Valley project EPEA [3], the concept of concurrent engineering developed with the CNES under the platform “Plate Architecture of Orbital Systems” PAOS [4] was applied to the field of EMC modeling of components. A prototype activity of service in study, in partnership with NEXIO company, was started in January 2008.

## II. PRINCIPLE OF THE EMC PLATFORM

The platform of EMC service has as an ambition to answer the industrial problems regarding EMC studies. The field of the studies relates to the modeling of components and electronic board for emission or immunity aspect. After a validation step of the concept, the studies could be extended to the other fields of the EMC.

The base of the EMC platform is to answer the industrial matter problems and especially the project management of EMC study. The platform supports the recruitment of the experts and human resources required for the operational aspect of the project. A planning of the various actions is proposed at the beginning of project in order to optimize the time of the study. The example of the CNES platform shows that the principle of collaborative platform allows reduction by four times of the preliminary phases of project. If the study requires phases of measurements or all other services not being able to be provided by the customer, it will be proposed to carry out its actions by the platform itself, if that is possible (schedule constraint, availability of the test bench,...), or to subcontract to external partners identified by the platform.

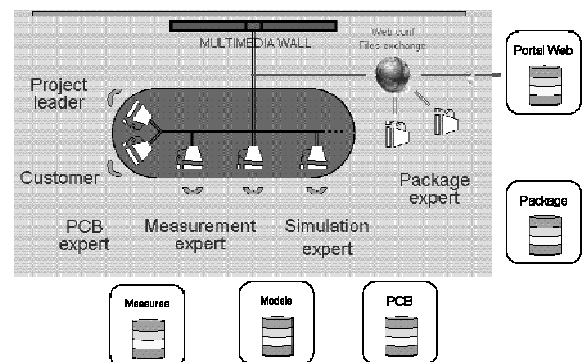



Fig. 1 Collaborative Platform of EMC models construction

By some means materials are placed at the disposal of the platform in order to facilitate the exchanges (Figure 1). The exchange of information is critical for a project. It is often the deceleration source which can even block the project. We must also not forget the problem of data confidentiality. In order to answer these problems inherent in the innovation and research project, the platform has last technologies for information sharing. The platform also tries to answer the problem of mobility of anybody. A system of video and/or audio conference is available.

Following the case study submitted by the customer, a phase of thorough specification is launched with the customer in order to well understand his needs. The document presented Figure 2 in addition with the technical proposal will be supplemented by the customer.

		<b>Statement of requirements for component immunity model</b>	
Date : 20/10/2008		Nom projet : Plateforme CITEA Réference : etudyactuweb.doc	

**1. General information**

Customer :	
Company :	Internal
Address :	Address
Customer contact :	Internal Internal Phone number
Technical contact :	Internal Internal Phone number
Finance contact :	Internal Internal Phone number
Related project :	Internal <input type="checkbox"/> Internal <input type="checkbox"/> National <input type="checkbox"/> European <input type="checkbox"/> Other (please specify)

**2. Constraints**

Dead line :	Agree meeting date for end of study		
Undisclosed level :			
Study :	<input type="checkbox"/> Basic	<input type="checkbox"/> Private public	<input type="checkbox"/> Confidential
Measure :	<input type="checkbox"/> Basic	<input type="checkbox"/> Private public	<input type="checkbox"/> Confidential
Model :	<input type="checkbox"/> Basic	<input type="checkbox"/> Private public	<input type="checkbox"/> Confidential
Method :	<input type="checkbox"/> Basic	<input type="checkbox"/> Private public	<input type="checkbox"/> Confidential
Result :	<input type="checkbox"/> Basic	<input type="checkbox"/> Private public	<input type="checkbox"/> Confidential
Subcontracting authorization :	<input type="checkbox"/> Yes	<input type="checkbox"/> No	

\* Data can be used without limitation, \*\* Data can be used following ND's condition

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Fig. 2 The assistance document of the definition of customer need

At this step we obtain a commercial proposal including: the definition of the resources used, a planning of the spots and budget of the study. If needs an official authorization can follow this document in order to manage the confidentiality issues. From the validation of the documents by the customer, the platform is committed for making a study in accordance with the proposal. Figure 3 illustrates the flow chart used for the construction of components models.

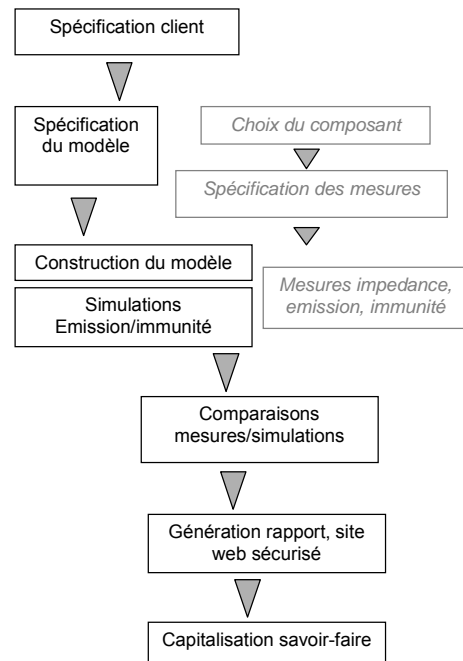


Fig. 3 Flow used for the construction of the components models

At this step, either the customer is able to carry out measurements, or the platform supports him. To do so, a national census of the test means was made (accredited or not), making it possible to quickly define the time, the cost and the quality of desired measurements (normative or not), with the means of equipment such as spectrum analyzers, TEM/GTEM cells, near field, scan benches, or radio frequencies generators, power amplifiers and broad band oscilloscopes (Figure 4).

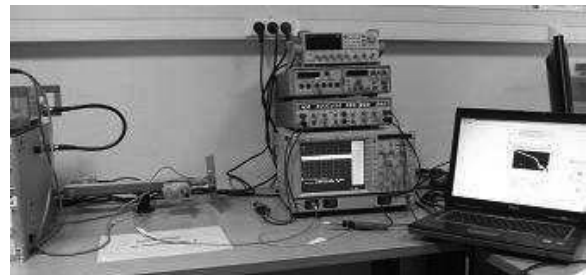


Fig. 4 Example of measurement setup bench (Susceptibility)

According to the duration of the study, progress reports are sent in order to inform the customer of evolution of work. A final report comes to conclude the study.

### III. PRESENTATION OF COLLABORATIVE PLATFORM

#### A. Description of the material platform

The communication within a project is a crucial point. A project is the grouping of entities from very different domains (administrative, different experts, tests technician ...), not having the same constraints. Maintaining the diffusion of information is very difficult but is crucial for the good progress of the project. The platform has important communication means (wall screens broad, audio/video connections with the customer), connections and data exchanges allowing a collaborative approach for models construction of components regarding both emission and immunity. This simplifies not only the relations between the customer and the experts, but also those between the experts. Make in network the very powerful materials and the good experts of EMC components permit to answer all requests of the customers.

On the software aspects, the experience gained in different components modeling [5], with a precursory role in the steps of standardization [6] makes it possible to answer in an increasingly effective way to the requests of industrials. A recent example is a proposal for a standard regarding the format to exchange near field scan measurements [7]. The expert group convened within this collaborative platform allows the development of models structure and to match the model according to the requests of the customers. The experience of the modeling, the validation of these models by comparisons with measurement and the utilization of our approaches will be valorizing within the international committee standardization (IEC).

#### B. Role of the experts

The various tasks required for establishment of a model are divided and each expert is responsible for a task. For example, the measurement expert evaluates the quality and the validity of the measurements provided by the customer. He can also ensure the cabling and the specification measurements, if the customer does not give measurements. It is then given the responsibility to deliver the files of measurements and, if needed, all information required for the design of the model. All the files of measurements are transformed thereafter in a standard format or in a format specified by the simulation expert in order to allow its use by the software and tools of the platform. All the files and documents are put in protected data bases to allow the network sharing between the experts around the collaborative platform. Then, a collaborative work starts between the model experts, simulation, circuit, PCB, package, measurements to design the model. All of the tasks are coordinated by a project manager (project leader) who guarantees the respect of times imposed by the customer. As of the model is completed, the project manager undertakes to deliver to the customer the files of the model and an expert report with all the criteria and specificities of the model.

### IV. EXAMPLE OF CUSTOMER REQUEST

#### A. Presentation of the case study

An experimental case of implementation of the service platform in modeling was carried out in collaboration with VALEO company. This study is the modeling of a voltage regulator "L4949" by using a PCB board manufactured by VALEO. The specification is the design of an immunity model extracted from DPI (Direct Power Injection) of the regulator following a criterion defined by the customer to approach the functional mode.

We have on the figure 5 the PCB board provided by the customer and the cabling of the component carried out by the measurements expert of the modeling platform to follow the directives and customer specifications.

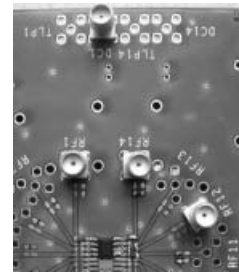


Fig. 5 L4949 regulator and Board of measurements

The measurement expert, after validation of cabling, delivers a measurement report (figure 6), which is in this case immunity DPI of the regulator, the impedances  $Z(f)$  and parameters  $I(V)$ , according to the needs declined as a preliminary by the customer. The report provides measurements results; the type of the equipment used, the kind description of the measurement test bench and the conversion of the measurements listings into data readable by all tools of the modeling platform. The measurement expert capitalizes all useful information that will be used, during the design phases of the model, and communicate them to the simulation expert.

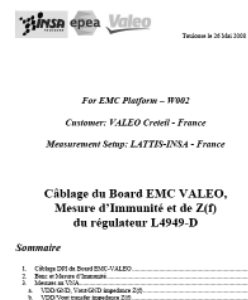


Fig. 6 The expert measurement report

The simulation expert describe first the electric of the model with the support of the measurement expert who will provide information on the measurement setup, with the PCB expert who will communicate the indications on the number of layers

of the board, the length and the characteristic of the tracks. The customer provides all information useful for the level of the blocks and internal specificities.

With the modeling platform, we will create the model and thereafter will compare it with measurement then according to the customer request in order to manage the difference between simulation and measurement, until reaching the customer's expectations.

### C. Synthesis of the study

In this case of study we made the immunity model from DPI (Direct Power Injection) of the regulator L4949 figure 7.

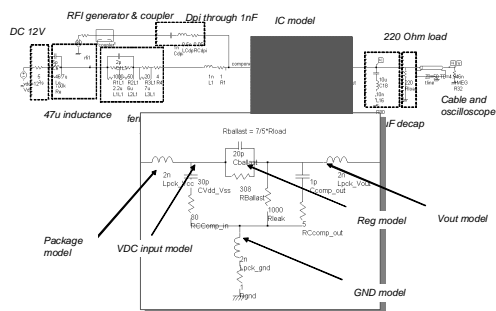


Fig. 7 Modeling deliverable by the expert of simulation

In this case we provided to our customer a model which we compared with measurement figure 8.

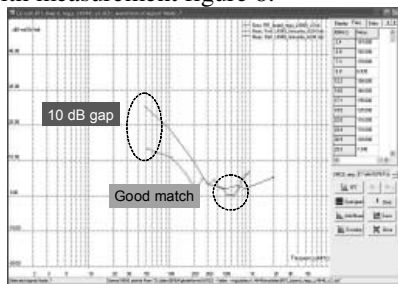


Fig. 8 Comparison measures/simulation

### C. Advantages of the modeling platform

The main interests of the approach suggested is the time saving. The organization of the meetings and the equipment of the working place allowing a co-operative development, while treating in parallel several aspects of modeling composing: the through on the approach choice, the assumptions, measurements treatment and the iterations on the model in order to converge towards the expected accuracy. Concentrate the experts in the same place, with capacities to share all

screens and simultaneous simulations, brings reactivity, an interaction and emulation impossible to reach in one traditional approach. One notes also the concern of the participants to prepare their technical expertise, to provide high quality contributions, to manage efficiency time and to take an active part in the meetings of problems solving. On the other hand, the mobilization cost of the experts in the same place and at the same time has a cost similar to that of an approach consisting in interacting with each person resource separately. The concept of platform of EMC modeling component applied on 5 projects, with an experiment of about 6 months, results in quality of the provided results. The total effectiveness of the methodologies employed are very satisfactory, and push us to deepen more still the concept.

## V. CONCLUSION

The future improvements of this collaborative platform relate to the integration of a system of Web conference making it possible to the customer to visualize on line all the chain of design of their model. All the customers will be able via a protected system internet to interact on the design level of the model. The strong partnership with NEXIO company also makes possible to consider at the end of the EPEA project a future and a perpetuation of this concept.

The points to be improved are the exchange, synchronization, the protection and the exploitation of the produced data. That passes by a dynamic creation of sites with automatic generation of the rights to the experts and customer, the update of the data concerning cabling the technical meetings, and the definition as of the phases of specification project in the way in which the studies can be exploited, as a private individual with respect to the steps of standardization in components modeling.

## REFERENCES

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