



# Enhanced Physical-Statistical Simulator of the Land Mobile Satellite Channel for Multipath Modelling Applied to Satellite Navigation Systems.

PhD defence of Mehdi AIT IGHIL

Monday the 28<sup>th</sup> of January 2013 at 2 pm

Auditorium  
ONERA Toulouse  
2 Avenue Édouard Belin  
31000 Toulouse

## Jury

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|---|--------------------|
| - Prof. Claude OESTGES, Université Catholique de Louvain, Belgium | (Reviewer)         |
| - Prof. Rodolphe VAUZELLE, Université de Poitiers, France         | (Reviewer)         |
| - Prof. Michel BOUSQUET, ISAE Toulouse, France                    | (Co-director)      |
| - Prof. Fernando PEREZ-FONTAN, Universidad de Vigo, Spain         | (Co-director)      |
| - M. Joel LEMORTON, ONERA Toulouse, France                        | (ONERA supervisor) |
| - M. Roberto PRIETO CERDEIRA, ESA/ESTEC, The Netherlands          | (Examiner)         |
| - M. Paul THEVENON, CNES Toulouse, France                         | (Invited)          |
| - M. Christophe BOURGA, Thales Alenia Space Toulouse, France      | (Invited)          |

## Abstract

This PhD work deals with land mobile satellite channel modelling and addresses the specific issue of satellite navigation systems in urban environments with a particular focus on multipath modelling and wide-band representation of the propagation channel. The developed land mobile satellite channel simulator, SCHUN (*Simplified CHannel for Urban Navigation*), is based on a hybrid physical-statistical approach satisfying fast computation requirements. The statistical component of the modelling is mainly used during the virtual city synthesis step based on known statistical distributions of building heights and street widths. The rest of the modelling comes from deterministic methods using simplified electromagnetic interaction models reproducing building macro-scattering (3CM model *Three Component Model*) and building blockage of the direct path. The main underlying electromagnetic methods are the physical optics and the uniform theory of diffraction.

The SCHUN simulator now opens interesting perspectives for the modelling of wide-band land mobile satellite propagation channel in dense urban environments. Optimised for pseudo real-time constraints, it uses both physical and statistical approaches. Furthermore, the SCHUN simulator has been designed and validated against measurements to answer specific needs of satellite diversity, receiving diversity, polarisation diversity or frequency diversity for satellite navigation applications.

## Key words

LMS channel propagation - Satellite navigation - Multipath