Editorial

Special issue on S-band mobile satellite technologies

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This special issue of the Wiley International Journal of Satellite Communications and Networking hosts a selection of papers related to S-band mobile satellite R&D activities recently completed in the frame of the European Space Agency ARTES programs. The S-band allocation to hybrid satellite and terrestrial services in Europe 2009 and in other parts of the world has attracted operator, industry, and research institution interest for its commercial exploitation.

The aim is to illustrate the most recent technical achievements either to improve the S-band satellite system performance or to demonstrate with prototypes the feasibility of new technologies in the user terminal receivers. Dealing with mobile satellite communication services in S-band, the reference air interface for all these scientific papers is the Digital Video Broadcasting - Satellite services to Handhelds (DVB-SH) standard [1], designed to support high-quality broadcasting services over the harsh land mobile satellite (LMS) channel while at the same time able to exploit the presence of terrestrial gap fillers. DVB-SH represents a state-of-the-art air interface for hybrid satellite/terrestrial mobile broadcasting (interactive) networks [2].

In [3], the authors have summarized key findings of an in-depth analysis of the benefits provided by different system architectures and technologies for next generation S-band mobile satellite broadcasting network with interactivity. Along with advanced antenna and payload architectures, a promising way forward in this context is the migration from the conventional single polarization per beam to an advanced dual polarization per beam MIMO architecture for effective spectrum exploitation. In this context, system capacity simulations are showing potential improvements in a 60% to 90% range in terms of overall throughput.

Two leading European antenna manufacturers present in [4] and [5] their user terminal antenna prototypes to primarily target professional automotive applications. The main aspects of antenna design are introduced, and the performance of switchable dual polarized vehicular transmit/receive antennas is validated. The form factor of the antenna design described is not only fully in line with typical automotive commercial requirements but also suitable for other markets such as the maritime or the machine-to-machine ones.

The aim of [6] is to review the state-of-the-art techniques and architectures supporting beamforming in mobile satellite systems and to evaluate the potential benefits/drawbacks of on-ground beamforming compared to on-board beamforming approach. For this analysis, also some of the beamforming error sources, such as propagation effects at feeder link level, on-board degradations at payload level, differential atmospheric perturbations and Doppler shift effect have been investigated. Finally, a preliminary assessment of the potential advantages given by adopting adaptive beamforming and more advanced on-ground signal processing techniques in multi-spots mobile satellite systems is presented.

Stimulated by the large capacity increase potential provided by the dual-polarized S-band satellite systems, the authors in [7] derive a comprehensive MIMO channel model. This paper describes the joint wideband and narrowband modeling approach, provides examples of the usage, and finally describes some evaluation results. This new MIMO model for a dual-polarized LMS-channel environment has been evaluated by comparing the simulated results with data gathered from an extensive field trials carried out within the duration of the project.

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In [8], the architecture and implementation of a full-featured DVB-SH receiver are presented together with its extensions toward interactivity via a low-data rate return channel following the S-band Mobile Interactive Multimedia standard [9]. The demodulator supports simultaneous reception of the satellite component (SC) and the complementary ground component (CGC), including antenna diversity and SC/CGC diversity combining. The performance of the DVB-SH demodulator has been proven during extensive laboratory tests and supporting several hybrid satellite/terrestrial field trials. In addition, the paper highlights some key results of receiver performance measurements by showing its impact on the optimum parameter selection for DVB-SH network deployment.

The advantages deriving from the exploitation of MIMO concepts to hybrid satellite/terrestrial broadcasting networks based on the DVB-SH air interface are illustrated in [10]. Four potential satellite and hybrid terrestrial/satellite MIMO scenarios for S-band land mobile applications are described and analyzed in detail. As far as MIMO techniques are concerned, the paper addresses the following four signal processing solutions: 2 × SISO (multiplexing gain through a simple extension of current DVB-SH SISO standard), Alamouti space–time block coding (full diversity gain but no multiplexing gain), spatial multiplexing (full-rate space–time code to exploit joint decoding of two symbols within one symbol slot), and Golden codes (optimal full-rate full-diversity technique). The performance of these MIMO schemes have been compared by performing comprehensive computer simulations in all investigated satellite/terrestrial scenarios.

In closing, we would like to thank all authors for their contributions that made this issue possible. We also thank the reviewers for their valuable comments and suggestions in improving the quality of the submitted papers. We are grateful to Prof. Barry Evans, the editor in chief of the International Journal on Satellite Communications and Networking, for kindly inviting us to conduct this editorial process, and Alice Wood for her help during the entire publication process. Finally, we hope that the readership will find this special issue interesting and stimulating.

REFERENCES

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Ana Bolea-Alamanac received the master’s degree in Telecommunications Engineering from the University of Zaragoza, Spain, in 1995 and the PhD from SUPAERO, in Toulouse, France, in 2004. From 1996 to 2001, she was with Telefonica, Madrid, Spain. After her PhD, she continued her work in the area of advanced digital communication techniques with the Research and Development Department of Thales Alenia Space in Toulouse, France. In 2005, she joined ESA's Research and Technology Centre (ESTEC), Noordwijk, the Netherlands, as a Communication System Engineer in the RF Payload and Systems Division, where she focused on advanced mobile satellite communication systems design and optimization. In January 2011, she joined the Future Programs Division in the Telecommunications directorate of ESA and since June 2013 she is the system and payload senior engineer for the SAT-AIS program in the Telecommunication Satellite Program department of ESA.

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Riccardo De Gaudenzi was born in Italy in 1960. He received his Doctor of Engineering degree (cum laude) in Electronic Engineering from the University of Pisa, Italy, in 1985 and the PhD from the Technical University of Delft, the Netherlands, in 1999. From 1986 to 1988, he was with the European Space Agency (ESA), Stations and Communications Engineering Department, Darmstadt (Germany), where he was involved in satellite telecommunication ground systems design and testing. In particular, he followed the development of two new ESA’s satellite tracking systems. In 1988, he joined ESA’s Research and Technology Centre (ESTEC), Noordwijk, the Netherlands, where in 2000, he has been appointed as Head of the Communication Systems Section, and since 2005, he is the Head of the Radio Frequency Systems, Payload and Systems Division. The division is responsible for supporting the definition and development of advanced satellite system, subsystems, and related technologies for telecommunications, navigation, and earth observation applications. In 1996, he spent 1 year with Qualcomm Inc., San Diego, USA, in the Globalstar LEO project system group under an ESA fellowship. His current interest is mainly related with efficient digital modulation and multiple access techniques for fixed and mobile satellite services, synchronization topics, adaptive interference mitigation techniques, and communication systems simulation techniques. He actively contributed to the development and the demonstration of the ETSI S-UMTS Family A, DVB-S2, and DVB-SH standards. From 2001 to 2005, he has been serving as associate editor for CDMA and Synchronization for IEEE Transactions on Communications. He is the co-recipient of the 2003 and 2008 Jack Neubauer Memorial Award Best Paper from the IEEE Vehicular Technology Society.