# CV EXECUTIVE SUMMARY

## Part A. PERSONAL INFORMATION

| CV date | 25/05/2024 |
|---|---|

| First and Family name | Ana Isabel Pérez Neira | | |
|---|---|---|---|
| Social Security, Passport, ID number | ⬛ | Birth | ⬛ |
| Researcher numbers | Researcher ID | L-4418-2013 | |
| | Author ID | 6701360457 | |
| | ORCID code | 0000-0003-4281-3934 | |

### A.1. Current position

| | |
|---|---|
| Current position | Director of CTTC <br> Catedrática de Universidad |
| Name of University/Institution | Universidad Politécnica de Cataluña (UPC) <br> Centre Tecnologic de Telecomunicacions de Catalunya (CTTC) |
| Department | Dept. de Teoría de la Señal y Comunicaciones at UPC <br> Space and resilient communication and systems at CTTC |
| Address and Country | c/ Jordi Girona 1-3, Edificio D5, 08034 Barcelona (UPC) <br> Av. Carl Friederich Gauss 7, Edificio B4, 08860 Castelldefels (CTTC) |
| Phone number | +34 6452900 |
| UNESCO code | 332505 and 332506 |
| IEEE member | IEEE Fellow <br> 03082260 |
| Key words | Satellite and wireless Communications. |

| Key words | Satellite and wireless Communications. | From | 2021 – 2006- |
|---|---|---|---|
| Website | https://www.cttc.cat/people/ana-isabel-perez-neira/ | | |

### A.2. Education

| Degree/PhD | University | Year |
|---|---|---|
| BSc in Electrical Engineering <br> TFG: "Codificación de imágenes por transformación de Walsh-Hadamard" (Excellent) | La Salle Bonanova, Barcelona | 12/1989 |
| MSc in Telecom Engineering <br> TFM: "Aplicación de los cumulantes de tercer orden en técnicas de procesado de arrays" (with Honors) | UPC, Barcelona | 12/1991 |
| PhD in Telecom Engineering <br> Specialization in signal processing and communications systems <br> "Array processing for multiuser access: application of a neural network theorem" (with Honors) | UPC, Barcelona | 05/1995 |

**A.3. JCR articles, h Index, thesis supervised and other research related numbers.**

h-index: 41, i10-index: 239, citations: 10181

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|---|---|---|---|
| Recognized Research Periods *(Sexenios)* | 5 | Journal publications | 84 |
| Recognized Teaching Periods *(Quinquenios)* | 6 | Conference Publications | >300 |
| Supervised PhDs | 15 | Invited Talks | 68 |
| PhD Evaluation Committees | 42 | Research Projects (IP) | 35(≈6M€)** |
| Evaluation of Academic Positions | 15 | Research Projects | >30 |
| International Stays | 6 | Reviewer of Projects/Awards/Research Centers | 24 |
| Books | 1 | Associate/Area Editor | 4 |
| Chapters in books | 13 | Research Seminars | 20 |
| Special Issue Editor | 13 | Patents | 8 |

** In addition, I have raised funding in other projects not leaded by me. Also, I am the responsible for the Space Program at CTTC (with income ≈8M€, aggregated from 2014 to 2023)

Currently, I am the coordinator of the European Space Agency Network of Excellence – SatnexIV-V, with 25 academic partners and 10 companies (2015-2024).

**Part B. CV SUMMARY**

**B.1. Past Positions**

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|---|---|
| **2008-2009** | Visiting Professor at KTH, Sweden (2008-2009) |
| **1997-2006** | Associate Professor of UPC (Signal Theory and comm. Dept.) |
| **1992-1997** | Assistant Professor of UPC (Signal Theory and comm. Dept.) |

**B.2. Academic Management**

| | |
|---|---|
| **2013-2021** | Scientific coordinator of CTTC |
| **2013-** | Responsible for Space Activities in CTTC |
| **2012-2013** | Founder of UPC Doctoral School |
| **2010-2014** | Vicerector of Research at UPC |
| **2005-2007** | Elected member of the Comisión Permanente of ETSETB at UPC |
| **2000-2003** | Vicedirector of ETSETB at UPC |
| **1993-1997** | Elected member of the Comisión Permanente of ETSETB at UPC |

**B.3. Research Management**

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|---|---|
| **2021-2023** | Vice-President for Conference of IEEE Signal Processing Society (elected) |
| **2019-2022** | Senior/Area editor of the IEEE Open Journal for Signal Processing |
| **2019-2021** | Member of IEEE Signal Processing Society Board of Governors (elected) |
| **2018-** | Member of the IEEE Future Networks Technology Working Group for Satellite |
| **2017-2018** | Director-at-large IEEE Signal Processing Society for region 8 |
| **2014-2021** | Scientific Coordinator at CTTC |
| **2014-2018** | Associate Editor of EURASIP Journal of Signal Processing |
| **2013-Present** | Responsible for Space Communications at CTTC |
| **2014-2016** | Vocal in the committee for profesorship evaluation in technical universities. |
| **2010-2016** | Associate Editor of IEEE Transactions on Signal Processing |
| **2010-2013** | President of the Award Committee at UPC |
| **2008-2016** | BoD Member of EURASIP (European Association for Signal Processing)(elected) |

| 2008- 2017 | Associate Editor of EURASIP Journal of Advances in Signal Processing (JASP) |
|---|---|
| **2006-Present** | Full Professor (nº1 National Habilitation) |
| **Since 1992** | Technical expert: reviewer of several journal publications, international committees, and national science foundations. |
| **Since 1992** | Technical Committee Member of several conferences such as SAM04, SPAWC06, PIMRC07, VTC13 |
| **General Chair Appointments** | IWCLD09, EUSIPCO 11, EW14, ISWCS14 and ASMS'16 (all IEEE technically co-sponsored), WWRF39, **ICASSP 2020 (around 15.000 virtual attendees, the first fully virtual conference of IEEE).** |
| **Technical expert** for the National Science Foundation (USA), Spanish Ministry for Research, European Commission and  Deutsche Forschung Gemainshaft (Germany), Swedish Research Council, Research Council of Luxembourg, Ireland Science Foundation, European Research Council. | |
| **Member of executive committees** for CERCA  research centers (depending on the Catalan Government) between 2010 and 2013. | |

## B.4. Awards and Recognitions

| 2024 | Narcis Monturiol medal given by the Catalan Government in recognition to my research activity and leadership. |
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| **2023** | Elected member of the Real Academia de Ingeniería de España (with the inauguration lecture on "Waveforms for Computing Over-the-air") |
| **2022** | EURASIP Fellow for her contributions to Signal Processing for communications |
| **2021-2025** | ICREA Academia (prestigious Catalan research institution) to develop physical layer concepts of New Space |
| **2019** | IEEE Fellow for her contributions to Signal Processing. |
| **2019** | Elected member of the Real Academia de las Ciencias y las Artes de Barcelona (Engineering Section) |
| **2018** | EURASIP Meritorius Service Award for "Leadership and Activities as EURASIP member and awards director and for continuous commitment with EURASIP over the last fifteen years in almost all aspects." |

## B.5. Most relevant journal publications (past 20 years)

[1] Ana Pérez-Neira, Marc Martinez-Gost, Alphan Şahin, Saeed Razavikia, Carlo Fischione, Kaibin Huang, "Waveforms for Computing Over the Air," arXiv:2405.17007, May 2024, submitted to IEEE SPMagazine.

[2] M. Martinez-Gost, A. Pérez-Neira and M. Á. Lagunas, "ENN: A Neural Network with DCT Adaptive Activation Functions," IEEE Journal of Selected Topics in Signal Processings, January 2024, doi: 10.1109/JSTSP.2024.3361154, arXiv:2307.00673, July 2023.

[3] A. Pérez-Neira, "Going for Sustainable Conferences [Perspectives]," IEEE Signal Processing Magazine, vo. 41, no.1, January 2024, 25-30, ISSN: 1053-5888, Online ISSN: 1558-0792, Digital Object Identifier: 10.1109/MSP.2024.3360955

[4] Anxo Tato, Carlos Mosquera, Pol Henarejos, A.I. Perez-Neira "Neural Network Aided Computation of Mutual Information for Adaptation of Spatial Modulation," IEEE Transactions on Communications, vol. 68, no. 5,  pp. 2809-2822, May 2020,

[5] Anye Wang, Anyue Wang, Lei Lei, Eva Lagunas, Ana I. Perez-Neira, Symeon Chatzinotas, Bjorn Ottersten ,·NOMA-Enabled Multi-Beam Satellite Systems: Joint Optimization to Overcome Offered-Requested Data Mismatches", IEEE Trans on Vehicular Technology, vol. 70, n.1, pp.900-913, January 2021. ISSN: 0018-9545

[6] Felip Riera, Guillem Femenias, Marius Caus, Musbah Shaat, A. Pérez-Neira, "Scalable Cell-Free Massive MIMO Networks with LEO Satellite Support," IEEE Access, accepted March

2022, Volume: 10, pp. 37557-37571, print ISSN: 2169-3536, Online ISSN: 2169-3536, DOI: 10.1109/ACCESS.2022.3164097

[7] Marius Caus, A. Pérez-Neira , "FBMC-based Random Access Signal Design and Detection for LEO Base Stations," IEEE Trans on Wireless Comm, March 2023, Volume: 22, Issue: 3, On Page(s): 2156-2170, Print ISSN: 1536-1276, Online ISSN: 1558-2248, Digital Object Identifier: 10.1109/TWC.2022.3209898

[8] Marc Martínez Gost, A. Pérez-Neira, Miguel A. Lagunas, "DCT-based Air Interface Design for Function Computation," IEEE Open Journal on Signal Processing, January 2023.

[9].- Ana I. Perez-Neira, Fernando Pereira, Carlo Regazzoni, Caroline Johnson "SPS FLAGSHIP CONFERENCES OVER THE PAST 10 YEARS," IEEE Signal Processing Magazine, pp. 2-11, print ISSN: 1053-5888, Online ISSN: 1558-0792, Digital Object Identifier: 10.1109/MSP.2023.3240852September 2022

[10]. I.Leyva-Mayorga, Israel; M. Gost, M. Moretti, A. Pérez-Neira, M. A. Vázquez, P. Popovski, B. Soret, "Satellite edge computing for real-time and very-high resolution Earth observation," IEEE Trans on Communications, IEEE Transactions on Communications, 2023 doi: 10.1109/TCOMM.2023.3296584

[11] Ana I. Perez-Neira, Xavier Mestre "A Green ICASSP 2020 in Virtual Barcelona," IEEE Signal Processing Magazine, vol. 37, no. 5, pp. 146-151, Sept. 2020, doi: 10.1109/MSP.2020.3002515.

[12] Eva Lagunas, Ana Perez-Neira, Marc Martınez, Miguel Angel Lagunas, Miguel Angel Vazquez, and Bjorn Ottersten "Precoding with Received-Interference Power Control for Multibeam Satellite Communication Systems"Frontiers in Space Technologies, section Aerial and Space Networks, Front. Space Technol., 24 May 2021 | https://doi.org/10.3389/frspt.2021.662883

[13] Marius Caus, Ana Perez-Neira, Eduard Mendez "Smart Beamforming for Direct LEO Satellite Access of future IoT" Special Issue "Satellite Networks for Massive IoT Communication", Sensors (ISSN 1424-8220; CODEN: SENSC9), July 2021

[14] Marius Caus, A. Pérez-Neira "FBMC-based Random Access Signal Design and Detection for LEO Base Stations," IEEE Trans on Wireless Comm, accepted September 2022

[15] P. Henarejos, A.I. Perez-Neira, "Dual Polarized Modulation and Reception for Next Generation Mobile Satellite Communications", IEEE Transactions on Communications, Vol. 63, No. 2, pp. 3803-3812, Oct. 2015. Justification: This work led also to a patent and 2 journal publications. It is a disruptive technique that allows to improve the waveform flexibility in satellite transmission without the need to modify its hardware. Note that waveform flexibility, such as adaptive code and modulation, is key to boost the transmission speed in bits/s in any wireless communication system and reach the achievable capacity.

[16] X. Artiga, A. I. Pérez-Neira, J. Baranda, E. Lagunas, S. Chatzinotas, R. Zetik, P. Gorski, K. Ntougias, D. Pérez, G. Ziaragkas, "Shared Access Satellite-Terrestrial Reconfigurable Backhaul Network enabled by Smart Antennas at mm-wave Band," IEEE Network magazine, vol. 34, September 2018. Justification: This work describes the main innovation of the EC project SANSA, which has recently been selected to be published in the EC innovation radar platform. It is a disruptive concept and technology that allows the satellite and terrestrial segment to share frequency without interferring each other; thus, improving the radio spectrum usage.

[17] A. I. Pérez-Neira, M. A. Vázquez, B. Shankar, S. Maleki, S. Chatzinotas, "Signal Processing for High-Throughput Satellites," IEEE Signal Processing magazine, vol.36, no.4, pp. 112-131, July 2019. Justification: A terabit amounts to one trillion bits or 'pieces' of binary data and is the amount of data that is transferred in a second between two telecommunication

points or within network devices. To make Terabit satellites a reality, the boundaries of 'multibeam' technology must be pushed and this work describes how.

[18] A.I. Perez-Neira, M. Caus, M.A. Vazquez," Non-Orthogonal Transmission Techniques for Multibeam Satellite Systems," IEEE Communications Magazine, vol. 57, no. 12, pp. 58-63, December 2019. Justification: In 5G wireless communications the peak spectral efficiency has to increase 100 times that of 4G systems. To achieve this goal, the conventional orthogonal access techniques in time or frequency are not enough. For the first time, this work studies how non- orthogonal access techniques can be implemented in the satellite segment. My work in this topic led to the project AIM-SAT and some work items within Satnex.

[19] Màrius Caus, Ana I. Pérez-Neira, Joan Bas, Luis Blanco, "New satellite random access preamble design based on pruned DFT-spread FBMC," IEEE Transactions on Communications, Volume: 68, Issue: 7, pp. 4592-4604, July 2020. Justification: Currently, New Space has arisen in front of the classical communications with geostationary satellites. Namely, the communications with non-geostationary satellites may introduce interesting new features, such as, lower delays and mobile batery savings. To adopt such New Space or non-geostationary communications, new modulations and synchronization processing are introduced in this paper. This work has been the seed for my ICREA Academia grant, a work item in Satnex and a recent project with Huawai.

[20] V.Joroughi, M.Á.Vázquez, A.Pérez-Neira, "On-Board Beam Generation for Multibeam Satellite Systems", IEEE Transactions on Wireless Communications, Vol. 16, no. 6, pp. 3714-3726, Jun. 2017. Justification: Completely original paper on on-board processing. Although most current satellite systems have transparent payloads, this paper envisioned the possibilities of a new payload paradigm.

[21] V.Joroughi, M.Á.Vázquez, A.Pérez-Neira, "Generalized multicast multibeam precoding for satellite communications," IEEE Transactions on Wireless Communications 16 (2), 952-966, Dec. 2016. Justification: Completely original contribution in two topics. The first one is the study of multicast satellite systems, which was rare in 2016. The second aspect is the multigateway processing, which contrasted the usual single gateway systems.

[22] M.A.Vázquez, A. Pérez-Neira, D. Christopoulos, S. Chatzinotas, B. Ottersten, P.D. Arapoglou, A.Ginesi, G.Taricco, "Precoding in Multibeam Satellite Communications: Present and Future Challenges," IEEE Wireless Communications Magazine, pp. 1536-1284, vol. 23, no. 6, Dec. 2016. Justification: I realized the need to collect the different features of fix broadband satellite communications, their impact in the spatial precoding design and implementation, and the support introduced in the recently published DVB-S2X. I wrote the main body of the paper and managed the other contributions. This work is related with patent EP14172961.6

[23] B Devillers, A Pérez-Neira, C Mosquera, "Joint linear precoding and beamforming for the forward link of multi-beam broadband satellite systems,"Global Telecommunications Conference (GLOBECOM 2011), Houston (USA), pp.1-6. Justification: I used my knowledge on spatial precoding and beamforming for cellular communications to diminish the interference in a satellite context with high frequency reuse. Due to its practicality, it is one of the most cited works in the satellite domain. It is related to patent 07821338.6

[24] A. Perez-Neira, C. Ibars, J. Serra, A. del Coso, J. Gomez and M. Caus, "MIMO applicability to satellite networks," 2008 10th International Workshop on Signal Processing for Space Communications, Rhodes Island (Greece), 2008, pp.1-9. Justification: I devised and evaluated for the first time different situations where satellite communication could exploit the MIMO diversity or multiplexing gain. This work was part of a European Space Agency (ESA) project, which involved also the rest of co-authors.

[25] K Liolis, J Gómez, E Casini, Ana Pérez-Neira, "Statistical modeling of dual-polarized MIMO land mobile satellite channels," IEEE Transactions on Communications, 58 (11), p. 3077 – 3083, November 2010. Justification: This is the first MIMO statistical model for satellite

communication, which has been adopted as a reference by all subsequent signal processing works on MIMO satellite communication system analysis. Here I led the ESA project that proposedinvented this valuable and unique model.

[26] A.Perez-Neira, M.Caus, R.Zakaria, D.Le Ruyet, E.Kofidis, M.Haardt, X.Mestre, Y.Cheng, "MIMO Signal Processing in Offset-QAM Based Filter Bank Multicarrier Systems," overview paper in IEEE Transactions on Signal Processing, pp. 5733-5762, vol. 64, no. 21, Nov. 2016. Justification: There is only 1 overview paper per year in this journal. This is the first work in the literature on MIMO techniques with channel state information at transmission for filter bank multicarrier systems, which has been the basis in the discussion for new signal waveforms in 5G, both satellite and terrestrial. Convex Optimization relaxation techniques are developed, and complete control of multichannel processing is shown.

[27] A. Pérez-Neira, X. Mestre, J.R. Fonollosa, "Smart Antennas in Software Radio" IEEE Communication Magazine, vol. 39, no.2, p.166-173, February 2001. Justification: This work originated from a seminal publication co-authored by the nominee on IEEE TSP on Frequency Diversity Spread Spectrum (FDSS), which put forth a general-purpose multi-antenna transceiver for coded multicarrier systems. ). This publication was several years before OFDM and it is still useful as it sets the basis for new 5G waveforms and systems. The European project SANSA targets the implementation of millimeter wave beamforming for satellite as a backhaul for wireless communications.

[28] Diego Bartolomé, A. Pérez-Neira, "MMSE Techniques for Space Diversity Receivers in OFDM-based Wireless LANs," IEEE Selected Areas in Communications, Vol. 21, no.2, p. 151-160, February 2003. Justification: This paper offered the first beamforming technique for OFDM which introduced time-domain processing instead of frequency-domain processing to markedly lower complexity in DSP implementation performed by CEA-LETI. I originated the idea, being the leader and active technical participant of the project. This paper has been the precursor for the work on MIMO Filter Bank.

[29] A Pascual-Iserte, AI Pérez-Neira, MA Lagunas, "On power allocation strategies for maximum signal to noise and interference ratio in an OFDM-MIMO system," IEEE Transactions on Wireless Communications 3 (3), p.808-820, May 2004. Justification: Triggered by its success in Digital Subscriber Lines (DSL), where power is allocated differently across OFDM subcarriers, I provided, for the first time, a complete comparative and general view of the most relevant power optimization criteria in MIMO-OFDM communication systems. Afterwards, I extended it to Time Area Spectrum licensed and decentralized scenarios for 5G.

[30] L Giupponi, AI Pérez-Neira, "Fuzzy-based spectrum handoff in cognitive radio networks," CrownCom 3rd International Conference, p.1-6, May 2008. Justification: My experience in fuzzy processing and cross-layer physical/access design was used in this work in order to propose a completely novel approach to hand-off based on expert rules.

[31] A.I. Pérez-Neira, M.A. Lagunas, M.A. Rojas, P. Stoica, "Correlation matching approach for spectrum sensing in open spectrum communications," IEEE Transactions on Signal Processing, 57 (12), p.4823-4836, December 2009. Justification: This is the first high-sensitivity spectrum sensing technique rooted on the spectral shape. It competes with currently reported approaches. My patent US8290459 B2 has been issued on this invention.

**B.6. Most relevant coordinated projects (in the last 5 years)**

[2] Project SatNEx IV - Satellite Network of Experts IV
Funded by European Space Agency (ESA), ESTEC (https://satnex4.org/)
PI: Ana Pérez-Neira
Funding: 350 K€
Years: 14 February 2015 - 18 February 2019

[3] Project SatNEx V - Satellite Network of Experts V
Funded by European Space Agency (ESA), ESTEC (https://satnex5.cttc.es/)
PI: Ana Pérez-Neira
Funding: 350 K€
Years: 1 July 2020 - 1 July 2024
Justification: Leading SatNEx Network of Excellence is a great experience because it means:
conceiving the network and nourishing it with activities. It requires a very dynamic leadership
in order to stir up discussions and involvement among the more than 30 network members.
Conceiving new topics for future research and discuss them with ESA is also part of my
work.

[4] Project " TERESA - Hybrid TERrEstrial/Satellite Air Interface for 5G and Beyond"
Funded by Ministerio de Ciencia e Innovación. Ciencia y Tecnología, contract TEC2008-
06327-C03-01
PI: Ana I. Pérez Neira
Funding: 300 K€
Years: 01 January 2018 - 31 December 2020

[5] Project: "SATAI - Machine Learning and Artificial Intelligence for Satellite
Communications"
Funded by European Space Agency (ESA), ESTEC
PI: Ana I. Pérez Neira
Funding: 100.000€
Years: 24 June 2019 - 31 January 2020

[6] Responsible of the Joint Research Unit (JRU) between HISPASAT and CTTC since April
2017.

[7] Contract Title: ATTACH – Access techniques Satellite Networks
Financing: Huawai, China
PI at CTTC: Ana I. Pérez-Neira
Total amount: 100.000€ (funded by the industrial partner)
Time Period: Sep. 2018 – Sept. 2019

[8] Contract Title: SERP - Prototype Receiver for Spectrally Efficient Transmission Schemes
Financing: ESA – European Space Agency
PI at CTTC: Ana I. Pérez-Neira
Total amount: 42.000€ (funded by the industrial partner)
Time Period: Sep. 2015 – Sept. 2018

[9] Contract Title: AIM-SAT - System Demonstrator for Advanced Interference Mitigation
Techniques in Satellite Networks
Partner: Joanneum Research, Austria
PI at CTTC: Ana I. Pérez-Neira
Total amount: 42.000€ (funded by the industrial partner)
Time Period: Sep. 2014 – Sept. 2016

[10] Contract Title: Advanced air interface PHY and MAC design for future integrated
satellite-terrestrial networks.
Financing: Huawai
PI at CTTC: Marius Caus
Total amount: 200.000€

Time Period: March. 2021 – Dec. 2022

[11] Grant Title: ICREA Academia
Financing: ICREA
PI: Ana I. Pérez-Neira
Time period: January 2021-December 2025


**B.7. Active Patents (out of a total of 8 patent filed)**
[1] José Rubio Fernández, Ana Perez-Neira, Miguel Angel Lagunas, DELTA-SIGMA CONVERTER WITH PM/FM NON-LINEAR LOOP", Patent nº: 16750143.6-1203, Submission Date: 2/8/2016, Published in March 2019.

[2]P. Henarejos, A.I. Pérez-Neira, "Method and System for providing diversity in polarization of antennas", Reference Nº: PCT/2014/51801, Published in August 2015. Owner: CTTC. Extended to USA.

[3] P.D. Arapoglou, A. Ginesi, G. Taricco, D. Christopoulos, S. Chatzinotas, B. Ottersten, M.A. Vazquez, A. I. Pérez-Neira, S. Andrenacci, A. Vanelli-Coralli, "Joint Transmitter Signal Processing in Multi-Beam Satellite Systems", Reference Nº: EP14172961.6, Published in May 2017.

Rest of Patents (8 in total):

Currently I am trying to commercialize:
DELTA-SIGMA CONVERTER WITH PM/FM NON-LINEAR LOOP",
Patent nº: 16750143.6-1203

Other international patents are that I have developed are:
1.- Patent: WO 01/61885 A1, "Method for repeating isofrequency signals and isofrequency signal repeater."
US 7043203 B2, "Process for re-transmitting single frequency signals and a single frequency signal repeater," February2000
XB Miquel, DI Archs, PM Albert, MML Orozco, MN Marton, AIP Neira, GV Grau (in alphabetical order).

This is the patent for an adaptive MSE (mean square error) canceller of the couplings between antennas in terrestrial repeaters for single frequency networks such as those that operate in Digital Video/Audio Broadcasting-DVB, DAB, GSM networks, etc... Although the problem to be solved was nonlinear, the proposed linear MSE solution proved to be very suitable. It was the result of a project carried out for the Spanish company Mier S.A and this invention was key for their business as it allowed to cover the same service area with a smaller number of repeaters, reducing the implementation costs of the network in question. Although there are 7 authors of the patent (arranged in alphabetical order regarding the UPC authors), the project was carried out mainly by three people: Xavier Barba, Meritxell Lamarca and me. From this collaboration with Mier another contract subsequently emerged for the design of a fuzzy precorrector for DVB signals.

2.- Patent: WO/2009/000329, "Power allocation method in multiantenna systems under partial channel knowledge."
3.- Patent: PCT/EP2007/060971 "Beamforming technique for broadband satellite communications."
4.- Patent: PCT/2008/58098, "Spectral Shape Detection and Location."
5.- Patent: PCT/EP2008/056760 " Method of efficient channel allocation in wireless systems."
6.- Patent: WO/2015/113603A1 "Method and system for providing diversity in polarization of antennas."
7.- Patent nº: 16750143.6-1203 "Delta-Sigma converter with Pm/FM nonlinear loop."
8.- Patent: WO/2015/192995 "Joint transmitter signal processing in Multi-beam Satellite Systems".