

1 PERSONAL DATA



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2 PROFESSIONAL SUMMARY

Senior Electronic Engineer with over 40 years of consolidated experience in Telecommunications and Spectrum Engineering, both in key regulatory bodies in Argentina (ENACOM and its predecessors AFTIC, CNC and SCom -all acronyms derived from their Spanish names) and in the private sector. Distinguished career in leadership roles such as Engineering Coordinator, Head of Engineering, and Operations Manager, directing consulting, design, and implementation of complex telecommunications projects for large private companies and for the Argentine Terrestrial Digital Television System (SATVD-T for its Spanish initials), and as Laboratory Head and Antenna Factory Manager, managing the complete lifecycle (R&D+i, design, production, quality, installation, and maintenance) of low, medium and high-power antennas and radiating systems.

Being (*by the grace and for the glory of God*) also an expert in: radio spectrum planning, allocation, coordination, and management; design and deployment of terrestrial radio networks (Broadcasting, Fixed, Mobile), satellite networks (GSO/Non-GSO), and specialized systems (MVDDS, SCADA, Radar, ILS, etc.); radiowave propagation; and application of national and international regulatory frameworks. Solid technical leadership in strategic projects, development of regulations and advanced methodologies, simulation tools, interference analysis and Electromagnetic Compatibility (EMC) between terrestrial radiocommunication services, between space (GSO/Non-GSO) radiocommunication services, and mixed scenarios (space-to-terrestrial / terrestrial-to-space).

Driven by a strong multidisciplinary background in R&D+i and comprehensive technology management, and guided by a firm commitment to continuous learning and adaptability, essential in the disruptive era of AI, I am currently focused on developing advanced competencies in Artificial Intelligence. The objective is to apply this knowledge to drive innovation in the telecommunications sector, actively exploring the potential of AI and Machine Learning (ML) in next-generation networks (6G/7G).

3 KEY TECHNICAL SKILLS

- **Spectrum Engineering:**
 - Spectrum Planning, Allocation, Management, and Optimization.
 - National and International Coordination (MERCOSUR, CITELE, ITU).
 - Interference Analysis and EMC (terrestrial services, (GSO/Non-GSO) space services, and mixed scenarios (s-E / E-s)).
 - Advanced Radiowave Propagation Modeling (ITU-R P-Series Recommendations).
- **Radiocommunications:**
 - **Terrestrial Broadcasting:** FM Radio, VHF-Lo/Hi analog TV, VHF/UHF DTT (ISDB-T/TB, DVB-T/T2).
 - **Satellite Systems:** GSO (geostationary) and Non-GSO/NGSO (SSO/LEO/MEO/HEO). Key satellite services: FSS, BSS, DBS, EES, MSS, RNSS, etc.
 - **Fixed Terrestrial Systems:** Point-to-Point (PtP) and Point-to-Multipoint (PtMP) (VHF/UHF and Microwave (SHF/EHF)), including high-capacity E-Band radio links for mobile network backhaul (4G, 5G, and future 6G).
 - **Mobile Systems:** IMT-2000 (3G), IMT-Advanced (4G LTE-A), IMT-2020 (5G NR), and IMT-2030 (6G) technologies.
 - **Specialized Systems:** MVDDS (Multichannel Video Distribution and Data Service) in Ku-band (12 GHz), wireless SCADA (VHF/UHF), Space Radar (SSA/STM) in S-Band (2.93 - 2.98 GHz), ILS (VHF/UHF), and others.
- **Antennas and Radiating Systems:**
 - Theory, Design, Simulation (2D/3D), Development, Prototyping, and Testing (Laboratory/Field).
 - Measurement and Technical Verification (Fraunhofer far-field and Fresnel intermediate-field regions, UAV/Drones).
 - Characterization, Production, Tuning, Quality Control, and Maintenance.
 - **Types:** Parabolic, Dihedral Reflectors, Flat Panels, Yagi-Uda, Dipoles with/without Reflector, Mobile, Arrays, and Radiating Systems (omnidirectional, sectoral, and directional), including High-power Unique System of Antennas for FM Radio and UHF-DTT transmission (with linear, elliptical and/or circular polarization).
 - **Parameters:** Patterns, Gain, Directivity, Polarization (Linear, Elliptical, Circular), Down Tilt, Null Fill, Zin, VSWR, etc.
- **Technical Management and Consultancy:**
 - Telecommunication Network Planning and Design (Fiber Optics, Radio Links (VHF/UHF/Microwave), Digital Trunked Radio System, Wireless SCADA System).
 - End-to-End Technical Project Management.
 - Preparation of Technical Specifications and Tender Documents.
 - Techno-Economic Evaluation of Solutions and Vendor Selection.
 - Supervision of Implementation, Operations, and Maintenance (O&M).

- **Software and Tools:**
 - **Simulation and Design:** MATLAB, Pathloss, Radio Mobile, ICS Telecom, AutoCAD, MicroStation, DesignCAD.
 - **Geospatial Analysis and Management:** GIS (ArcGIS, MapInfo, ERDAS Imagine), Visualization (Google Earth), and ITU Radiocommunication Bureau (ITU-R) Tools (IFIC, GIMS, SpaceCap, SPS).
 - **Development:**
 - **Languages/Environments:** Visual Studio .NET, Python.
 - **Machine Learning/AI:** PyTorch, TensorFlow (currently under research and self-learning).
 - **Office Automation:** Microsoft Office Suite.
- **GIS and Geospatial Data:**
 - **Digital Terrain Model (DTM):** SRTM 3/1 arc-second (Shuttle Radar Topography Mission 3/1 arc-second, approximately 90/30 m resolution at the equator)), with the understanding that the native SRTM data is a Digital Surface Model (DSM) being used as a DTM substitute, in raster format (e.g., GeoTIFF - .tif).
 - **Digital Surface Model (DSM):** Includes clutter data (information on land cover types – e.g., urban, forest, suburban, rural, water – and the height of above-ground obstacles, such as buildings and vegetation), in raster (e.g., GeoTIFF - .tif) or vector (e.g., Shapefile - .shp) formats.
 - **Building and Urban Fabric Mapping:** 3D Buildings in vector format (e.g., Shapefile - .shp).
 - **Cartographic Projections:** Geo (Geographic latitude/longitude), GK (Gauss-Krüger), UTM, UPS.
 - **Reference System:** WGS84, EGM96.
 - **Geographic Information Systems:** GIS-CNC (Geographic Information System of the National Communications Commission).
- **Regulations and Standards:**
 - **Argentine National (ENACOM, CNC, SECom):** General and Technical Directives (DGs and DTs for its Spanish initials) and Resolutions.
 - **International:** ITU Radio Regulations (RR), ITU-R/ITU-T Recommendations, MERCOSUR/CITEL Agreements, ETSI, FCC, 3GPP Standards, etc.
- **Other Competencies:**
 - **Verification of compliance with ICNIRP** (International Commission on Non-Ionizing Radiation Protection) limits for human exposure to electromagnetic fields (EMF/NIR).
 - **Non-GSO satellite orbit predictor** using Two-Line Elements (TLE) with different models:
 - **Keplerian Model** (basic theoretical, without perturbations).
 - **ITU Model** (Rec. ITU-R S.1503-3) (SGP4/SDP4 with simplified perturbations).
 - **SGP4** (Simplified General Perturbations 4) Model for Low Earth Orbits (LEO).
 - **SDP4** (Simplified Deep-space Perturbations 4) Model for Medium Earth Orbits (MEO) and Highly Eccentric Orbits (HEO) with a geostationary apogee altitude (approx. 35786.055 km).
 - **Quality of Service (QoS) and Availability of Digital Fixed Radio Systems (DFRS) Point-to-Point (PtP)** (PDH 2/8/34/140 and SDH 1/2/4 x STM-1 Networks).
 - **AI/ML applications in mobile radiocommunications (6G/7G)** (currently under research and self-learning).

4 PROFESSIONAL EXPERIENCE

Continuity of employment under different names: National Communications Commission (CNC) (03/1997 – 12/2014), Federal Authority for Information and Communication Technologies (AFTIC) (12/2014 – 01/2016), National Communications Entity (ENACOM) (01/2016 – Present).

4.1 Senior Professional, Satellite and DTT Technical Support Area, Subdirectorate of Radioelectric Networks (SRR), National Directorate of Planning and Convergence (DINAPyC), National Communications Entity (ENACOM) (07/2015 – Present)

Technical leadership in the continuous development of advanced methodologies, software applications, and regulatory frameworks for Satellite services (GSO and Non-GSO), FM Radio (analog) and DTT broadcasting services, and mobile services; adapting to new technologies (5G/6G, Non-GSO, E-Band, etc.).

- **Update of GMC Resolution No. 64/97** "Procedures Manual for Coordination between Earth Stations (GSO and Non-GSO) and Terrestrial Fixed Service Stations within MERCOSUR countries (in frequency bands between 100 MHz and 174.8 GHz)." (09/2024 – Present).
- Development of methodologies and tools for **EMC analysis between Terrestrial Fixed Service (Point-to-Point DFRS) and Non-GSO Fixed Satellite Service (NGSO FSS) Earth Stations in E-Band (71 - 76 GHz and 81 - 86 GHz)**, including Non-GSO satellite orbit prediction (e.g., Starlink Gen2 satellite network) and calculation of coordination zones around NGSO FSS earth stations (e.g., Gen2 Starlink Gateway Site) (09/2024 – Present).
- Leadership in **updating General Directive 61 version 3 (DG 61-03 for its Spanish initials) for interference calculation in Fixed Services (0.1 - 174.8 GHz, includes E-Bands (70 GHz and 80 GHz), W-Band (92 - 114.5 GHz), and D-Band (130 - 174.8 GHz))**, incorporating very high-capacity backhaul radio links for 4G, 5G, and future 6G mobile networks, aligning with ITU-R P.452-18, (09/2024 – Present).
- Development of methodology, procedure, and a software application tool for **antenna and antenna system measurement with 3D modeling, including planning and execution of flight plans (including autonomous operations)**

for measurement campaigns with **Unmanned Aerial Vehicles (UAV/Drones)** in the frequency range of 30 MHz to 44 GHz, based on ITU-R BS.1195-1 and SM.2486-1 (for far-field and intermediate-field regions) (07/2024 – Present).

Main measurements:

- Directivity, gain, and 3D radiation patterns (co-polar and cross-polar).
- Main beam tilt (Down Tilt) and first null fill (Null Fill).
- Equivalent Isotropically Radiated Power (EIRP), off-axis power density, and cross-polarization discrimination.
- Antenna gain towards the horizon as a function of azimuth (0° to 360°).
- Measurement of radiofrequency electromagnetic fields (EMF/NIR) to determine compliance with human exposure limits provided by ICNIRP based on ITU-T K.52-7, K.61-3, and K.100-6.

Key applications:

- **30 - 300 MHz:** FM Radio (76 - 108 MHz) and VHF TV (analog & digital), VHF ILS (108 - 112 MHz), and VHF PtP systems.
- **300 - 6000 MHz:** UHF DTT, mobile networks (4G, 5G), Wi-Fi, UHF ILS (328.6 - 335.4 MHz), and PtP/PtMP systems.
- **1 - 44 GHz:** High-capacity terrestrial PtP/PtMP systems, including mobile network backhaul (3G/4G/5G), and GSO earth stations for satellite broadcasting (BSS) and fixed (FSS) services.
- Development of the **FM Radio regulatory framework (76 - 108 MHz, including extended 76 - 87.8 MHz band)**, aligned with MERCOSUR GMC Resolution No. 47/2022 (V2.0 – 04/2024).
- Development of a software application tool for **Point-to-Point (PtP) and Point-to-Zone (PtZ) radio links (30 MHz - 6 GHz)** based on ITU-R P.1546/P.1812, determining useful/interfering signal coverage (or level) for outdoor/indoor reception (V2.0 – 12/2023) for services:
 - **Analog systems:** Open channel radio, single-channel systems, trunked systems (MPT1327), FM Radio, and VHF TV.
 - **Digital systems:** TETRA, DMR, UHF DTT (DVB-T/T2, ISDB-T/TB), Mobile Systems up to 5G.
- Development of methodology, and a software application tool for **LTE Private Broadband Mobile System (SPBAM for its Spanish initials) coverage simulation** based on ITU-R P.1812 (V1.0 – 04/2023).
- Development of a methodology for **predicting useful and (co-channel/adjacent-channel) interfering signals in UHF SFN networks (470 - 698 MHz, Chs. 14 - 51) for calculating ISDB-T/TB DTT coverage in Argentina's Open Digital Television (TDA for its Spanish initials) (V3.0 – 04/2021).**

Main components of the method:

- Field strength prediction model, Tx-Rx radio link model, receiver model, and sum model of log-normal distributions.
- **Carrier-to-Interference-plus-Noise Ratio (CINR)** calculation.
- **Coverage probability** model.
- Technical Analysis of **LeoLabs Inc.'s S-Band PAFR (Phased Array Offset-Fed Reflector) Space Radar System** for detection and tracking of LEO objects/debris: Impact on Space Situational Awareness (SSA) and Space Traffic Management (STM) (07/2020)

Main Features:

- System performance analysis for detecting objects with **minimum Radar Cross Section (RCS)**, as a function of elevation angle for dynamic or static scanning.
- Evaluation of the system's capacity to prevent catastrophic collisions, complying with **the Space Situational Awareness (SSA) and the Space Traffic Management (STM)** requirements.
- Real-life case studies of satellite tracking (e.g., **COSMOS 2484, IRIDIUM 111, SAOCOM 1A, and STARLINK-1347**).
- **Impact Evaluation of Directive Receiving Antennas in UHF MFN TDT Networks for TDA (Open Digital Television of Argentina) (11/2019).**
- Development of coverage a software application tool for **MVDDS (12 GHz), FM Radio, VHF-Lo/Hi TV, and UHF DTT (12/2018 – 04/2019).**
- **Technical supervision, survey, and field testing of MM Comunicaciones S.A.'s MVDDS experimental system. (12/2018).**
- Development of methodologies and specifications for **UHF DTT receiving antennas (10/2018).**
- **Planning of MVDDS services in 12.2 - 12.7 GHz, including interference assessment with DBS/DIRECTV. (01/2018).**

4.2 Engineering Coordinator of the Advisory Council of the Argentine Terrestrial Digital Television System (SATVD-T for its Spanish initials), Ministry of Planning, Public Investment, and Services in Telecommunications (03/2010 – 06/2015)

- Led the **comprehensive technical coordination of the nationwide deployment of SATVD-T (ISDB-T/TB standard)**, from technology assessment to network optimization.
- Managed the **planning of DTT (Digital Terrestrial Television) networks in multi-frequency (MFN), single-frequency (SFN), and hybrid MFN-SFN topologies, including infrastructure design, UHF spectrum optimization, and system administration.**
- Supervised the **generation of over 2300 technical documents** (Reports, EDTs (Digital Terrestrial Stations, from Spanish initials) Technical Data Sheets, Standards, Simulations, GIS Maps).
- Made decisive contributions to key **SATVD-T Technical Standards (NT 001 - 004, RE 003) and foundational Resolutions.**
- Designed and specified over **240 DTT radiating systems (High/Medium/Low-Power A/B/C/D/D+ Types (DTT), and High-Power Differential Types (DTT-FM): Ministry of Public Works (MOP) Building, Alas Building (Alas), Devoto, Florencio Varela, and Avellaneda Unified Communications Tower (Avellaneda (TUC)).**
- Performed **over 2900 coverage/interference simulations, generated over 2900 thematic GIS/SDI maps, and executed far-field Non-Ionizing Radiation (NIR) calculations generated for all types of SATVD-T transmitter stations.**

- Designed and developed the calculation methodology and an accompanying software tool for **high-availability (99.999%+) 2+1 SDH STM-1 (155.52 Mbit/s) Studio-to-Transmitter Links (STL)** utilizing space and frequency diversity. These critical links support the distribution of DTT and digital radio (DAB/DAB+) signals, as well as telecom backhaul, operating primarily within licensed microwave bands (e.g., 6 GHz, 8 GHz) as per local regulations.
- Conducted **studies and analysis of interference (internal/external; co-channel/adjacent-channel) in and between SFN (Single Frequency Network) and MFN (Multiple Frequency Network) systems** for:
 - **SATVD-T** (Argentine Digital Terrestrial Television System)
 - **AFSCA** (Federal Authority for Audiovisual Communication Services)
- Managed the planning and implementation of **SATVD-T Phases I, II, and III (deployment of >110 EDTs)** and the planning of **Final Phases (>150 additional EDTs)**, including **complex high-power differential sites (MOP, Alas, Devoto, Avellaneda (TUC))**.
- Planned **network optimization strategies (Phase IV)**, including the development of **DSM/Clutter models and advanced propagation algorithms**.
- Led the **strategic international technical commissions for the design of the Avellaneda Unified Communications Tower (TUC)**, evaluating technologies and best practices by visiting world-class manufacturers, specialized laboratories, antenna measurement ranges, and iconic transmission towers worldwide:
 - **TECHNICAL MISSION (04/06/2013 – 15/06/2013):**
 - **AUSTRALIA:** RFS (Radio Frequency Systems) and TXA (TX Australia Pty Limited) transmission site towers at Ornata Road and Eyre Road.
 - **TECHNICAL MISSION (25/06/2010 – 09/07/2010):**
 - **BRAZIL:** KATHREIN (Kathrein Broadcast GmbH), São Paulo Tower.
 - **GERMANY:** LS Telcom (LS telcom AG), R&S (Rohde & Schwarz GmbH), SPINNER (Spinner GmbH), KATHREIN, Wendelstein Mountain Tower, Munich Unique Communications Tower.
 - **SPAIN:** RYMSA (now Sener), MIER (Mier Comunicaciones S.A.), Torrespaña RTVE (Radiotelevisión Española), Collserola Tower.
- **Visit to the CPqD Foundation (Center for Research and Development in Telecommunications) in Campinas, São Paulo, Brazil, for the presentation and validation of the Provision of Services and the Spectrum Control Tool for broadcasting (AM, FM) and television (TV) services in Argentina, intended for AFSCA (11/11/2013 to 14/11/2013).**
- **Visit to the CONSULFEM S.A. antenna factory and the Antenna Measurement Laboratory (LaMA) of the National Commission on Space Activities (CONAE for its Spanish initials) to conduct the world's first validation of UHF DTT Radiating Systems WITH SLANT POLARIZATION, an innovation proposed by Eng. Omar Alfredo Castaño (06/24/2013).**
- Provided expert technical advice and design support for the **initial deployment of National Digital Terrestrial Television (DTT) systems in Venezuela (SVTVD-T), Bolivia (SBTVD-T), and Paraguay (SPTVD-T), based on their Spanish acronyms.**
- **Technical Lead for the Commissions on the Initial Deployment of the SATVD-T (Argentina) and SBTVD-T (Bolivia) Systems.** Led the process of site surveys, site selection, and coverage analysis for the installation of high and medium-power Digital Terrestrial Television (DTT) Transmitter Stations (EDT, the acronym for the Argentine system).
 - **Bolivian Commission (Initial Phase of SBTVD-T) (03/06/2013 – 17/06/2013):** Directed the technical analysis across all departmental capitals, as well as in other cities and strategic locations.
 - **Argentine Commission (Initial Phases of SATVD-T) (01/03/2010 – 30/09/2010):** Directed the technical analysis across all provincial capitals, as well as in other cities and strategic locations.

(See Certificate of Employment from the SATVD-T Advisory Council with specific technical details and support for this period, available in Attachment 1)

4.3 Coordinator of the Spectrum Engineering Working Group (ETIE for its Spanish initials) of the CNC (10/2004 – 01/2009)

- Led a multidisciplinary team focused on **modernizing regulations and Technical Analysis tools**.
- Coordinated the **"Technical Analysis Project"** (Res. CNC N° 3180/04), responsible for the development and implementation of **methodologies and tools for radio spectrum engineering and management**; where I was author/co-author/leader of the following developments:
 - **57 Technical Reports (ITs for its Spanish initials) covering:**
 - Radio propagation modeling (diffraction, gases, rain, multipath; 10 kHz - 1000 GHz).
 - Analysis and modeling of terrestrial/satellite antennas and antenna systems (2D/3D patterns, directivity, gain, noise temperature; >30 MHz).
 - **Antenna Measurement Laboratory (ALMA for its Spanish initials):** Development of the techno-economic feasibility study to implement a laboratory for far-field/near-field (FF/NF) antenna and radiating system measurements (88 MHz - 44 GHz+). This laboratory is designed to verify key electrical characteristics for national (Testing requirement of verification and homologation) and international technical recognition, and is essential for efficient spectrum management and electromagnetic compatibility (EMC).
 - Development and specification of Digital Terrain Models (DEM/DSM) (SRTM 3/1 arc-second, clutter data).
 - Geodesy and cartography (WGS84/EGM96, Geo/GK/UTM/UPS, TLE).
 - Electromagnetic Compatibility (EMC), EMF/NIR limits, frequency coordination.
 - Analysis of GSO/Non-GSO Satellite Systems (dfp (Power Flux Density)/epfd (Equivalent Power Flux-Density)).

- System parameters (RSL (Receive Signal Level), FM (Fade Margin), TD (Threshold Degradation), NF (Noise Figure), T_{rx} (Receiver Temperature), T_{ant} (Antenna Temperature), T_{rx_system} (Receiving system noise temperature), G/T Ratio (Figure of Merit), NFD (Net Filter Discrimination), BER (Bit Error Rate), etc.).
- **7 volumes of the Radio Spectrum Engineering Manual (Manual IER for its Spanish initials) standardizing calculations** (based on ITU-R):
 - **Vol 1:** Calculation of Point-to-Area/Point-to-Multipoint (PtZ/PtMP) Radio Links (30 MHz - 50 GHz).
 - **Vol 2:** Calculation of Point-to-Point (PtP) Radio Links (useful and interfering) between stations (SF/ET) on the surface of the Earth (>30MHz).
 - **Vol 3:** Coordination Zones for Non-GSO Earth Stations (App. 7 of the ITU RR / Rec. ITU-R SM.1448-1).
 - **Vol 4:** International Coordination (EMC) between GSO Satellite Systems vs Fixed Service (SF) Systems.
 - **Vol 5:** International Coordination (EMC) between Non-GSO Satellite Systems vs Fixed Service (SF) Systems.
 - **Vol. 6:** Design of GSO FSS Satellite Radio Links (C/Ku/Ka).
 - **Vol. 7:** Verification of Power Flux Density (PFD) in GSO FSS (Art. 22 of the ITU RR).
- **11 Functional Specifications (EFs for its Spanish initials)** for software development (Antenna Visualization, GIS, Orbital Prediction).
- **Development of GIS-CNC (Geographic Information System)** integrating DEM/DSM, Landsat, communications layers.
- **27 Draft Technical Standards Projects (PNTs for its Spanish initials)** to update regulations (CNC GDs) and align with MERCOSUR/ITU.
- **Technical databases** (Antennas, Equipment, Geo-Climatic factors).
- **Training Courses (CCs for its Spanish initials).**

4.4 CNC Technical Representative and Member of the Coordinating Committee of the CNC-CONAE Specific Cooperation Project (PEC CNC-CONAE) (10/2005 – 01/2009)

- Managed CNC-CONAE technical collaboration for **Electromagnetic Compatibility (EMC) between systems belonging to the Earth Exploration-Satellite Service and the terrestrial Fixed Service operating in shared bands and zones.**
- Coordinated exchange/integration of technical products:
 - **From CONAE:** **Orbital prediction software** (SGPP, HPOP, and ORBANS), **Software for automatic reading** (ITU BR IFIC (Space Services), and NORAD TLE (Two-Line Elements)), and **Geographic Sciences Support Products** for the PEC CNC-CONAE Study Area, composed of:
 - MDT (Digital Terrain Model) cells 5° x 5° / 1° x 1° Geo.
 - MDS (Permanent and Semi-Permanent Water Bodies) cells 1° x 1° Geo/UTM/GK, with metadata.
 - Geo mosaics by Path of Permanent and Semi-Permanent Digital Water Bodies.
 - Georeferenced Landsat Images Geo/UTM/GK (5 TM and/or 7 ETM+) with 5 bands, including metadata.
 - Landsat Image Quality Patterns (5 TM and/or 7 ETM+) 1° x 1° with 3 Bands (3, 2, and 1).
 - Landsat Images 1° x 1° / 3° x 3° Geo/GK (5 TM and/or 7 ETM+) with 3 Bands (3, 2, and 1), including metadata.
 - **To CONAE:** **Development of Interference Simulation Software Tool**, including:
 - **Non-GSO orbital simulator** (ITU/SGP4/SDP4 propagators).
 - **Calculation of horizon profiles** (based on DEM).
 - **Statistical analysis of antenna gain towards the horizon (CDF/CCDF).**
 - **Coordination Zone calculation module** (TVG method - Rec. ITU-R SM.1448-1).
 - **Detailed Interference Analysis Modules within the Coordination Zone.**
 - **Generation of GIS layers.**
- Facilitated the production of compatible **geographic data (DEM/DSM)** (WGS84, Geo/GK/UTM).
- Ensured EMC analysis capabilities in the shared frequency bands between Fixed Services (FS) and Earth Stations operating in the Earth Exploration-Satellite Service (EESS), for CONAE's Córdoba Earth Station (located at the Teófilo Tabanera Space Center (CETT for its Spanish initials), in Falda del Carmen), which operates with the Argentine satellites SAOCOM and SAC-A/B/C/D/Aquarius, as well as international satellites such as Landsat, Spot, EROS, Terra, Aqua, NPP, NOAA, and GOES.

4.5 Co-author of the Integrated Management System (SIA for its Spanish initials) Project and Technical Analysis Project of the CNC (01/2004 – 10/2004)

4.5.1 Coordinator in Spectrum Engineering Affairs of the CNC Engineering Management (05/2000 – 09/2004)

- Responsible for updating and developing new GDs/TDs, harmonizing technical criteria (national/international).
- Developed the standard: **"Digitization of Radiation Pattern Envelopes for Terrestrial Antennas Operating in the 30 MHz to 60 GHz Frequency Range"**. This work was presented at the following events in 2001:
 - 18th Meeting of MERCOSUR's Working Group #1 "Communications", in Montevideo (July 31).
 - The Argentine Chamber of Informatics and Communications (CICOMRA for its Spanish initials) (September 6).
 - The Professional Council of Telecommunications, Electronic, and Computer Engineering (COPITEC for its Spanish initials) (December 19).
- Author of the technical project **"Expansion of the Coverage Area of the Cellular Mobile Radiocommunication Service (CMRS) for the City and International Airport of El Calafate, Perito Moreno Glacier, and Access Routes"**, working commission held from April 21 to 24, 2000.
- Co-author of **General Directives (DGs for its Spanish initials) (for Fixed and Mobile Services)** (2000):

- **DG 33:** Maximum Admissible Useful Signal for Terrestrial Fixed and Mobile Services in Metric and Decimetric Waves.
- **DG 36:** Useful Signal Calculation for Terrestrial Mobile Service Systems below 512 MHz.
- **DG 54:** Useful and Interfering Radio Link Calculation for Analog Single-Channel Systems below 512 MHz.
- **DG 61:** Interfering Radio Link Calculation Methodology for Radiocommunication Systems operating at frequencies above 1000 MHz.

4.6 Head of the Non-Geostationary (Non-GSO) Sub-sector of the Space Services Area, CNC Engineering Management (03/1997 – 09/2004)

- Performed technical analysis, coordination, approval, and assignment of GSO and Non-GSO space systems (Little LEO, Big LEO -MEO-, and Broadband LEO).
- Author of the technical analysis **"Spectrum Coexistence in Teledesic's LEO Satellite System (Non-GSO FSS)"** (2003).
 - Evaluated the network architecture of Teledesic's proposed 288-satellite Low Earth Orbit (LEO) constellation, a "Broadband LEO" system designed for global broadband services.
 - Focused on spectrum sharing in the 18.8 - 19.3 GHz Ka-band for space-to-Earth downlinks, assessing interference risks with terrestrial Fixed Services (FS).
 - Findings indicated significant coexistence challenges, influencing regulatory decisions such as Argentina's Resolution 1608SC/98, which allocated the band exclusively to Non-Geostationary Fixed-Satellite Service (NGSO FSS) to mitigate interference.
 - Today, this same band is critical for Starlink's second-generation (Gen2) constellation, deployed since late 2022 to enhance global capacity and coverage.
- **Served as technical expert representing CNC at the ITU Working Party 4A (WP 4A) meeting in Geneva, which evaluated technical criteria for spectrum sharing in the 18.8-19.3 GHz Ka-band by Non-Geostationary Fixed-Satellite Service (NGSO FSS) systems (18/03/2003 – 18/03/2003).**
- Presentation **"Space Services Area"** developed at CNC for the Administration of the Republic of Bolivia, December 6, 2002.
- Presentation **"Synthesis of Aspects Related to Space Services"** developed at the Buenos Aires Institute of Technology (ITBA for its Spanish initials) on September 19, 2002.
- Member of the radiopropagation specialists' commission to elaborate the **"Manual for Frequency Coordination of Earth and Terrestrial Stations (in C and Ku Bands)"** of MERCOSUR Working Group No. 1 "Communications" (GMC RESOLUTION No. 60/01) (1997 – 2001).
- Technical responsible for **coordination of pioneering Non-GSO earth stations:**
 - **Orbcomm (LEOTELCOM-1, Little LEO type)** in Justo Daract, San Luis Province (1997 – 1999).
 - **Globalstar (HIBLEO-4FL, Big LEO type)** in Bosque Alegre, Córdoba Province (1998).
- Responsible for **the international coordination of the ICO Global Communications satellite network (Non-geostationary Intermediate Circular Orbit (ICO) system) with Terrestrial Fixed Service Systems in the shared 2185–2200 MHz downlink (space-to-Earth) band (1998 – 1999).**
- Responsible for the Validation of **the FS/MSS Interference Simulation Program Version 2.00 for the coordination of the ICO Global Communications satellite network (Non-geostationary Intermediate Circular Orbit (ICO) system) with Terrestrial Fixed Service Systems, commission carried out at CPqD in Brazil (1999).**
- Actively participated in **MERCOSUR commissions, and in evaluation of the AFMS (Automated Frequency Management System) IT System, and international delegations as expert in Non-GSO Satellite systems (ITU-R, WRC-2000, CITE).**
- Conducted technical audits and international consultancy (ITU to Peru) and Acted as Rapporteur WRC-2000 Preparatory.
- Co-Author of the automated Table of Frequency Allocations in the Argentine Republic (CABFRA99) (1999).
- **Interim Head of the Space Services Area (1999).**

4.7 Operations Manager (ENTESA for its Spanish initials) / Head of Engineering and Development (Radiocommunications, Propagation, and Antennas) (PCSA for its Spanish initials)

Empresa de Nuevas Tecnologías S.A. (ENTESA) (07/1994 – 02/1997) & Professional Communications S.A. (PCSA) (03/1994 – 06/1994)

Leadership and Management: Progression from Head of Engineering and Development (PCSA) to Operations Manager (ENTESA S.A.), supervising multidisciplinary teams and operations of comprehensive consulting and specialized support in advanced technological projects.

Strategic and Technical Consulting: Directed and participated in comprehensive consulting services for key clients (EDEER S.A., Gas Natural BAN S.A., Petrolera San Jorge S.A.), covering:

- Strategic and scenario planning.
- Feasibility, risk (technical, regulatory, financial), and operational/commercial needs analysis.
- Diagnosis of existing systems and design of technological solutions (SCADA, data networks, VHF/UHF mobile).
- Evaluation and selection of technologies and suppliers.
- Development of corporate communications plans and implementation plans.

System Design and Engineering: Responsible for the detailed design and engineering of complex telecommunications systems, including:

- Backbone and access networks (Fiber Optics, Microwave, Cable).

- Mobile Communications Systems (traffic analysis, coverage, channel allocation).
- SCADA systems for telemetry and telecontrol in energy and oil/gas sectors.
- Design of site infrastructures (towers, shelters).

Project and Tender Management:

- General coordination and management of "turnkey" project implementation.
- Preparation of detailed Request for Proposal (RFP) documents, defining technical, contractual, and security specifications.
- Assistance in bidding processes: technical/economic evaluation of offers and contract negotiation.
- Supervision of execution, inspections (factory/field), audits, and acceptance tests.

Regulatory Compliance: Management and preparation of technical documentation for submissions and obtaining licenses from regulatory bodies: Argentine Air Force (FAA for its Spanish initials) and National Telecommunications Commission (CNT for its Spanish initials).

Innovation and Development (R&D): Actively contributed to R&D programs, including the development of organizational models, analysis methodologies, and the design of Special Radiating Systems with innovative technology (applied in projects for Gas Natural BAN S.A. and EDEER S.A.), a precursor to later designs (UHF DTT Single Antenna Systems) carried out by the SATVD-T Advisory Council in 2013.

Highlighted Projects:

- **EDEER S.A.:** Design and implementation of the Corporate Communications Plan.
- **Gas Natural BAN S.A.:** Design and implementation of the Comprehensive Communications Plan (Data, Voice, SCADA).
- **Petrolera Argentina San Jorge S.A.:** Design and implementation of telecommunication systems for SCADA in oil fields.
- **Argencard S.A.:** Project and implementation of a data radio link.

(<https://professionalcommunicationssa.com/>)

4.8 Head of Antenna Laboratory / Factory Manager (Acting) (07/1986 – 11/1993)

Antenas Profesionales S.A. (07/1991 – 11/1993), AHF Antenas S.A. (07/1987 – 06/1991) y AMPO S.A.C.I.F.A. (07/1986 – 03/1987)

Companies specialized in consulting, design, production, and commercialization of Radiating Systems and Equipment for Radio, Television, and Radiocommunications (standard and professional).

Assumed Head of the Antenna Laboratory for 8 years in three leading companies in the sector, comprehensively managing the technical lifecycle of radiating systems. My key responsibilities included:

Technical Management and Laboratory Leadership:

- **Leadership of the Antenna Laboratory:** Comprehensive management of the area, ensuring operational efficiency and technical quality.
- **Quality and Adjustment Supervision:** Responsible for supervising the adjustment and quality control processes of all manufactured and/or commercialized radiating systems.
- **Technical Project Management:** Analysis and cost estimation for new antenna and radiating system projects.
- **Technical Responsibility:** Acted as Technical Responsible in quality inspections and in public/private tenders related to radiating systems (AMPO).

Design, Development, and Innovation (R&D):

- **R&D Leadership:** Led and executed the development of new radiating systems and the optimization/improvement of existing products.
- **Development of Antennas and Components:** Carried out the design and development of a wide range of antennas and components (with complete manufacturing drawings in CAD) for various applications:
 - **Low, Medium, and High-Power TV/FM Radiating Systems:** Design and development of antennas for transmission/reception in VHF (Channels 2-13) and UHF (Channels 14-83) bands, including dipoles (open, folded), dipole arrays (2 to 16 dipoles), Yagi antennas (3 to 13 elements, 50/75 ohms), Batwing antennas (H-polarization), and FM transmitting antennas (V/H/Circular polarization).
 - **Radiocommunications Radiating Systems:** Development of antennas for fixed/base stations in VHF and UHF, including omnidirectional and mobile antennas (double 5/8λ UHF, 800-900 MHz cellular line).
 - **High-Gain Antennas:** Development of parabolic antennas (2, 3, 4 m grid reflectors; dismountable / welded / semi-dismountable) and antennas with para-dihedral, flat, and dihedral reflectors, with their corresponding illuminators for VHF/UHF.
 - **Low, medium and high-power RF Components:** Design and development of broadband harnesses (up to 26 ways), adjustable high-power dividers (up to 8 ways), harmonic filters, and baluns for VHF/UHF.
- **Test Infrastructure:** Design and dimensioning of the test range for VHF/UHF antennas, defining measurement methodologies and protocols.

Technical Support, Consulting, Production and Operations Management (Additional Responsibilities):

- **Technical Consulting:** Provided specialized technical support to the Commercial Area, developing projects and offering advice on VHF/UHF radiocommunication systems.
- **Production Supervision:** Controlled and organized the production of special antennas and supervised the production line.

- **Acting Factory Manager:** Temporarily assumed the leadership of Factory Management, reporting to General Management. Was responsible for organizing production and supervising key areas: Assembly (standard/special antennas, electronics), Technical Office, Warehouses, Maintenance, Machining (machining, sheet metal, welding, tool and die, presses), and Purchasing.

4.9 Specialist Engineer (05/1983 – 06/1986) / Technician (04/1980 – 04/1983)

Secretariat of Communications (SECom) (04/1980 – 06/1986)

- Progressed from Technician to Specialist Engineer, supervising analysis, approval and assignment of frequencies/systems for Fixed Service (single and multichannel in VHF/UHF/Microwave) and Mobile Service (single channels in VHF/UHF) under national and international regulations (ITU).
- Development of methodologies for the prediction of useful and interfering signals for quality calculation in radio communication systems of the Fixed Service (FS), operating on frequencies above 30 MHz within the VHF, UHF, and microwave bands.

This work was carried out as a member of a joint working commission between SECom (through its Spectrum Engineering and Frequency Assignment Departments) and the Argentine Chamber of Electronic Industries (CADIE for its Spanish initials), with the participation of its main associated companies (TELETTRA ARGENTINA S.A.I.C., THOMSON-CSF ARGENTINA S.A.I.C., GTE INTERNATIONAL INC., and EASTEL S.A.I.C.).

The primary responsibility of the commission was to elaborate the quality calculation methodologies for:

- Single-channel Fixed Service (FS) Systems operating below 512 MHz.
- Multi-channel Frequency Division Multiplexed (FDM) Systems of the Fixed Service operating below 1 GHz.
- Analog and Digital multi-channel Radiocommunication Systems of the Fixed Service operating above 1 GHz.
- **Acting Head of the VHF, UHF, and SHF (Microwave) Section**, comprising the Terrestrials Fixed and Mobile Service Sub-Sectors (1985).

5 RELEVANT COMPLEMENTARY TRAINING (Selection)

- Continuous self-directed learning to stay at the forefront of R&D+i in Telecommunications, with high resilience and adaptability to dynamic environments, emerging technologies, and changing paradigms. (AI/ML for 6G, Neural Modeling, E2E Optimization, MLOps and THz, and autonomous systems (SDR, drones, robotics) + spectral monitoring (Tools: PyTorch, TensorFlow, etc.) (2024 – Present).
- Postgraduate Degree in Digital TV – University of Palermo (384 hours, 2009–2011)
- ITU Seminars / International Forums (Radiocommunications, VSAT, GMPCS, Satellites) (1997 – 2008)
- .NET Development Courses (ASP.NET, VB.NET, XML Web Services) – Microsoft Certified (2005)
- Seminars on Space Systems and Interference (Dr. Benito Gutiérrez Luaces, CSC/NASA) (1998 and 2008)
- Courses on Satellite Link Calculation and Satellite Communications (COPITEC, NahuelSat) (1997 – 1998)
- Specific Technical Courses (RF Measurements, TV and Communications Systems) (SECom/LaNTel, UTN/ENTel, UTN/ATC) (1983 – 1986)

6 EDUCATION

- **Electronic Engineer** – National Technological University (UTN), Avellaneda Regional Faculty (1983)
- **Electronics Technician (Telecommunications)** – E.N.E.T. No. 3 "Dr. Salvador Debenedetti" (1976)

Certificate of Employment

Buenos Aires, June 8, 2015

We hereby certify that Eng. Omar Alfredo Castaño, National ID No. 12507724, has been providing professional services from March 1, 2010, to the present date as Engineering Coordinator for the Advisory Council for Terrestrial Digital Television (TDA) of the Ministry of Planning, Public Investment, and Services in Telecommunications, from Monday to Friday, from 7:30 am to 3:30 pm, at the office located at 744 Tucumán Street, 6th floor, Buenos Aires City. Among the professional services he provides are:

Terrestrial Digital Television Coordinator:

Performing coordination tasks, from local implementation to the national scope of the Terrestrial Digital Television System, for all stages of network acquisition and operation, such as:

- ✓ **Technology assessment**
- ✓ **Project modeling**
- ✓ **Infrastructure dimensioning and project design**
- ✓ **Network planning**
- ✓ **Spectrum optimization**
- ✓ **Sharing engineering data**
- ✓ **System administration**
- ✓ **Network optimization**

Special Tasks, Commissions, and Surveys:

- **Diseño**Design of Medium, Low, and High-Power Digital Terrestrial Stations (EDTs) for SATVD-T (2009 to current date):

- Type A $H_{TOWER} = 153m$ and DTV Power = 12x1kW for Coverage_{OUTDOOR} = 44km
- Type B $H_{TOWER} = 81m$ and DTV Power = 12x1kW for Coverage_{OUTDOOR} = 34km
- Type C $H_{TOWER} = 45m$ and DTV Power = 12x0.5kW for Coverage_{OUTDOOR} = 22km
- Type D+ $H_{TOWER} = 75m$ and DTV Power = 12x0.5kW for Coverage_{OUTDOOR} = 21.9km
FM Power = 4x1kW for Coverage_{OUTDOOR} = 38.9km
- Type D $H_{TOWER} = 45m$ and DTV Power = 12x0.3kW for Coverage_{OUTDOOR} = 17km
FM Power = 4x0.5kW for Coverage_{OUTDOOR} = 13.1km

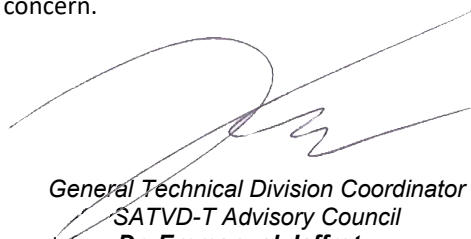
Preliminary Project, Initial Coverage Prediction, Survey, Final Project, Final Coverage Prediction, NIR Calculation, and Implementation of:

- For PHASE I of SATVD-T (51 EDTs)
 - 36 Type A EDTs
 - 13 Type B EDTs
 - 2 Differential High-Power Type EDTs EDTs:
 - Alas Building $H_{TOWER} = 170m$
DTV Power = 9x1kW
 - MOP Building $H_{TOWER} = 170m$
DTV Power = 6x5kW



- For PHASE II of SATVD-T (38 EDTs)
 - 17 Type A EDTs
 - 10 Type B EDTs
 - 9 Type C EDTs
 - 2 Type D+ EDTs
- For PHASE III of SATVD-T (21 EDTs)
 - 8 Type A EDTs
 - 3 Type B EDTs
 - 1 Type C EDT
 - 5 Type D+ EDTs
 - 1 Differential High-Power Type EDT
 - Devoto $H_{TOWER} = 96m$
DTV Power = $4 \times 6.25kW$
- For PLANNED FINAL PHASES of SATVD-T (156 EDTs)
 - 15 Type A EDTs
 - 24 Type B EDTs
 - 1 Type C EDT
 - 84 Type D EDTs
 - 29 Type D+ EDTs
 - 3 Differential High-Power Type EDTs
 - Puerto Madero $H_{TOWER} = 180m$
DTV Power = $7 \times 6.25kW + 1 \times 1.25kW$
 $5 \times 6.25kW + 4 \times 3.125kW + 2 \times 0.625kW$
FM Power = $2 \times (10 \times 15kW)$
 - Florencio Varela $H_{TOWER} = 265m$
DTV Power = $8 \times 6.25kW$
 - Avellaneda (TUC) $H_{TOWER} = 368.5m$
DTV Power = $4 \times (8 \times 6.25kW)$
FM Power = $2 \times (10 \times 15kW)$
- Design of High-Power Digital Terrestrial Stations (EDTs) for The Venezuelan Terrestrial Digital Television System (SVTVD-T) (2012): Preliminary Project, Coverage Prediction for PHASE I (INITIAL) of SVTVD-T (13 EDTs): 13 Type A EDTs ($H_{TOWER} = 153m$ and DTV Power = $12 \times 1kW$)
- Design of High-Power Digital Terrestrial Stations (EDTs) for The Bolivian Terrestrial Digital Television System (SBTVD-T) (2013): Survey, Preliminary Project, Coverage Prediction for PHASE I (INITIAL) of SBTVD-T (13 EDTs): 4 Type A EDTs DTV Power = $12 \times 1kW$ y 9 Type B EDTs DTV Power = $12 \times 1kW$
- Design of High-Power Digital Terrestrial Stations (EDTs) for del The Paraguayan Terrestrial Digital Television System (SPTVD-T) (2013): Survey, Preliminary Project, Coverage Prediction for PHASE I (INITIAL) of SPTVD-T (10 EDTs): 8 Type A EDTs DTV Power = $12 \times 1kW$ y 2 Type B EDTs DTV Power = $12 \times 1kW$
- Design of Digital Radio Links SDH 2+1 STM-1 (155.52 Mbit/s) with combined diversity (space + frequency) for interconnection of headends with EDTs operating in Single Frequency Network (SFN) mode and/or as backup for FO (Fiber Optic) links of the transport network between studios and transmitter plant (2014).

This certificate is issued to be presented to whom it may concern.


 General Technical Division Coordinator
 SATVD-T Advisory Council
Dr. Emmanuel Jaffrot