Propagation Modeling and Coverage Estimation of UHF Broadcast Services in the 600 MHz Band in Brazil

Higo T. P. Silva, Thiago A. Soares, Hugerles S. Silva, Daniel G. Silva, P. D. Alvim and Ugo S. Dias

Abstract— **This paper presents a comprehensive geographic coverage analysis of Brazilian broadcasting services operating in the 600 MHz band, currently allocated to digital television and considered for future applications such as TV 3.0. A custom simulation framework implementing the ITU-R P.1812 propagation model was developed to estimate field strength using real-world operational data from 5,198 broadcasting stations, sourced from Anatel's Mosaico platform. The methodology integrates digital elevation models, land cover classification, and radioclimatic zoning to compute coverage metrics at both municipal and urban sector levels. Results indicate that services in the 600 MHz band currently cover approximately 3.46 million km², representing 40.6% of the Brazilian territory, with full coverage observed in 78.8% of urban sectors within the served regions. Significant regional disparities were identified, with coverage exceeding 90% in the South and falling below 15% in the North. The covered area distribution follows a lognormal pattern, and a power-law relationship between coverage area and effective radiated power (ERP) was observed. These findings provide valuable insights for spectrum planning and public policy formulation regarding the evolution of broadcasting services and the potential reallocation of the 600 MHz band.**

Keywords— **600 MHz Band, Broadcasting Services, Coverage Modeling, Broadcasting Planning.**

I. Introduction

Emerging wireless communication services, including fifth-generation (5G) technologies, require significantly broader bandwidths to operate efficiently [1]. To accommodate these demands, regulatory and spectrum management bodies must reassess existing allocations and explore new usage scenarios. This includes not only identifying viable frequency bands, such as millimeter-wave ranges for mobile broadband, but also considering the repurposing of legacy broadcasting bands in the ultra high frequency (UHF) and very high frequency (VHF) ranges [2].

In Brazil, the 600 MHz band (spanning 600–700 MHz) constitutes a critical portion of the UHF spectrum, currently allocated to digital terrestrial television services for both generation (GTVD) and retransmission (RTVD) purposes. The band encompasses 14 digital channels and is characterized by advantageous propagation features, including strong indoor penetration and large-area coverage with relatively low infrastructure investment. These properties render the 600 MHz band particularly attractive for supporting next-generation broadcasting applications, such as the upcoming TV 3.0 standard [3], as well as potential use cases involving 5G broadcast services. Recent discussions at the regulatory level have considered the partial or full repurposing of this band to accommodate emerging technologies [4], [5]. Such initiatives, however, necessitate robust technical studies and coordinated spectrum planning by the Ministry of Communications (MCom) and the National Telecommunications Agency (Anatel), which are the governing bodies responsible for spectrum policy and technical regulation in the country.

In this context, accurate assessment of the current geographic coverage provided by services operating in the 600 MHz band is essential to inform policy decisions and support engineering analyses. Despite the relevance of this topic, the literature lacks comprehensive nationwide studies that incorporate real-world deployment data and terrain-aware propagation modeling. To address this gap, this paper presents a large-scale coverage analysis of broadcasting services operating in the 600 MHz band across Brazilian territory. A simulation framework was developed based on the ITU-R P.1812 propagation model, enabling detailed field strength prediction while accounting for terrain elevation, land cover classification, and radioclimatic zoning. The framework integrates operational parameters of 5,198 broadcasting stations, retrieved from Anatel's Mosaico platform, and produces coverage estimates with spatial granularity at both the municipal and urban sector levels. The outcomes include area-based and population-based coverage metrics, with an emphasis on identifying regional disparities and quantifying the effective service reach.

The remainder of the paper is organized as follows. Section II details the methodology used for the geographic coverage analysis, including the field intensity prediction and the estimation of the covered area. Section III presents the numerical results of the study, offering insights into the coverage characteristics and statistical analysis. Finally, Section IV concludes the paper, with the key findings and potential implications of this work.

II. Geographic Coverage Analysis

A. Field Intensity Prediction Methodology

The geographic coverage analysis conducted in this study is based on the ITU-R P.1812-4 propagation model [6],

Higo T. P. Silva (higo.silva@unb.br), Hugerles S. Silva (hugerles.silva@unb.br), Daniel G. Silva (danielgs@unb.br), P. D. Alvim (pedro.alvim@redes.unb.br) and Ugo S. Dias (udias@unb.br) are with the Department of Electrical Engineering, University of Brasilia, Brasilia-DF, Brazil. T. A. Soares (tasoares@gmail.com) is with the Brazilian Ministry of Telecommunications, Brazil.

which provides a path-specific prediction method for terrestrial services in the VHF and UHF bands. The model is capable of incorporating frequency-dependent parameters, terrain profiles, antenna characteristics, land cover classification, and radioclimatic zoning to produce field strength predictions with high spatial resolution. The prediction model is implemented through a custom Python framework designed to preprocess all required inputs for accurate field strength calculations. Adopting an object-oriented programming paradigm, specialized classes are applied to handle: propagation environment data processing, BS parameters management and coverage calculations integrated with the ITU-R P.1812 model. The framework automatically processes the data needed for inputs into the prediction model.

The field strength prediction algorithm begins by preprocessing the propagation environment, relying on the `PropEnv` class, which integrates all necessary information and methods. Accurate field strength prediction depends on precise characterization of the propagation environment. For this purpose, digital elevation models (DEMs) from the National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) [7] are applied. By processing the GeoTIFF[1] files in this dataset, it is possible to access the terrain elevation profiles across the entire Brazilian territory at a maximum spatial resolution of 30 m $\times$ 30 m [7]. For a particular case of study, the region of interest is defined as a square area centered on the BS coordinates and discretized into an $N_\mathrm{a} \times N_\mathrm{a}$ grid. The receiving points are distributed across the grid, with each point indexed as (i, j), in which $i, j \in [1, \cdots, N_\mathrm{a}]$. The BS itself is positioned at the center pixel, indexed as $(N_\mathrm{a}/2, N_\mathrm{a}/2)$. It is assumed that the height above the ground of the receivers is constant and denoted as h_rx. Therefore, when loading the GeoTIFF file, it is obtained a map $\mathtt{H}(i, j)$ that indicates the height of the terrain (relative to sea level) at pixel (i, j).

A critical preprocessing step is the accurate characterization of land cover for each pixel in the grid, since this significantly influences field strength predictions. To achieve this, it is employed the methodology from [8] which combines NASA's MCD12Q1 Moderate Resolution Imaging Spectroradiometer (MODIS) dataset with the International Geosphere-Biosphere Programme (IGBP) classification scheme. This integration maps IGBP land cover categories to the ITU-R P.1812 classification system. As a result, any geographic coordinate (within the resolution limits of GeoTIFF data) can be categorized into one of the following ITU-R P.1812 land cover types: water/sea, open/rural, suburban, urban/trees/forest and dense urban. This classification ensures compatibility with the ITU-R P.1812 propagation model, enhancing prediction accuracy. Thus, at the end of this process, a map $\mathtt{C}(i, j)$ has been created, indicating the land cover class at the pixel (i, j).

An additional classification step involves determining the radioclimatic zone type for the environment, as required by ITU-R P.1812. The standard specifies three zone categories: sea, coastal, and inland. To implement this classification, the intersection of the land cover mapping $\mathtt{C}(i, j)$ with Brazil's coastal boundary data provided by Brazilian Institute of Geography and Statistics (IBGE) [9], [10] is considered. The resulting radioclimatic zone mapping is formally represented as $\mathtt{RZ}(i, j)$, completing the environmental parameterization needed for accurate propagation modeling.

In turn, the `Transmitter` class encapsulates all the data and methods necessary to characterize a BS. Actual operational data from broadcasting BSs are applied in the simulations. These data are obtained through Anatel's Mosaico platform [11]. This approach enables the evaluation of simulations considering real-world parameters for accurate field strength prediction, including: operating frequency, effective radiated power (ERP), antenna polarization characteristics and radiation patterns and BS coordinates and heights.

Once the propagation environment and BS parameters have been fully characterized, the system executes the coverage prediction process through the `Coverage` class. This class takes initialized `PropEnv` and `Transmitter` objects as inputs and implements a point-to-point prediction methodology, systematically evaluating field strength at each pixel across the entire propagation grid. The prediction using the ITU-R P.1812 model depends on characterizing both the elevation profile and land cover types along the propagation path between link endpoints. The Bresenham line algorithm [12] is applied to determine the pixel indices along the straight-line path connecting the BS at $(N_\mathrm{a}/2, N_\mathrm{a}/2)$ with any given receiver at position (i, j). For each receiver location (i, j), we define $\mathtt{I}(i, j)$ as the set of pixel indices along this propagation path. The terrain elevation profile is then represented by $\mathtt{H}[\mathtt{I}(i, j)]$, with values of a specific coordinate defined in the GeoTIFF file previously loaded. In turn, the corresponding land cover and radioclimatic types on the path are described by $\mathtt{C}[\mathtt{I}(i, j)]$ and $\mathtt{RZ}[\mathtt{I}(i, j)]$, respectively.

Based on the input data, which is used to characterize the environment, the transmitter and the link, the path losses $L_{i,j}$ at each position (i, j) can be determined using the ITU-R P.1812 recommendation. The corresponding received field strength, expressed in dBμV/m, is then calculated as [6]

$$E_{i,j} = 199.36 + 20\log_{10}(f) + 10\log_{10}(P_{\mathrm{tx;kW}}) + G_{i,j} - L_{i,j}, \tag{1}$$

in which f is operation frequency (in GHz), $P_{\mathrm{tx;kW}}$ is the ERP in kW and $G_{i,j}$ is the antenna gain (in dBi) in the direction of the receiving point (i, j). This procedure generates an $N_\mathrm{a} \times N_\mathrm{a}$ field strength map $E_{i,j}$ containing the received signal intensity values for all positions.

B. *Estimation of Covered Area*

In this work, digital sound and image generation (GTVD) and retransmission (RTVD) services in the 600-700 MHz band are evaluated. For these services, the Anatel establishes a threshold of 51 dBμV/m for proper service operation [13]. Consequently, any receiving point with field strength below this pre-established threshold is considered to be in outage and is discarded, resulting in a map with effectively covered points denoted as $\hat{E}_{i,j}$. To determine the size of the covered area and identify which municipalities fall within this area, the

[1] GeoTIFF is a raster image file format that contains geospatial metadata, allowing the extraction of geographic information.

outer coverage boundaries are converted into a set of polygons, denoted as $\mathcal{P}(\hat{E}_{i,j})$. Note that, due to the geographic configuration of the environment, which determines different coverage zones, $\mathcal{P}(\hat{E}_{i,j})$ consists of K closed polygons, represented as $p_k \in \mathcal{P}(\hat{E}_{i,j})$, with $k \in [1, \cdots, K]$. For the coverage area calculation to be performed correctly, the polygons p_k must be mutually disjoint. Thus, denoting the operator $\mathrm{A}\{\cdot\}$ as the area of a polygon, the elements p_k must satisfy

$$\mathrm{A}\{p_k \cap p_{k'}\} = 0, \forall\, k \neq k', \tag{2}$$

where $p_k \cap p_{k'}$ denotes the intersection polygon between p_k and $p_{k'}$. Based on this premise, the total covered area of the map $\hat{E}_{i,j}$ is given by

$$A(\hat{E}_{i,j}) = \sum_{k=1}^{K} \mathrm{A}\{p_k\}. \tag{3}$$

For illustration purposes, Fig. 1 shows a coverage map (left), with colors scaled in dBμV/m, and the corresponding limiting polygons.

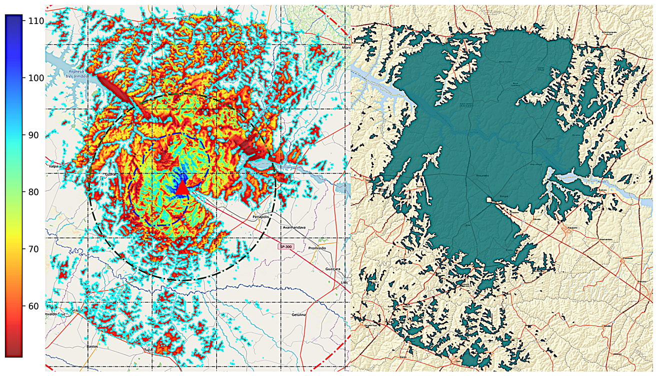

Fig. 1. Example of coverage map (left) and the corresponding limiting polygons (right).

The set of polygons $\mathcal{P}(\hat{E}_{i,j})$ covers irregular regions spanning one or more surrounding municipalities. Calculating the area covered by a particular BS within a given municipality requires computing the intersection between the polygons $p_k \in \mathcal{P}(\hat{E}_{i,j})$ and the municipal boundary polygons. To efficiently determine whether a polygon p_k and municipal boundaries are proximate enough to potentially intersect, a spatial indexing methodology across the Brazilian territory is applied. Let denote the set of Brazilian municipal boundaries polygons as $\mathcal{B} = \{b_1, b_2, \cdots, b_m, \cdots, b_M\}$, in which b_m is the m-th municipal polygon and M is the number of cities in the Brazilian territory. The national territory is partitioned into a grid of $N_\mathrm{g} \times N_\mathrm{g}$ square units with side length Δg, where each unit is indexed by coordinates (m, q). For any polygon intersecting a grid unit (m, q), this spatial relationship is recorded. This procedure is executed for all municipal boundaries and BS coverage polygons, resulting in an indexed list $\mathtt{L}(q, u)$ that identifies which polygons intersect each grid unit (q, u). From $\mathtt{L}(q, u)$, it is also possible to determine the inverse mapping, that is, the set of pairs of indices of the units which a given polygon intersects. Mathematically, this set is represented by $\mathtt{Q}(p_k) = \{(q, u) \in [1, M] \times [1, M] : p_k \in \mathtt{L}(q, u)\}$. The set of all unit indices that the coverage map $\hat{E}_{i,j}$ intersects is then denoted as

$$\mathcal{Q} = \bigcup_{k=1}^{k} \mathtt{Q}(p_k). \tag{4}$$

In turn, the set of municipalities polygons in the region covered by map $\hat{E}_{i,j}$ is determined by $\mathcal{B}' = \{b_m \in \mathcal{B} : b_m \in \mathcal{Q}\}$. By applying this spatial indexing methodology, the search scope for intersections is considerably reduced, thus decreasing the computational cost. Based on the determined quantities, it is possible to determine a list of intersection areas between the region covered by $\hat{E}_{i,j}$ and the corresponding municipalities using the algorithm presented in Algorithm 1.

```
Input: Ê_{i,j}, Δg, B
Result: List of areas covered by the BS: A
Compute P(Ê_{i,j});
Index Brazilian territory with Δg-size units;
Compute L(m, q);
Compute Q = ⋃_{k=1}^{k} Q(p_k);
Compute B' = {b_m ∈ B : b_m ∈ Q};
Initialize A = ∅;
for b_m ∈ B': do
    Compute the intersection area between the
     coverage polygon and the municipality polygon
     b_m: A' = Σ_{p_k ∈ P(Ê_{i,j})} A(p_k ∩ b_m);
    if A' > 0 then
        A ← A ∪ {A'}
    end
end
return A;
```

Algorithm 1: Algorithm for extracting coverage areas.

III. Numerical Results

A total of 5,198 broadcasting stations (BSs) operating digital television services (GTVD and RTVD) in the 600 MHz band are included in the simulations. These BSs are geographically distributed across the Brazilian territory, with technical and geographic parameters retrieved from Anatel's Mosaico platform [11]. Based on the methodology described in Section II, individual field strength maps are generated for each station, enabling a detailed evaluation of coverage at both municipal and urban sector levels. Two shapefile datasets provided by IBGE are used: one defining the boundaries of 5,572 municipalities, and another delineating urban census sectors, as classified in the 2022 census [14]. Urban areas were constructed by aggregating all census sectors designated as urban within each municipality, and population figures were extracted accordingly. For the purpose of this analysis, only municipalities with at least 5% of their total area and urban area covered by a BS are considered. This criterion resulted in a total of 5,062 municipalities being minimally covered by at least one of the 5,198 BSs.

Fig. 2 presents the union of coverage areas of all individual coverage polygons corresponding to the BSs. The analysis reveals that approximately 3,458,266 km^2 of the national territory is covered by services operating in the 600 MHz band, corresponding to 40.6% of the total national area. The regional distribution of this coverage is detailed in Table I. The South region demonstrates the highest percentage coverage, with approximately 90.3% of its area (521,109.4 km^2) served by 600 MHz band services. In contrast, the North region shows the lowest coverage percentage, with only 14.7% of its area (566,872 km^2) covered. This significant regional disparity primarily results from the distribution pattern of station installations, which are predominantly concentrated in urban areas. The North region's particularly low coverage density reflects its characteristic demographic and geographic features, including low urban concentration and extensive rural and forested areas.

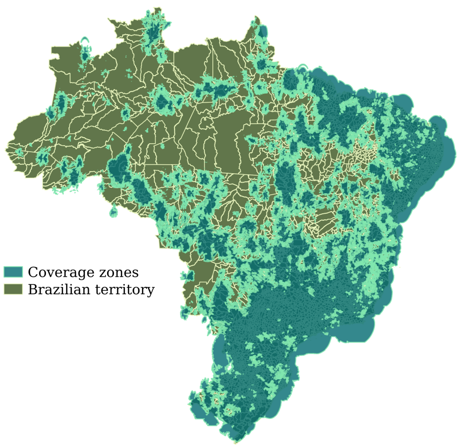

Fig. 2. Coverage zones of the 600 MHz band services across the Brazilian territory.

TABLE I
SUMMARY OF COVERAGE BY GEOGRAPHIC REGION.

Region	Covered Area (km^2)	Coverage Percentual (%)
North	566,872.0	14.7
Northeast	937,698.0	60.4
Southeast	781,093.7	84.4
South	521,109.4	90.3
Midwest	651,494.7	40.5

Fig. 3 presents the empirical cumulative distribution function (CDF) of the covered are sizes. The simulation results reveal that the coverage areas closely follows a lognormal distribution pattern, which is denoted as $\mathcal{LN}(\mu, \sigma)$ notation, where μ and σ are the distribution parameters. The maximum likelihood estimation based on the data yields optimal adherence with parameters $\mu = 7.5$ and $\sigma = 1.4$. According to Fig. 3, where the empirical CDF is superimposed by the corresponding lognormal CDF, a adequate adhesion is observed. The median of the simulation data is highlighted in this figure, indicating that 50% of the BSs cover an area of up to 4207 km^2.

In turn, it is observed a power-law relationship between coverage areas and ERP (in kW), which is modeled as

$$\hat{A}(P_{\text{tx}}) = \kappa \left(\frac{P_{\text{tx}}}{1 \text{ kW}} \right)^{\beta} + \epsilon, \tag{5}$$

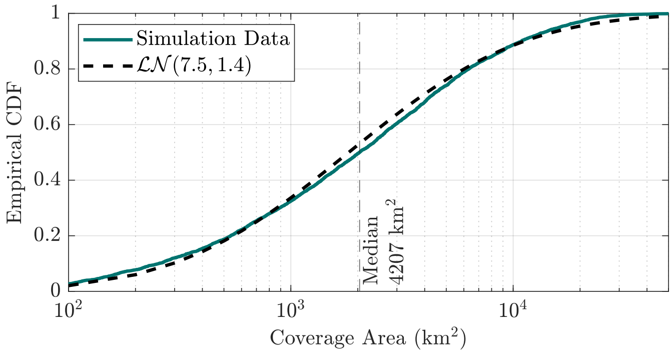

Fig. 3. Empirical CDF of covered areas overlaid by the corresponding lognormal CDF $\mathcal{LN}(7.5, 1.4)$.

where κ represents the scaling coefficient, β is the power-law exponent, and ϵ denotes the model error term following a zero-mean Gaussian distribution $\mathcal{N}(0, \sigma_\epsilon^2)$. The parameter estimation from simulation data results in $\kappa = 3567$ km^2, $\beta = 0.45$, and $\sigma_\epsilon = 4.5 \times 10^3$ km^2. Fig. 4 illustrates the simulation coverage area data plotted with the proposed power-law model. This behavior is expected, given that with the increase in transmitted power, a larger area is covered.

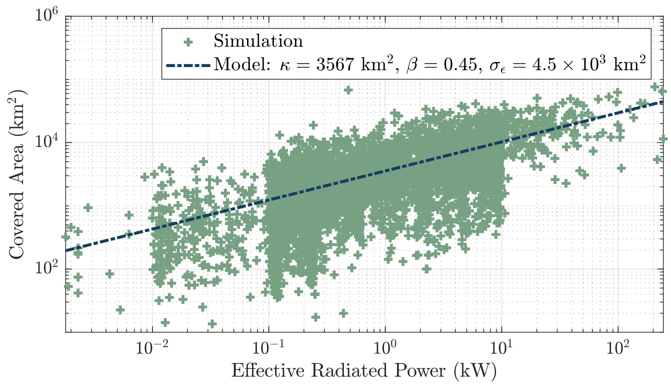

Fig. 4. Simulation data of the coverage area as a function of ERP overlaid by the proposed power-law model.

The following results focus on municipal and urban coverage. As previously stated, 5,062 Brazilian municipalities have some level of service coverage in the 600 MHz band. The geographic landscape of Brazil is predominantly composed of municipalities with low urban density, that is, large territorial areas containing relatively small urban sectors. Fig. 5 presents the empirical CDFs of the percentage coverage for both the municipality and its corresponding urban sector, based on the BSs that provide the most extensive coverage to the corresponding city. It is observed that approximately 49.8% of municipalities and 21.2% of urban sectors are covered by stations that serve less than 100% of their area. Nonetheless, there is a notable concentration of municipalities and urban sectors where at least one station fully covers the entire geographic area. For municipalities, which typically encompass large geographic regions, around 50.2% are entirely covered by at least one station operating in the 600 MHz band. In contrast, approximately 78.8% of the evaluated urban sectors have full coverage. This higher percentage is attributed to the smaller geographic size of urban sectors and their increased likelihood of being located near a transmission station, which is often installed in urban areas. It is important to note that these statistical findings refer specifically to the sample of 5,062 municipalities that have at least minimal coverage by a station operating in the 600 MHz band.

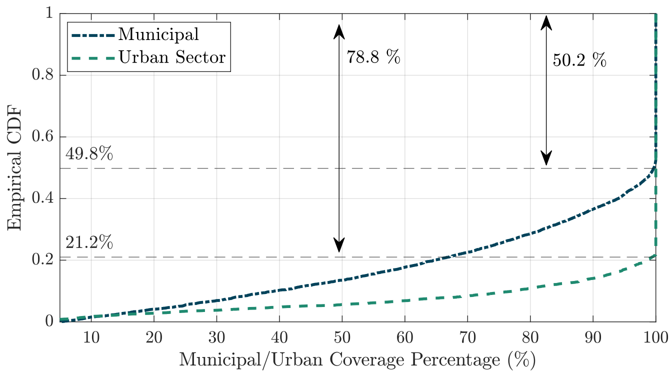

Fig. 5. Empirical CDFs of the maximum coverage percentage of Brazilian municipalities and urban sectors. Curves are valid for the 5,062 cities that are minimally served by BSs operating in the 600 MHz band.

Assuming an even population distribution across urban sectors, the percentage of urban coverage directly corresponds to the population coverage percentage. Based on this assumption, Fig. 6 presents a histogram of the estimated urban population coverage by 600 MHz services in Brazilian municipalities, with bins representing 10% intervals. The histogram reveals a pronounced peak, indicating that approximately 2,666 municipalities have 90–100% of their urban population covered by 600 MHz channels. In contrast, only 85 municipalities exhibit coverage for up to 10% of their population. These findings are derived from the same dataset of 5,062 municipalities with relevant 600 MHz coverage.

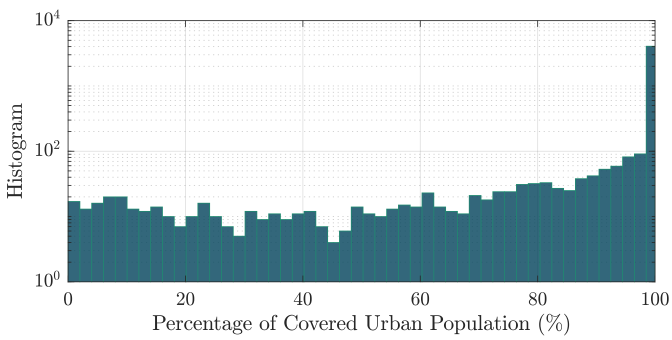

Fig. 6. Histogram of the percentage of urban population per municipality covered by services in the 600 MHz band.

IV. Conclusions

This paper presented a nationwide analysis of the geographic coverage of digital broadcasting services operating in the 600 MHz band in Brazil, employing a custom simulation framework based on the ITU-R P.1812 propagation model and real deployment data from 5,198 broadcasting stations. The results indicate that approximately 3.46 million km^2 (40.6% of the national territory) are currently covered, with full coverage observed in 78.8% of urban sectors within the 5,062 municipalities analyzed. The study identified strong regional disparities, particularly between the highly covered South region and the underserved North. Coverage areas exhibited a lognormal distribution and a power-law relationship with effective radiated power, providing quantitative insights into network performance. These findings offer valuable guidance for spectrum planning, regulatory decision-making, and the deployment of emerging services such as TV 3.0 and 5G broadcasting.

Aknowledgements

This work has been funded by TED UnB-MCom 01/SERAD/2022.

References

[1] T. Shitomi, T. Nakatogawa, A. Sato, K. Furuya, and M. Okano, “Spectral Efficiency Evaluation of an NR-Based 5G Terrestrial Broadcast System for Fixed Reception,” *IEEE Transactions on Broadcasting*, vol. 68, no. 2, pp. 487–500, 2022.

[2] S. Barnes, P. Botha, and B. Maharaj, “Spectral Occupation of TV Broadcast Bands: Measurement and Analysis,” *Measurement*, vol. 93, pp. 272–277, 2016.

[3] Allan S. S. Chaubet *et al.*, “TV 3.0: An Overview,” *IEEE Transactions on Broadcasting*, vol. 71, no. 1, pp. 11–18, March 2025.

[4] GSMA, “600 MHz no Brasil Preenchendo a Brecha Rumo à Inclusão Digital,” Global System for Mobile Communications (GSMA), Technical Report, 2024, accessed: 2025-05-08. [Online]. Available: https://www.gsma.com/connectivity-for-good/spectrum/gsma_resources/600-mhz-brazil/

[5] ——, “Reallocation of the 600 MHz Band for Mobile Broadband in Brazil,” Global System for Mobile Communications (GSMA), Technical Report, 2025, accessed: 2025-05-08. [Online]. Available: https://www.gsma.com/connectivity-for-good/spectrum/gsma_resources/600-mhz-brazil/

[6] ITU – International Telecommunication Union, “Recommendation ITU-R P.1812-4 – A Path-Specific Propagation Prediction Method for Point-to-Area Terrestrial Services in the VHF and UHF Bands,” International Telecommunication Union, Geneva, Switzerland, techreport P.1812-4, Jul. 2015.

[7] NASA JPL, “NASA Shuttle Radar Topography Mission Global,” https://doi.org/10.5067/MEaSUREs/SRTM/SRTMGL1.003, 2013, accessed 2025-04-19.

[8] D. R. de Castro Aguiar, H. T. P. Silva, H. S. Silva, and U. Dias, “Enhancing Signal Prediction Across Brazil: A Clutter Mapping Module for the ITU-R P.1812,” in *XLII Simpósio Brasileiro de Telecomunicações e Processamento de Sinais*. Belém, Brazil: Simpósio Brasileiro de Telecomunicações e Processamento de Sinais, Oct. 2024.

[9] Instituto Brasileiro de Geografia e Estatística (IBGE), “Municípios Defrontantes com o Mar.” [Online]. Available: https://www.ibge.gov.br/geociencias/organizacao-do-territorio/estrutura-territorial/24072-municipios-defrontantes-com-o-mar.html

[10] ——, “Atlas Geográfico das Zonas Costeiras e Oceânicas do Brasil,” Instituto Brasileiro de Geografia e Estatística (IBGE), Rio de Janeiro, Tech. Rep. 83741, 2011.

[11] Mosaico – Sistema Integrado de Gestão e Controle do Espectro. [Online]. Available: http://sistemas.anatel.gov.br/se/public/view/b/srd.php

[12] E. Angel and D. Morrison, “Speeding up Bresenham’s Algorithm,” *IEEE Computer Graphics and Applications*, vol. 11, no. 6, pp. 16–17, 1991.

[13] Agência Nacional de Telecomunicações (Anatel), “Requisitos Técnicos de Condições de Uso de Radiofrequências para os Serviços de Radiodifusão de Sons e Imagens e de Retransmissão de Televisão.” [Online]. Available: https://informacoes.anatel.gov.br/legislacao/atos-de-requisitos-tecnicos-de-gestao-do-espectro/2022/1688-ato-9751

[14] Instituto Brasileiro de Geografia e Estatística (IBGE), “Malha de Setores Censitários,” 2022. [Online]. Available: https://www.ibge.gov.br/geociencias/organizacao-do-territorio/estrutura-territorial/26565-malhas-de-setores-censitarios-divisoes-intramunicipais.html