

Spectrum Usage and Occupancy Analysis Across Somaliland Using Wideband RF Measurements

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Abstract—

This paper presents a comprehensive spectrum usage and occupancy analysis conducted across major cities in Somaliland. The objective of the study is to evaluate frequency utilization, identify active transmissions, and support regulatory spectrum planning. Measurements were performed using the Anritsu MS2090A spectrum analyzer across frequency bands ranging from 700 MHz to 3500 MHz. The results indicate high occupancy in 800 MHz and 2100 MHz bands (approximately 100%), moderate utilization in 900 MHz and 1800 MHz bands (approximately 90%), and increasing deployment in higher bands such as 2300 MHz, 2600 MHz, and 3500 MHz. The study highlights current spectrum congestion, operator deployment strategies, and the need for optimized spectrum allocation. These findings provide a baseline for regulatory coordination and future network planning.

Index Terms—

Spectrum monitoring, interference, RF scanning, LTE/4G, 5G, spectrum occupancy, telecommunications, Somaliland.

I. INTRODUCTION

The radio frequency spectrum is a critical resource for modern wireless communication systems. Efficient spectrum utilization is essential to ensure high-quality service delivery, minimize interference, and enable the deployment of advanced technologies such as 4G and 5G networks.

This paper presents the results of a wideband spectrum scanning campaign conducted across major cities in Somaliland, including Hargeisa, Burao, Borama, Berbera, Gabiley, Wajaale, Sheikh, and Arabsiyo. The objective is to evaluate spectrum occupancy, identify active frequency usage, and support regulatory decision-making.

The study covers frequency bands from 700 MHz to 3500 MHz and includes analysis of occupancy levels, signal strength, and technology distribution across different regions.

II. BACKGROUND AND OBJECTIVES

A. Background

With the rapid growth of mobile broadband services, demand for radio spectrum has increased significantly. Regulatory authorities require continuous monitoring to ensure compliance, detect interference, and optimize spectrum allocation.

B. Objectives

- To conduct wideband RF spectrum scanning across Somaliland
- To measure spectrum occupancy across low and mid bands
- To identify active telecom operator frequencies
- To detect interference and noise levels

- To support spectrum refarming and regulatory planning
- To analyze frequency usage by major operators (Somtel, Telesom, Somcable)

III. SCOPE OF MEASUREMENT

A. Geographic Scope

Measurements were conducted across multiple environments, including urban city centers, commercial zones, residential areas, highways and airport roads, government zones, and elevated locations.

B. Frequency Bands Covered

700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2600 MHz, 3500 MHz.

IV. MEASUREMENT METHODOLOGY

A. Equipment Used

Spectrum Analyzer: Anritsu MS2090A

Antenna: Log Periodic Antenna

GPS: Magnet-mounted GPS for location tagging

B. Measurement Configuration

Resolution Bandwidth (RBW): 500 kHz

Video Bandwidth (VBW): 167 kHz

Sweep Time: Auto

Measurement Duration: 60–120 seconds per band

Measurements were conducted during peak and off-peak hours to capture temporal variations.

V. RESULTS AND OBSERVATIONS

A. Spectrum Occupancy

800 MHz & 2100 MHz: Highly congested (~100%)

900 MHz & 1800 MHz: Moderately high (~90%)

2300 MHz & 2600 MHz: High usage in urban areas

3500 MHz: Emerging usage (~60%)

B. Signal Strength

Measured signal levels ranged from –30 dBm to –80 dBm, with stronger signals in dense urban areas.

C. Technology Distribution

2G, 3G, 4G, and 5G NSA observed

4G dominant in 1800 MHz, 2100 MHz

5G observed in 2300 MHz and 2600 MHz bands

D. Coverage Characteristics

Low bands: Wide coverage

Mid bands: Balanced coverage and capacity

High bands: Capacity-focused deployment

E. Cross-Border Interference

Signal spillover observed in Wajaale from external networks.

VI. INTERFERENCE ANALYSIS

No significant unauthorized transmissions were detected. Noise levels remained within acceptable limits. Minor cross-border interference observed.

VII. COMPLIANCE STATEMENT

The spectrum measurement campaign was conducted in accordance with international best practices for spectrum monitoring.

VIII. CONCLUSION

The study demonstrates that key spectrum bands in Somaliland are heavily utilized. Increasing demand for mobile broadband services necessitates optimized spectrum allocation and regulatory intervention.

Recommendations include spectrum refarming, expansion of higher frequency bands, and improved coordination among telecom operators.

ACKNOWLEDGMENT

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