



## Surface radio refractivity variation over north-western Nigeria

<sup>1</sup>Mohammed, Z.D., <sup>2</sup>Oyedum, O.D., <sup>2</sup>Eichie, J.O., <sup>2</sup>Ibrahim, A.G., and <sup>3</sup>Muhammad, B.L.

<sup>1</sup>ITC/CMO, Network & Communications Unit, Federal Road Safety Corps, National Headquarters  
Abuja, Nigeria.

<sup>2</sup>Physics Department, Federal University of Technology, Minna, Nigeria.

<sup>3</sup>Physics Department, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria.

E-mail: [mzdoko@yahoo.com](mailto:mzdoko@yahoo.com)

### Abstract

Good knowledge of refractivity profile is essential for good planning of communication links; surface refractivity profile of a station is particularly required for enhanced planning and performance prediction of terrestrial radio links, especially in tropical regions where ITU-R has called for such local propagation data. The monthly and seasonal variability of surface radio refractivity over North-western Nigeria was investigated for a period of Five years (2008-2010). The monthly mean surface radio refractivity over the region is lower and more variable in the dry season, but higher and less variable in the wet season at all the study stations. About 288 N-units monthly mean surface radio refractivity ( $N_s$ ) was recorded in dry season and 368 N-units in wet season. Average value of about 328 N-units is observed with annual range of 80 N-units in the North-western Nigeria. The result of the investigation also showed that relative humidity and Temperature have major influence on the variation of surface radio refractivity while pressure has relatively less influence on  $N_s$  variability. The surface refractivity profile shows that for a transmitter height of 200 metres radio horizon distance is between 60.5 km in wet season and 58.4 km in dry season in North-western Nigeria. Therefore, terrestrial radio communication links must be planned in line with the findings of this research work for best performance in the North-western Nigeria.

**Keywords:** Surface radio refractivity, pressure, relative humidity, radio horizon.

### 1. Introduction

Radio communication is the wireless transmission of radio wave signals through free air medium by electromagnetic radiation of certain frequency (significantly below that of visible light, about 30 kHz to 300 GHz). Propagation conditions in the troposphere and radio paths are governed by various properties of the under surface layer such as the physical and geographical, as well as the climatic features of the region. Changes in atmospheric propagation conditions may be manifested in the variation of the radio field strengths and the radio horizon distance (Adeyemi and Emmanuel, 2011). Thus, the propagation of radio wave signals through the