Surface Refractivity Profile Construction on One-Fourth Kilometer Square Area for 1800 to 1900 Mhz Frequency

SAYYED SHAHID HUSSAIN,1,2 LUQMAN ALI,3 ALTAF HUSSAIN,1,2 ASIF ULLAH,4 LI SUN,1,2 AND GUOHE ZHANG1,2

1Shenzhen Research Institute, Xi'an Jiaotong University, Shenzhen 518057, China
2School of Microelectronics, Xian Jiao Tong University, Xian 710049, China
3School of Electronics and Information Engineering, Harbin Institute of Technology, Harbin 150001, China
4School of Electronics and Information Engineering, Zhejiang University, Hangzhou 310058, China

Corresponding author: Guohe Zhang (zhangguohe@xjtu.edu.cn)

Abstract The meteorological parameters review the impact of refractivity on received signal strength for the one-fourth kilometre square area is confer for frequency 1800 to 1900 MHz. It is necessary to know the refractivity profile of radio frequencies in the surface layer of the atmosphere to predict the execution of a radio system for the consistent gradient of refractivity. The data were accumulated from the Atoll software and then an experimental setup was used on the same investigated area to compare both figures and find out the effect of refractivity on received signal strength. It has been analyzed that environmental parameter such as temperature, humidity, and height above the ground level play a major role in varying refractivity. The information recorded from the experimental arrangement shows that when refractivity is high (more particularly around the afternoon time and in the morning time, the humidity is high) the quality of the signal strength is degraded, while at that point when the refractivity is low (more particularly during the daytime when humidity is low due to high temperature) the quality of the signal strength is better. Refractivity and signal strength are inversely proportional to each other. It is essential to apply an accurate path loss prediction technique to demonstrate the need for a precise accounting of the refraction and ducting when planning future radio networks.

Index Terms Refractivity, signal strength, atoll, gradient refractivity, humidity, temperature.

I. INTRODUCTION

In a wireless communication system, the main aim of a mobile network is to support the different application, e.g. voice data, information and media communication on switched systems. In such system, communication in a balanced individual can be improved with the help of excellent images, recordings, access to information, service in both the open and private schemes. They can be further enhanced by improving the Quality of Service (QoS) and increasing data rate along with good security. The quantities of the offers are being produced at a remarkable rate and they are appreciative to do all things considered for the future [1]–[8].

Among the meteorological parameters, the temperature and humidity assume the key work for refractivity [9]–[18]. When the radio waves propagate, a link between these waves and the environment is created which reduces the quality level of the signal. It incites the path loss and ultimately limits the coverage [19]. The effects of such an environment on the propagation of radio waves depend heavily on the frequency used. The physical idea of the path of intercession shows basic effects to generate with the final objective that has the adjustments in the T-S profiles of the expected mass of water that would impact. Radio waves within the sea increase with the frequency of the signal. This infers a low frequency of radio transmission and signals travel deep in the sea for better communication without any distortion.

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Radio waves at frequencies of around 20,000 Hertz (Hz) is a very low frequency (VLF) which pass through the ocean water at depths of a few feet and extremely low-frequency (ELF) waves infiltrate the ocean to the depths of numerous feet, allowing communication with submarines while defending secrecy [15], [20]–[24]. Our inspiration for research is to guarantee the best QoS in moderate places. The performance of the correspondence connection can estimate the operational principle of the path propagation in which it is deviated by variation in the profiles of navigable bulks of water in the atmosphere. For the mobile network, since the margin of mobile network channel changes arbitrarily with the passage of time, an exertion to give deterministic QoS (i.e., which requires zero QoS possibilities) is likely to be deciphered to a large extent in conventional confirmations. For example, in a Rayleigh declining channel, the point of confinement is insured in a deterministic manner which is zero. The traditionalist guarantee is clearly useless. Subsequently, it is appropriate to consider the quantifiable QoS considered in this paper.

The activities emerging from meteorological parameters has been some of the main elements affecting radio propagation. Atmospheric meteorological parameters such as relative humidity, temperature, pressure, and water vapor density amplify the complexity of the troposphere and substantially has an amazing impact on microwave propagation. They combined many approaches to have an effect on radio wave propagation and the radio refractivity gradient in the tropics, particularly in the shoreline [25]. It is worth noting that the refractivity of the atmosphere will not only range as the peak modifications but also affect radio signals. The choice of the troposphere in this paper lies on the truth that the vicinity between 0 m and 100 m has the best awareness of water vapor, and makes it tough for propagating the radio-link network. The prevalence of sea and land breezes which play a main role in the development and intensification of climate occasions also money owed for the high concentration of water vapor in the coastal cities [26]. Refractivity gradient in 1 km interval above the floor are necessary for the estimation of super–refraction and ducting phenomena, and their consequences on radar observations and Very excessive frequency (VHF) the subject points past the horizon cannot be undermined [27]. It is a common fact that refractivity gradients can be decided both through the direct method using refractometers or circuitously using a constant measuring techniques such as TV tower, radiosonde measurement, far off sensing techniques, statistical and deterministic model [28].

The most important advantage of GSM testing during a time of its innovation is operating on time division multiple access. The company such like Nokia, Siemens, and Ericsson make it reliable and faster to place it on a high marked in market. The GSM in the started days established the voice performance very effectively even support the internet facility but limited. It allows the transmission of information at both end due to its digital nature. In [29], the signal strength of GSM module variate with atmosphere factor. This study, state that variation of radio signal strength in different domain but same data get in the same domain at different time. Out of whole week thrice day displaying a positive correlation between the signal strength with humidity, temperature and refractivity gradient. This analysis was carried out for just seven days which is not enough to make a well prediction of weather scenario. In [30]–[37], the investigation of environmental parameters on signal strength is performed in South Western Nigeria for UHF radio propagation. It noticed, as the temperature increased thus a relative humidity decreased and in response a received signal strength is better and UHF path loss also degrade. It shows that on UHF signal in the troposphere region a temperature relative humidity has a great role on a RSSI. In [38]–[44], investigated the effect of climatic change on mobile communication signal propagation by sampling the three ITU regions in Nigeria at different climatic seasons of rain (May–June) and harmattan (November–March). The result obtained revealed that climate affects signal propagation, depending on the climatic parameters (rain and harmattan), frequency of transmission and ITU regions of propagation (which is related to the volume of rain and harmattan intensity) in Nigeria.

In this paper, a quantitative evaluation of propagating path losses has been considered from 1800-1900 MHz frequency under different environmental conditions. Different parameters of the atmosphere such as humidity, temperature, and water vapour pressure effect on the signal path loss has been calculated. Radio waves are propagated through the atmosphere which is influenced mostly by the inconsistency of radio refractivity, causes a decrease in their speed, and for long-distance propagation delay or path loss in the troposphere. Refractivity data for the moderated area were determined. The information recorded from the experimental setup when the estimate of the GSM standard reported was also taken in Islamabad, Pakistan. Nevertheless, the measurement reveals that in several point when refractivity was high (more particularly around the afternoon time and in the morning when the muggy was high) the quality of the signal strength was low and at the point when the refractivity was low (more particularly during the day when humidity was low due to high temperature) the quality of the signal strength was higher. Along these lines, the higher the refraction the lower the quality of the signal strength for the purpose of perception in the troposphere, i.e., they are inversely proportional to each other.

The proposed path loss model can evaluate path loss comes about for changing duct heights and channel parameters. Consequently, the created technique can give quick gauges of path loss under differing channel conditions. By utilizing the created strategy, we break down postpone spreads to decide the fading behaviour of the channel. The atmospheric radio refractive index, \( n \) & radio refractivity can be computed for it. The humidity, temperature and atmospheric pressure can find by using sensor such as DHT22 and BMP180 along with arduino to grab-up the environmental weather update. It will
enable us to analyse modified refractivity for evaporation duct and its consequence.

The experimental setup is characterized in Sect. 2 while the propagation model of the Atoll software for finding Received Signal Reference Quality (RSRQ) and Received Signal Reference Power (RSRP) is described in Sect. 3. A brief analysis of the refractivity profile on five different locations is discussed in Sect. 4, and the effect of refractivity on signal strength is concluded in Sect. 5.

II. EXPERIMENTAL SETUP

The experimental setup is composed of sensors such as Digital Humidity Temperature (DHT) and Barometric Measure Pressure (BMP) sensors. DHT is a multifunctional sensor that gives you temperature and relative humidity data in the meantime. DHT sensor can solve general-purpose estimation problems and provides solid readings when the condition of humidity in the medium of 20% RH and 90% RH, and the temperature condition in the middle of 0°C and 50°C. These sensors are extremely fundamental and moderate, but they are incredible for specialists who need to make an essential information record. The DHT sensors consist of two sections, a capacitive adhesion sensor, and a thermistor. There is also an essential chip inside that makes some simple to advanced processing and releases a computerized movement with temperature and humidity. The advanced pointer is really simple to read using any microcontroller.

The DHT sensor consist of four pins:
- Vcc (5Volt)
- Data
- Nc (no connection)

The Vcc of DHT can be connected to Arduino Vcc. The Data pin can be connected with arduino to any pin to show data on a serial monitor. This connection can be made through a pull-up-resistor from 5k to 10k ohm resistor. To enable high data line communication between the DHT sensor and arduino as shown in Figure 1a.

BMP180 is an atmospheric pressure sensor which measures the absolute pressure around the atmosphere and altitude above the earth surface. This pressure changes with the weather and height. Contingent on how the information is translated can show changes in climate, measure elevation, or some other tasks that require an accurate reading of the pressure. It uses peso-resistive innovation for high accuracy, linearity, EMC resistance and reliability for a longer period of time. The BMP180 sensor must be associated with arduino UNO as shown in Figure 1b:
- Vcc to 3.3V
- GND to GND
- SDA to A4
- SCL To A5

Both these two sensors are connected with the Arduino. These sensors collect data and then communicate recorded information with the Arduino. Two seconds delay is taken between each recorded data so as a whole 1800 value is noticed per hour. This setup is located on five different locations per day and night as shown in Figure 2. The coverage area of transmitter IIB009 for the considered location is shown in Figure 3 while the overall parameters of a base station are given in Table 1.

Network Cell Lite is a mobile observation and driving test instrument as shown in Figure 4. It is an Android application...
that offers VU-like meters for the serving cell, in addition to the neighboring cells. It covers several networks that include LTE, HSPA+, HSPA, WCDMA, EDGE, GSM, CDMA and EVDO. It has 6 measure protection pointer that indicates the management cell, in addition, the characteristics of the adjacent cell indicator. Its confinement eliminates (0m, 5m, 10m . . .) between the progressive indicators in the MAP tab. Its area precision limits the alternative for recording estimates. It has development pointer with powerful selectable options. It has sound clues when the period of development of the mobile network (2G/3G/4G) change the cell ID (OFF according to the normal procedure, you can activate them within the configuration). The sorting of 2G/3G/4G arrangements can be noticed in the alert panel.

Table 2 & 3 is per day and night refractivity profile that is obtained on five different locations of a considerable territory.

III. RESEARCH METHODOLOGY

A. PROPAGATION ENVIRONMENTAL DESCRIPTION

Islamabad is located in Pakistan at the latitude of 33.43°N and longitude of 73.04°E, at the edge of the Potohar Plateau which is located at the foot of the Margalla hills. The total area of Islamabad is 906 square kilometres. The specified area of the F-8 Sector, with the Margalla Hills in the north and northeast, is the investigated area. With a total population of two million, it is the 10th largest city in Pakistan. The aerial view of the investigated area of Islamabad, sector F-8 is as shown earlier in Figure 2.

B. BASE STATION COVERAGE AREA

The base station that is located in the dense suburban and urban clutters of the F-8 sector, Islamabad was identified within the clusters of cells of Global System Module (GSM) 1800-1900 MHz network in this area. The sites ensure to have a good radio frequency clearance so that they are not in any way obstructed. The receiver in this sites represents the full variation of antenna heights in the area covered by the survey. The terrain within a relevant radius around each selected base station is ensured to be a true representation of the entire area. The Atoll software is actually used for the prediction of the coverage area. In Atoll Software, the Standard Propagation Model (SPM) is used because it has a better outcome in urban, suburban and rural areas. The SPM is based on the Okumura-hata and Hata model and it is suitable for predictions of transmission coverage in the range of 150 – 3500 MHz frequency band over long distances ranging from 1 – 20 km. It is best suited to GSM 900 and GSM 1800, UMTS, CDMA 2000, WIMAX and LTE radio technologies. The Standard propagation Model path loss can be expressed in Equation (1) for suburban and urban areas.

$$\text{Path loss} = K_1 + K_2 \log (D) + K_3 \log (H_{\text{txeff}}) + K_4 \times \text{Diffraction loss} + K_5 \log (D) \times \log (H_{\text{txeff}}) + K_6 (H_{\text{reffe}}) + K_{\text{clutter}} (\text{clutter})$$  

where,

- $K_1$ = Propagation path loss constant value
- $K_2$ = log (d) correction factor
- $D$ = Distance between receiver and transmitter (m)
- $K_3$ = log ($H_{\text{txeff}}$) correction factor
- $H_{\text{txeff}}$ = Transmitter antenna height (m)
- $K_4$ = Diffraction loss correction factor
- $K_5$ = log ($H_{\text{txeff}}$) log (D) correction factor
- $K_6$ = Correction factor
- $H_{\text{reffe}}$ = Receiver antenna height (m)
- $K_{\text{clutter}}$ = clutter correction factor

The Atoll software uses Standard Propagation Model, the Reference Signal Received Power (RSRP) and Reference Signal Received Quality (RSRQ) can be easily evaluated from Atoll as shown in Figure 5 & Figure 6 (Aerial view of RSRP and RSRQ of the investigated area). This data then is compared with the experimental data setup. The atmospheric parameters such as humidity, height and temperature continuously make a slope in the gradient of refractivity, in other words, distort the level of received signal strength [29]–[37]. The humid condition in the atmosphere when increases the signal strength degrades but when the temperature increases the refractivity profile decreases with less modified units and that’s why the signal strength becomes better. The transmitter IIB009 are deployed in the investigated area by the vendors (ZTE) and its parameters are given in Appendix Table 1, the transmission and reception losses can be taken constantly at 0.5dB.

In cellular systems, when a portable device moves from one cell to another to perform a cell assortment or re-assortment,

![FIGURE 4. Measuring signal strength device.](image_url)
it must measure the quality or strength of the signal in the neighboring cells. In the LTE network, a User Equipment (UE) estimates two parameters on the reference signal, Received Signal Reference Power (RSRP) and Received Signal Reference Quality (RSRQ). RSRP is a type of Received Signal Strength Indicator (RSSI) measurement. It quantifies the normal control obtained over the active components that transmit specific reference movements of the cell within a certain capacity for transferring frequency bandwidth. RSRP is relevant in both the idle and connected mode with RRC, while RSRQ is only applied in the connected mode with RRC. In the process of cell selection or reselection in idle mode, RSRP is used. The standard deviation of RSRP for the investigated area coverage is $-65$ dB as shown in Figure 7.

The RSRP of the carrier measures the average aggregate of the power perceived only in OFDM symbol that contains reference symbol to receive at port 0 (that is, 0 & 4 OFDM symbol in a slot) in the ability to measure bandwidth on nth blocks. The aggregate obtained by the intensity of the RSSI carrier includes the power of the service cells and non-serving cells, the adjacent channel impedance, thermal noise etc. The RSRQ estimate provides additional data when RSRP is not suitable for a reliable handover or a choice of cell reselection.

In the handover method, the LTE requirements provide the adaptability to use RSRP, RSRQ, or both. The standard deviation of RSRQ for the investigated area coverage is 8,150.8 kbps while the mean value is 5,135 kbps as shown in Figure 8.

**IV. DATA COLLECTION**

The propagation of electromagnetic radiation through the atmosphere is controlled by the vertical and horizontal gradient of the refractive index of air, $n$ is characterized as the ratio of the speed of a radar wavefront (EM) through a vacuum over the velocity through the air. Waves twisted or refracted towards the region of $n$ higher locations. Since $n$ is so close to one, refractivity is often used, $N$ representing the distinction of $n$ from one. For microwave radiation and millimetre wave, $N$ is identified with the environmental factors of the temperature ($T$), water vapour pressure ($e$) and the atmospheric pressure ($p$) can be calculated from the following equation [45]–[56]:

\[
N = (n - 1) \times 10^6 = 77.6 \frac{p}{T} - 5.6 \frac{e}{T} + 3.75 \times 10^5 \frac{e}{T^2} \tag{2}
\]

where “$T$” representing the temperature in kelvin “$P$” representing the atmospheric pressure (hPa) “$e$” representing the water vapour pressure (hPa)

To resolve the proximity or non-appearance of ducts and capture layers in the environment, a quantity called modified refractivity $M$ is used, which considers the curvature of the surface are characterized as given below:

\[
M = N + \frac{Z}{r_e \times 10^{-6}} = N + 0.157z \tag{3}
\]

where $r_e$ is the earth radius ($\approx 6.378 \times 10^6$ m), $z$ is the height above the surface earth, both communicated in meters.

The water vapour pressure can be evaluated from Equation 4

\[
e = \frac{e_{sH}}{100} \tag{4}
\]
In the above Equation (4) “H” is humidity that relates with temperature. “e” is a saturated water vapour pressure that can be calculated from Clausius-Clapeyron in Equation 5.

\[ e_s = 6.11 \exp \left( \frac{17.26 (T - 273.16)}{T - 35.87} \right) \]  

“T” is the temperature in Kelvin.

\[ M = N(z) + 0.157z \]  

In above equation “N” is refractivity profile that represents the atmospheric factor impact on the various surface of the earth and can be changed up to unit \( M(z) \). “z” represents altitude (in meters) above the ground level.

V. DISCUSSION AND ANALYSIS

During the daytime, a refractivity profile on one-fourth km² is performed by establishing an experimental setup on five different locations of investigated area per day/night. The recorded information on the first location describes the humid condition of the atmosphere due to humidity. Next three days on location 2, 3 and 4 as given in Table 2, the weather is partially humid but this data was recorded at height. The signal strength improved on this location as compared to location 1.

Whenever the refractivity profile is as high as given in Figure 9, the signal strength is degraded. The final day on location 5 same humid condition but this time information recorded at a low height as given in Figure 10. This outcome clearly characterizes that altitude also playing the main role, that’s why better signal strength was recorded on location 2, 3 & 4.

During the night time the refractivity profile construction for one-fourth km² is performed by establishing experimental setup on five different locations. The signal strength is better on location 4 means low refractivity profile. The information recorded on location 3 & 4 at a height up to more than 18 meters above the ground level. It means that the altitude also affects the signal quality. At a high altitude, the signal is less refracted to reach toward the reception and that’s why signal strength doesn’t degrade as compared to a low height. Because on location 4 temperature is low as given in Figure 11 while the water vapour pressure in the atmospheric environment is high at that night as given in Figure 12. The refractivity profile construction for night time is given in Table 3.

The signal strength is better on location 2, 3 and 4 as given in Figure 13 because whenever the refractivity profile is high, the signal strength degrades and vice versa. The signal...
strength degrades on location 1 & 5 because on that night atmospheric condition is humid so that’s why the refractivity profile will be high and low signal strength recorded on that night. The radio signal wave and refractive list are always inversely proportional.

The signal strength is better on location 2, 3 and 4 as given in Figure 13 because whenever the refractivity profile is high, the signal strength degrades and vice versa. The signal strength degrades on location 1 & 5 because on that night atmospheric condition is humid so that’s why the refractivity profile will be high and low signal strength recorded on that night. The radio signal wave and refractive list are always inversely proportional.

The Atoll software is used for the investigated area to collect analysis about the coverage of the investigated area. The Reference Signal Received Power and Reference Signal Received Quality have been taken to show the best frequency planning in the considered region. The experimental setup is constructed in the same region in order to demonstrate the relationship between signal strength and the refractivity profile. In reality signal strength is degrade more than prediction software about the quality of the signal, because RSRP is $-65\,\text{dB}$ in the investigated area that is analyzed from the Atoll software (transmission prediction coverage). The humid condition of atmosphere actually degrades the signal because whenever there is communication between the transmitter

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**TABLE 3. Night Refractivity Profile for 1/kilometer square.**

| S. no | Altitude (meters) | Temperature (Kelvin) | Water Vapor Pressure (hPa) | Signal Strength (dBm) | Refractivity (M-m) | Location |
|-------|-----------------|----------------------|---------------------------|-----------------------|-------------------|---------|
| 1.    | 5               | 302                  | 24                        | -74                   | 342               | 1       |
| 2.    | 5.5             | 302                  | 24                        | -74                   | 342               | 1       |
| 3.    | 6.5             | 299                  | 21                        | -72                   | 340               | 2       |
| 4.    | 7.5             | 299                  | 21                        | -72                   | 340               | 2       |
| 5.    | 18              | 298                  | 23                        | -70.5                 | 335               | 3       |
| 6.    | 18              | 298                  | 23                        | -70.5                 | 335               | 3       |
| 7.    | 19              | 295                  | 19                        | -69.5                 | 334               | 4       |
| 8.    | 19              | 294                  | 19                        | -69.5                 | 334               | 4       |
| 9.    | 7               | 294                  | 20                        | -72.5                 | 339               | 5       |
| 10.   | 6.5             | 294                  | 20                        | -72.5                 | 339               | 5       |
and the receiver in case of high humidity, the signal refract more in the humid condition of the atmosphere and in outcome signal strength degrades. Thus designer must benefit from this outcome while designing a channel for such type of moderated climatic territory. During day time on monthly basis data was recorded at a same location for seven months. In overall month some days were foggy condition in atmosphere and some days were sunny appearance. The outcome showing signal strength is better when the atmosphere is less foggy as shown in figure 13. But whenever temperature is low as shown in figure 14-17 but a better signal quality because due to increase in height. This outcome report that at high altitude, signal strength is better mostly.

Data is record on monthly basis at a same location during night time as given in below figures 18-21, the refractivity profile was low and better signal quality was obtained. Next day's humidity was high due to foggy condition in atmosphere. This outcome also showing that refractivity profile is always inversely proportional to signal strength due to the meteorological parameter which effect the radio refractivity.

The meteorological parameter temperature, humidity, water vapor pressure and altitude effect a lot in varying radio refractivity. This can be evaluated from above cases that refractivity list and radio signal propagation are inversely

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**Figure 14.** Signal Strength vs Refractivity (Monthly basis/day time).

**Figure 15.** Temperature vs Refractivity (Monthly basis/day time).

**Figure 16.** Water Vapour Pressure vs Refractivity (Monthly basis/day time).

**Figure 17.** Altitude vs Refractivity (Monthly basis/day time).

**Figure 18.** Signal Strength vs Refractivity (Monthly basis/night time).
proportional. High humidity means high refractivity profile and in outcome, degradation in signal quality. In day time mostly the temperature is high, due to which no foggy condition in atmosphere and in outcome our signal refract less to reach toward the reception. In cloudy weather radio signal refract more to reach toward the receiver that’s why the signal quality becomes poor. But by changing the position at height there is a possibility that our signal strength become better. Following are some recorded data information in table 3 that clearly characterize in some point high signal strength due to low refractivity profile and low signal strength due to high refractivity profile.

**TABLE 4. Refractivity Profile vs Signal Strength weekly basis.**

| S. No | Refractivity Value (N) | Signal Strength (dBm) |
|-------|------------------------|------------------------|
| 1.    | 336                    | -71                    |
| 2.    | 339                    | -72.5                  |
| 3.    | 337                    | -71.5                  |
| 4.    | 341                    | -73                    |
| 5.    | 344                    | -75                    |
| 6.    | 342                    | -74                    |
| 7.    | 351                    | -78.5                  |
| 8.    | 353                    | -79.5                  |
| 9.    | 354                    | -80                    |
| 10.   | 355                    | -80.5                  |
| 11.   | 342                    | -74                    |
| 12.   | 343                    | -74.5                  |
| 13.   | 345                    | -75.5                  |
| 14.   | 340                    | -73                    |
| 15.   | 340                    | -73                    |
| 16.   | 338                    | -72                    |
| 17.   | 338                    | -72                    |
| 18.   | 338                    | -72                    |
| 19.   | 332                    | -68                    |
| 20.   | 338                    | -72                    |
| 21.   | 364                    | -84                    |
| 22.   | 380                    | -91                    |
| 23.   | 372                    | -88                    |
| 24.   | 353                    | -79                    |

The refractivity list was calculated on weekly basis and the quality of the signal measured for the moderate was related as shown in Table 4. The graph of the refractivity versus the quality of the measured signal is shown in Figure 18-21.
The recorded refractivity list on weekly basis characterize that in two or three points that refractivity was high (more especially around the evening time and in the morning, when the refractivity profile is low exhibit a better signal strength.

The refractivity list was calculated on weekly basis and the quality of the signal measured for the moderate was related as shown in Table 4. The graph of the refractivity versus the quality of the measured signal is shown in Figure 22. The recorded refractivity list on weekly basis characterize that in two or three points that refractivity was high (more especially around the evening time and in the morning when the sudden was high) while radio signal at that point was low and right when the refractivity was low (more especially amidst the day when moisture was low an aftereffect of high temperature) the nature of the signal quality was higher. Consequently, the higher the refraction the lower the method for the signal quality with the genuine target of sharpness in the troposphere, i.e., they are conflicting as to each other.

VI. CONCLUSION

The aim of this work is to study the variation in radio refractivity for frequency 1800 MHz-1900 MHz at different locations. Through the Atoll software, transmission coverage has been analyzed for the investigated area. Both Reference Signal Received Power (RSRP) and Reference Signal Received Quality (RSRQ) are measured and show a better result in the considered territory. After that, an experimental setup was established on the same locations of the investigated area. The meteorological factors are promoted still a lot of variation in radio refractivity, but when the height increase although in the humid condition of atmosphere the refractivity profile degrades and have better signal strength. There is a variety of radio refractivity between the dry and stormy weather. The refractivity profile and signal strength are inversely proportional to each other. When the temperature is high and there is no humid condition in the atmosphere, the refractivity profile is low, then signal quality is better.

The signal strength only degrades when the atmospheric weather is humid due to high humidity. It shows that when humidity is high, refractivity is also high which in turn affects the quality of the signal strength, where during the day when humidity is low due to the high value of temperature, the refractivity is low and the signal strength is enhanced. The propagation model showing better outcome still needs improvement. This outcome is known then it gives an advantage to the vendor, especially while designing a proper communication channel.

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ALTAF HUSSAIN was born in Swat, Pakistan. He received the bachelor’s degree in telecommunication from Hazara University Dodial Mansehra, Pakistan, in 2016. He is currently pursuing the master’s degree with the School of Electronics Science and Technology, Shenzhen Research Institute, Xi’an Jiaotong University, Xi’an, China. His research interests include integrated circuit design, machine learning, and image processing.

ASIF ULLAH was born in Peshawar, Pakistan, in 1992. He received the B.S. degree from COMSATS Islamabad, Pakistan, in 2015, and the master’s degree from Xi’an Jiaotong University, China, in 2015. He is currently pursuing the Ph.D. degree with the School of Control Science and Engineering, Zhejiang University, Hangzhou, China. His research interests include bio sensors, machine learning, integrated circuit designs, and hardware co-design and implementation for deep learning.

LI SUN studied computer science at the Northwestern Polytechnic University, China, and received the Ph.D. degree from Northwestern Polytechnic University, in 2010. In 2016, she became an Associate Professor of information and communication engineering with the Airforce Engineering University. She is currently working for machine learning with the Microelectronics Academy, Xi’an Jiaotong University. Her research interests include image processing, machine learning, and probabilistic graphical model.

GUOHE ZHANG was born in Hubei, China, in 1981. He received the B.S. and Ph.D. degrees from Xi’an Jiaotong University, China, in 2003 and 2008, respectively. He is currently an Associate Professor with the School of Microelectronics, Xi’an Jiaotong University, Xi’an, China. His research interests include the semiconductor device physics and integrated circuits design, image processing and intelligent systems, algorithm and hardware co-design and implementation for deep learning and signal processing systems, and error-resilient low-cost computing techniques for embedded systems.