Trends in
Applied Sciences Research

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Research Article
SOM Attributes for a Ubiquitous P2P Communication in Wireless LAN Application

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Abstract

Objective: Line-of-sight (LOS) is a characteristic of simple visible site in selected distant from the transmitter antenna location to the receiver. The main objective of this study is to presents a prediction of System Operating Margin (SOM) of propagation loss for site specific scenarios on a line-of-sight (LOS) having an intersection for demonstrating the propagation loss characteristic in Flexible Antenna Height Communications (FAHC). **Methodology:** The design analysis is applied to the propagation prediction generated by MATLAB simulation based on the geometrical theory and the link between antennas were established as a dual slope having variables of distance, frequency, road width and antenna height. **Results:** In this analysis, the position of breakpoint is determined so that the RMS error of the regression becomes the smallest on both slope regions due to its position as important factor for good prediction accuracy. **Conclusion:** This study concludes the predicted delay is performed in 2 GHz and 5 GHz bands and the effectiveness of the prediction formula is confirmed by evaluating the prediction errors.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Line-of-Sight (LOS) radio propagation viewable pathway is characterized as the straight line connection, clear of any obstruction, between the transmitter and receiver[1]. Poor correspondences can bring about two unfriendly impacts: Missed alignment and an abbreviated connection life[2]. On the off chance that a signal strength experiences difficulty corresponding with a communication it might need to re-build up an association while reporting a level of signal attenuation. This procedure draws out radio wave propagation and further depletes the connection. In the event that an appropriate LOS communication can't be set up, the missing level perusing will be skipped from the target, specially the short range of microwave link.

Radio propagation is the investigation of how radio waves go from a transmitter to a receiver site through the air. Radio signs are influenced by landscape rise between the destinations and blocks, including trees, structures, terrain and other factor, that might be in the middle of the two locales. Radio signs are likewise influenced by climatic and other climate related conditions.

Any development of line-of-sight connection quality relates on the dependability of a LOS connection to way length, geophysical area, equipment's ability, radio frequency and meteorological variables. The geophysical and meteorological variables are depicted as far as an atmosphere climate factor and component, such rain, humidity and temperature. The significance of atmosphere on the dependability of interchanges connections has been abundantly exhibited by involvement in selected area[3].

MATERIALS AND METHODS

LOS propagation prediction: Radio path loss between two sights uses free space loss only with no other loss parameters are considered. Viewable pathway is essentially noticed from the transmitter reception apparatus area towards the receiver if the distance is short and accessible, it is considered inside of the scope range. This is referred to as optical observable pathway scope. The fresnel zone viewable pathway technique does not consider reflections or the slight twisting of radio waves laterally to the curve of the earth as a radio waves foldaway in straight lines.

The early science of radio propagation developed via mathematical model considered that radio and light were basically the same and normally follow the same way. In a distant site could be seen optically through graphs according to radio with correspondence to conceivable wave. Consequently, there is a choice to show observable pathway scope in visual plot representing the physical path loss due to free space is the mismatch of the link between antennas and it doesn't consider deterrents. It accept that the space are totally free, thus the expression "Free space". It might likewise be called "Viewable pathway loss". The regularly acknowledged mathematical statement for ascertaining Free Space Loss (FSL) is:

$$\text{FSL (dB)} = 36.57 + 20 \times \log 10 \text{ (D)} + 20 \times \log 10 \text{ (F)} \qquad (1)$$

Where:
FSL = Free space loss (dB)
D = Distance (miles)
F = Frequency (MHz)

RESULTS AND DISCUSSION

Accurate los planning: After some extensive literature review and data analysis of wave propagation, it was found that if the diameter of the earth is initiated by roughly 1.33, radio waves will travel in conservative/straight lines over this bigger earth[4]. The 1.33 earth radius is named the factor 'K-factor' and frequently expression up in radio path strategy and propagation philosophy as shown in Fig. 1.

The 'K' factor is the difference between performing radio propagation studies as line of sight paths and actual radio paths. It is also worth noting that 'K' is another of the variables that changes with atmospheric conditions. The typical values[5] of K is 4/3. However, it can range anywhere from about 2/3 to up as high as 10. These ranges do not occur often, however, they can and have occurred on microwave test ranges[6].

Figure 2 and 3 displayed the effect of diffraction loss for P2P link for random antenna height planning according to the given parameters shown in Table 1. This supplement values is being driven by the software steady for higher transmission capacity interchanges to upgraded sight and joint cooperation
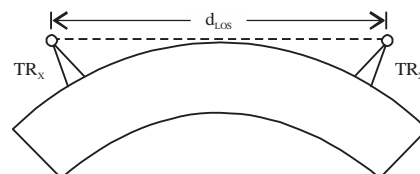

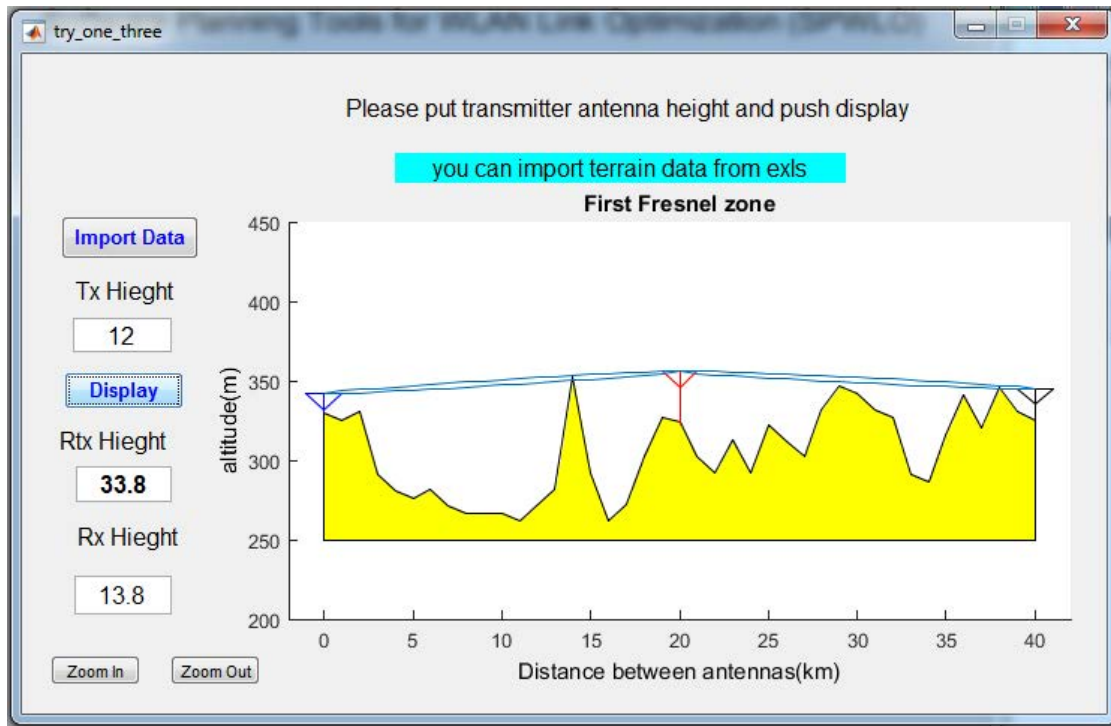Fig. 1: Line of sight view due to earth curvature

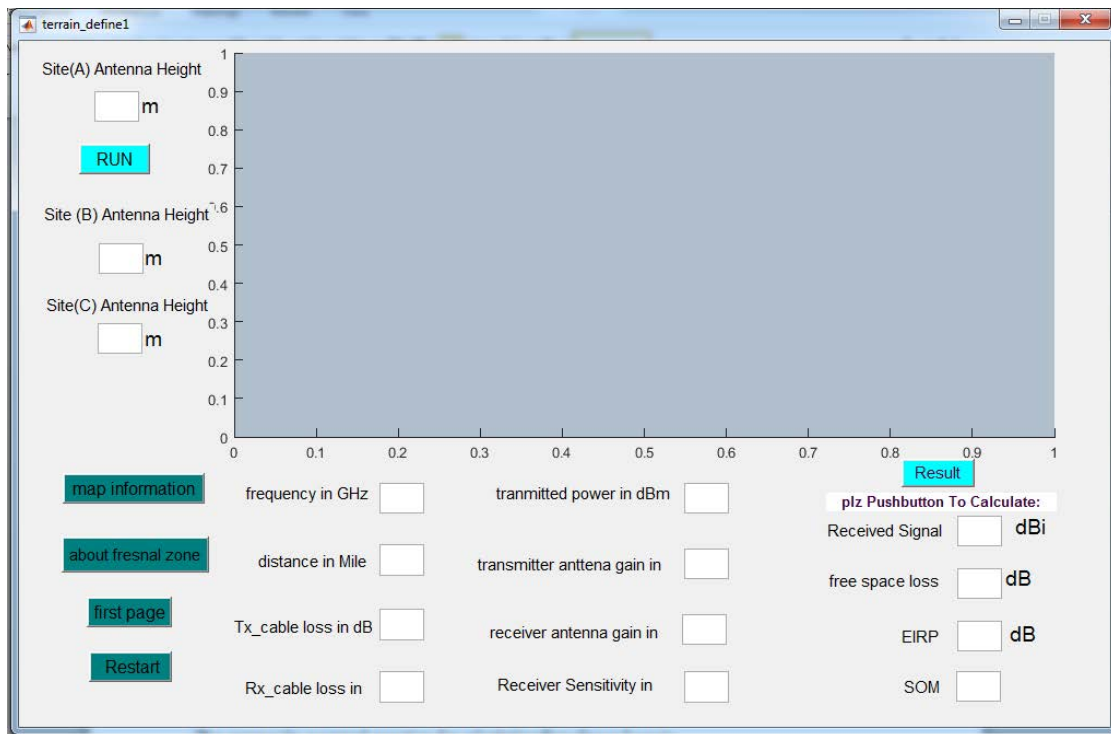Fig. 2: First fresnel zone design for point to multipoint transmission system

Fig. 3: Main window for system operating margin calculation for line of sight

devices as shown in Fig. 4 for k (true earth radius) equal to 1.3. The new innovation that empower this transformation in

ability is being made accessible by business created advancements that will give higher transfer speed, upgraded
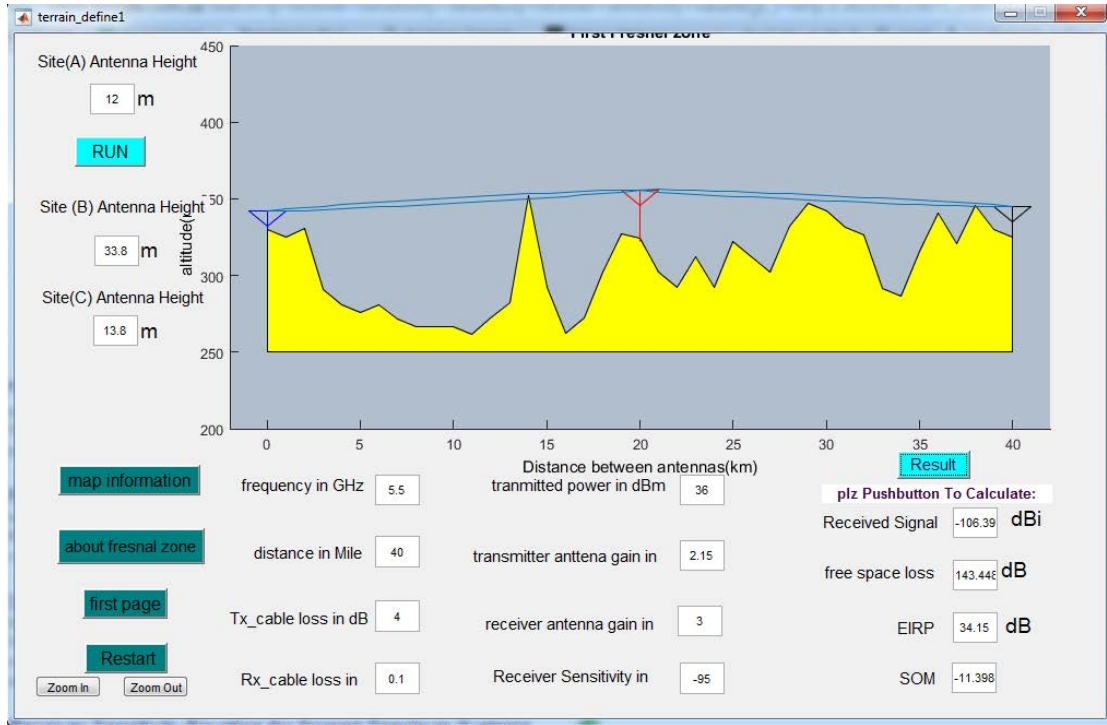
Fig. 4: System operating margin calculation when key factor (K) =1.3 for true earth radius

Table 1: Link budget design condition for system operating margin with different key factor

Condition	Parameter	Value
Initial values	Frequency (GHz)	5.50
	Distance (mile)	40.00
	Tx cable loss (dB)	4.00
	Rx cable loss (dB)	0.10
	Tx power (dBm)	36.00
	Transmitter antenna gain	2.15
	Receiver antenna gain	3.00
Results		
SOM for K = 1 (true earth radius)	Received signal	-211.26
	Free space loss	185.43
	EIRP	22.00
	SOM	-33.991
SOM for K = 1.3 (true earth radius)	Received signal	-106.39
	Free space loss	143.446
	EIRP	34.15
	SOM	-11.389

proficiency and the combination of information, voice and video[7]. The accompanying subparagraphs give a brief outline of the advancements equipment in this configuration conducted while the true earth curvature is equal to 1 as shown in Fig. 5. The link prerequisite for expanded data transfer capacity and abilities couldn't be met without good planning for transmission frameworks[8].

The objective of these planning criteria is to give engineers mindful to actualizing the configuration of any physical frameworks with data on approaches, plan imperatives, relocation technique and target models via line-of-sight transmission. The reason for this planning aided to give the most extreme direction in the usage of LOS frameworks where appropriated to the wireless link planning used for technical application[9,10].

Link budget analysis for los propagation prediction: There are three antennas that added together as the atmospheric and distance loss between a transmitter and receivers site. Both can be considered between as stated between the transmitter and receiver sites. Due to the distance between sites, it does not take into account any other factor rather than obstruction (terrain). It is expected that the destinations are totally free, thus the term free space depend on diffraction loss from signals being obstructed by terrains, trees, buildings or other obstructions in between. The propagation loss prediction results as the distance between sites intensifications and the earth curvature obstruction of the path. Usually the earth curvature obstruction is referred to the earth bulge being bending due to radio signals over an edge.

The direction of the radio wave will change the direction of the signal. However, the transmitting and receiving radio wave ought to be both polarized either on a level plane or vertically[11]. Contiguous reception apparatuses on various frequencies can be fractious polarized to lessen interference between the two links. Furthermore, the LOS link should be clear of any radio frequency conductive substances within a horizontal spacing identical to the distance[12].
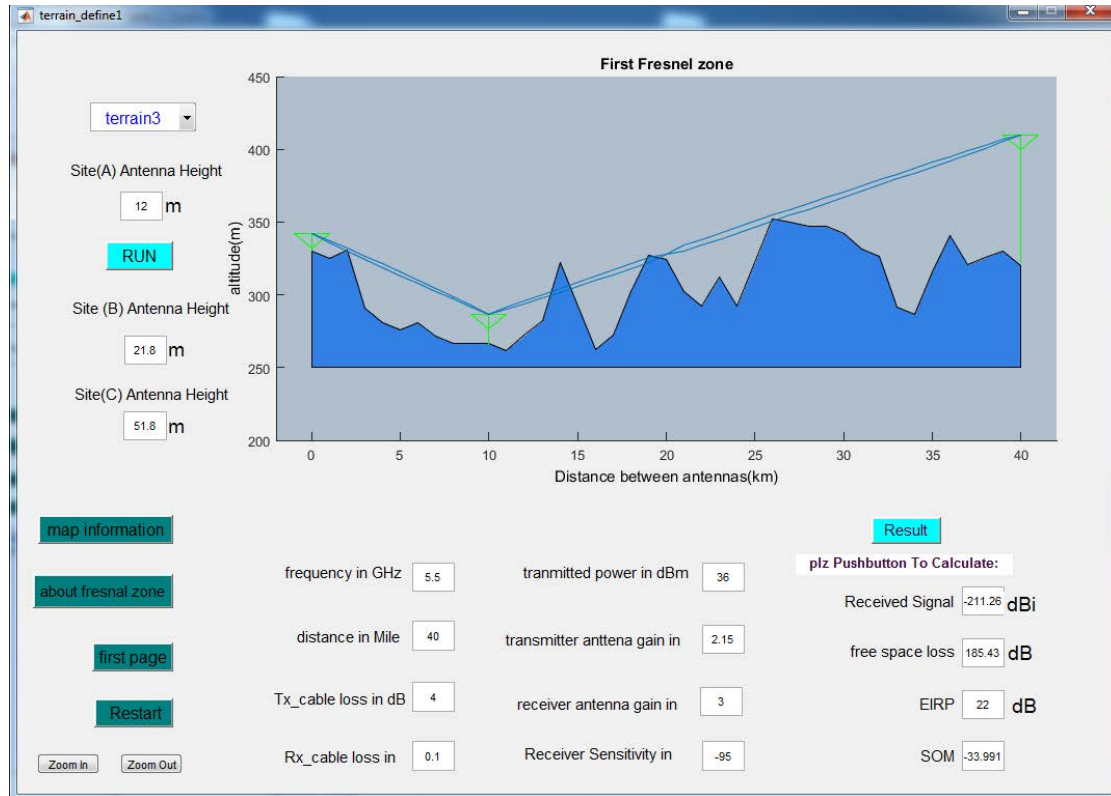
Fig. 5: System operating margin calculation when key factor (K) increased to1.3

Table 1 provides understanding into the planning essential to prepare your site for your fixed wireless system. The establishment of a wireless link system requires much the same essential arranging as any wired system. The principle contrast is that the control signal requires some extra arranging, such as directivity and antennas height. This arranging incorporates radio frequency site readiness and establishment of open free space air conditions.

CONCLUSION

A basic attention for line of sight link planning in a physical location of the sites at each end of the link may need. Because RF signals travel in a conservative line, a clear LOS link between antennas is superlative. However, the sites of the desired links are fixed, when a clear LOS cannot be realized, you must plan consequently. The planning of a LOS link involves gathering information and making verdicts. This study will help you to determine which physical part is serious to the site and will be assistance in the assessment making procedure to initiate a specific connection. It is significant that the features of the path be carefully surveyed. With this information, mechanisms and network necessities can be appropriately planned for your exact request.

REFERENCES

1. Garlington, P.E.T., 2006. Microwave line-of-sight transmission engineering. WP No. AMSEL-IE-TS-06015, June 2006.
2. Garg, V.K., 2007. Wireless Communications and Networking. 1st Edn., Morgan Kaufmann, San Francisco, USA.
3. Dutta, S., M. Mezzavilla, R. Ford, M. Zhang, S. Rangan and M. Zorzi, 2015. Frame structure design and analysis for millimeter wave cellular systems. arXiv:1512.05691 [cs.NI]. http://arxiv.org/pdf/1512.05691.pdf
4. Naimi, A. and G. Azemi, 2009. *K* factor estimation in shadowed Ricean mobile communication channels. Wireless Commun. Mobile Comput., 9: 1379-1386.
5. Oestges, C., V. Erceg and A.J. Paulraj, 2004. Propagation modeling of MIMO multipolarized fixed wireless channels. IEEE Trans. Vehicular Technol., 53: 644-654.
6. Doukas, A. and G. Kalivas, 2006. Rician K factor estimation for wireless communication systems. Proceedings of the International Conference on Wireless and Mobile Communications, July 29-31, 2006, Bucharest, Romania, pp: 69-10.1109/ICWMC.2006.81.
7. Rangan, S., T.S. Rappaport and E. Erkip, 2014. Millimeter-wave cellular wireless networks: Potentials and challenges. Proc. IEEE., 102: 366-385.

8. Lehpamer, H., 2010. Microwave Transmission Networks: Planning, Design and Deployment. 2nd Edn., McGraw-Hill, New York, ISBN-13: 978-0071701228, Pages: 496.

9. Federal Communications Commission, 2005. CFR Part 101.147, frequency assignments. https://www.law.cornell.edu/cfr/text/47/101.147

10. Ford, R., M. Zhang, S. Dutta, M. Mezzavilla, S. Rangan and M. Zorzi, 2016. A framework for cross-layer evaluation of 5G mmWave cellular networks in ns-3. WNS3, June 15-16, 2016, Seattle, WA, USA.

11. Ghosh, A., T.A. Thomas, M.C. Cudak, R. Ratasuk and P. Moorut *et al.*, 2014. Millimeter-wave enhanced local area systems: A high-data-rate approach for future wireless networks. IEEE J. Selected Areas Commun., 32: 1152-1163.

12. Varela, F., P. Sebastiao, A. Correia, F. Cercas, A. Rodrigues, F.J. Velez and D. Robalo, 2010. Unified propagation model for Wi-Fi, UMTS and WiMAX planning in mixed scenarios. Proceedings of the 21st Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, September 26-30, 2010, Instanbul, pp: 81-86.