

A Review: Locally Implementable Portable Communication Tower for Telephonic Connectivity in Remote Areas

Saurabh Shivshankar Kure

(Department of Electronics and Telecommunication Engineering, Government College of Engineering, Chandrapur - Gondwana University, Gadchiroli, Maharashtra, India.)
Corresponding author: Sarah Shivshankar kure

Abstract : A portable tower is a device which is used to connect High power tower(HPT) and cell phone(which is not in range). It is also used to create distortion less communication. Every HPT has particular area or region under it.If a cell-phone leaves that particular area or region, distortion in signals may occur. This effect can be overcome by using the portable tower.Portable Tower can be used in urban,rural areas.This model is referred from NASA. The innovators at NASA JOHNSON SPACE CENTRE have invented a portable communication signal booster device which is currently licensing.It was designed to improve communication during lunar missions and astronomical purpose. But this device is heavy and big in size.

Keywords–Cell-Phone, Communication Signal Booster, HPT (high power tower),LPT(low power tower), P.T(Portable tower).

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I. Introduction

In the world mobile network play very important role, which has made whole world near us, but in a certain area, due to lack of communication devices and network range they cannot connected with outer world which leads to limited development of that area. There are many mobile network operators available. But they are not keen in providing. the network operators in certain urban areas as it requires a lot of money and it is not beneficial. This problem can be sorted by portable tower. Portable tower works on the concept of repeater and amplifier. It acts as a repeater. Signals are emitted from HPT then it is received by receiver of portable tower which is connected to cell phone, this provides connectivity between mobile and HPT and gives distortion-less communication. Portable tower removes total fluctuation during communication; thereby acting as a filter. Here main tower acts as HPT and portable tower acts as LPT(low power tower).So, we can say that portable tower is the combination of HPT and LPT.

$$P.T = HPT + LPT$$

This model is referred from NASA[1]. The innovators at NASA JOHNSON SPACE CENTRE have invented a portable communication signal booster device which is currently licensing. It was design to improve communication during lunar missions and astronomical purpose. But this device is heavy and big in size. These drawbacks of the device have been overcome in the form of PORTABLE TOWER; thereby decreasing size and weight.This can boost incoming signal and improve local reception for cellphones,laptop and wi-fi internet receivers without need of power plugs,cable,batteries.Portable tower can be cheap in rate. Moreover, it offers distortion-less communication, and transmission line with-out distortion[5]. It is small in size and easy to use,hence it can be moved from one place to another. Also, it consumes less power in compare to HPT. These points can act as merits of portable tower.

II. Working Principle

Portable tower solves the range problem and overcomes the drawback created in communication by HPT,the working principal of portable tower explain below-

A) The signal is transmitted by transmitter of HPT toward the cellphone (away from the range),Portable tower connects the mobile phone (not in range) with HPT using wireless system.

B) Portable tower consists of receiver whose receiving range is more, hence it easily receives the signal from HPT. This received signal is transferred toward the mobile phone (not in range) which is connected to P.T in such a way signal from HPT is transmitted toward the mobile phone (not in range), but mobile communication is two-way communication system i.e. signal, data, bits, etc. received from cell-phone should be transmitted back to HPT.

- C) To complete this process the receiving signal from mobile (not in range) should be transmitted to the portable tower and then it gets transmitted to HPT. The receiver present in P.T. as a transmitting capacity, but it is sufficient to transmit signal. In this way the signals are transmitted from mobile (not in range) to HPT.
- D) From above description it is clear that P.T. is one of the successful way to connect the mobile (not in range) with HPT without distortion in communication.
- E) The merits of P.T are it is easy to understand, design, implement the circuit.
- F) P.T. is connected to mobile like router.

III. Equations and Circuitries

In order to have distortion-less communication DTL(Distortion-less transmission line)should be present; which can be created using portable tower. In below expressions, R and C acts as distortion or losses which is remove by P.T. Equation for loss less transmission line. [5]

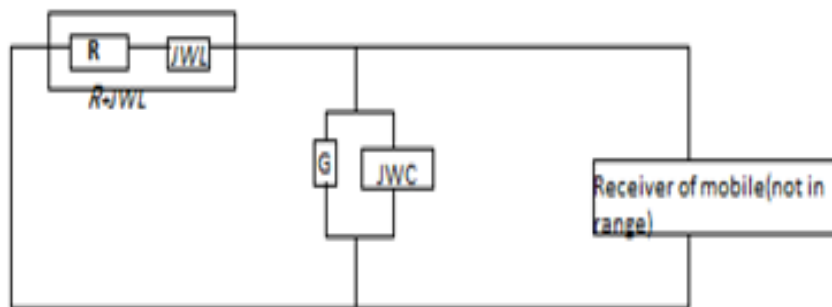


Fig. 1: Circuit for Distortion-less Transmission Line.

Here, Z=Impedance, Y=Admittance,

$$Z = JWL \Delta x \text{ (in ohm)}$$

$$Y = JWC \Delta x \text{ (in mho)}$$

$$\Delta V = ZI$$

$$\Delta V = JWL \Delta x \cdot I$$

$$dV/dx = \Delta V/\Delta x = JWL \cdot I \quad \dots\dots\dots(1)$$

$$\Delta I = JWC \Delta x \cdot V$$

$$dI/dx = \Delta I/\Delta x = JWC \cdot V \quad \dots\dots\dots(2)$$

$$d^2V/dx^2 = JWL \cdot dI/dx$$

$$d^2V/dx^2 = (JWL)(JWC)V$$

$$= -W^2(LCV)$$

$$d^2V/dx^2 = -W^2(LCV) \quad \dots\dots\dots(3)$$

$$d^2I/dx^2 = -W^2(LCI) \quad \dots\dots\dots(4)$$

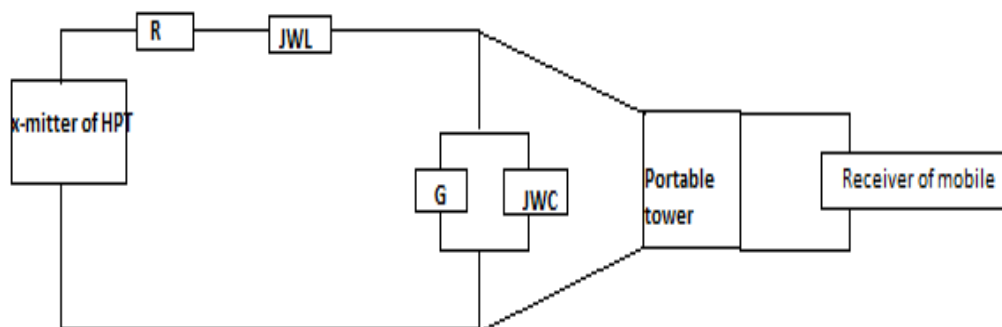


Fig. 2: Circuit for Distortion-less Transmission Line with Portable Tower.

IV. Methodology

Figure 3 shows the need of a portable tower. There are two HPT's in the figure. Every HPT covers a particular area, but they are not able to cover the total area.

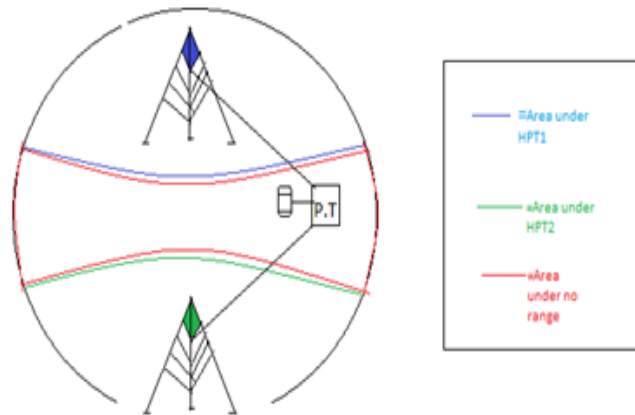


Fig. 3: Traditional HPT communication network range in given area.

In figure 3, Green line shows the area covered by green tower and blue line shows the area covered by blue tower. Hence it is clear that there is no range present in area covered by red line. Therefore, communication is not possible in this area. But by using portable tower in this area cellphone gets easily connected to both the towers.[3]

First the signal is transmitted by transmitter of HPT toward the cellphone (away from the range), Portable tower connects the mobile phone (not in range) with HPT using wireless system.

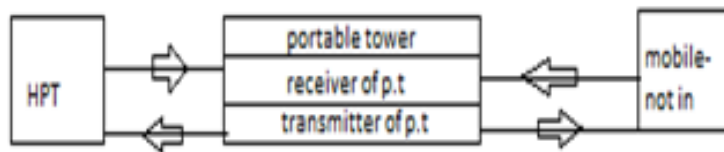


Fig. 4: Communication through Portable Tower.

Portable tower consists of receiver whose receiving range is more, hence it easily receives the signal from HPT. This received signal is transferred toward the mobile phone (not in range) which is connected to P.T. in such a way signal from HPT is transmitted toward the mobile phone (not in range), but mobile communication is two-way communication system i.e. -signal, data, bits, etc. received from cell-phone should be transmitted back to HPT.

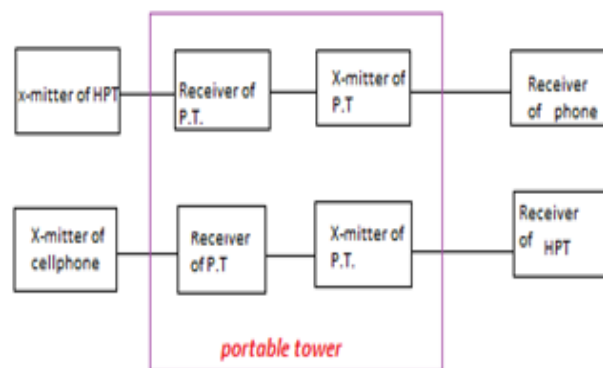


Fig. 5: Communication between HPT and Cell-Phone (Out of Range) through Portable Tower.

To complete this process the receiving signal from mobile(not in range)should be transmitted to the portable tower and then it gets transmitted to HPT.The receiver present in P.T as a transmitting capacity, but it is sufficient to transmit signal.In this way the signals are transmitted from mobile (not in range) to HPT.

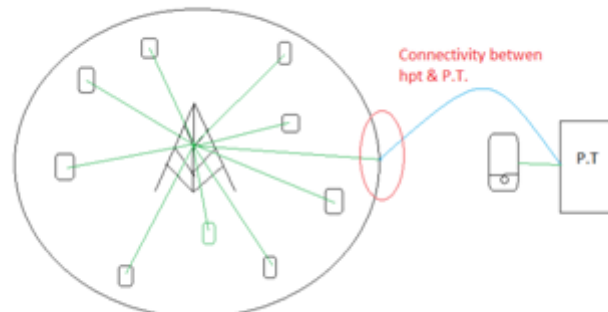


Fig. 6: Extended Connectivity between Portable Tower and Traditional HPT.

Above figure shows when cellphones are in range of tower,they get easily connected to the tower,shown by green line.Inorder to bring cellphone in range portable tower is used which is denoted using blue line.[3]

V. Conclusion

From above information it is clear that-

- 1) Portable tower can able to overcome the limitations.
- 2) Portable tower is cheap in price.
- 3) It offers distortion-less communication.
- 4) It can be moved from one place to another.
- 5) It may require more power to satisfy the demand of range.

The presented methodology has resource and financial dependencies so that the implementation are in future scope. For further research work, this presented review can be relevant and the development of the portable tower in remote areas is seemingly possible.

Acknowledgements

The supplementary research documents and Patents Documentations are taken from publicly available source of NASA and their expertise work and depth of knowledge motivates me to do further research in analogous topic. This review paper is inspired and derived from their work.

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