A Point to Point Microwave Link with Its Solar Power System

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Background :

The main process of this research is to design and implementation of microwave link for internet access with solar power supply system. In this process we analysis in three parts: solar power supply system, access point and subscriber module configuration, and the connection between power supply and the transmitter and the receiver. This project will provide where the electricity is not get all times places. For emergency case or rural area, this system with its own power station is very suitable to get internet access.

Targets:

The main aim of this system is to provide internet access for rural area using ePMP Force 180 5GHz subscriber module.

Proposed Method:

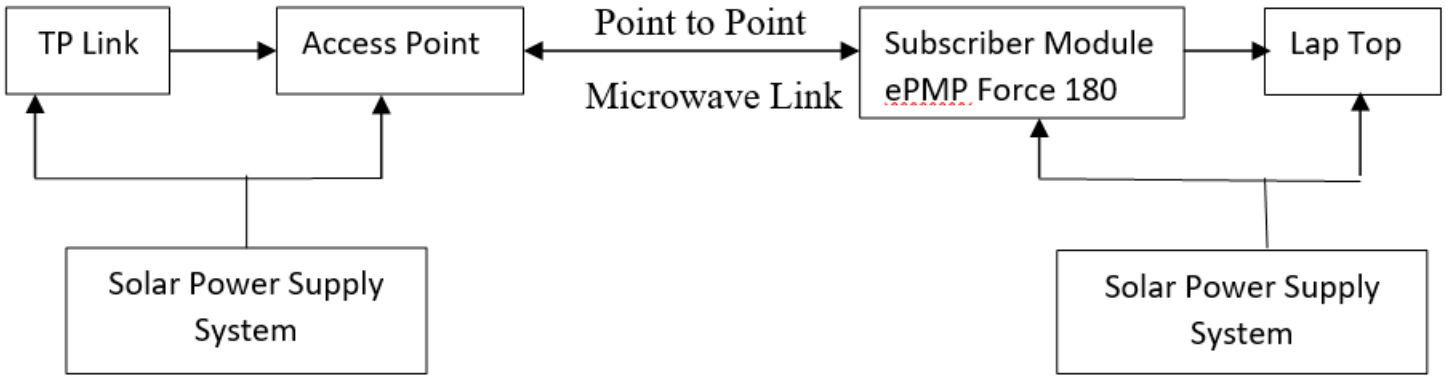

Fig 1.Block Diagram of Point to Point Microwave Link

- Solar power supply system is supplied to the TP link and access point (AP).
- In the TP link the SIM Card has 4G Internet and it reach to the access point (AP).
- And then via the point to point microwave link the 4G Internet reach subscriber module ePMP force 180.
- In this case, we must design the location, the transmit power range, the bandwidth and the frequency which has between the AP and SM. The ePMP Force 180 is the second generation of ePMP Integrated Radio Modules.
- From the subscriber module the 4G Internet reach to the laptop. Both subscriber module and laptop are supplied by the solar power supply system in order to get power in 24 hours.

Proposed Method: (Continued)

MICROWAVE LINK DESIGN PROCESS

To implement our own point-to-point microwave link, we have considered the first three factors in terms of required distance and capacity, desired availability target for the link and availability of Clear Line-of-Sight (LOS) between end nodes. Firstly, we select the two target sites, the first one is at the Technological University (Loikaw), and the other end is at the Taung Kwe Pagoda. These two sites are located in Loikaw, the capital of Kayah State. Moreover, for the required frequency band, the ISM (Industrial Science & Medical) 5.8 GHz band with the channel bandwidth 40 MHz has been chosen.

The processes that are taken:

- **Site Selection**
- **Antenna Height Calculation**
- **Fresnel Zone Clearness**
- **Antenna Down Till Calculation**
- **Link Budget Calculation**

Proposed Method: (Continued)

IMPLEMENTATION PROCESS

- Coordinate's Configuration using Google Earth Pro
- Path Profile using Link Planner Software
- Getting Path Profile
- Hardware installation of TP link Router, Access Point and Subscriber Module
- Testing of Solar Power System
- Testing of Point to Point Microwave Link for Internet Access

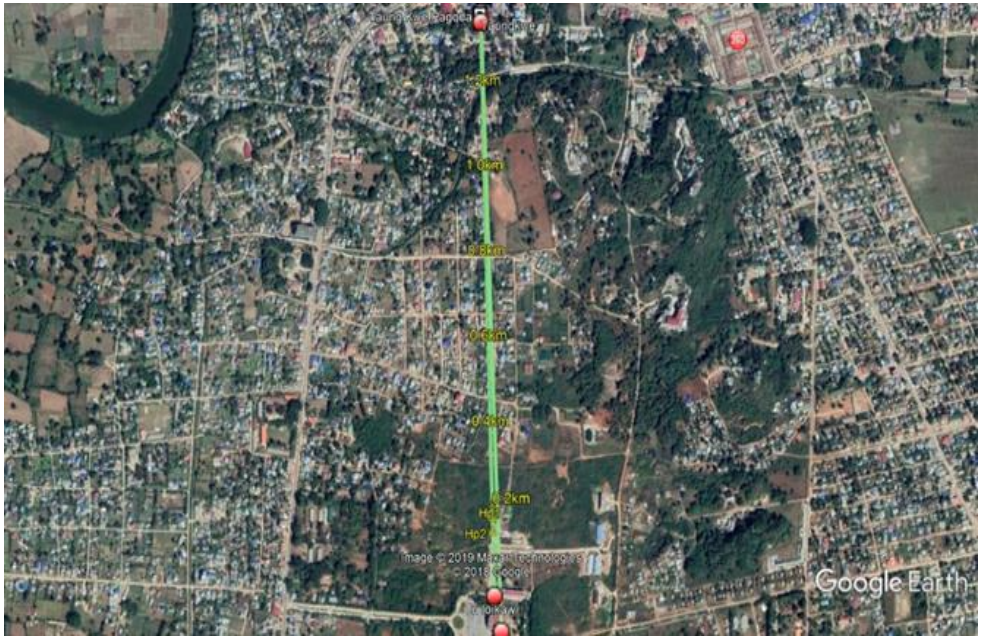

Figure 2.Geography of the specified site locations using Google Earth Pro

Impact:

Discussion:

The location of the site is very important for the design before the parameters, the values and parameters depends on the data of the sites. In choosing a site location, many factors are to be considered such as the operating frequency, free space loss, system fixed loss, fade margin, system reliability, height of communication tower, antenna gain, waveguide losses and total height of obstruction (TEO) due to highest obstruction, Fresnel clearance, earth curvature and additional clearance antenna gain. These factors are considered in choosing the proper equipment to be used and constructing the appropriate towers and parabolic antennas.

However, It is hard to locate or determine the highest obstruction present between the two sites without their specific location. Using the internet for the data path profile instead of the topographical map may also decrease the accuracy of the measured distance. Considering the criteria regarding the selection of the sites, the proponents arrived at TU (Loikaw) linking to Taung gwe.

Recommendation:

After the success of the design, the proponents recommends to other researchers especially for those engineering students to research more about microwave engineering to enhance their knowledge about line-of-sight propagation. For those who will be given the same project, always take note that every parameter should be considered and calculated with reliable and accurate data to avoid design failure. The university instructors should pursue the microwave engineering for the engineering students especially for electronics engineering to practice the students in the field before they work in reality after graduating.

Output/Outcome:

(a) (b) (c)

Figure 3. (a)Overall Implementation of Transmitter Site
(b) Overall Implementation of Receiver site
(c) Overall solar power system at receiver site

Conclusion:

Point to point microwave links are widely used as a cost effective alternative to fiber optic cabling for interconnecting the network of two sites with distances of few hundred meters and up to 50 km or more. In this system, the distance between two points is 1.45 km longs and two antennas must be line of sight. In microwave communication, higher frequency bands are used in shorter hops and lower frequency bands are used in longer hops. The lower frequency band is not used in urban areas. The link planner software is developed to help telecommunications engineers to design and simulate a new microwave line-of-sight radio link over varieties of terrain and paths without going into detailed mathematical equations. This system is simulated with Cambium link planner software to achieve link availability of 99.999%. However, design and implementation of a successful and reliable point to point microwave link requires good theoretical knowledge about RF design and antennas, as well as good deal of practical experience.

The design of the solar PV system for the point to point microwave link was conducted through a multi-staged criterion in order to best optimize the selection of the ratings of the main components needed by the solar PV System. The results showed promise for solar PV system. The location where the PV panel is installed in has the best solar suitability from solar designing point of view; it should be strongly considered for solar PV system as this technology becomes more affordable relative to fossil fuels.