# AN IMPLEMENTATION FOR SNR INVESTIGATION AND ITS MULTIPATH FADING EFFECTS USING GPS SYSTEM

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**Abstract**
**In this paper the mathematical basis for calculating multipath phase error parameter on the basis of SNR (signal to noise ratio) different multipath signals are handled separately and the GPS Diag. software used for calculating it. In this work we have analyzed the estimation of SNR, no additional information about the geometry of the surroundings of the receiving station at right time of acquisition is considered. The scattering phenomenon is generally due to the composition of several single multipath contributions, each one characterized by specific frequency. The algorithm takes an advantage to decompose the variations of the SNR into individual components in an iterative procedure. Spectral and Statistical analyses were implemented to compare the observed phase residual obtained from the GPS measurements and the estimated multipath error obtained by the MATLAB results.**
**Keywords: GPS, carrier phase multipath, SNR.**

## I. Introduction

GPS is a radio based navigation system that gives three dimensional coverage of the earth 24 hours a day the system is reliable and accurate. The GPS is an earth orbiting-satellite based navigation system. It is well known from the study that multipath error is one of the major sources of error affecting the positional accuracy of GPS although, its effect can be reduced by choosing sites without multipath reflectors or choosing proper antennas to minimize the reflected signal. It is very difficult to totally reduce these effects from GPS observations but we can apply some technique to reduce multipath effect. This paper shows that a ring choke antenna can play a vital role in reducing the fading effect. The Global Positioning system is a space-based radio positioning and navigation system that provides 24 hour, all weather, and world-wide coverage with position, velocity and timing information.

## II. System Functioning

It is composed of a space segment, a control segment and a user segment. It is very difficult to totally reduce these Segments of Satellite: Satellite is composed of three segments (a) Space Segment, (b) Control Segment and (c) User Segment. Space Segment: There are 24 satellites revolving around the earth.The distance of these satellites from the earth is appox. 20200 Km. It completes one rotation in 12 hours and this process continued. At time there are 26 satellites revolving the earth out of which 2 to 3 satellite visible. The clocks generate 10.23MHz frequency on which the signals are transmitted from the satellite.

Control Segment: It consists of 5 monitor stations, 4 ground antennas and one master control station spread among 5 locations roughly on the earth equator. It updates the position of GPS satellites, adjusts and synchronizes and GPS receiver searches each satellite. The satellite signals are read at JIET Jodhpur.

User Segment: It uses a GPS receiver and determines their position and time. Applications within the user segment are vehicle location, surveying, marine, navigation, aerial navigation, machine control here,GPS Trainer ST2276 used.

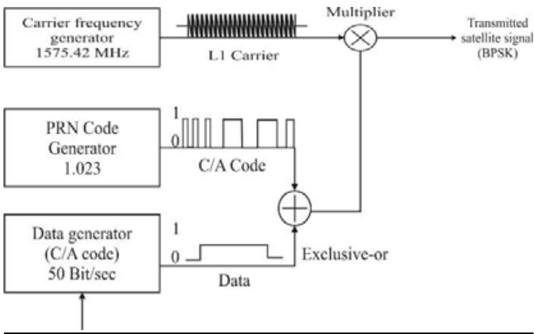


Fig. 1 Diagram Showing GPS Satellite Transmitter

Information Transmitted by the Satellites:
It describes where all the satellites are roughly, allowing the receiver to know where to look for a satellite. This data is broad- cast to the User Segment so that it can be stored and employed for initial satellite acquisition and for visibility prediction.
Satellites are recognized as:
Space Vehicle Number (SVN), and Pseudo Random Noise number (PRN). The Space Vehic1e number indicates the linear order in which the satellites were launched and the PRN is used to identify which satellite they are observing.

## III. System Environment & Designing

In the environment, so many obstacles i.e. buildings, vehicles, trees, mountains, curve dearth, surface, street lights present. To reduce multipath to almost the level of receiver noise was demonstrated in trial. The effectiveness on real data was demonstrated with controlled static experiments. Small errors remained, predominantly from high frequency multipath [4].

## IV. Working Platform

In order to investigate SNR , we connected three devices, in various months in different meteorological conditions and improved SNR for different multipath problem by designing Ring choke antenna .Firstly GPS trainer kit ST 2276 is connected with PC and number of satellites were detected along with PRN number, Azimuth, elevation angle and altitude as shown in Fig. 2

Fig 2: A typical experimental setup of GPS Receiver Kit, Software used, and Ring choke Base, Receiver Patch Antenna for investigation of SNR.

Table 1: Represents SNR for with and without Ring Choke Base &Satellites Detected.

| Month | With ring choke SNR | Without Ring Choke SNR | No. of satellites detected without ring choke | No. of satellites detected with ring choke |
|---|---|---|---|---|
| Oct. | 39 | 38 | 3 | 4 |
| Nov. | 40 | 40 | 3 | 6 |
| Dec. | 48 | 45 | 5 | 5 |
| Dec. | 43 | 37 | 5 | 6 |

The Design of Ring Choke Antenna as shown in fig 3, with appropriate physical parameters, the Ring choke [2] can lessen the multipath effect. Some results have been achieved by fabrications the height of the choke ring (H) .The difference of the radii of adjacent choke rings should be0.09lembda, the smallest choke ring should be as small as possible.

Fig. 3 Diagram Showing Ring Base Antenna prepared from Aluminum

## V. Result and Conclusion

The data collected from GPS trainer receiver kit ST 2276 using patch Antenna and Ring Chock antenna and observed reading from Jan to July. We observed that in the month of May, the signal strength of satellites is more because they are in line of sight. On the basis, we have concluded these results which has shown on graph further I saved the observations by using GPS diagnosis software on that I have observed various reading in several months and concluded that GPS reading in the month of May is very clear, Signal strength is very good because of atmospheric clear condition another observation is comparative study of various satellites SNR. Graph plotted for each month.

This paper shows that SNR improvement can be done using Ring choke Antenna implementing it with GPS receiver system, and this can be validated using results shown in fig.4, we have investigated throughout the month of January to September 2015. Since this paper shows only received signal SNR. In future it can be implemented in GPS system by miniaturizing Ring Choke antenna for compatible GPS System.

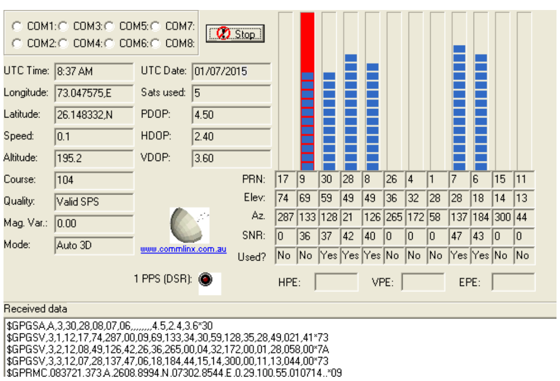


Fig. 4 Snap Shot of SNR in the month of January without ring base

In this month i.e. January 07, we have observed that four satellites are received at 12:37pm on that latitude is 26.148332N, longitude is73.047575E, and speed is 0.1, altitude is 195.2 Course is 104; quality is SPS in 3D PDOP is 4.50, HDOP is 2.40and VDOP is 3.60, highest SNR on that day is 47 dB. Whose PRN number is 7, Elevation angle of that antenna is 28degree, azimuth angle is 137degree.

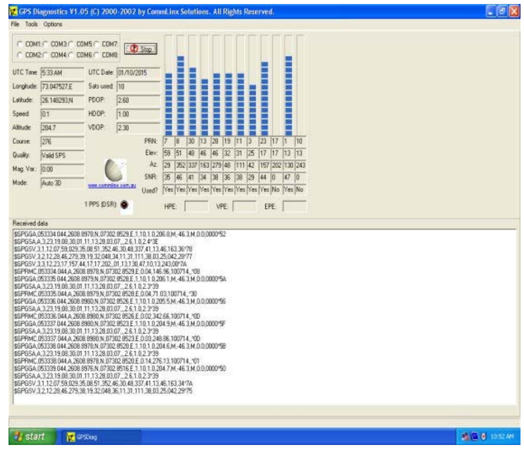

Fig. 5 Snap shot of SNR in the month of January without ring base

In this month i.e. January 10, we have observed that six satellites are received at 10:33 am on that latitude is 26.148293N, longitude is73.0475E, and speed is 0.1, altitude is 204.7 Course is 276; quality is SPS in 3D PDOP is 2.60, HDOP is 1.00and VDOP is 2.30, highest SNR on that day is 47 db. Whose PRN number is 1, Elevation angle of that antenna is 13degree, azimuth angle is 130degree.

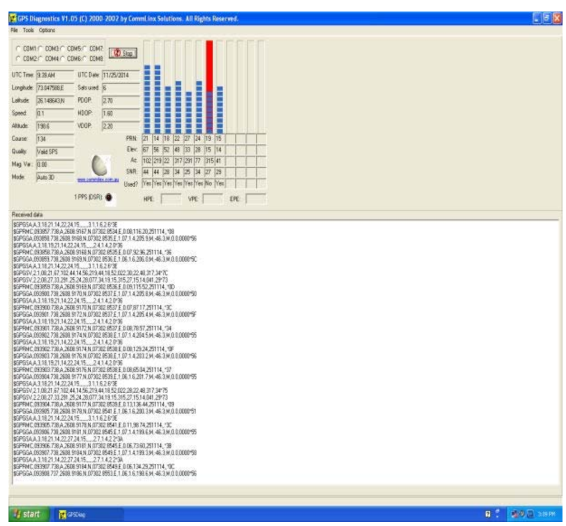

Fig.6 SNR in the month of December without Ring Base

taking lots of snaps lastly taking Snap Shot of SNR in the month of December without Ring Base a Terrace (By GPS Diag Software V1.1) In this month i.e. December 5 I have observed that six satellite signal are received at 12:46 PM on that day latitude is 26.148225N, longitude is73.0475E, and speed is 0.1, altitude is219.0 Course is 119,quality is valid SPS in 3D PDOP is 3.00,HDOP is 1.60.and VDOP is 2.50,highest SNR on that day is 43 db. Whose PRN number is 21, Elevation angle of that antenna is56degree, azimuth angle is 349 degree without Ring Base Month Wise evaluation of SNR :

Table 2: Cumulative SNR in the month of January without ring base.

| DATE | SNR |
|---|---|
| 1/1/15 | 47 |
| 2/1/15 | 49 |
| 3/1/15 | 49 |
| 5/1/15 | 46 |
| 7/1/15 | 46 |
| 8/1/15 | 44 |
| 9/1/15 | 44 |
| 10/1/15 | 47 |

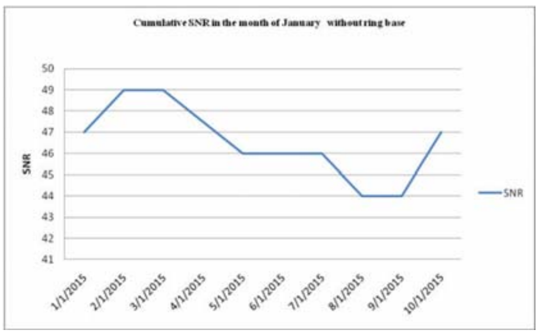


Fig. 7 Graph showing SNR v/s Date

Table 3: Cumulative SNR in the month of May without ring base

| DATE | SNR |
|---|---|
| 13/5/14 | 36 |
| 14/5/14 | 36 |
| 20/5/14 | 37 |
| 24/5/14 | 39 |
| 26/5/14 | 47 |
| 27/5/14 | 38 |
| 28/5/14 | 43 |
| 29/5/14 | 41 |
| 30/5/14 | 40 |

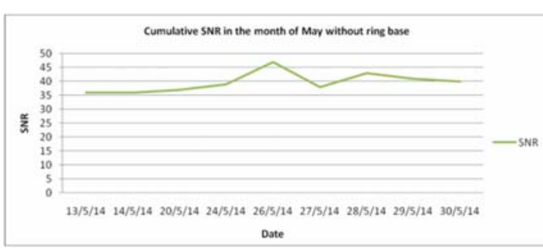


Fig. 8 Graph showing SNR v/s Date

Table 4: Cumulative SNR from January to September without ring base in tabular as well as graphical form

| Month | SNR |
|---|---|
| January | 44 |
| April | 23 |
| May | 42 |
| June | 38 |
| July | 46 |
| September | 42 |

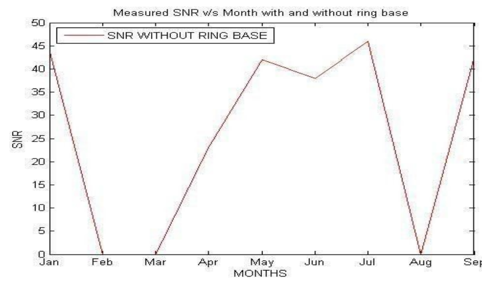


Fig. 9 Graph showing SNR v/s Month

Table 5: Cumulative SNR from Oct-Dec. with and without ring base in tabular as well as graphical form.

| Month | SNR with ring | SNR without ring |
|---|---|---|
| Oct. | 4<br>4 | 40 |
| Nov. | 4<br>2 | 38 |
| Dec. | 4<br>8 | 39 |

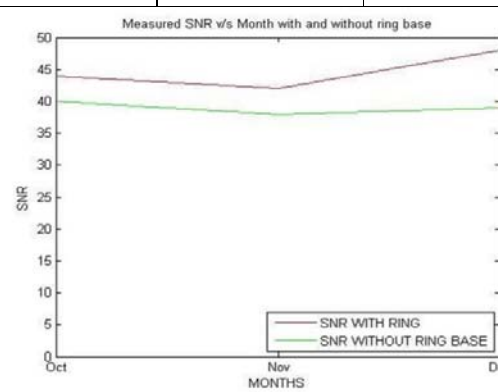


Fig 10: Measured SNR v/s Month with and without ring base.

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