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LINK BUDGET ANALYSIS FOR SATELLIES IN LOW EARTH ORBIT AND GEOSTATIONARY  
ORBIT USING NIGERIAN SAT-1 AND NIGCOMSAT-1

**Abstract**

Link budget calculation is a very important step in the design phase of any satellite, in order to ensure its proper operation. This is to ensure the normal functioning of the satellite after launch and it requires a careful analysis to be performed. There is always a big challenge to reach a delicate balance of the power and bandwidth requirement. The first step in designing every satellite network is the performance of a satellite link budget analysis. The link budget analysis will determine what size of antennae to use, power requirements, link availability, the error rate, and at large, the overall customer satisfaction of the analysis. It involves the creation of a link budget and usually starts with power usage and accounts for power attenuation as the signal propagates. The NigeriaSat-1 and NigcomSat-1 were used for this research which is a LEO and GEO satellites respectively. The research used three methods (Matlab, Excel and the SatMaster pro) to establish the performances of the LEO and GEO satellites. This research was able to set up a link between the station signal transmission and a receiver (user) to ensure that a balance is achieved between the power and bandwidth requirement. The choice of parameters are done carefully and this is to make sure that the system functions normally with these parameters and link budget calculation with sufficient margin of error. The result obtained from one of the receiving stations after careful selection of the transmitted power, coding, modulation technique, the bit rate, the receiver gain and other known parameters for the  $C/N$  (measure of the performance of the link) was 19.1dB whereas the required was calculated to be  $C/N$  10.3dB. The margin of unexpected degradation is 8.8dB margin giving the signal fade an increase of 8.8dB which is an efficient link budget satellite design. The analysis also investigated into a number of methods for the calculation and discovered that all methods produced similar results but the use of the excel sheet presented more advantages. An investigation into further research work, STK tool is being used to develop a model with pre-set values of the different geographical locations determining the signal's fade margin (rain and atmospheric) during propagation. This analysis will assist satellite operators in predicting the performance of their satellite after launch and ensuring that the expensive resources are well utilized. **KEY WORDS:** Link Budget, LEO, GEO, Bandwidth Requirement, Power Requirement