Validating Link Budget

1. From the samples collected by pointing sensor towards the sky, determine the average noise power using bins 76 to 154 (clear from the close in towards DC bin).  
     
     
     
     
   Total Noise power estimated = 64.11 dB (above plot Y axis is Noise density)
2. From the samples collected from pointing down the sensor from known height, determine the power of the return.  
     
     
     
     
     
   Signal Power of ~60 meters return = 66.10 dB  
   Signal Power of ~30 meter return = 71.75 dB
3. From above steps (1 & 2) determine the SNR  
     
   SNR of ~60 meter return = 1.99 dB  
   SNR of ~30 meter return = 7.65 dB
4. Using datasheet information on IF BW and NF, determine the thermal noise.  
     
   NF of sensor = ~14 dB  
   IF BW = 10 MHz (also from datasheet, however lower end is limited by a configurable HFP which is in 100KHz or so)  
   Theoretical Noise Power = -90 dBm
5. Get the approximation of the power of the received signal from steps 4 and 3  
     
   Estimated Signal Power of ~60 meter return = -88 dBm  
   Estimated Signal Power of ~30 meter return = -82.35 dBm
6. Validate the power of the received signal from the formula below ( Link Budget Analysis of FMCW Radio Altimeter: Egypt 2021, this is only reference for 1/R^2 relationship. Meets our observation as well)

|  |  |
| --- | --- |
| Pt | 12 dBm from datasheet |
| Gt | ~10 dBi for a single antenna. Need to compute for Tx beamforming case in MRR (TODO) |
| Gr | ~10 dBi. No beamforming in Rx |
|  | 5 dB (from Link budget paper) |
|  | Since Tx and Rx have different beampatterns because of beamforming in Tx, need to think about this. |
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| Pr | -94 dBm (Assuming, Gt as 13 dBi, Gr as 12 dBi and as 14 degree and as 30 degrees as 5 dB, R as 60 meters) |

1. Determine the expected SNR for the entire range and verify with TI’s SNR vs Range check to weed out returns that are due to glazing incidence etc (TODO)



Note: Since noise from one bin to another bin is uncorrelated, we cannot add them in amplitude. We can only add them in power. So TI’s method of finding SNR will not give true SNR but some kind of approximation that can be used compare returns.

<https://e2e.ti.com/support/sensors-group/sensors/f/sensors-forum/798111/awr1843boost-how-to-obtain-the-radiation-pattern-of-the-antenna-far-field-information>