What is the question?

***how big does the receive antenna need to be****to detect the signal transmitted by the radar of interest after it bounces off the moon in order to achieve a 20 dB peak SNR?*

Only thing given:

SNR = 20dB

What is SNR?

How to solve for and ?

= Radar Range Equation   
 = Antenna Noise Power Equation

Antenna Noise Power Equation

How to solve for it?

**=Boltzman’s constant**

**T=system noise temp.**

**B=bandwidth(CIA article, time-frequency duality of Fourier transformation)**

What is T?

**= affective transmission temp/noise temp as seen for receiver terminals**

**=noise temp of the receiver itself**

How to solve for ?

**= attenuation constant**

**=length of the transmission line(assume L=0)**

**=noise temp of the antenna**

**=noise temp at the receiver’s terminals**

**= temp of transmission line**

***If l=0, then the equation becomes:***

How to solve ?

**= antenna’s radiation efficiency(look up typical efficiency of dish antennas)**

**= antenna’s physical temp(assume room temp. or if you want to be fancy average temp in Palo Alto)**

How to solve ?

Brightness temp. integral

A picture containing clock

Description automatically generated

(reference article that has )

Radar Range Equation

A screenshot of a cell phone

Description automatically generated  
A close up of a map

Description automatically generated

A picture containing clock, meter

Description automatically generated

\*\*\*Check this equation, but this is the right approach\*\*\*

A screenshot of a cell phone

Description automatically generated`

* CIA Article: observed radar pulse width of 800 microsecond pulse

Taking the Fourier transform of a pulse in T.D. is a sinc function in F.D.

* The 3dB Bandwidth of radar pulse would be 1/PW (PW= length of pulse width)
* Since PW = 800 microsecs 🡪 1/(800\*10^-6) = 1250Hz = 3dB BW

A close up of a map

Description automatically generatedA screenshot of a cell phone

Description automatically generated

Things that need to be researched

* Dimensions of the Hen house (to solve for the gain of transmitter)
  + <https://www.cia.gov/library/readingroom/docs/CIA-RDP78T05439A000400340021-1.pdf>
* Transmission power (the signal intercepted from ionized cloud)
  + <https://www.cia.gov/library/center-for-the-study-of-intelligence/kent-csi/vol11no2/html/v11i2a05p_0001.htm>

* Distance from Earth to moon, and prove mathematically that we can treat this system as a monostatic system (worst case, antennas are on the opposite sides of earth)
  + I have an article
* Cross section of the moon
  + <https://nvlpubs.nist.gov/nistpubs/jres/66D/jresv66Dn3p215_A1b.pdf>

* Gain equations to solve for the antenna Dimensions
  + Book?