Ka Band Cloud Radar Constant and MDdBZ- Eureka General Mode

$f := 35.86 \cdot 10^9$

Wavelength (m)

$\lambda_r := 2.998 \cdot \frac{10^8}{f}$ $\lambda_r = 8.36 \times 10^{-3}$

$\theta := 0.31$ Beamwidth (deg)

$\theta_r := \frac{\theta}{57.3}$

$P_{tdB} := 50.3$ Transmitted power (dBm)

$\phi := 0.30$ Beamwidth (deg)

$\phi_r := \frac{\phi}{57.3}$

$P_t := 10^{\frac{P_{tdB}}{10}}$ $P_t = 1.072 \times 10^5$

$G_{0dB} := 53.48$ Antenna gain (dB)

$K := \sqrt{0.93}$

$CODE := 1$

$G_0 := 10^{\frac{G_{0dB}}{10}}$ $G_0 = 2.228 \times 10^5$

$\Delta R := 90$ Range resolution (m)

$L_{cp} := 0$

$L_R := 1.35$ Receiver path loss (dB)

$L_{MF} := 2.3$

$L_T := 1.0$ Transmitter path loss (dB)

$Lsys_{dB} := L_R + L_T + L_{cp} + L_{MF}$ $Lsys_{dB} = 4.65$

$L_{sys} := 10^{\frac{Lsys_{dB}}{10}}$ $L_{sys} = 2.917$

$$RC := \frac{512 \cdot \ln(2) \cdot \lambda_r^2 \cdot 10^{18} \cdot L_{sys}}{P_t \cdot G_0^2 \cdot \theta_r \cdot \phi_r \cdot \Delta R \cdot \pi^3 \cdot K^2 \cdot CODE}$$ $RC = 185.007$

$RC_{dB} := 10 \cdot \log(RC)$ $RC_{dB} = 22.672$ Radar Constant (dB)

$k := 1.38 \cdot 10^{-23}$ Boltzman's constant

$N_F := 3.4$ dB

$F_n := 10^{\frac{N_F}{10}}$

$F_n = 2.188$ Noise figure

$T_{op} := 290 \cdot F_n$ System noise temp (K)

$T_{op} = 634.451$

$FFTL := 128$

$NSpec := 26$

$IPP := 96 \cdot 10^{-6}$

$NCI := 5$

$B := \frac{150}{\Delta R} 10^6$

$B = 1.667 \times 10^6$

$V_{NQ} := \frac{\lambda_T}{4 \cdot IPP \cdot NCI}$

$V_{NQ} = 4.354$

$T_0 := IPP \cdot NCI \cdot FFTL \cdot NSpec$

$T_0 = 1.597$

$SNR := \frac{25}{FFTL \cdot \sqrt{NSpec}}$

$SNR = 0.038$

$SNR_{dB} := 10 \cdot \log(SNR)$

$SNR_{dB} = -14.168$

$$MDS := k \cdot T_{op} \cdot \frac{B}{NCI} \cdot SNR \cdot 1000 \qquad MDS_{dB} := 10 \cdot \log(MDS)$$

$MDS_{dB} = -129.516$ Minimum detectable signal (dBm)

$Z_{min}(R) := MDS_{dB} + 20 \cdot \log(R) + RC_{dB}$ $Z_{min}(5000) = -32.865$ Minimum detectable dBZ