Fluctuation of antenna temperature from background sources at the resolution limit

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From formula (5) of NRAO Publ.No. 2 we have for the number of sources, in general,

$$N = 624\ \lambda^{1.2}\ S^{-1.5} \quad \text{sources/steradian, with fluxes} \geq S$$

and the resolution limit of an antenna of diameter a is given by formula (24) as

$$N_{res} = 1.18 \times 10^{-2}\ (a/\lambda)^2 \ \text{sources/sterad.}$$

Both together give, for the flux of the faintest sources at the resolution limit:

$$S = 1.31 \times 10^3\ \lambda^{2.13}\ a^{-4/3} \quad \left\{ \begin{array}{l} S \text{ in flux units} \\ \lambda \text{ in meter} \\ a \text{ in meter} \end{array} \right.$$

These numerical values were obtained by a fit to the 3C data. We now should rather fit to Hoglunds SOS data; it turns out that by doing so we must multiply S by 1.5, which gives

$$S = 1.97 \times 10^3\ \lambda^{2.13}\ a^{-4/3}\ .$$

These values were derived by adopting a signal/noise ratio of 5; thus, we divide by 5 in order to get the fluctuations. We then transform the flux denisty S into antenna temperature T by use of

$$T = 1.71 \times 10^{-4}\ S\ a^2$$

and obtain finally

$$\underline{\Delta T = 6.7 \times 10^{-2}\ \lambda^{2.13}\ a^{2/3}} \quad \left\{ \begin{array}{l} \Delta T \text{ in } {}^{o}K \\ \lambda \text{ in meter} \\ a \text{ in meter} \end{array} \right.$$

λ(cm)	85 ft	140 ft	300 ft
100	0.59	0.85	1.36
40	.083	.12	.19
20	.019	.026	.044
10	.0043	.0060	.010
6	.0014	.0020	—
3	.00033	.00046	—
2	—	.00020	—

= ΔT in °K

For lunar occultations, the resolution of the antenna plays no role. The antenna temperature from moon and sky is, for example:

Frequency	234	405	1400	MHz
Antenna Temperature	91	65	130	°K