Comments to the diagrams

The diagram of "reception performance" shows the signal-to-noise ratio of extra terrestrial signal reception (sun noise) dependent on f/D ratio.

Using a 0,5dB NF front end, the best performance of the receiving system looks at 0,52 f/D (correspon-ding to −12,6 dB dish edge illumination). The maximum gain is achieved at 0,59 f/D (corresponds to −9,9 dB dish edge illumination).

The best over all performance requires a compromise. In this case, compromise means an f/D ratio which gives equalized loss of transmission- and reception-performance. A closer look at the diagram shows this compromise at 0,55 f/D (both losses approx 0,2 dB) which corresponds to 11,3 dB apertur taper.

However, small movements in the 0,5 -0,6 f/D range archieves no significant effects on performance.

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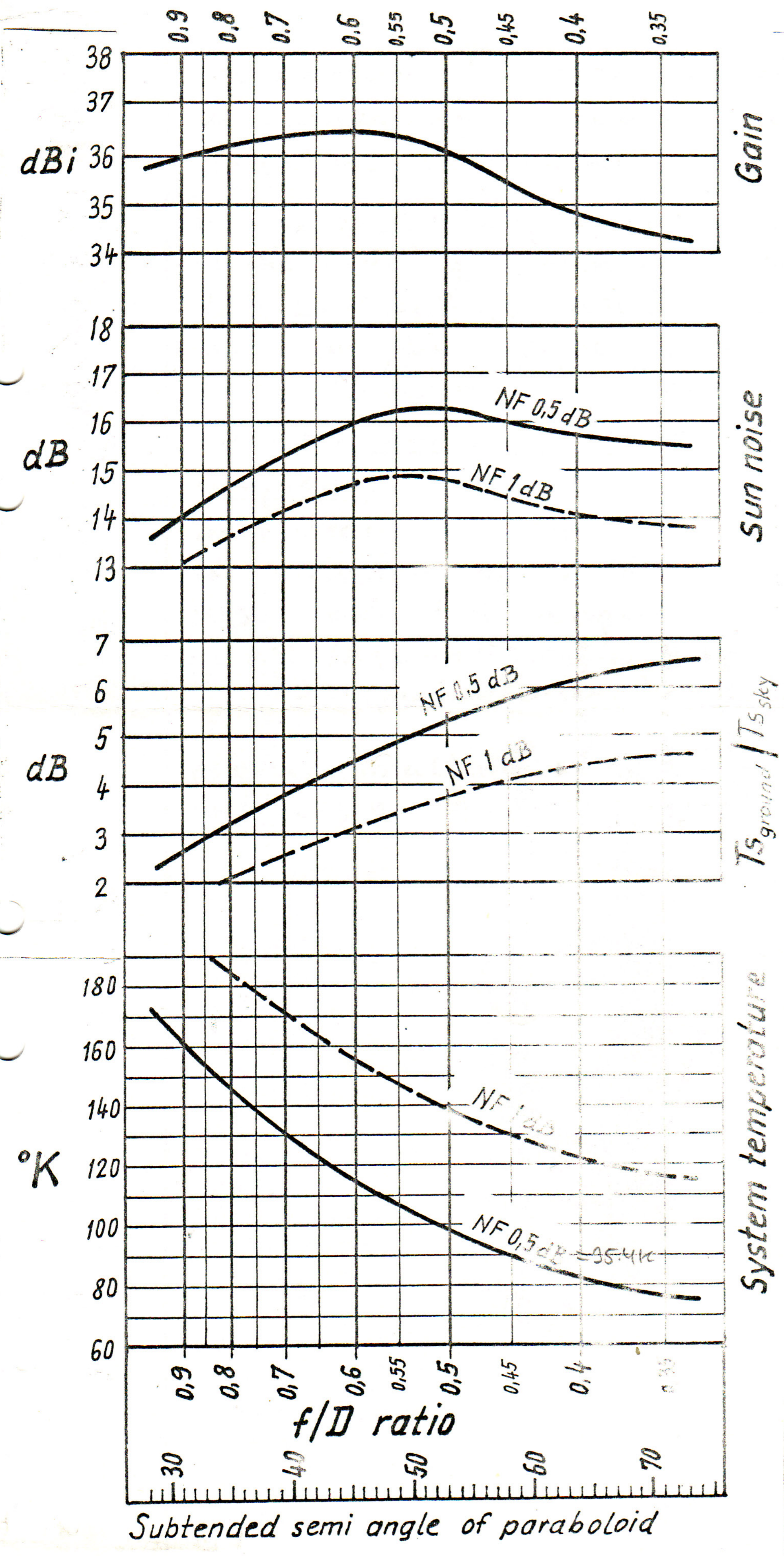
Performance of a dish antenna in relation to f/D ratio, illuminated by a dual mode horn (W2IMU design) on 1296 Mc



TRANSMISSION PERFORMANCE

Gain of 20ft dish dia

On 0,59 f/D maximum aperture efficiency $\eta^f = 0{,}645$, where spill-over $\eta^s = 0{,}831$ and illumination $\eta^i = 0{,}776$

RECEPTION PERFORMANCE

maximum at 0,52 (0,54) f/D ratio

Calculated sun noise (Flux 65) for a 20ft dish and 0.5 (1.0) dB noise figure preamp.

Ratio of thermal earth noise (antenna aimed [illegible] elevation) on cold sky reception.

It is a measure of receiver system temperature independent of antenna gain.

Noise temperature of receiving system with 0.5 (1.0) dB NF front end, antenna aimed at zenith.

All values are calculated based on a measured beam pattern diagram of the feed horn.
Reflector-, phase- and polarization efficiencies are $\eta = 1$.

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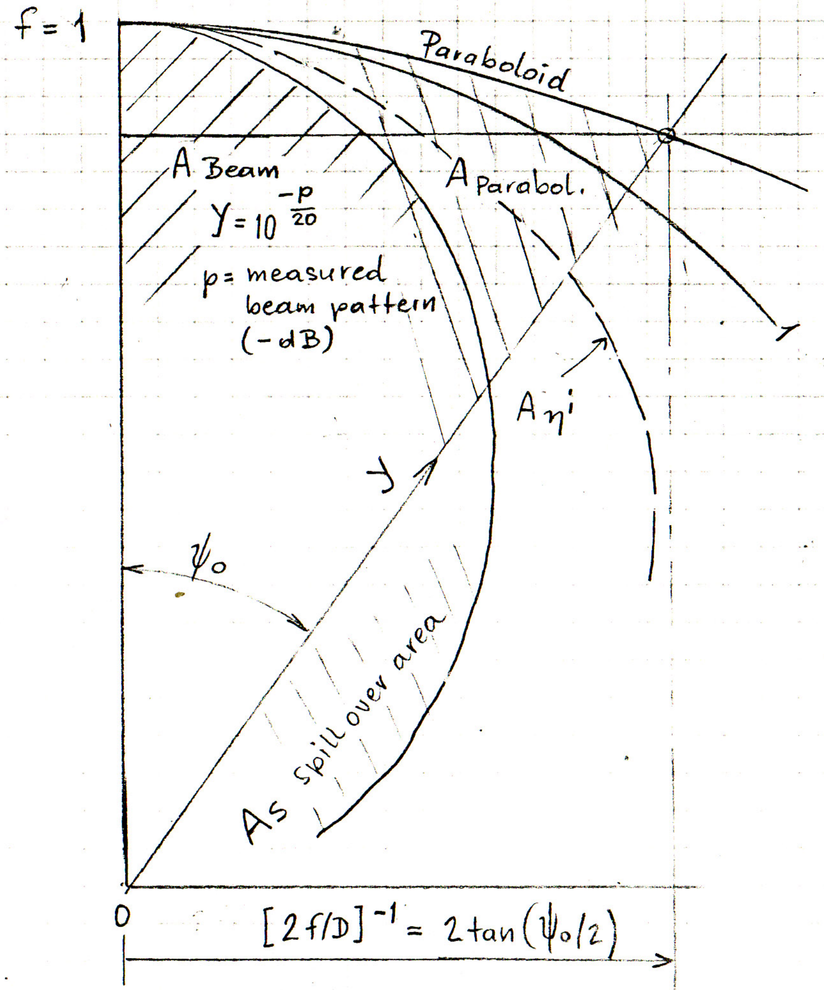
SCHEME FOR CALCULATION

of illumination efficiency η^i and spill over effeciency η^s of a paraboloid antenna illuminated by a radiator with equal E- and H-plan beam pattern (W 2 IMU-horn)



$$A_P = (4f/D)^{-1} + \left[192(f/D^3)\right]^{-1} = \tan(\psi_o/2) + \frac{[\tan(\psi_o/2)]^3}{3}$$

$$A_B = \int_0^{\psi_o} f(\psi)\,d\psi \overset{*}{\approx} \frac{h}{3}(y_0 + 4y_1 + 2y_2 + 4y_3 + 2y_4 + \ldots$$
$$\ldots + 2y_{2k-2} + 4y_{2k-1} + y_{2k})$$

* Simpson's appoximation

$$\frac{h}{3} = \frac{\pi \cdot \psi_o}{3 \cdot 360 \cdot n} \; ; \; n = 2k$$

$$A_{\eta^i} = \sqrt[3]{A_B \cdot A_P^2} \; ; \quad \eta^i = \frac{A_{\eta^i}}{A_P} = \sqrt[1,5]{\frac{A_B}{A_P}}$$

$$A_s = \int_{\psi_o}^{180^\circ} f(\psi)\,d\psi \; ; \quad \eta^s = \frac{A_B + A_s}{A_P}$$

Apertur efficiency $\eta^f = \eta^i \cdot \eta^s \cdot \eta^\phi \cdot \eta^p \cdot \eta^R$; η^ϕ (phase) ≈ 1, η^p (polarization) ≈ 1, η^R (reflector performance) $\approx 0{,}85 \ldots 0{,}995$

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