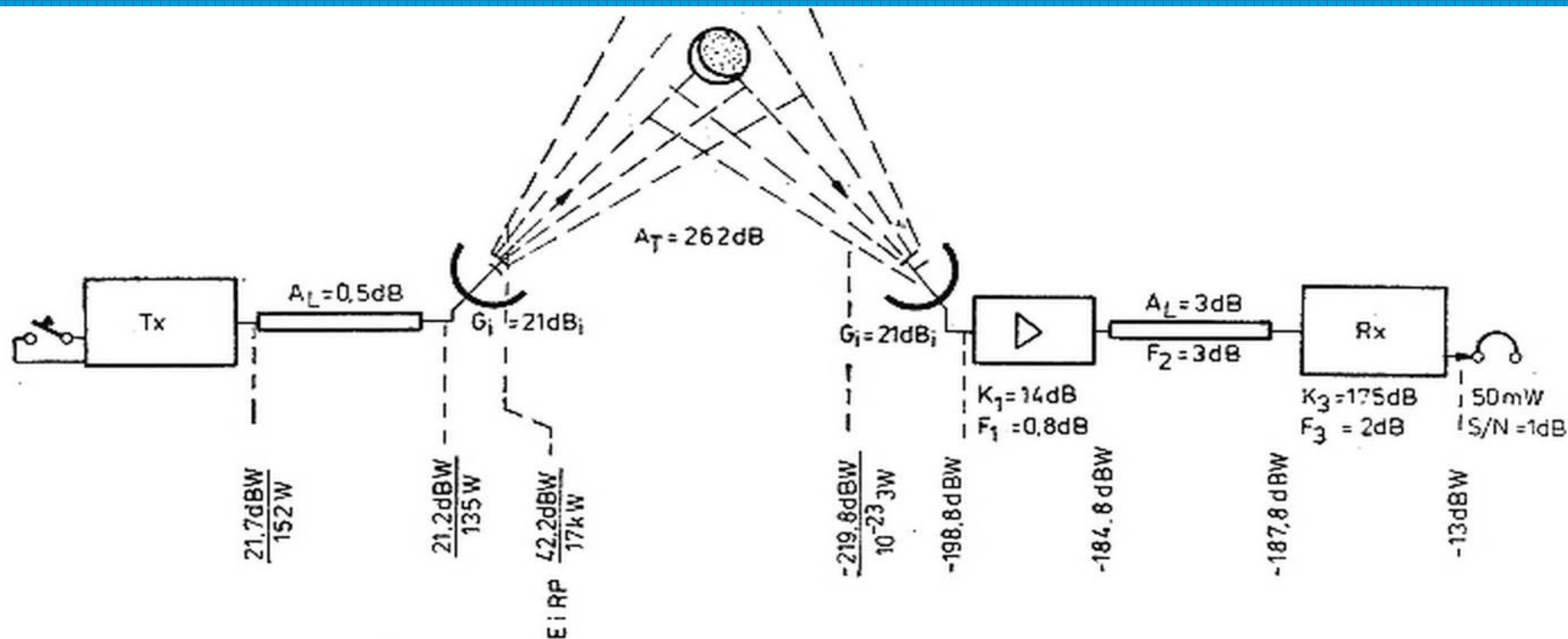


Szum w bilansie łączą radiowego teoria a rzeczywistość

Tomasz Salwach SQ6QV
Zieleniec 2025, 30.09.2025

Bilans łącza radiowego (SP6LB 1988 r.)



4.6. Bilans łącza EME

Bilans

VK3UM 2002 r.

VK3UM EME Performance Calculator Ver 11.11 UTC Date 11th sierpień 2025

Two Station EME Rx Performance Source Pos. Planets Sky Map Home Data

Tx A (Home Station) Default

Rx BW Diam Mesh Spacing H-V Sys Sensitivity Echo S/N

1296 MHz 270.76 dB 10 K 2500 Hz Solid Dish -141.9 dBm -23.29 dB

Frequency Path Loss Aqu or Leo Effective ground 240 K 0.90

Your last sfu data record has been loaded.

10.7cm 18.44 K 101.20 K 16.12 K 2.98 dB

75 0.20 dB 1.30 dB 20.0 dB 2.0 dB 6.0 dB 43.42 K 0.00 K 5.84 dB

Get sfu LNA Loss LNA NF LNA Gain Coax Loss Rx NF Spillover Feedthrough derived from Mesh size Sun Y 0.01 dB

Tx A Output Power Transmission Loss Power at Feed Moon Y

250 Watts 23.98 dBW 0.8 dB 208 Watts 23.18 dBW 87 117 W EIRP

RxTK 135.76 K = 1.67 dB Ground Temperature 290 K 17 °C **TSys 189.18 K = 2.18 dB** System Noise Temperature

Dx Station as received at Home Station -18.73 dB

Home Station as received at Dx Station -15.48 dB

Change Moon Distance Moon noise included

Perigee 374 968 kms Apogee

Tx B (Dx Station) Default

Rx BW Diam Mesh Spacing H-V Sys Sensitivity Echo S/N

1296 MHz 270.76 dB 10 K 2500 Hz 2.92 mm 10.00 mm -145.0 dBm -10.92 dB

Frequency Path Loss Aqu or Leo Effective ground 238 K 0.90

Your last sfu data record has been loaded.

10.7cm 7.58 K 35.39 K 0.15 K 2.98 dB

75 0.10 dB 0.50 dB 33.0 dB 2.0 dB 1.0 dB 39.04 K 0.42 K 12.63 dB

Get sfu LNA Loss LNA NF LNA Gain Coax Loss Rx NF Spillover Feedthrough derived from Mesh size Sun Y 0.07 dB

Tx B Output Power Transmission Loss Power at Feed Moon Y

250 Watts 23.98 dBW 1.0 dB 199 Watts 22.98 dBW 249 135 W EIRP

RxTK 43.11 K = 0.60 dB Ground Temperature 290 K 17 °C **TSys 92.58 K = 1.20 dB** System Noise Temperature

Operating Frequency Click to enter a User Frequency

50 MHz 432 MHz 2304 MHz 10.368 GHz 70 MHz

144 MHz 900 MHz 3456 MHz 24.048 GHz 406 MHz

222 MHz 1296 MHz 5760 MHz 47.088 GHz 2295 MHz

x 10 Multiplier Note Pad Hint - Res Ver. History VK3UM.com Help About Exit

Yagi Array ..

Single Yagi Gain in dBd Number of Yagis G/T E Beam Width

16.00 dBd 1 0.00 H 26.04 ° 16.00 dBd 18.15 dBi

User Defined Yagi

Parabolic Reflector

Focal length 1.17 m Feed Type W2IMU dual-mode Linear Pol. Circular Pol.

Diameter Size f/D Efficiency Beam Width Gain Dish Gain

1.80 m Metric 0.65 70.1% 9.00° 419 24.07 dBd 26.22 dBi

Dish diameter is less than K

Home Station ... Y Factor Calc

Noise Source (Hot) Noise[hot] Flux Quiet [cold] Sky System TK

Sagittarius A Taurus A 1718 Jy 10 K 189.18 K

Cassiopeia A Virgo A

Cygnus A Termination

Centaurus A

Point Source Y Factor 0.03 dB

YU1AW Aperture Source calculations. These are only valid for 144 and 432 MHz. Point Sources should be used for 1296 MHz and above.

Noise Source Positions. Y Figure Information

Yagi Array ..

Single Yagi Gain in dBd Number of Yagis G/T E Beam Width

12.00 dBd 1 0.00 H 41.27 ° 12.00 dBd 14.15 dBi

User Defined Yagi

Parabolic Reflector

Focal length 1.35 m Feed Type OK1DFC with choke ring Linear Pol. Circular Pol.

Diameter Size f/D Efficiency Beam Width Gain Dish Gain

3.00 m Metric 0.45 75.8% 5.40° 1255 28.83 dBd 30.98 dBi

13.0 Lambda

Effective Aperture Beam Width Ratio Set Current Moon Moon Data

TxA 1.78 M² 0.06 S/F Update Moon Phase 0.57

TxB 5.34 M² 0.10 Illu 95.1 %

Moon Beam Fill Factor Sun Beam Fill Factor G/T Ratio 3rd Quarter

TxA 1.00 0.01dB 1.00 0.01dB 2.21 3.45dB P Angle 204°

TxB 1.00 0.01dB 1.00 0.01dB 13.55 11.32dB

Moon Radar Equ. Current Moon Distance Moon Angular Diam Moon Temp

52.70 dB 374 968 kms 0.531° 31'52.1" 225 K

Moon return Loss Moon Flux 10° -22 Moon Declination Frequency adjusted sfu

270.76 dB Sv = 0.08 Dec. -7.33 ° 83

Engineering Panel 1296 MHz

VK3UM Ver 11.11

Save Data Get Data Default Print Exit

Bilans

OE2IGL & DF3GJ

2022 r.
<https://wetersat.bplaced.net/EME/EME.html>

Frequency [GHz]	10.368
Wavelength	28.9 mm
Lunar reflectivity ϵ	0.07
Moon temp. center, average	242 K
Rx antenna temp. of moon	7.97 K
Days after full moon	6.37

TX Locator: J054CG13 - DL0SHF-10	
Latitude [N°]	54.2644
Longitude [E°]	10.1788

Transmitting Antenna: Gauss, max ant. η = theor.-2.5%	
Dish diameter [m], ant.gain _{theo}	7.2 57.86 dBi
Dish f/D	0.35
Offset angle if offset dish [°]	0
Surface RMS [mm], peak err	0.85 +/- 1.7 mm
Feed out-of-axial-focus [mm]	0
Feed blocking area [m ²]	0.0707
Ohmic efficiency η_{ohm}	1.0
Illumination efficiency η_i	0.885
X-polarization efficiency η_{pol}	0.985
Spillover efficiency η_s	0.921
Phase efficiency η_{phase}	1
Illum*phase*spill*xpol $\eta_{ip*ps*x}$	0.802 56.9 dBi
Surface efficiency η_{Ruze}	0.873
Focus efficiency η_{focus}	1
Blocking efficiency η_{block}	0.994
Mesh grid diam, spacing [mm]	0 0
Mesh grid eff. η_{mesh} , loss	1 0 dB
Max. antenna efficiency η_{max}	0.671 56.13 dBi
Used antenna efficiency η_{real}	0.599
Edge taper [dB], feed taper	-11 -7.4 dB
Dish center - rim	71.1°
HPBW _{real} , gain _{real}	0.266° 55.64 dBi

Position x,y on Moon [°]	0 0
Intercepted power fraction	0.941 -0.26 dB
Illuminated fraction	0.332 -4.79 dB

TX temperature [°C]	15
TX humidity [%]	50
TX absolute pressure [mbar]	980
TX zenith atmosph.attenuation	0.048 dB

Use time locked TX/RX azimuth/elevation for: NO, set elevation manually

TX azimuth [°]	---
TX refrac.corr. elevation [°]	30
TX LOS atmosph.attenuation	0.096 dB
additional cloud loss [dB]	0

Swap stations, Tx <=> Rx

RX Locator: JN67MT87 - OE2IGL-10	
Latitude [N°]	47.8227
Longitude [E°]	13.0705

Receiving Antenna: Gauss, max ant. η = theor.-2.5%	
Dish diameter [m], ant.gain _{theo}	0.815 38.94 dBi
Dish f/D	0.67
Offset angle if offset dish [°]	21
Surface RMS [mm], peak err	0.17 +/- 0.34 mm
Feed out-of-axial-focus [mm]	0
Feed blocking area [m ²]	0
Ohmic efficiency η_{ohm}	1.0
Illumination efficiency η_i	0.866
X-polarization efficiency η_{pol}	0.985
Spillover efficiency η_s	0.937
Phase efficiency η_{phase}	1
Illum*phase*spill*xpol $\eta_{ip*ps*x}$	0.8 37.97 dBi
Surface efficiency η_{Ruze}	0.995
Focus efficiency η_{focus}	1
Blocking efficiency η_{block}	1
Mesh grid diam, spacing [mm]	0 0
Mesh grid eff. η_{mesh} , loss	1 0 dB
Max. antenna efficiency η_{max}	0.77 37.8 dBi
Used antenna efficiency η_{real}	0.69
Edge taper [dB], feed taper	-12 -11 dB
Dish center - rim	36.5°
HPBW _{real} , gain _{real}	2.38° 37.33 dBi

Position x,y on Moon [°]	0 0
Received fraction (BWF)	0.607 -2.17 dB
RX fill factor moon	0.0348 -14.58 dB

RX temperature [°C]	15
RX humidity [%]	50
RX absolute pressure [mbar]	980
RX zenith atmosph.attenuation	0.048 dB

RX azimuth [°]	---
RX refrac.corr. elevation [°]	30
RX LOS atmosph.attenuation	0.096 dB
additional cloud loss [dB]	0

Echo mode, set Rx = Tx

UTC YY/MM/DD hh:mm:ss 2025/8/1 14:24:31

Moon: Lunar reflectivity varies radially	
Isotropic path loss (radar equation)	-276.7 dB
Path loss (corrected for beam widths)	-278.9 dB
ϵ * gain _{TX} * gain _{RX}	81.4 dB
TX power [W]	28 44.5 dBm
Received signal power	-153.2 dBm
RX NoiseFigure [dB], temp	0.72 52.3 K
RX bandwidth [kHz]	2.5
RX noise power	-147.4 dBm
Signal/Noise	-5.7 dB
Received Moon noise	-156.4 dBm

Sky+CMB, zenith+CMB temp	8.36 K 5.4 K
Spillover temp., add. spillover	140 K 0
RX antenna noise temp.	28.1 K
RX main beam eff. η_{MB} , η_F	0.84
Spatial polarization, pol.loss	---
use +/-90° feed rotation	---

Y-dish&feed: Absorber/SkyZenith	5.74 dB
Y-dish&feed: Gnd/SkyZenith	5.17 dB
Y-dish&feed: Absorber/Sky@Elevation	6.27 dB
Y-dish&feed: Gnd/Sky@Elevation	5.69 dB
Y-feed: Gnd(or absorber)/SkyZenith	7.63 dB
SFU@frequency, Sun temp.	0 12530 K
Y-Sun: 1+Sun/(Sky+Noise)	7.2 dB
Y-Moon: 1+Moon/(Sky+Noise)	0.34 dB

G/T _{EME} incl. RX noise temp	17.92 dB/K
S/N EME: Signal/(0+Sky+Noise):	-8.3 dB
S/N EME: Signal/(Moon+Sky+Noise):	-8.7 dB

Decoding mode: Q65-60E

RX libration rate [°/min]	0.003052
RX libration spreading	213 Hz
Mutual libr. spread, beam corr.	201 Hz 156 Hz
Doppler libration	0 Hz
CW integr. time [s], x-sigma	---
decoder threshold	-23.8 dB
Margin = S/N EME - threshold	15.1 dB

Calculate

Szum – definicja (ITU-R P.372-17)

Źródła naturalne:

- emisje z gazów atmosferycznych i hydrometeorów
- powierzchnia Ziemi; np. emisyjność lądu, oceanu i innych przeszkód znajdujących się w zasięgu anteny
- promieniowanie pochodzące z kosmicznych źródeł radiowych
- promieniowanie pochodzące z wyładowań atmosferycznych i innych wyładowań elektrostatycznych (szum atmosferyczny)

Szum – definicja (ITU-R P.372-17)

Źródła pochodzenia ludzkiego:

- w szczególności w przypadku anten zewnętrznych, zagregowane niezamierzone promieniowanie pochodzące z maszyn elektrycznych, urządzeń elektrycznych i elektronicznych oraz sieci, linii przesyłowych energii elektrycznej, komunikacji energetycznej, bezprzewodowego przesyłu energii, urządzeń przemysłowych, naukowych i medycznych (ISM) lub z zapłonu silników spalinowych, a także promieniowanie elektromagnetyczne pochodzące z niedoskonale ekranowanych obudów, linii przesyłowych i kabli

Szum – definicja (ITU-R P.372-17)

Źródła pochodzenia ludzkiego:

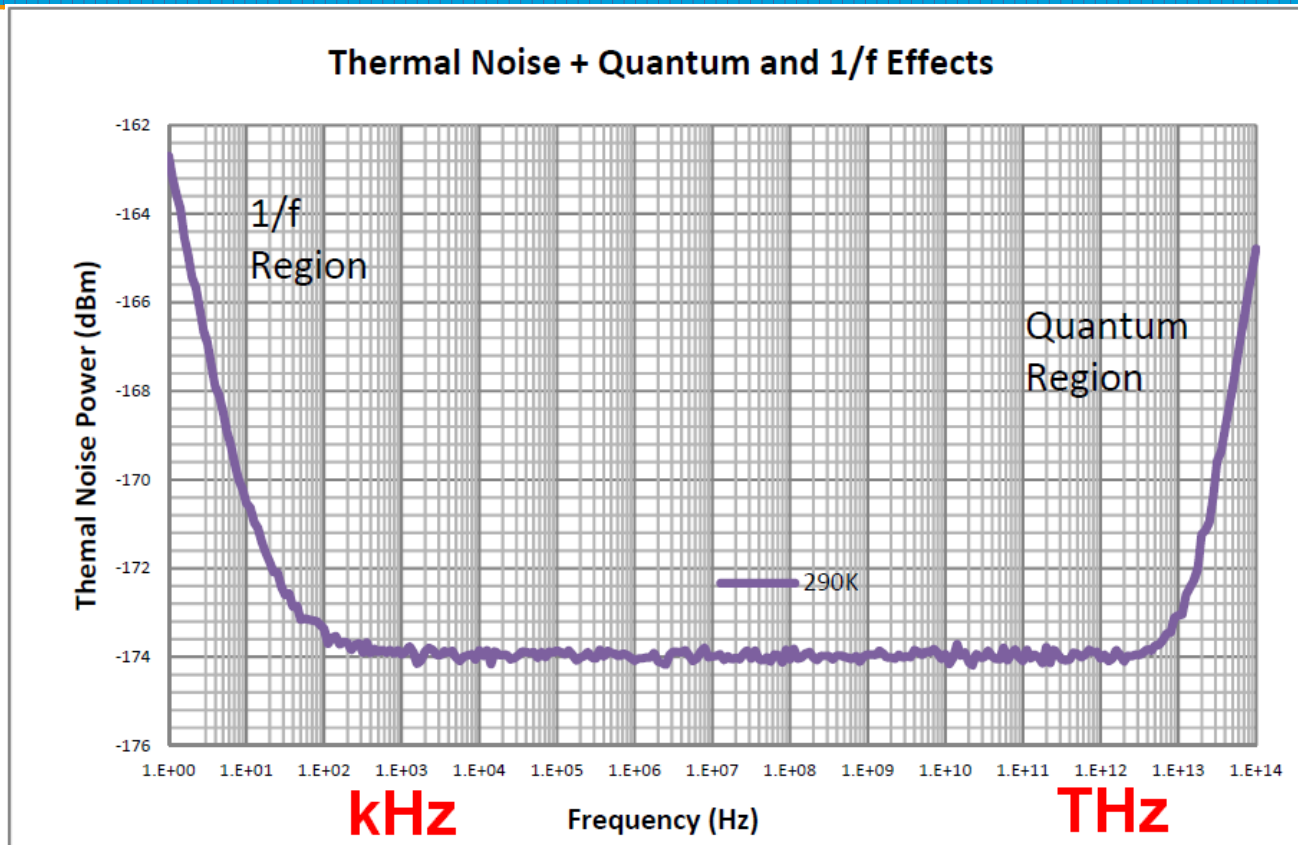
- w pomieszczeniach lub w przypadku anten znajdujących się w pobliżu przeszkód, zagregowane promieniowanie niezamierzone, jak powyżej, w możliwym zakresie, ale również obejmujące typowe poziomy promieniowania pochodzące z pojedynczych lub niewielkiej liczby źródeł, w określonych typowych środowiskach.

Szum – definicja (ITU-R P.372-17)

Szum w systemie odbiorczym ma wiele źródeł.

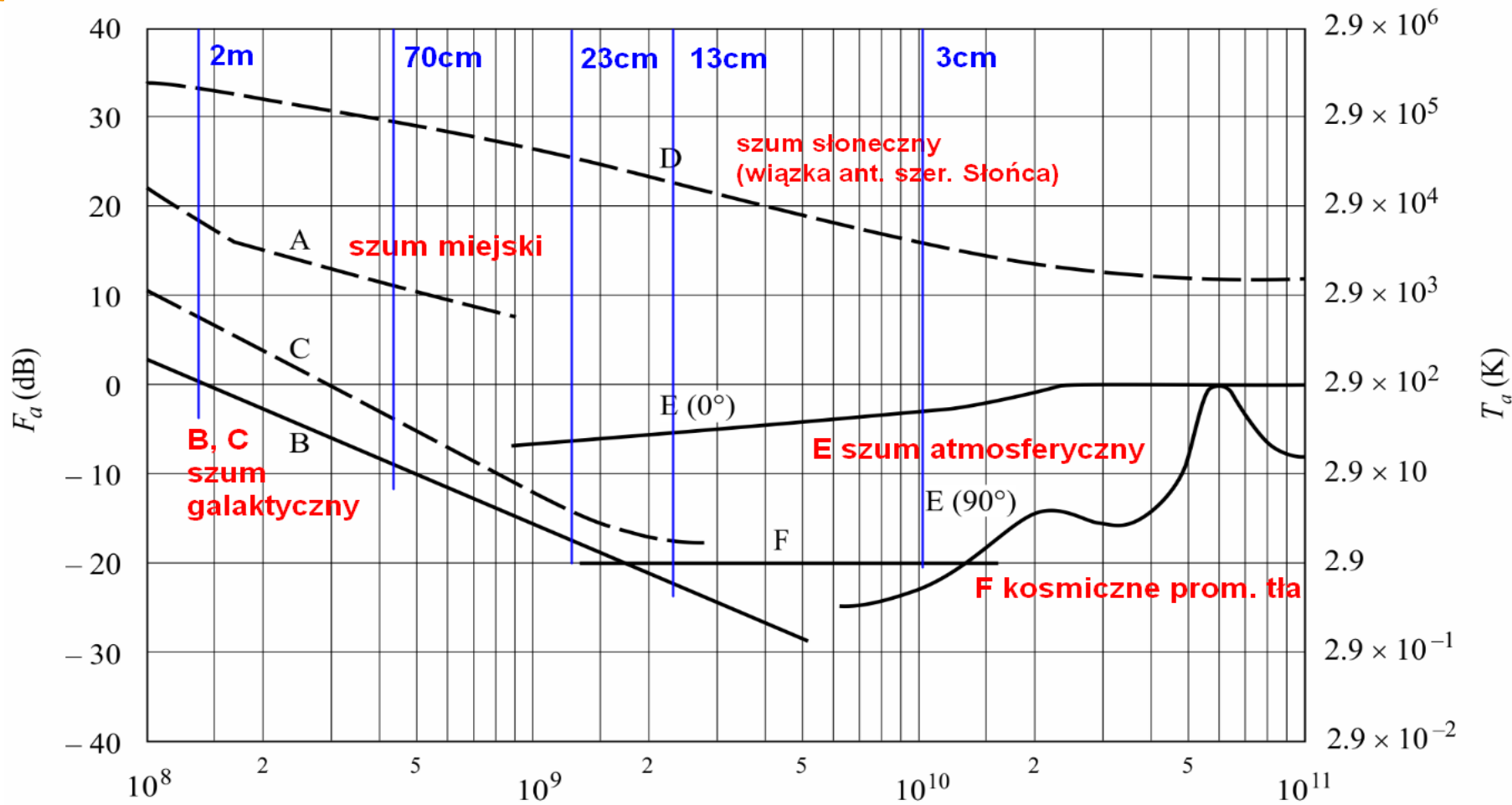
- Należy wziąć pod uwagę zarówno szum zewnętrzny, jak i szum wewnętrzny generowany w odbiorniku.
- Jedynym odpowiednim punktem odniesienia dla ogólnego szumu roboczego systemu odbiorczego są zaciski równoważnej bezstratnej anteny odbiorczej. (Taka antena nie istnieje fizycznie).

Fizyka – temperatura szumowa

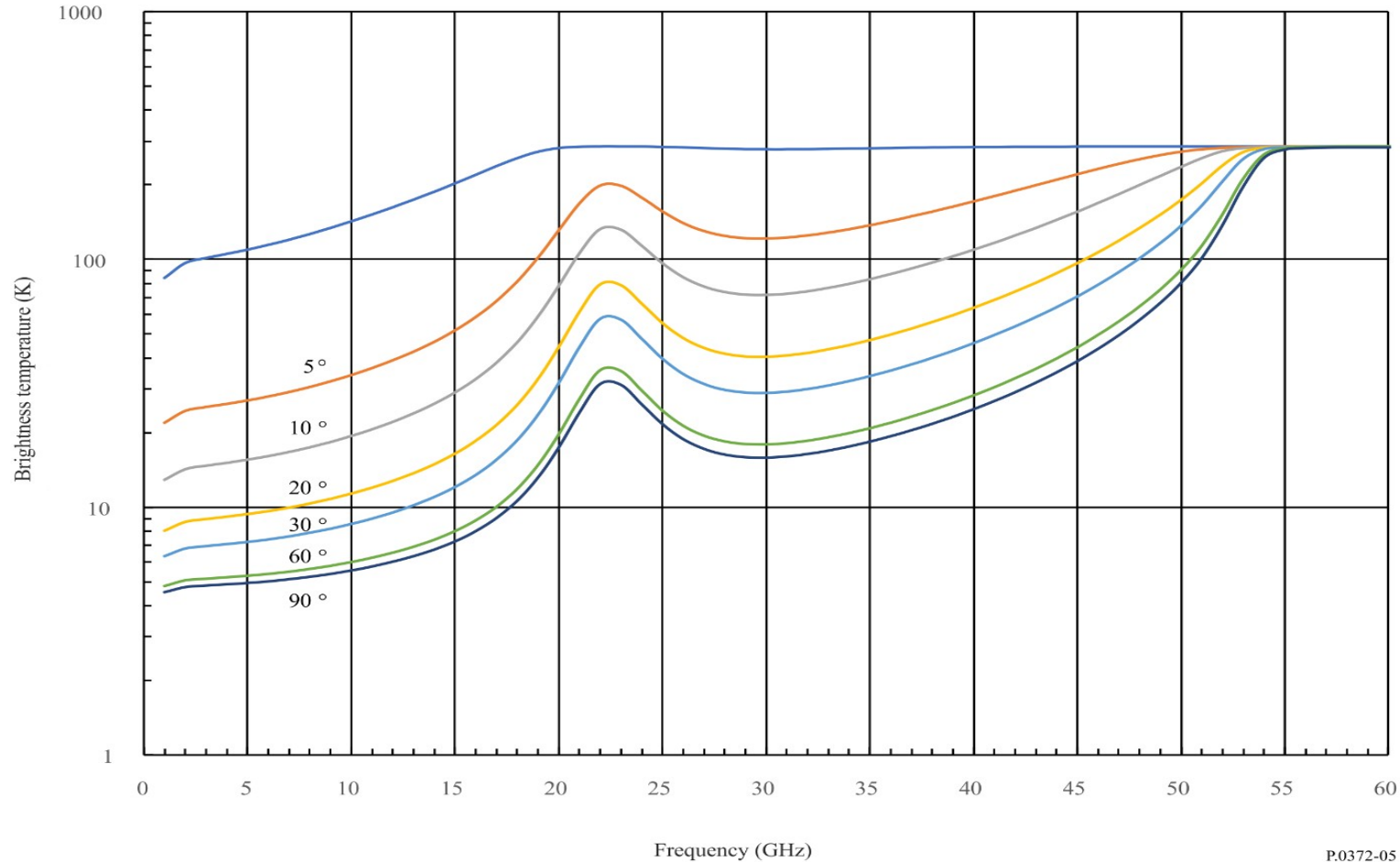


- <https://www.microwaves101.com/encyclopedias/noise-notes>

Fizyka – źródła w zależności od częstotliwości (ITU-R P.372-17 Fig. 3)



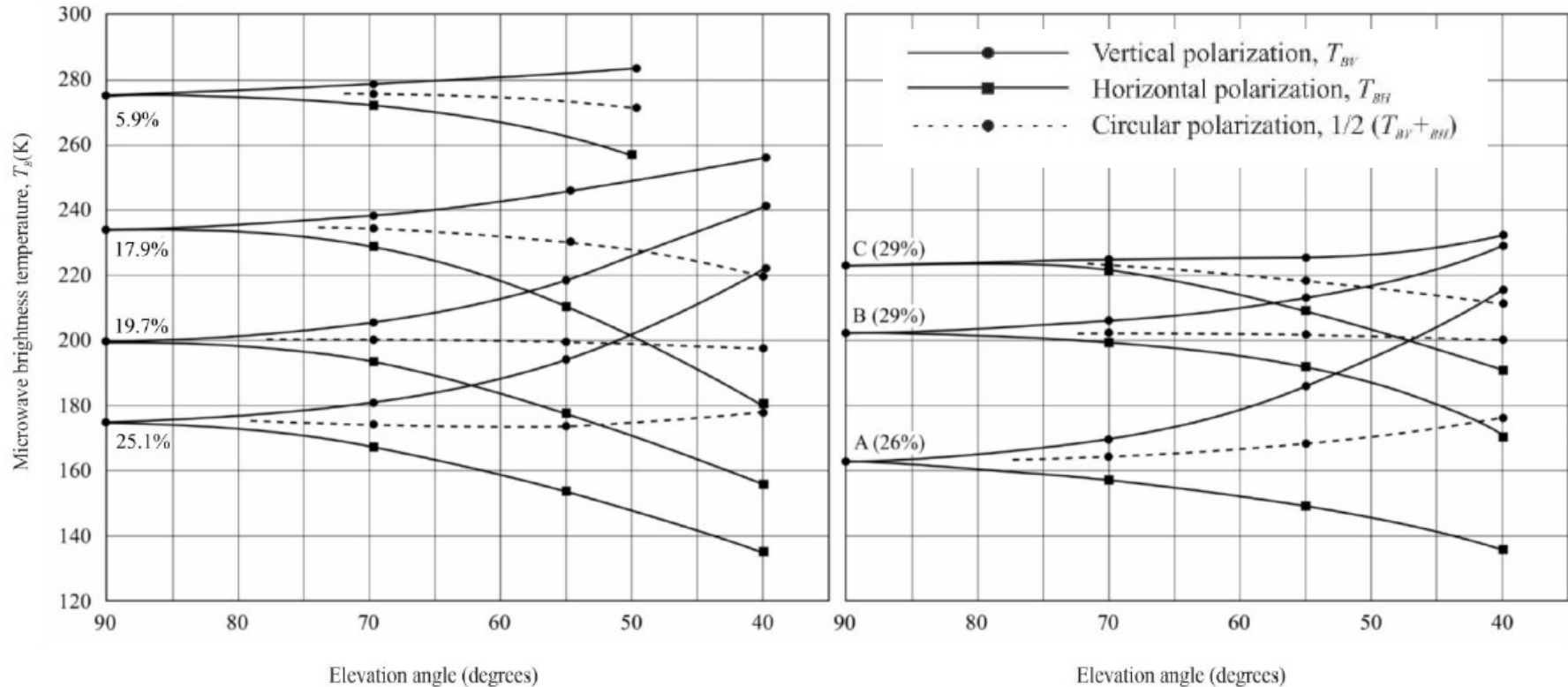
Fizyka – szum atmosferyczny (brightness temperature) (ITU-R P.372-17 Fig. 5)



Fizyka – Ziemia z kosmosu. Szum jest spolaryzowany!

(ITU-R P.372-17 Fig. 8)

Brightness temperature at 1 430 MHz of the ground as a function of elevation angle



a) Moisture content from 5.9% to 25.1% for a bare, smooth field

b) For (A) smooth field (B) medium roughness and (C) rough (deeply ploughed) field with percentage water content as indicated

Fizyka – komunikacji troposferycznej i odbicia od nierównych powierzchni

500 stron – 60 lat temu

THE SCATTERING OF ELECTROMAGNETIC WAVES FROM ROUGH SURFACES

Petr
Beckmann

André
Spizzichino

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Temperatura szumowa anteny (Dragoslav Dobričić, YU1AW)

VHF Antenna Noise Temperature, antennex Issue No. 132 – April 2008

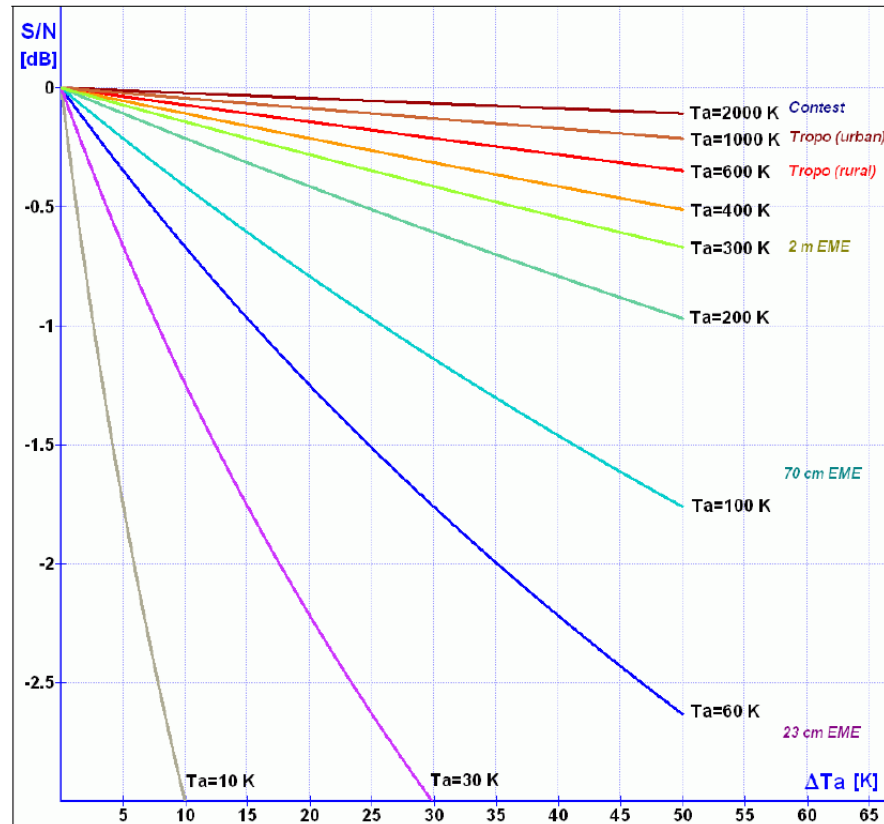


Fig. 5: Relative S/N versus antenna noise difference ΔT_a

Temperatura szumowa anteny zależy całkowicie od środowiska anteny, rodzaju komunikacji i częstotliwości roboczej. Analiza pokazuje, że wpływ temperatury szumu anteny T_a na zdolność odbiorczą anteny wyrażoną jako stosunek sygnału do szumu S/N jest marginalny w pasmach VHF. Nawet w przypadku komunikacji kosmicznej, takiej jak EME, wpływ ten nie jest tak istotny, jak można by się spodziewać. Różnica temperatury szumu anteny między podobnymi antenami o podobnej długości wysięgnika, wynosząca około 20-30 K, wytwarzana w systemach łączności EME o długości 2 metrów, daje różnicę w stosunku S/N wynoszącą zaledwie 0,3 dB!

W przypadku pracy naziemnej z wykorzystaniem rozpraszania troposferycznego, ze względu na wyższą temperaturę szumu anteny T_a , różnica ta jest jeszcze mniejsza.)

Temperatura szumowa anteny (Rastislav OM6AA et al.)

https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual-Mode_Feed

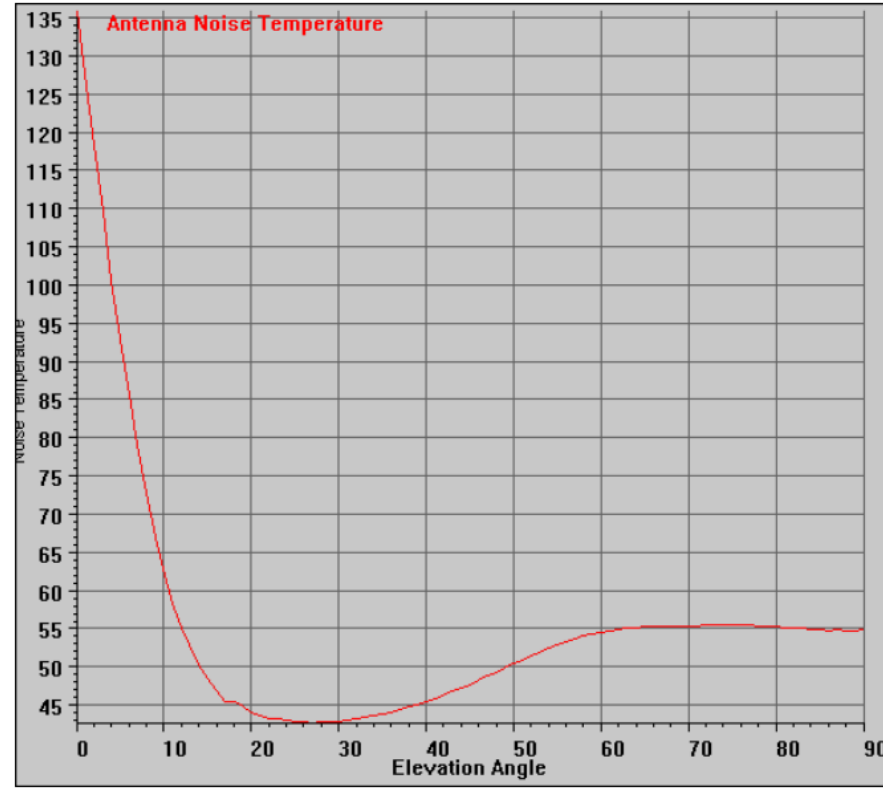


Fig. 7 - Dependence of antenna noise temperature on elevation angle for a dish with f/D ratio 0.65. Note accrual of antenna noise temperature for higher elevation angles, above 50 degrees, due to antenna spillover.

Temperatura szumowa anteny (Rastislav OM6AA et al.)

https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual-Mode_Feed

Fig. 6 shows that maximum antenna gain for a prime focus antenna configuration employing the W2IMU dual-mode feed is attained with a dish having an f/D ratio of 0.6. Such antenna configurations are best used for transmitting and will be referred to as TX optimum.

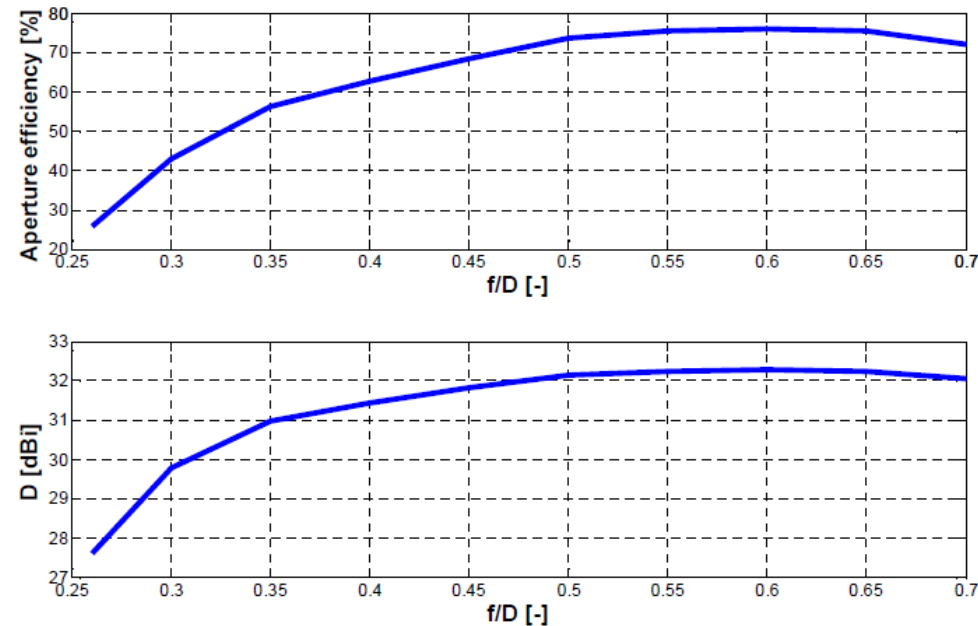
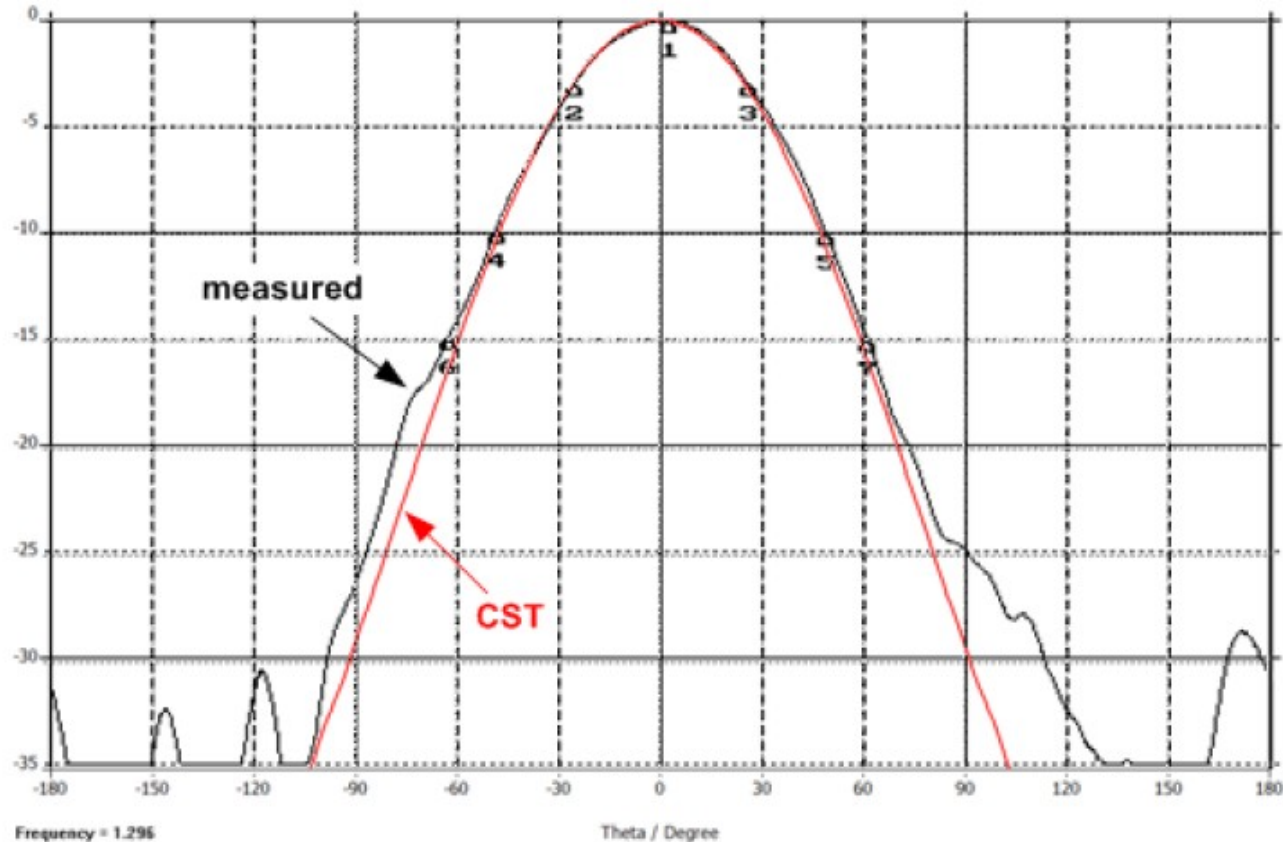


Fig. 6 - Antenna efficiency and directivity

Temperatura szumowa anteny (Rastislav OM6AA et al.)

https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual-Mode_Feed



Temperatura szumowa anteny (Rastislav OM6AA et al.)

https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual-Mode_Feed

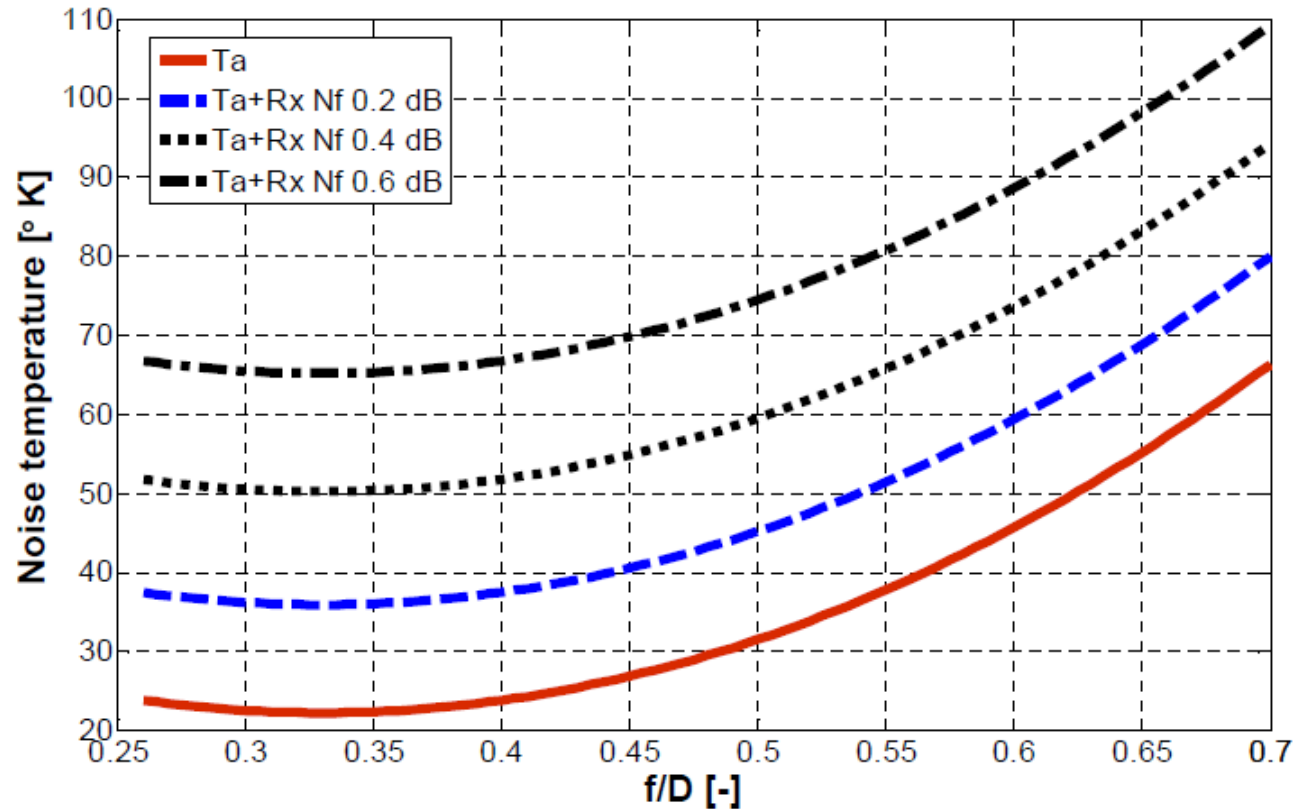


Fig. 8 - Average antenna and system noise temperature

Temperatura szumowa anteny (Rastislav OM6AA et al.)

[https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual-Mode_Feed](https://www.researchgate.net/publication/301657591_Parabolic_Antenna_Noise_Characteristic_with_Dual_Mode_Feed)

5. Optimal receiving (RX) performance, G/Ts ratio

The computed G/Ts curves from the above results (Figs. 6 and 8) are shown in Fig. 9.

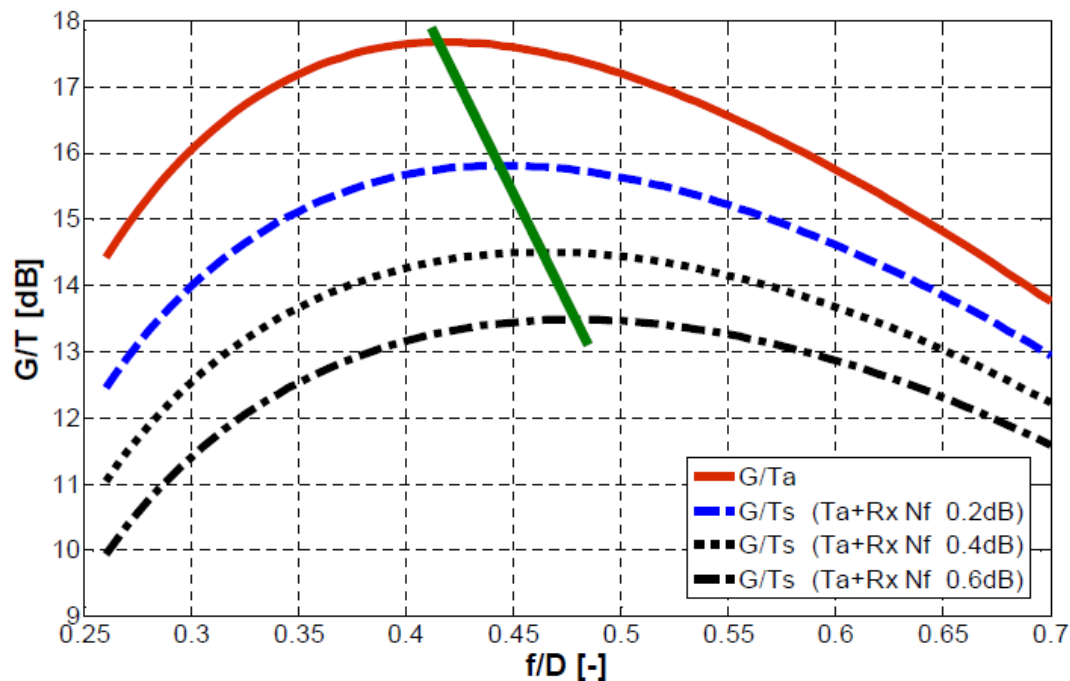


Fig. 9 - Antenna and System G/T ratio

Low Noise Amplifier with 7 K Noise at 1.4GHz and 25 °C

Sander Weinreb, Life Fellow, IEEE and Jun Shi, Member, IEEE

Weinreb/Shi 7K LNA Paper, Jan. 13, 2021



(a)



(b)



(c)

Fig. 9. (a) 4.6 m prime focus paraboloid, (b) LNAs mounted on low-loss, dual-linear polarization feed, and (c) feed mounted at prime focus of paraboloid.



(a)



(b)

Fig. 10. Two methods of using LN2 cooled terminations to measure the noise of an LNA and then calibrate noise diodes for faster measurements.

16								
15								
14								

Low Noise Amplifier with 7 K Noise at 1.4GHz and 25 °C

Sander Weinreb, Life Fellow, IEEE and Jun Shi, Member, IEEE

TABLE III
COMPOSITION OF MEASURED SYSTEM NOISE

Source	Noise (K)	Comment
Cosmic Background	2.7	Measured to mK accuracy in hundreds of experiments
Galactic	1	Spatial average of many discrete sources and will vary with location of galactic plane in antenna beam
Atmosphere	3	Oxygen and water at 30-degree zenith angle
Spillover	3	Calculated from feed pattern; higher at zenith
Feed Blockage	2	Estimate based upon 0.38 m feed diameter and 150 K average brightness of scatterd pattern
Feed Loss	2	EM integration of surface current and surface resistance
T_{LNA} NF = 0.10 dB	7	Measure in laboratory with noise source calibrated with LN ₂
Post LNA Noise	1	Due to 600 K next stage, 3 dB cable loss, and 36 dB LNA gain + fiber link noise
Total NF = 0.31 dB	21.7	Total measured with absorber vs sky, Feb 20, 2020

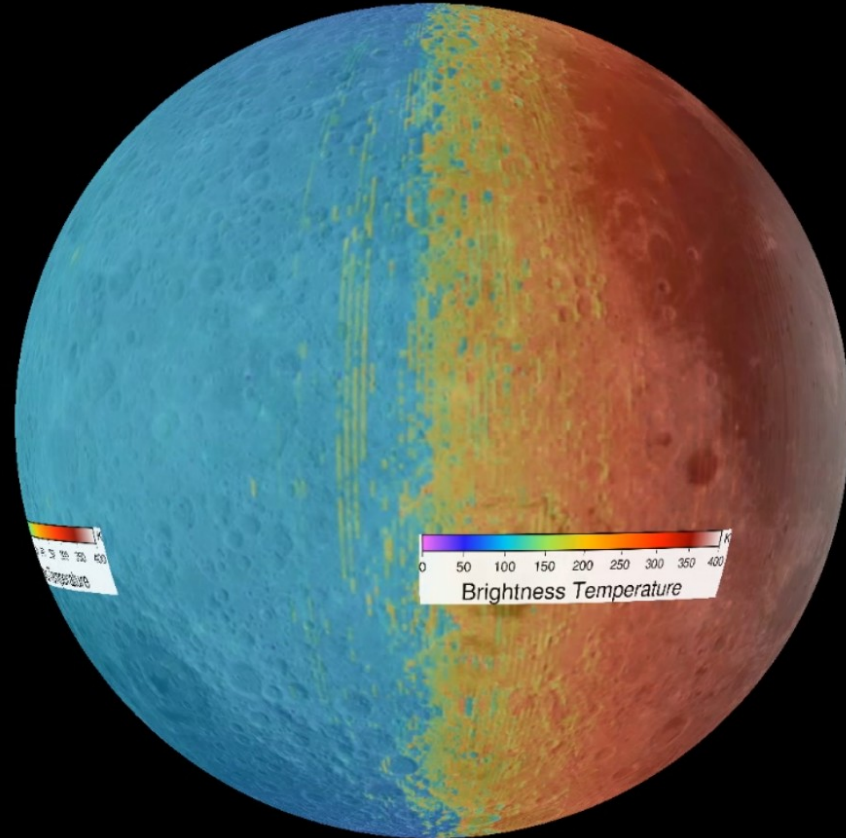
Nasze amatorskie pomiary...

https://pa0ehg.com/10_ghz_stations.htm

Info from other EME stations							
Call Sign	Dish size (Mtr)	Moon noise		Solar Noise		Ground Noise	
W6HD	3	1.6	dB	14.8	dB	4.9	dB
WA7CJO	4.9	2.9	dB	17.8	dB	x	dB
SM4DHN	6	2.8	dB	16	dB	x	dB
W5LUA	5	1.8	dB	16	dB	x	dB
PA0BAT	3.7	1.95	dB	16.2	dB	6.2 feed only	dB
PA3CSG	3	1.7	dB	15.5	dB	x	dB
AA5C	3.3	1.0	dB	13	dB	x	dB
F6KSX	3	2.0	dB	16	dB	x	dB
PA0EHG	3	1.7	dB	15	dB	5.1	dB
LA8LF	4.6	3.1	dB	20.3	dB	#22	

Zmienna temperatura powierzchni Księżyca

<https://sos.noaa.gov/catalog/datasets/moon-surface-temperature/>



Temperatura księżyca z uwzg. szerokości wiązki anteny i błędu śledzenia (Joachim Köppen DF3GJ)

<https://portia.astrophysik.uni-kiel.de/~koeppen/JS/AimRadioMoon.html>

Station: longitude [W] latitude [N]
Date [YMD] day of year 230
Time [UT]

Sun

Ra 148.07 Dec 12.92
AZ 193.69 El 47.94
Ang.Diameter [deg] 0.526

Moon

Ra 84.67 Dec 27.94
AZ 274.1 El 32.26
Phase [0 = Full Moon] 120 waning crescent
Angle to Sun [clockwise from top] 311
Distance [km] 372976
Ang.Diameter [deg] 0.533

Frequency [GHz]
No. of bins

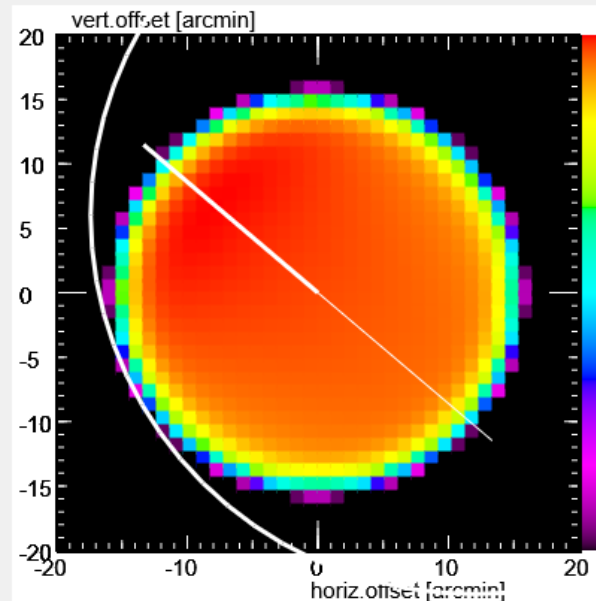
Antenna beam HPBW [°]

Average temperature 190.9 K
Temperature at disc centre 219.8 K

Beam offsets in X, Y [°]
Temperature in beam 31.6 K
Fill factor in antenna beam 0.164

Mouse position:

X position 13 arcmin = 0.21°
Y position -12 arcmin = -0.2°
brightness temperature 0 K



Kalkulator współczynnika Y dla szumu Słońca

SimpleCalc, Carsten OZ9AAR

SimpleCalc - Cascaded noise figure and sun noise calculator. By OZ9AAR V.1.0.0.9 *

File Get SFU data.. Measure noise.. Two station echoes.. Settings.. About..

Antenna ohmic losses (dB):
0.09
6.072 K

Ta(K):
40.00

Gain (dBi):
26.50

☐ Enable crosscheck

SFU data
S. Italy - San Vito
2025-08-24 1200
SFU 10.7 cm: 141

SFU @ Band:
101.7

Band
☐ 50 MHz
☐ 144 MHz
☐ 222 MHz
☐ 432 MHz
☐ 900 MHz
☒ 1296 MHz
☐ 2304 MHz
☐ 3456 MHz
☐ 5760 MHz
☐ 10368 MHz
☐ 0 MHz

Results

Receiver NF/temperature
(from antenna connector to radio)
1.051 dB
79.41 K

Overall NF/temperature
(incl ohmic losses and Ta):
1.58 dB
127.14 K

Figure of merit, M (G/T):
5.55 dB(K⁻¹)

Expected Y-Sun level:
8.21 dB

Current Az/EI of sun:
78.30° 24.58°

Line 1

Loss (dB):
0.30
20.741 K

NF (dB):
0.35
24.339 K

Gain (dB):
15.00

LNA1

Line 2

Loss (dB):
3.00
288.626 K

NF (dB):
3.00
288.626 K

Gain (dB):
15.00

LNA2

Line 3

Loss (dB):
5.00
627.061 K

NF (dB):
3.00
288.626 K

RX/Radio/
transverter

Load default values

Save values as default

Edit comments

Kalkulator współczynnika Y dla szumu Słońca

SimpleCalc, Carsten OZ9AAR

Two station performance and echoes - */

File

Antenna ohmic losses (dB):

0.09

6.072 K

Ta(K):

40.00

Gain (dB):

26.50

Home

Copy from main window

1296 MHz

Copy from main window

Power at feed (W):

400

25.93 dBW

175.0 KW (EIRP)

Home stations own echos:

-18.65 dB

Receiver NF

1.05 dB

79.41 K

Overall NF

1.58 dB

127.14 K

System sensitivity

-143.58 dBm

Line 1

Loss (dB):

0.30

20.741 K

NF (dB):

0.35

Gain (dB):

15.00

Line 2

Loss (dB):

3.00

288.626 K

NF (dB):

3.00

Gain (dB):

15.00

Line 3

Loss (dB):

5.00

627.061 K

NF (dB):

3.00

RX BW:

2500 Hz (WSJT)

Radio

Antenna ohmic losses (dB):

0.00

0.000 K

Ta(K):

40.00

Gain (dB):

24.60

DX

Power at feed (W):

400

26.02 dBW

115.4 KW (EIRP)

DX stations own echos:

-21.66 dB

Receiver NF

0.91 dB

67.99 K

Overall NF

1.37 dB

107.99 K

System sensitivity

-144.29 dBm

Line 3

Loss (dB):

2.50

225.701 K

NF (dB):

15.00

RX BW:

2500 Hz (WSJT)

Radio

Line 2

Loss (dB):

0.00

0.000 K

NF (dB):

0.00

Gain (dB):

0.00

Line 1

Loss (dB):

0.60

42.965 K

NF (dB):

0.27

Gain (dB):

37.00

Home station hears DX station:

-20.46 dB

DX station hears home station:

-19.85 dB

Parameters

Degradation (dB):

0.0

Moon distance (km):

384000

Current

Pathloss (dB):

271.16

Load default values

Save values as default

Bilans

OE2IGL & DF3GJ

2022 r.
<https://wetersat.bplaced.net/EME/EME.html>

Frequency [GHz]	10.368
Wavelength	28.9 mm
Lunar reflectivity ϵ	0.07
Moon temp. center, average	242 K
Rx antenna temp. of moon	7.97 K
Days after full moon	6.37

TX Locator: J054CG13 - DL0SHF-10	
Latitude [N°]	54.2644
Longitude [E°]	10.1788

Transmitting Antenna: Gauss, max ant. η = theor.-2.5%	
Dish diameter [m], ant.gain _{theo}	7.2 57.86 dBi
Dish f/D	0.35
Offset angle if offset dish [°]	0
Surface RMS [mm], peak err	0.85 +/- 1.7 mm
Feed out-of-axial-focus [mm]	0
Feed blocking area [m ²]	0.0707
Ohmic efficiency η_{ohm}	1.0
Illumination efficiency η_i	0.885
X-polarization efficiency η_{pol}	0.985
Spillover efficiency η_s	0.921
Phase efficiency η_{phase}	1
Illum*phase*spill*xpol $\eta_{ip*ps*x}$	0.802 56.9 dBi
Surface efficiency η_{Ruze}	0.873
Focus efficiency η_{focus}	1
Blocking efficiency η_{block}	0.994
Mesh grid diam, spacing [mm]	0 0
Mesh grid eff. η_{mesh} , loss	1 0 dB
Max. antenna efficiency η_{max}	0.671 56.13 dBi
Used antenna efficiency η_{real}	0.599
Edge taper [dB], feed taper	-11 -7.4 dB
Dish center - rim	71.1°
HPBW _{real} , gain _{real}	0.266° 55.64 dBi

Position x,y on Moon [°]	0 0
Intercepted power fraction	0.941 -0.26 dB
Illuminated fraction	0.332 -4.79 dB

TX temperature [°C]	15
TX humidity [%]	50
TX absolute pressure [mbar]	980
TX zenith atmosph.attenuation	0.048 dB

Use time locked TX/RX azimuth/elevation for: NO, set elevation manually

TX azimuth [°]	---
TX refrac.corr. elevation [°]	30
TX LOS atmosph.attenuation	0.096 dB
additional cloud loss [dB]	0

Swap stations, Tx <=> Rx

RX Locator: JN67MT87 - OE2IGL-10	
Latitude [N°]	47.8227
Longitude [E°]	13.0705

Receiving Antenna: Gauss, max ant. η = theor.-2.5%	
Dish diameter [m], ant.gain _{theo}	0.815 38.94 dBi
Dish f/D	0.67
Offset angle if offset dish [°]	21
Surface RMS [mm], peak err	0.17 +/- 0.34 mm
Feed out-of-axial-focus [mm]	0
Feed blocking area [m ²]	0
Ohmic efficiency η_{ohm}	1.0
Illumination efficiency η_i	0.866
X-polarization efficiency η_{pol}	0.985
Spillover efficiency η_s	0.937
Phase efficiency η_{phase}	1
Illum*phase*spill*xpol $\eta_{ip*ps*x}$	0.8 37.97 dBi
Surface efficiency η_{Ruze}	0.995
Focus efficiency η_{focus}	1
Blocking efficiency η_{block}	1
Mesh grid diam, spacing [mm]	0 0
Mesh grid eff. η_{mesh} , loss	1 0 dB
Max. antenna efficiency η_{max}	0.77 37.8 dBi
Used antenna efficiency η_{real}	0.69
Edge taper [dB], feed taper	-12 -11 dB
Dish center - rim	36.5°
HPBW _{real} , gain _{real}	2.38° 37.33 dBi

Position x,y on Moon [°]	0 0
Received fraction (BWF)	0.607 -2.17 dB
RX fill factor moon	0.0348 -14.58 dB

RX temperature [°C]	15
RX humidity [%]	50
RX absolute pressure [mbar]	980
RX zenith atmosph.attenuation	0.048 dB

RX azimuth [°]	---
RX refrac.corr. elevation [°]	30
RX LOS atmosph.attenuation	0.096 dB
additional cloud loss [dB]	0

Echo mode, set Rx = Tx

UTC YY/MM/DD hh:mm:ss 2025/8/1 14:24:31

Moon: Lunar reflectivity varies radially	
Isotropic path loss (radar equation)	-276.7 dB
Path loss (corrected for beam widths)	-278.9 dB
ϵ * gain _{TX} * gain _{RX}	81.4 dB
TX power [W]	28 44.5 dBm
Received signal power	-153.2 dBm
RX NoiseFigure [dB], temp	0.72 52.3 K
RX bandwidth [kHz]	2.5
RX noise power	-147.4 dBm
Signal/Noise	-5.7 dB
Received Moon noise	-156.4 dBm

Sky+CMB, zenith+CMB temp	8.36 K	5.4 K
Spillover temp., add. spillover	140 K	0
RX antenna noise temp.	28.1 K	
RX main beam eff. η_{MB} , η_F	0.84	0.85
Spatial polarization, pol.loss	---	---
use +/-90° feed rotation	---	---

Y-dish&feed: Absorber/SkyZenith	5.74 dB
Y-dish&feed: Gnd/SkyZenith	5.17 dB
Y-dish&feed: Absorber/Sky@Elevation	6.27 dB
Y-dish&feed: Gnd/Sky@Elevation	5.69 dB
Y-feed: Gnd(or absorber)/SkyZenith	7.63 dB
SFU@frequency, Sun temp.	0 12530 K
Y-Sun: 1+Sun/(Sky+Noise)	7.2 dB
Y-Moon: 1+Moon/(Sky+Noise)	0.34 dB

G/T _{EME} incl. RX noise temp	17.92 dB/K
S/N EME: Signal/(0+Sky+Noise):	-8.3 dB
S/N EME: Signal/(Moon+Sky+Noise):	-8.7 dB

Decoding mode: Q65-60E

RX libration rate [°/min]	0.003052
RX libration spreading	213 Hz
Mutual libr. spread, beam corr.	201 Hz
Doppler libration	0 Hz
CW integr. time [s], x-sigma	
decoder threshold	-23.8 dB
Margin = S/N EME - threshold	15.1 dB

Calculate

Podstawy radioastronomii

(Joachim Köppen DF3GJ)

<https://portia.astrophysik.uni-kiel.de/~koeppen/Haystack/basics.html>

