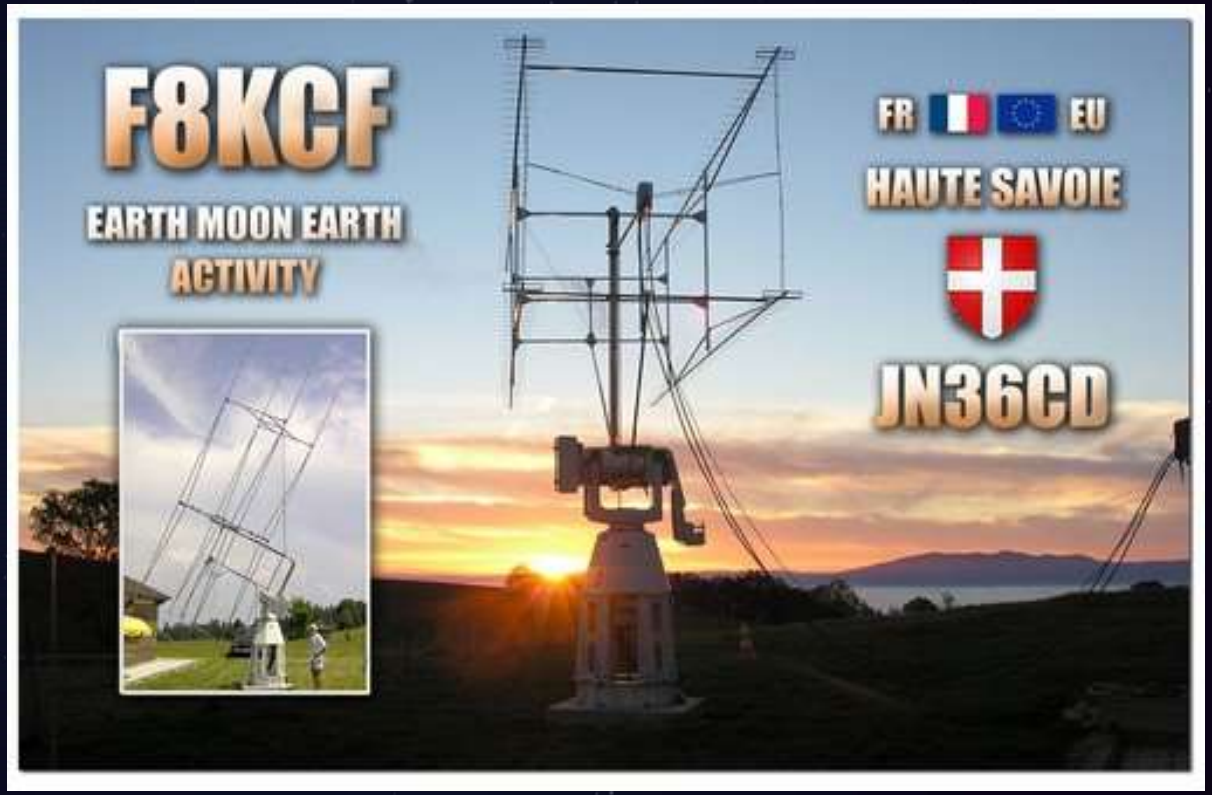
Amateurfunk und Weltraum

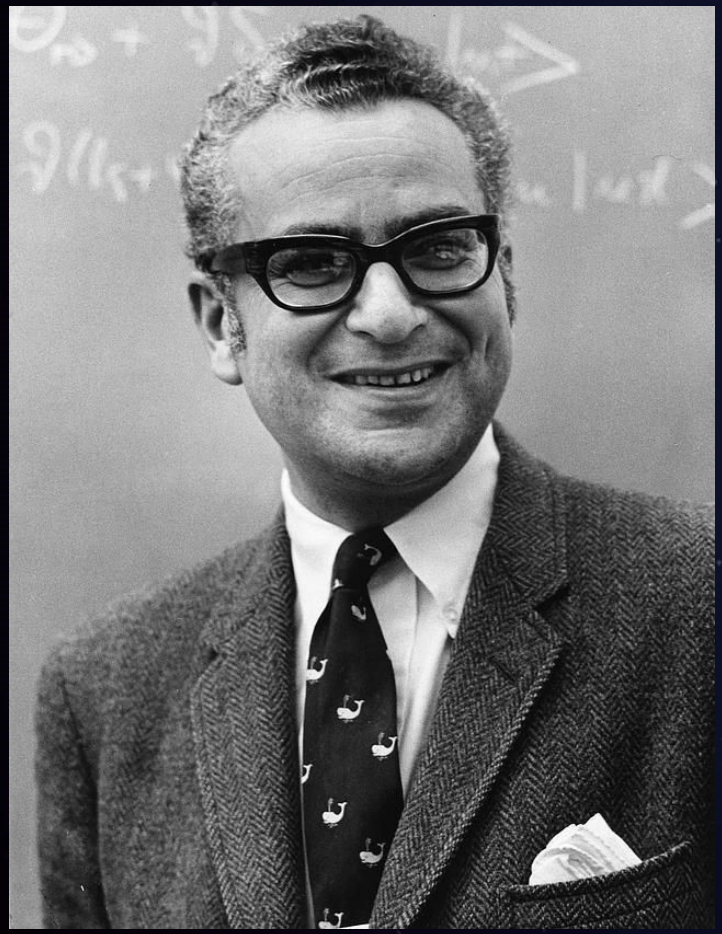
Wie passt das zusammen?

Hinweis


F8KCF
EARTH MOON EARTH
ACTIVITY
FR
EU
HAUTE SAVOIE
JN36CD


RSOISS
СССР
80 лет со дня рождения
первого космонавта планеты Земля
- Ю.А.Гагарина
10/12 Серия

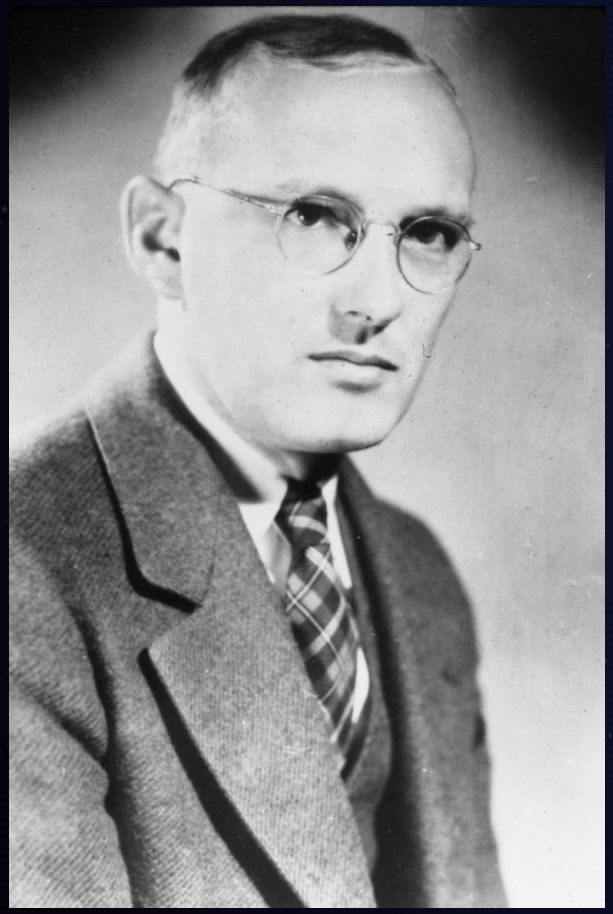

LY2Ø13SAT
VILMANTAS MORKUNAS
P.O.BOX 88
Siauliai, LT-76002
LITHUANIA
Loc:KO15PV ITU:29 CQ:15
QSL via LY3BY
To: GØSFJ This confirms our 2-way CW QSO
Date: December 4, 2013 Time: 14:32 UTC
Band: 30M UR Sigs: 599

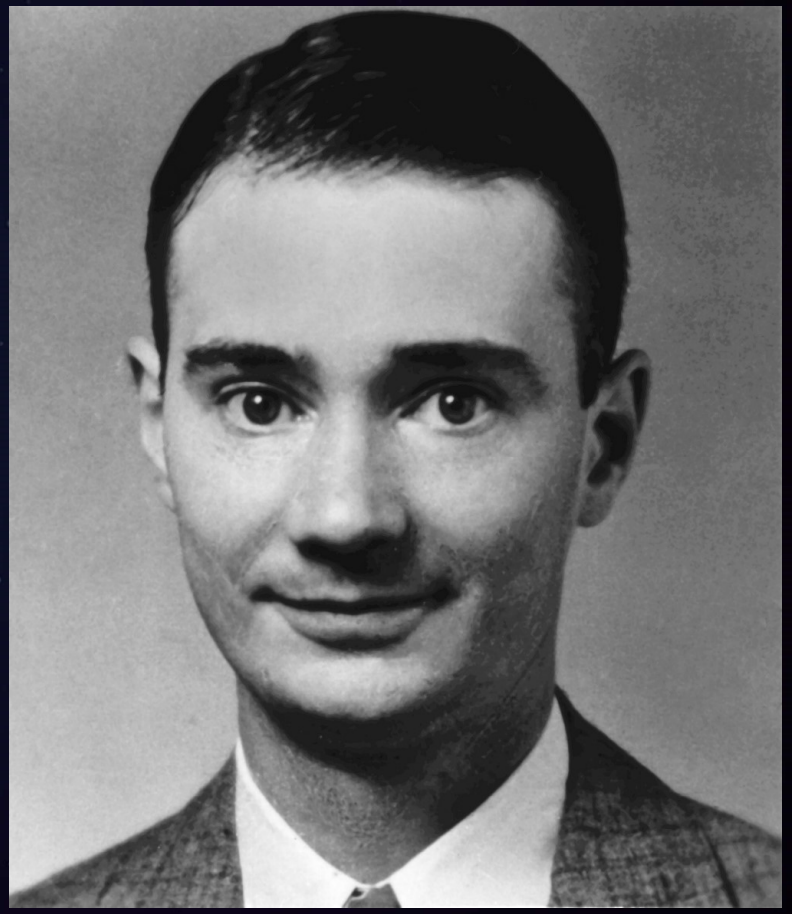


But when researchers at Bell Labs discovered that static tends to come from particular places in the sky, the whole field of radio astronomy opened up.

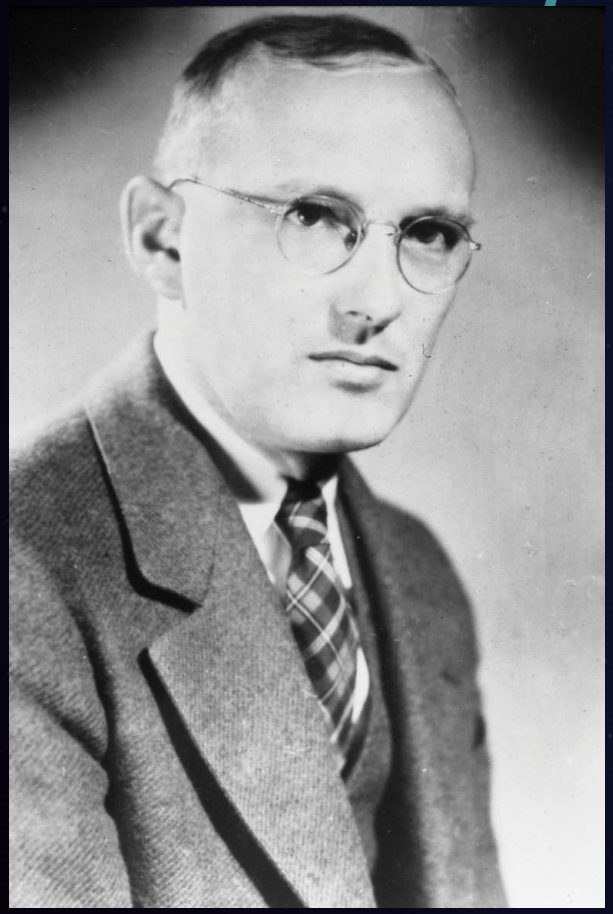
— Murray Gell-Mann —

Geschichte



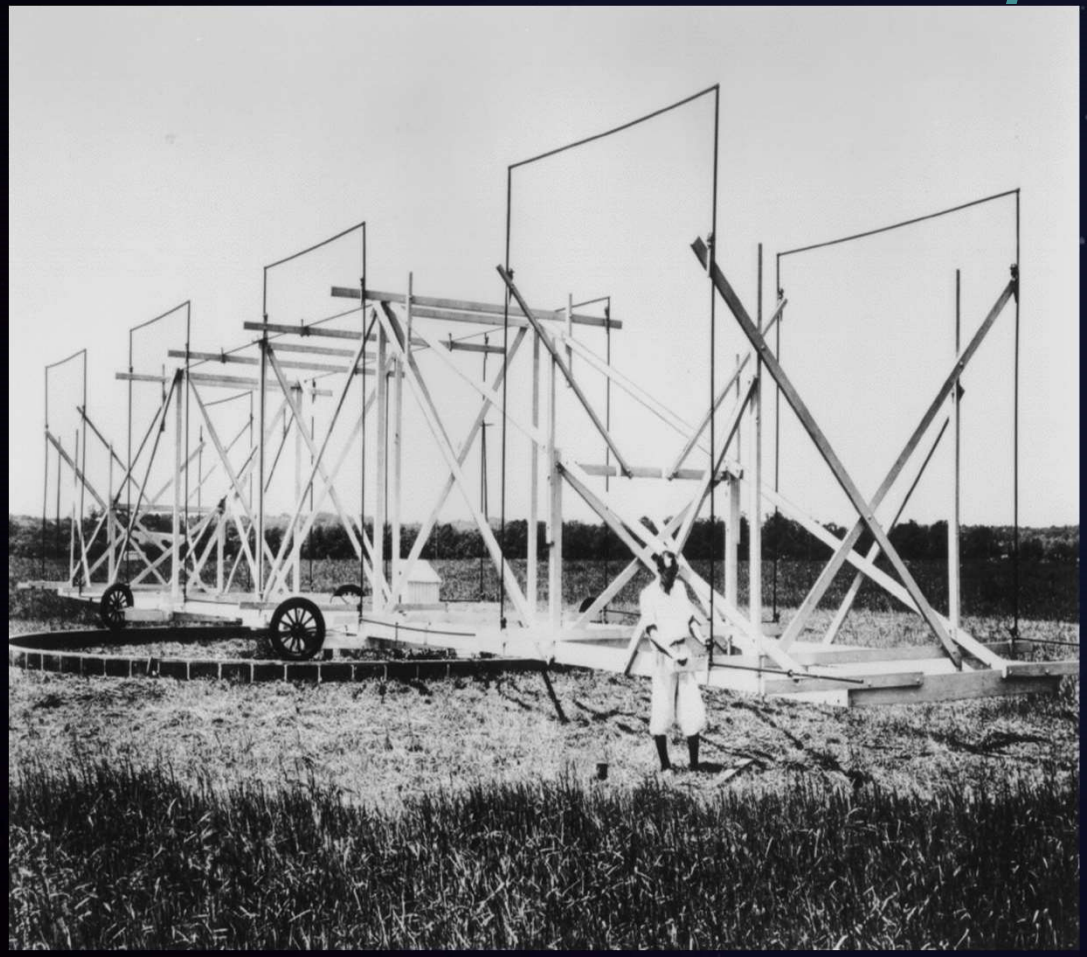


Karl G. Jansky



- Geboren: Oktober 1905
- Arbeitete bei Bell Telephone Laboratories
- Erstes Radioteleskop
- Entdeckte die ersten Signale aus dem All
- $1\,Jy = 10^{-26}\frac{W}{m^2 * Hz}$

Jankys Arbeit



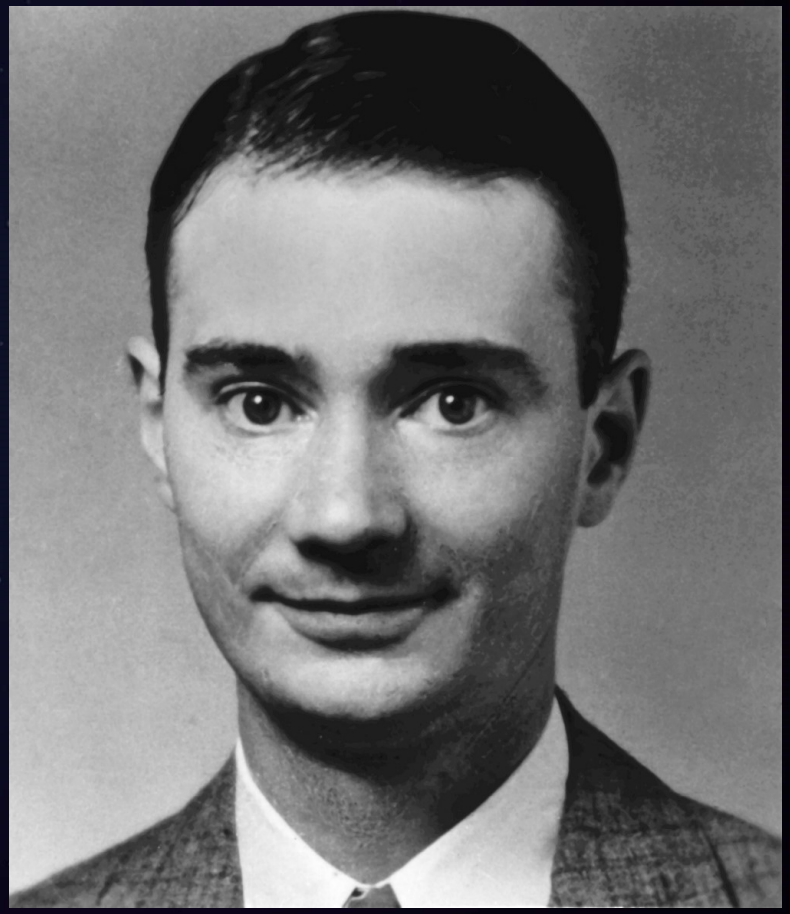
- Störungssuche HF

1. Nahe Gewitter
2. Ferne Gewitter
3. Schwaches, unbekanntes Rauschen

- 23h 56min

Grothe Reber

- Geboren: Dezember 1911
- W9GFZ
- Führte Jankys Arbeit weiter
- Parabolspiegel ø 9.5m
- Radioastronomie nach WWII



Rebers Arbeit

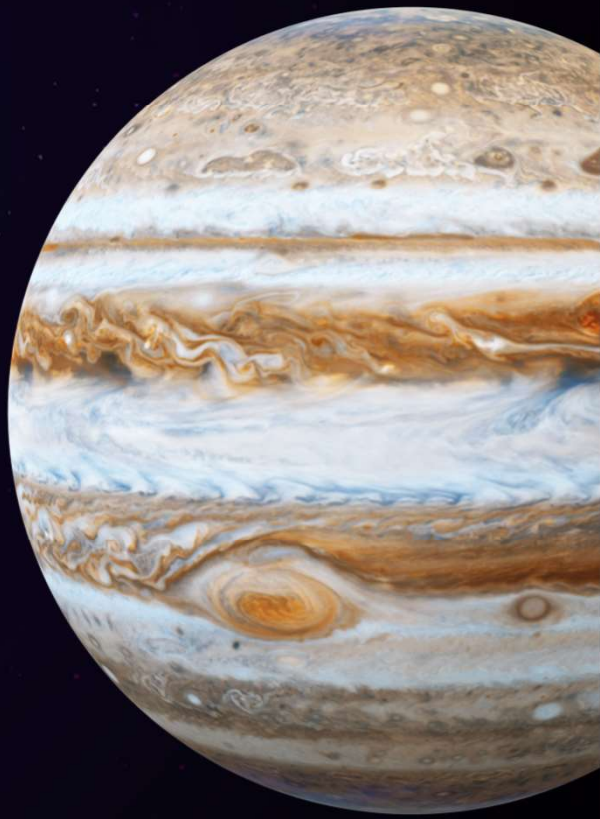
- Parabolspiegel ø 9.5m im Garten, selbstgebaute LNAs
- Störungsbedingte Nachtarbeit
- Misserfolg auf 3.3 GHz, 900 MHz
- Erfolg mit 160 MHz 1938
- Erste Radiokarte der Milchstrasse

Die Suche

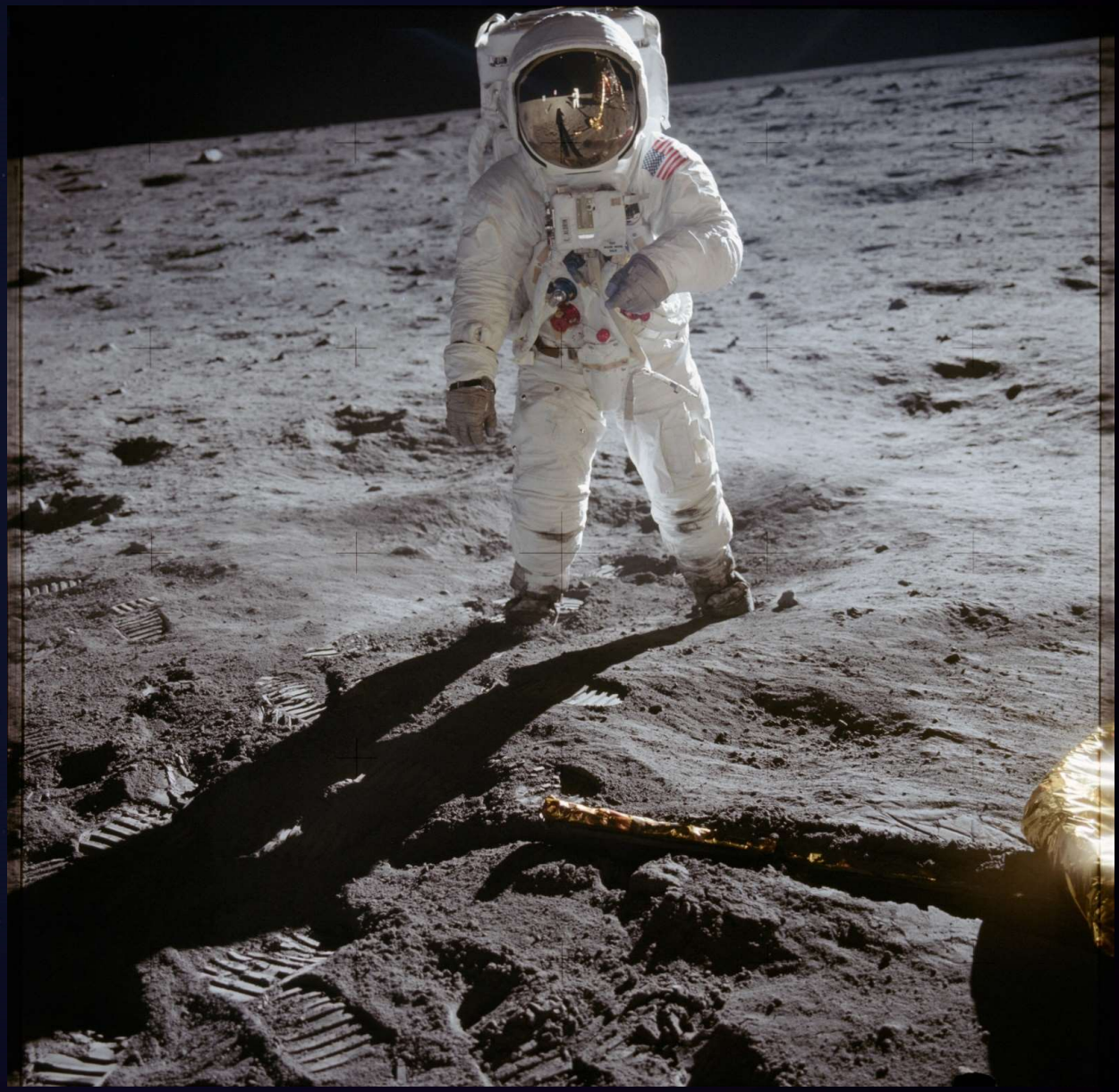

esa


MIAMI
BEACH

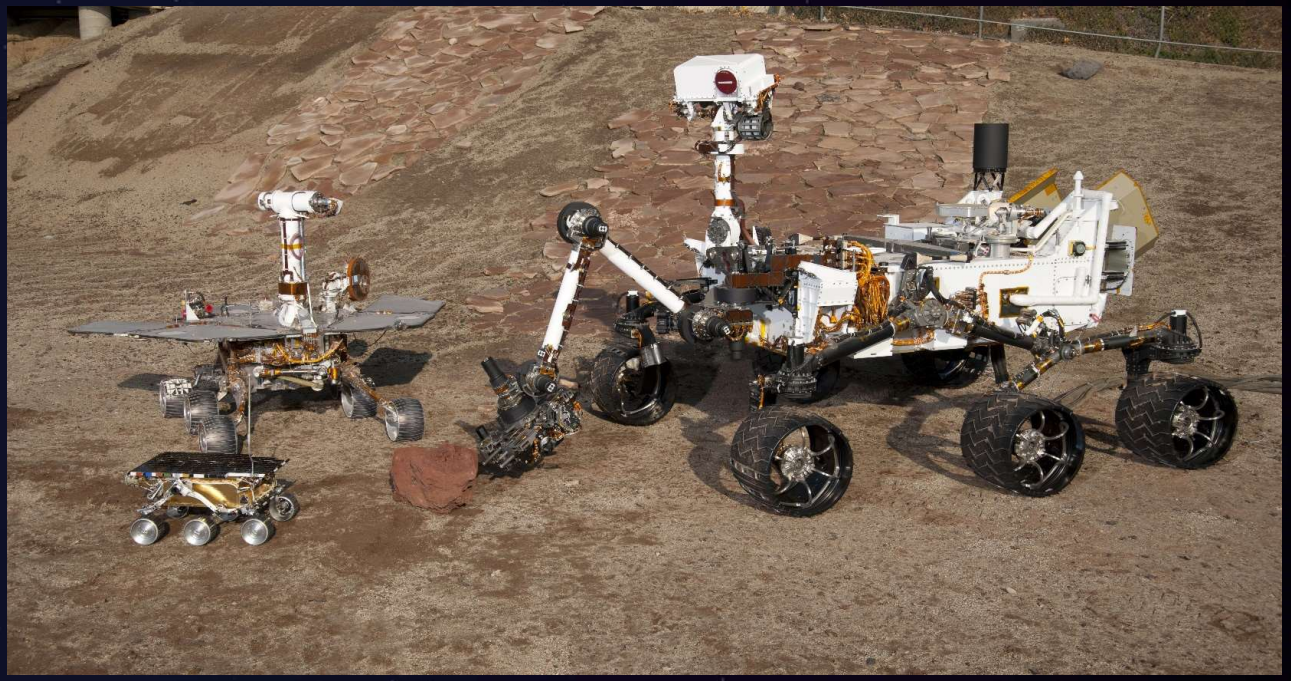
Nachbarschaft der Erde



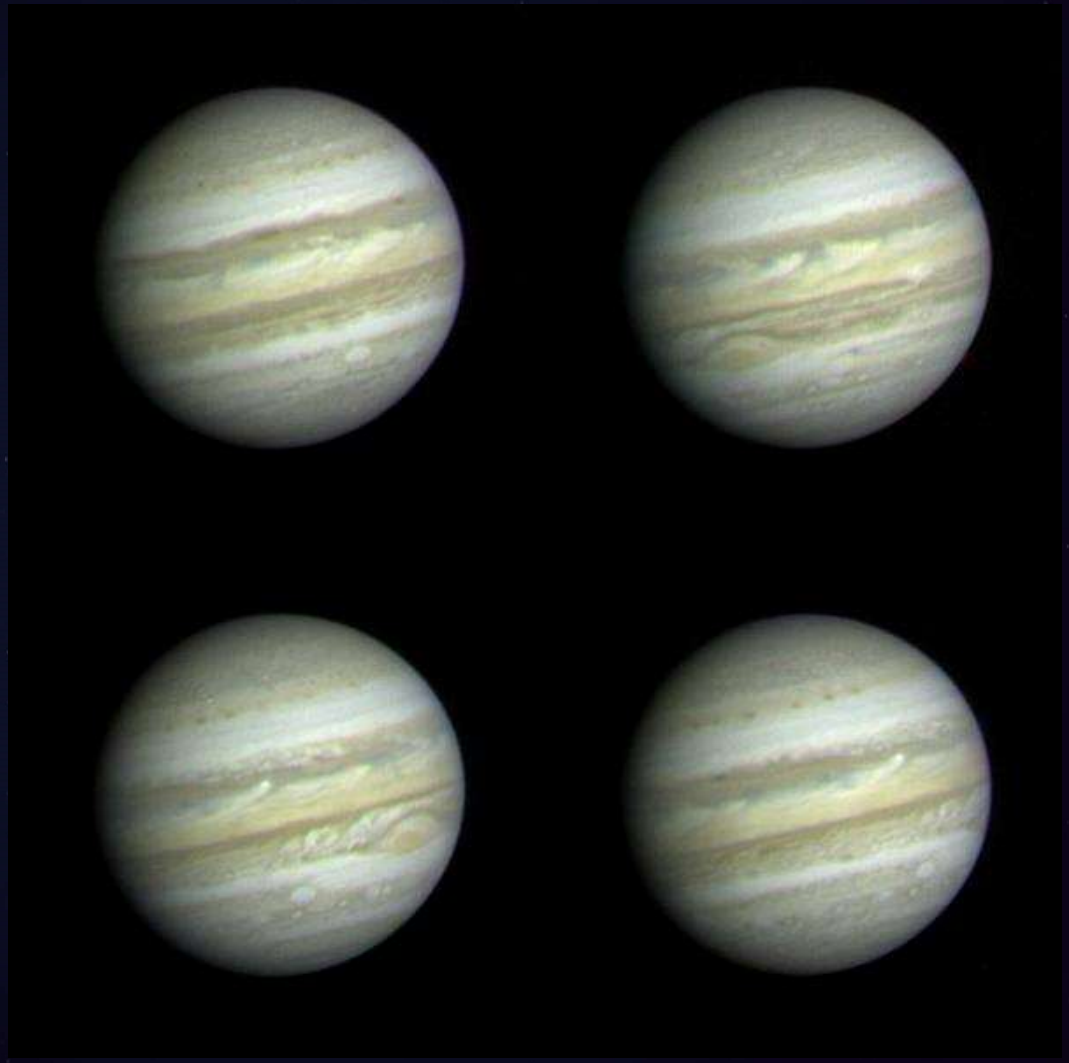
Mond



Mars



10-11.12.78



>82 * 10^6km

Voyager 1

Was wollen wir untersuchen?

Long Bursts (L-Bursts)

Short Bursts (S-Bursts)

Was benötigen wir?

- Antenne
- BP-Filter
- LNA
- LO / Mixer
- LP-Filter
- Audio Preamp
- Line Level Driver
- Computer

Antenne

- Simpel
- Kostengünstig
- «klein» @ 20.1 MHz

Antwort:

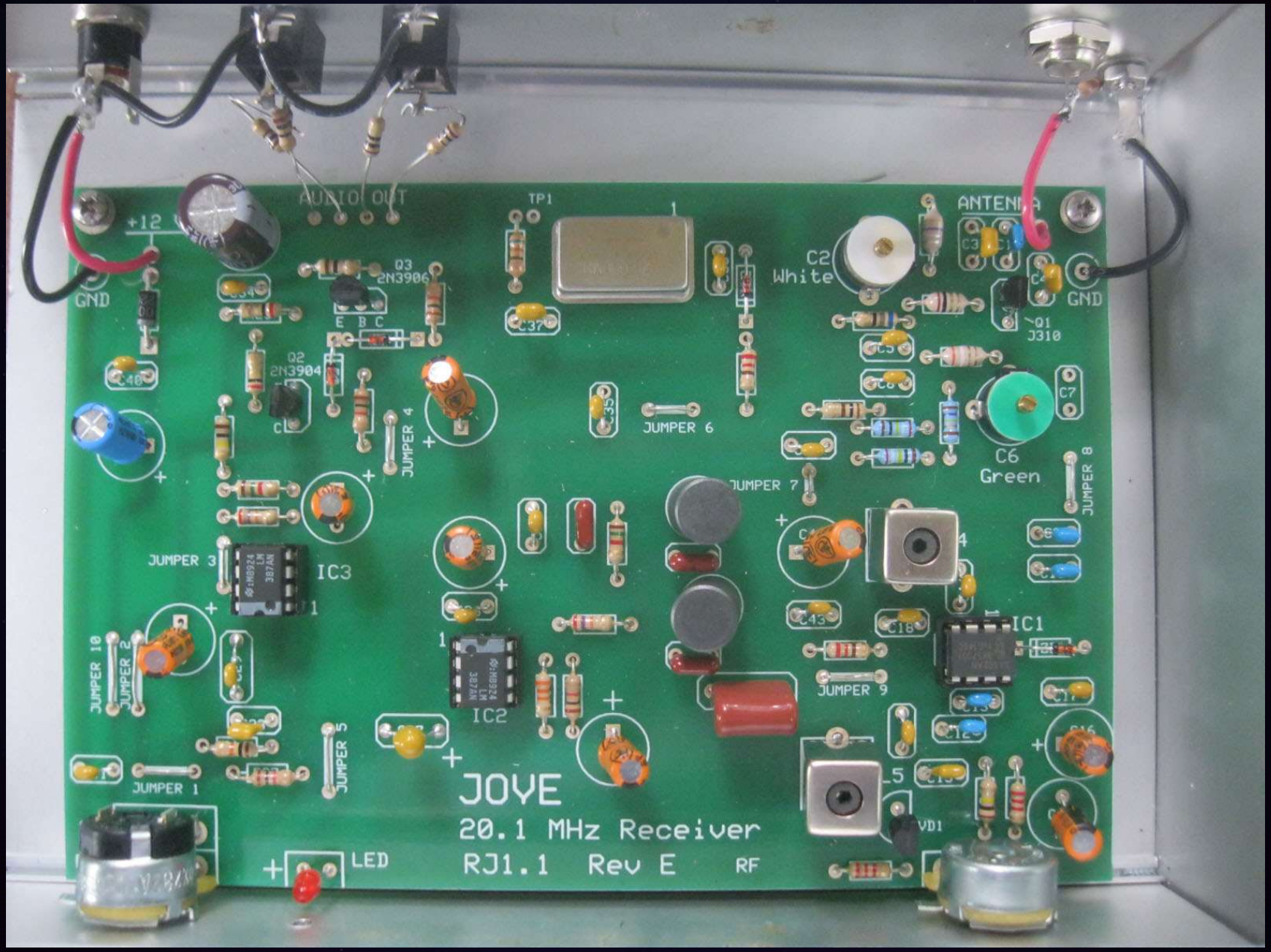
Lambda ½ Dipol

Next Level Antenne

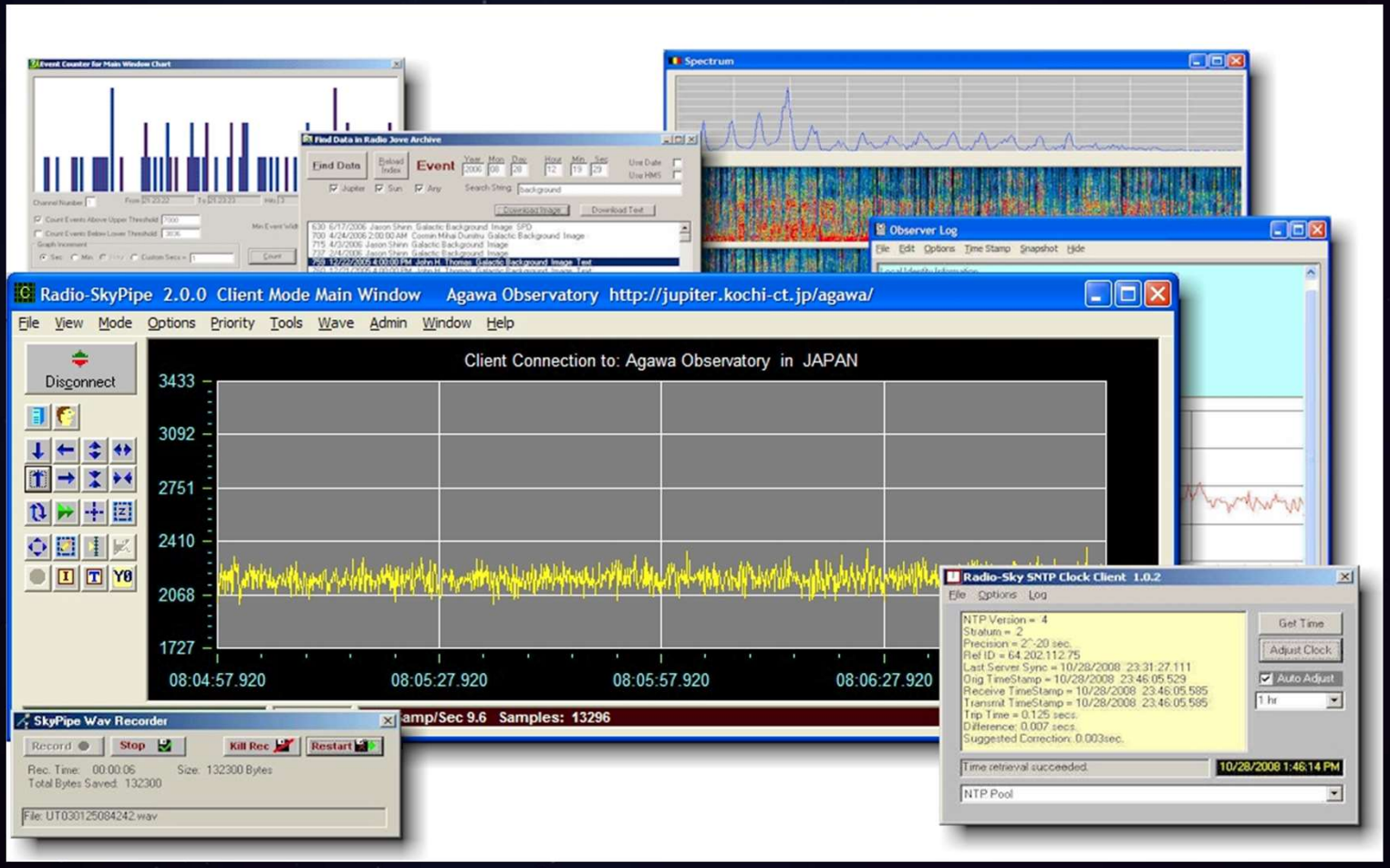
- Mehr Gewinn
- Steuerbar
- Kostengünstig
- «klein» @ 20.1 MHz

Antwort:

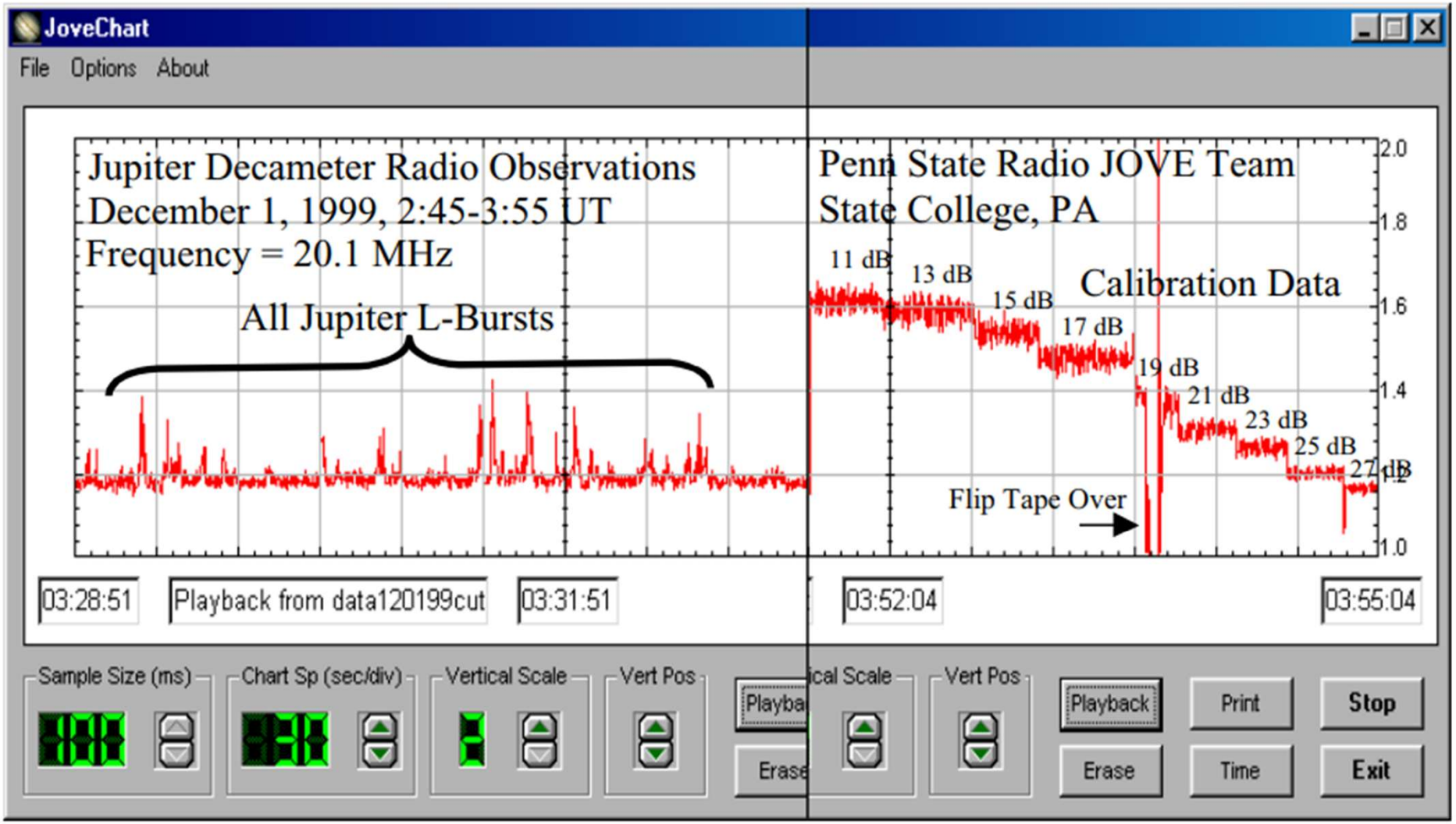
2 phased Lambda ½ Dipol

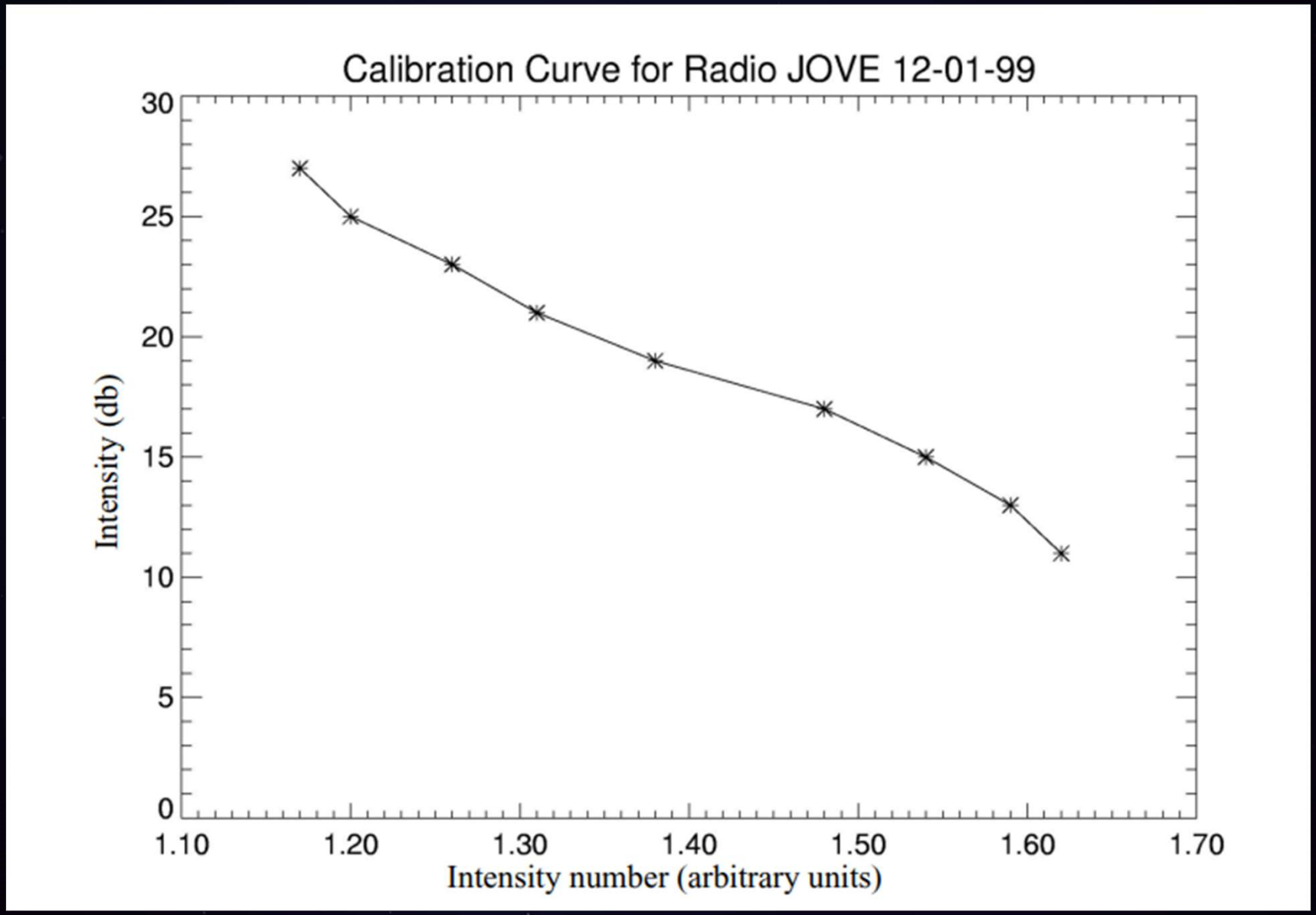

AUDIO OUT
TP1
+12
GND
ANTENNA
C2
White
GND
Q3
2N3906
E B C
Q2
2N3904
Q1
J310
C6
Green
JUMPER 1
JUMPER 2
JUMPER 3
JUMPER 4
JUMPER 5
JUMPER 6
JUMPER 7
JUMPER 8
JUMPER 9
JUMPER 10
IC1
IC2
IC3
LED
JOYE
20.1 MHz Receiver
RJ1.1 Rev E
RF

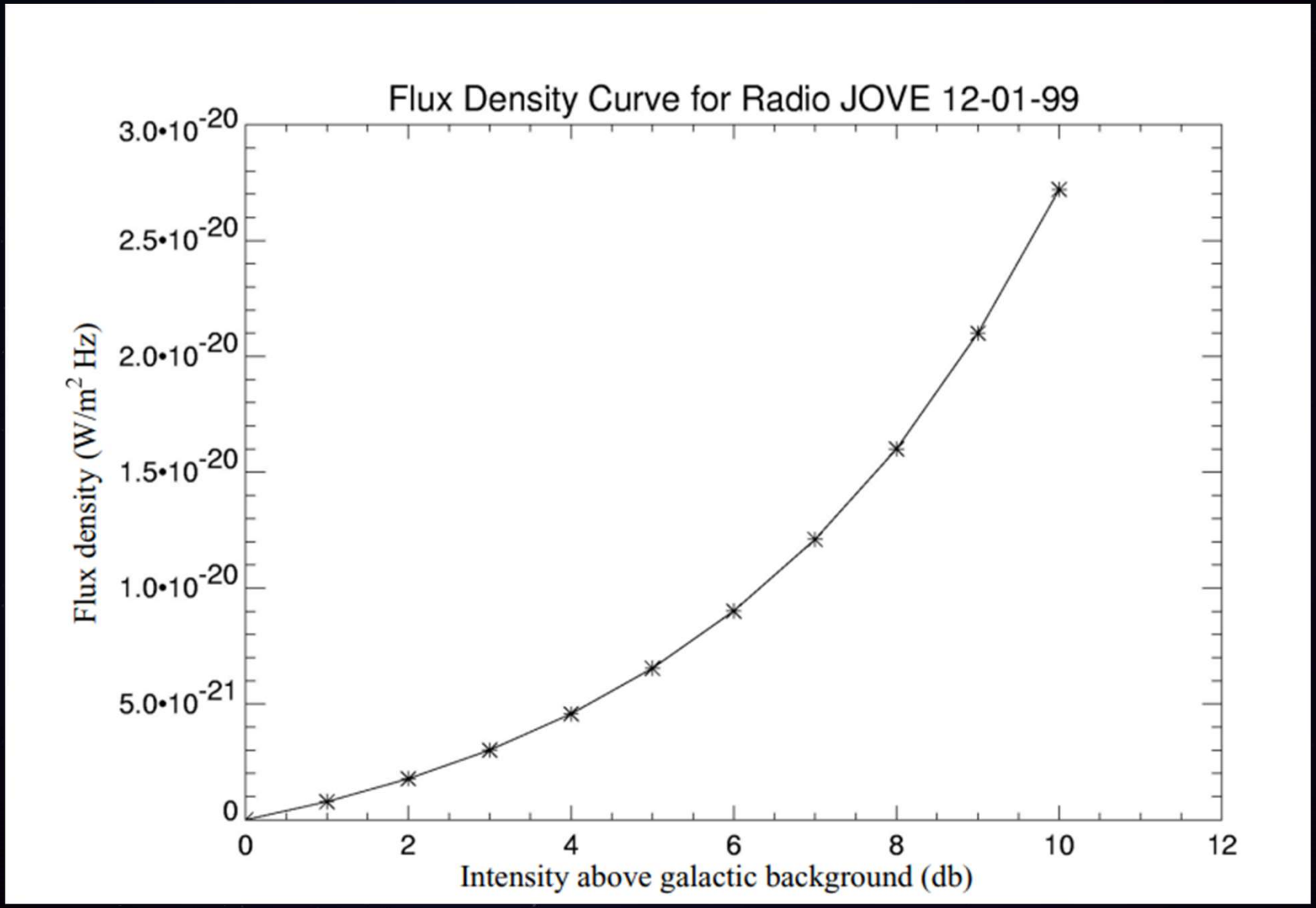
Radio-SkyPipe II



Jupiter Radio Storm Data Analysis




Calibration Curve for Radio JOVE 12-01-99
Intensity (db)
30
25
20
15
10
5
0
1.10
1.20
1.30
1.40
1.50
1.60
1.70
Intensity number (arbitrary units)


Flux Density Curve for Radio JOVE 12-01-99
3.0•10-20
2.5•10-20
2.0•10-20
1.5•10-20
1.0•10-20
5.0•10-21
0
Flux density (W/m2 Hz)
0
2
4
6
8
10
12
Intensity above galactic background (db)

Flussdichte

$$S = 1.21\text{E}{-20}\left(\frac{\_\text{W}}{\_\text{m}^2 \cdot \_\text{Hz}}\right)$$

Distanz Erde–Jupiter

Distanz Sonne–Jupiter = 5.2AU

Distanz Sonne–Erde = 1.0AU

$d_{EJ}=5.2\cdot \_au-1.\cdot \_\text{au} \blacktriangleright d_{EJ}=628.311\text{E}9\cdot \_\text{m}$

Kreisfläche des Signals

$a=4\cdot \pi\cdot (628311000000.\cdot \_\text{m})^2 \blacktriangleright a=4.96089\text{E}24\cdot \_\text{m}^2$

Spektrale Leistung des Signales pro Hz

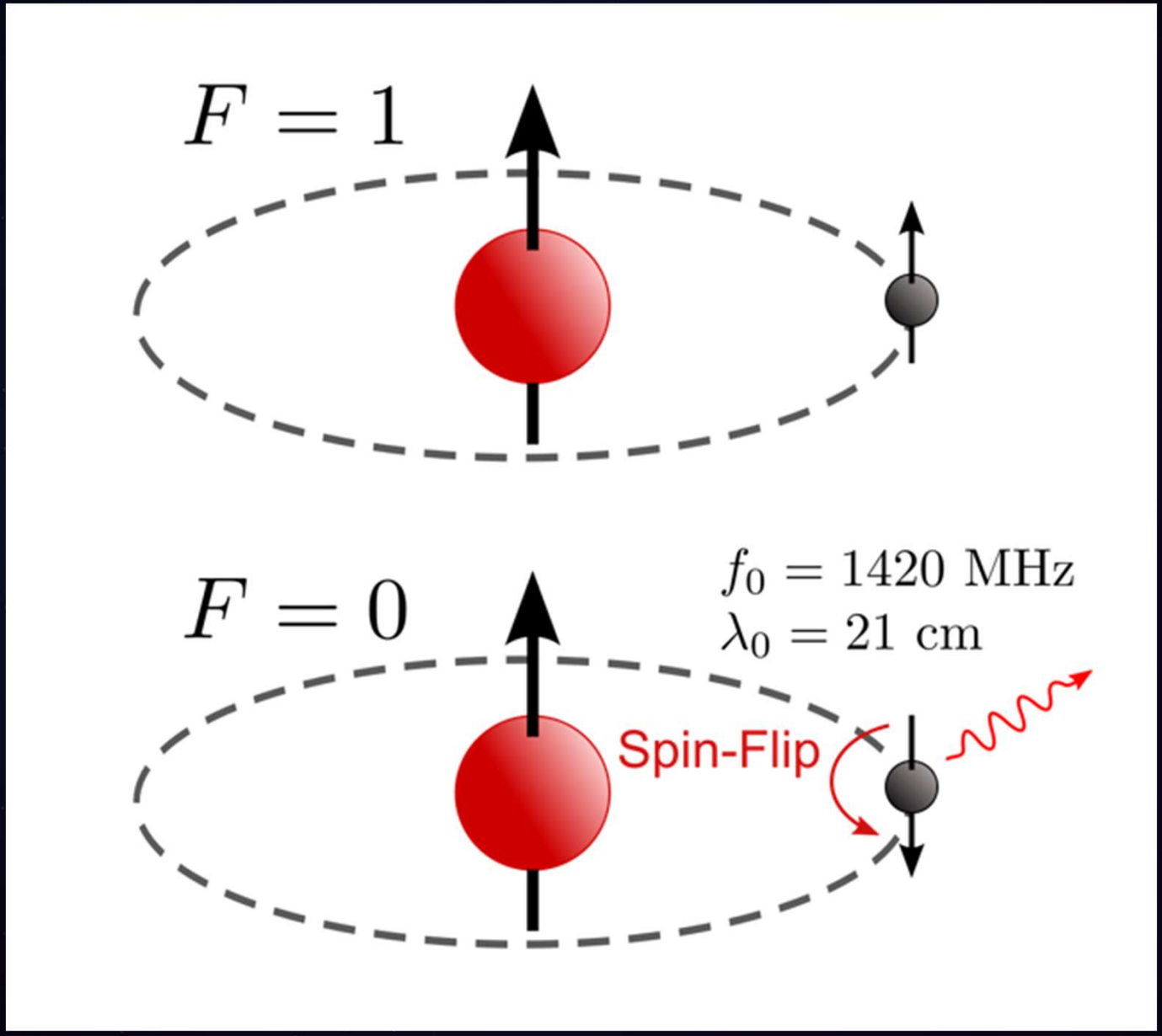
w = Flussdichte * Fläche

$$w=1.21\text{E}{-20}\cdot \frac{\_\text{W}}{\_\text{m}^2 \cdot \_\text{Hz}}\cdot 4.96089\text{E}24\cdot \_\text{m}^2 \blacktriangleright w=60.0268\text{E}3\cdot \_\text{J}$$

Lestung der Quelle über die gesammte Bandbreite

$p=60026.8\cdot \_J\cdot 10000000.\cdot \_\text{Hz} \blacktriangleright p=600.268\text{E}9\cdot \_\text{W}$

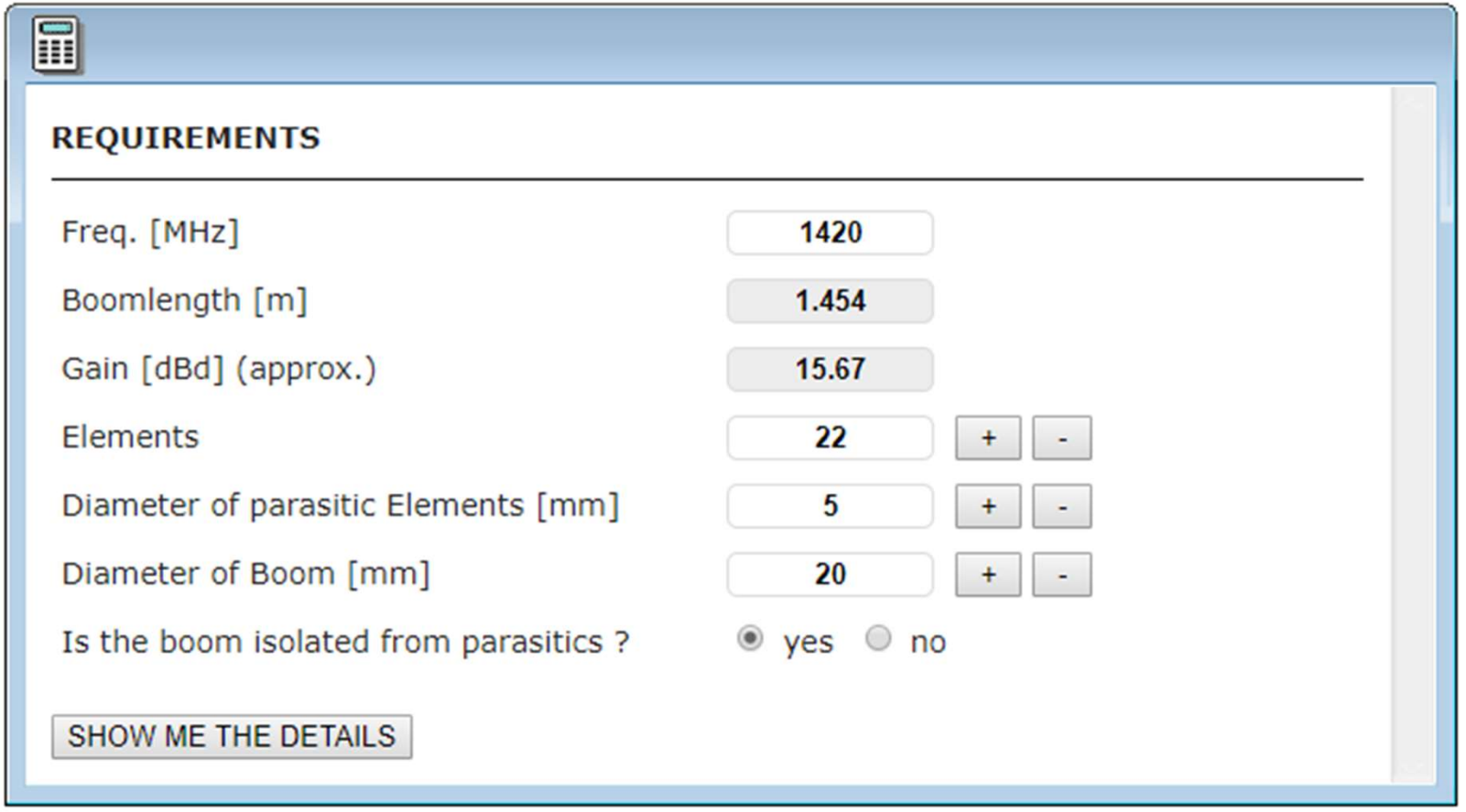

6
C
12,01
H2C–OH
HC–OH
H2C–OH


$F = 1$
$F = 0$
$f_0 = 1420$ MHz
$\lambda_0 = 21$ cm
Spin-Flip

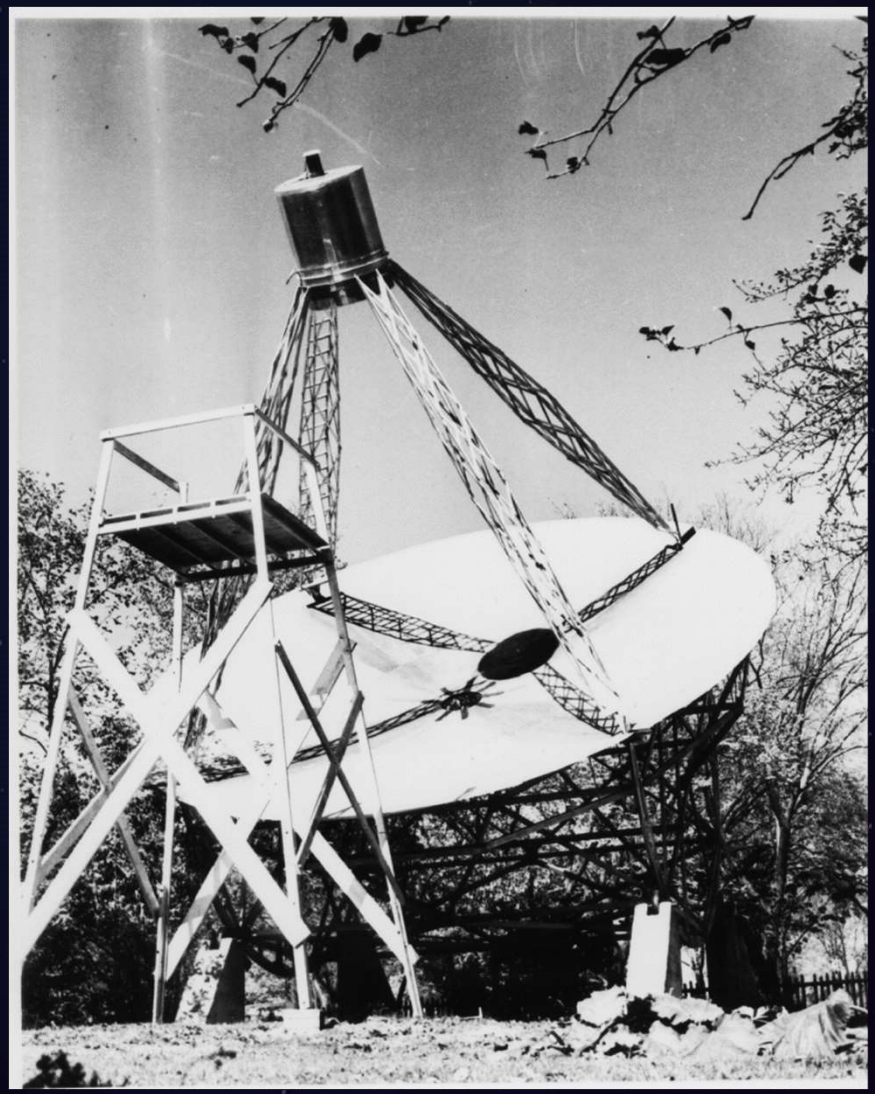
Was benötigen wir?

- Antenne
- LNA OIP3 gross
- BP-Filter
- LNA
- Bias-T
- RTL-SDR
- USB-Filter
- Computer

Antenne


REQUIREMENTS
Freq. [MHz]
1420
Boomlength [m]
1.454
Gain [dBd] (approx.)
15.67
Elements
22
+
-
Diameter of parasitic Elements [mm]
5
+
-
Diameter of Boom [mm]
20
+
-
Is the boom isolated from parasitics ?
yes
no
SHOW ME THE DETAILS

Nur 15.67dB?



Frequency of operation in GHz (input1) :

1.420

Antenna diameter in meter (input2) :

1.454

Antenna Gain in dB (Output1):

24.536142427564695

Half Power Beamwidth in degrees (Output2):

8.71805800414592

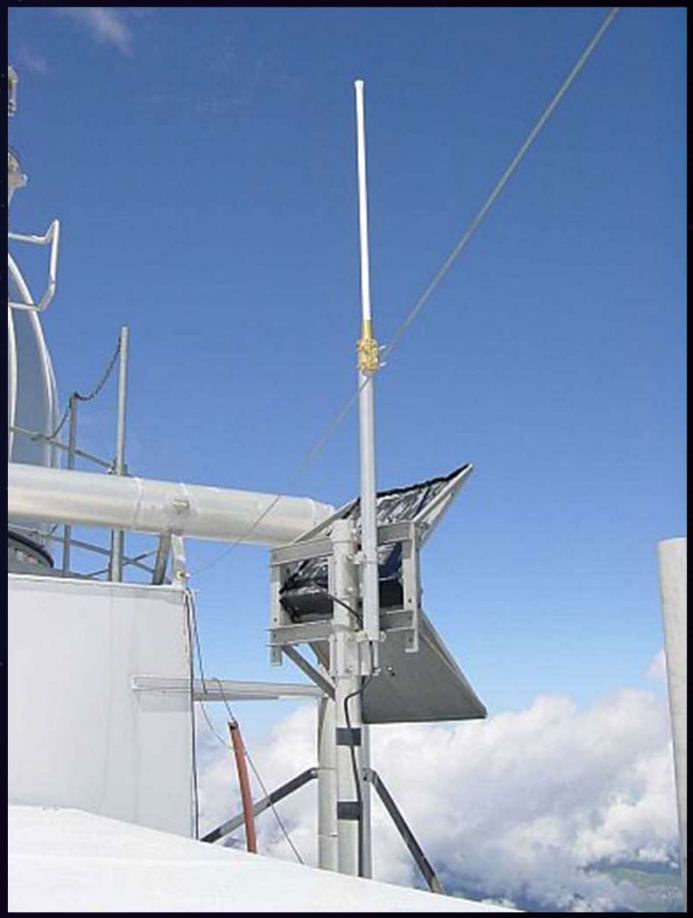
Effective Aperture in meter^2 (Output3):

0.9962536941654957

1st stage LNA

- Grosssignalfest
- Tiefe Rauschzahl
- Hohe Verstärkung

LTE



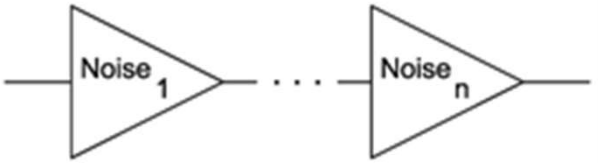
Rauschzahl

$$Noise_{total} = 10 \log_{10}\left(n_1 + \sum_{i=2}^{M} \frac{n_i - 1}{\prod_{j=1}^{i-1} g_j}\right)$$

$$n_i = 10^{\frac{N_i}{10}}; \quad g_i = 10^{\frac{G_i}{10}}; \quad Gain_{total} = \sum G_i$$

Select number of cascaded amplifiers:

3



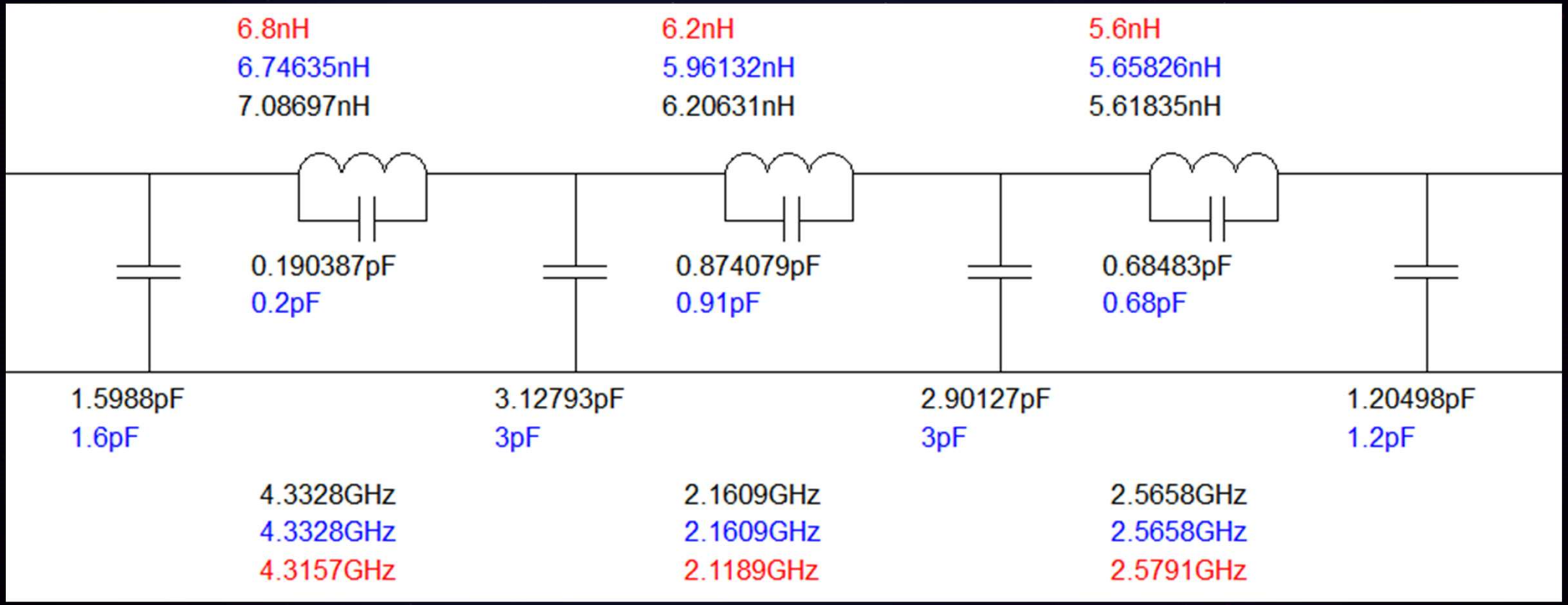
Noise(dB)	Gain(dB)
0.35	20
0.75	16
0.75	16

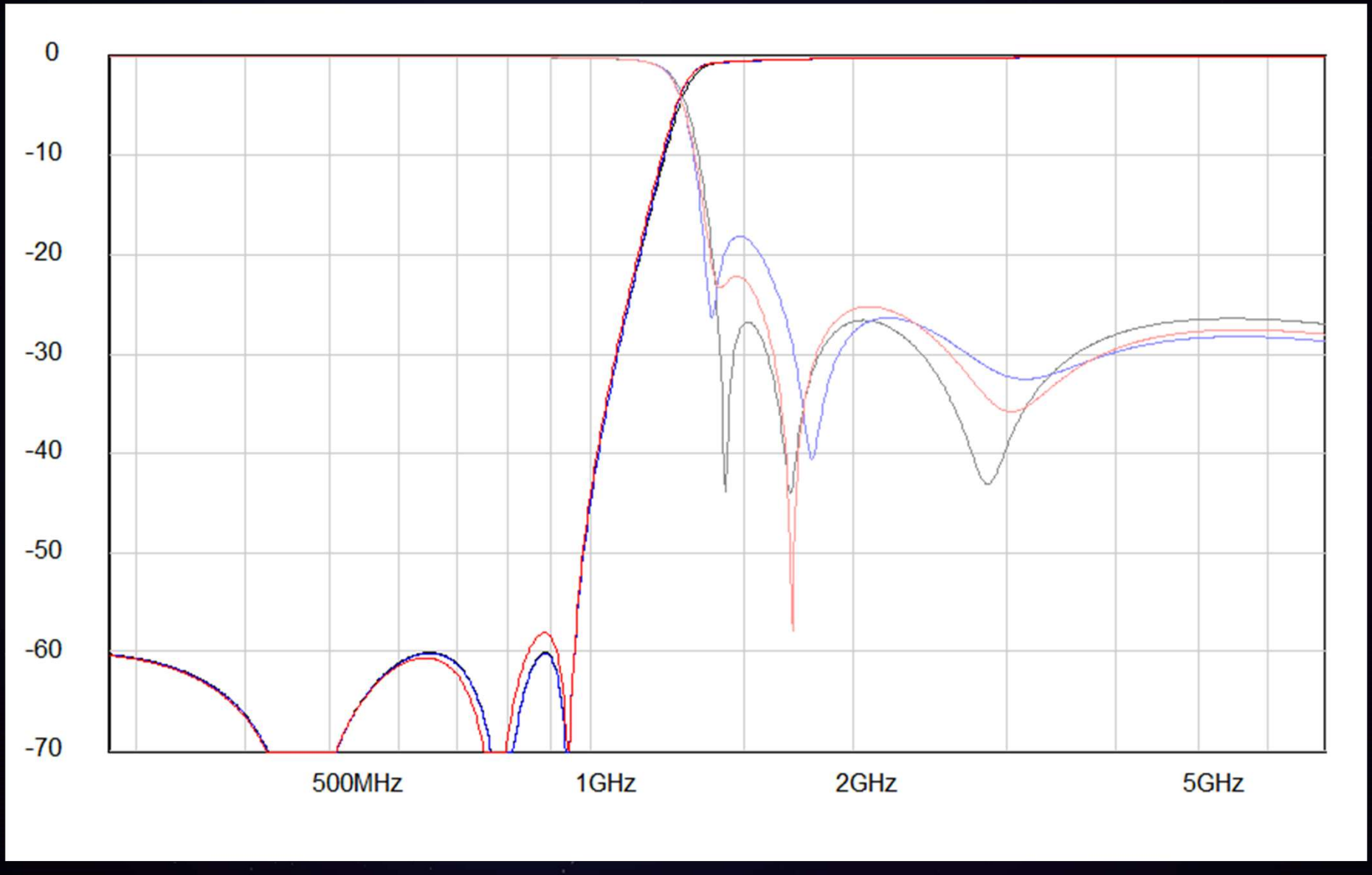
Calculate

Result:

Total Noise Figure: 0.3577 dB
Total Gain: 52.00 dB

Bandpass-Filter

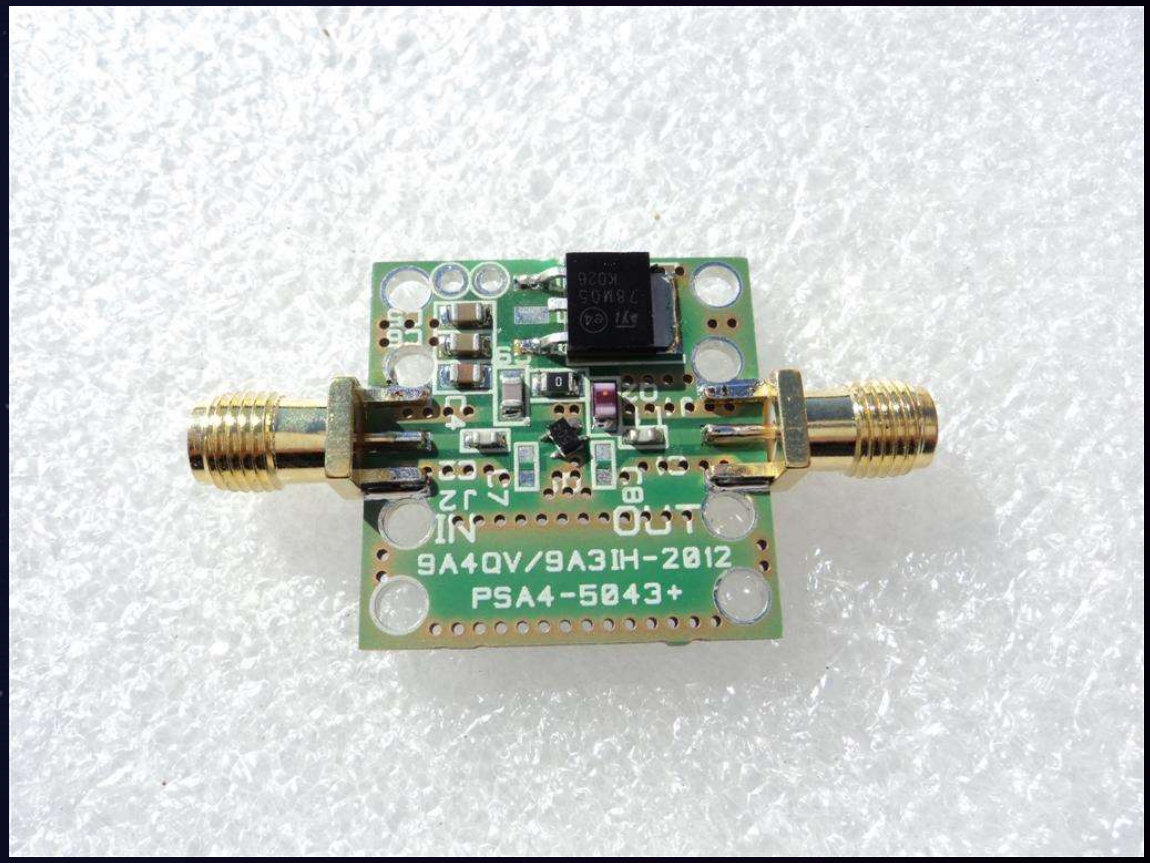



0
-10
-20
-30
-40
-50
-60
-70
500MHz
1GHz
2GHz
5GHz

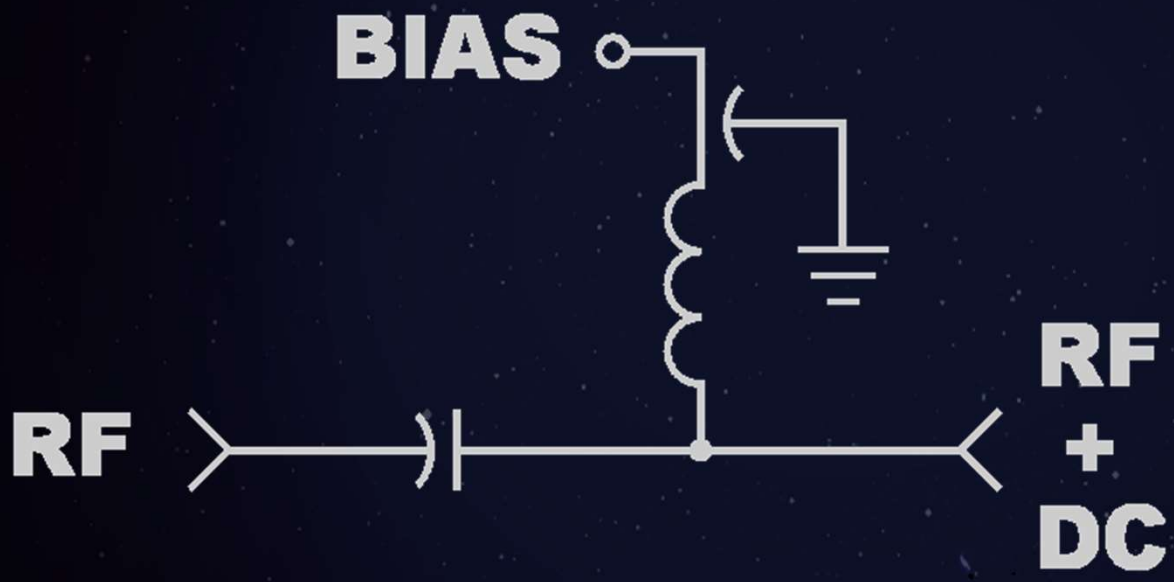
2nd / 3rd stage LNA

- Hohe Verstärkung
- Rauschzahl zweitrangig
- Preiswert

- LNA4ALL
- 0.75db NF @ 1.4 GHz
- 16dB @ 1.4 GHz
- 20€ ohne Gehäuse
- Al-Gehäuse 33€



Bias Tee



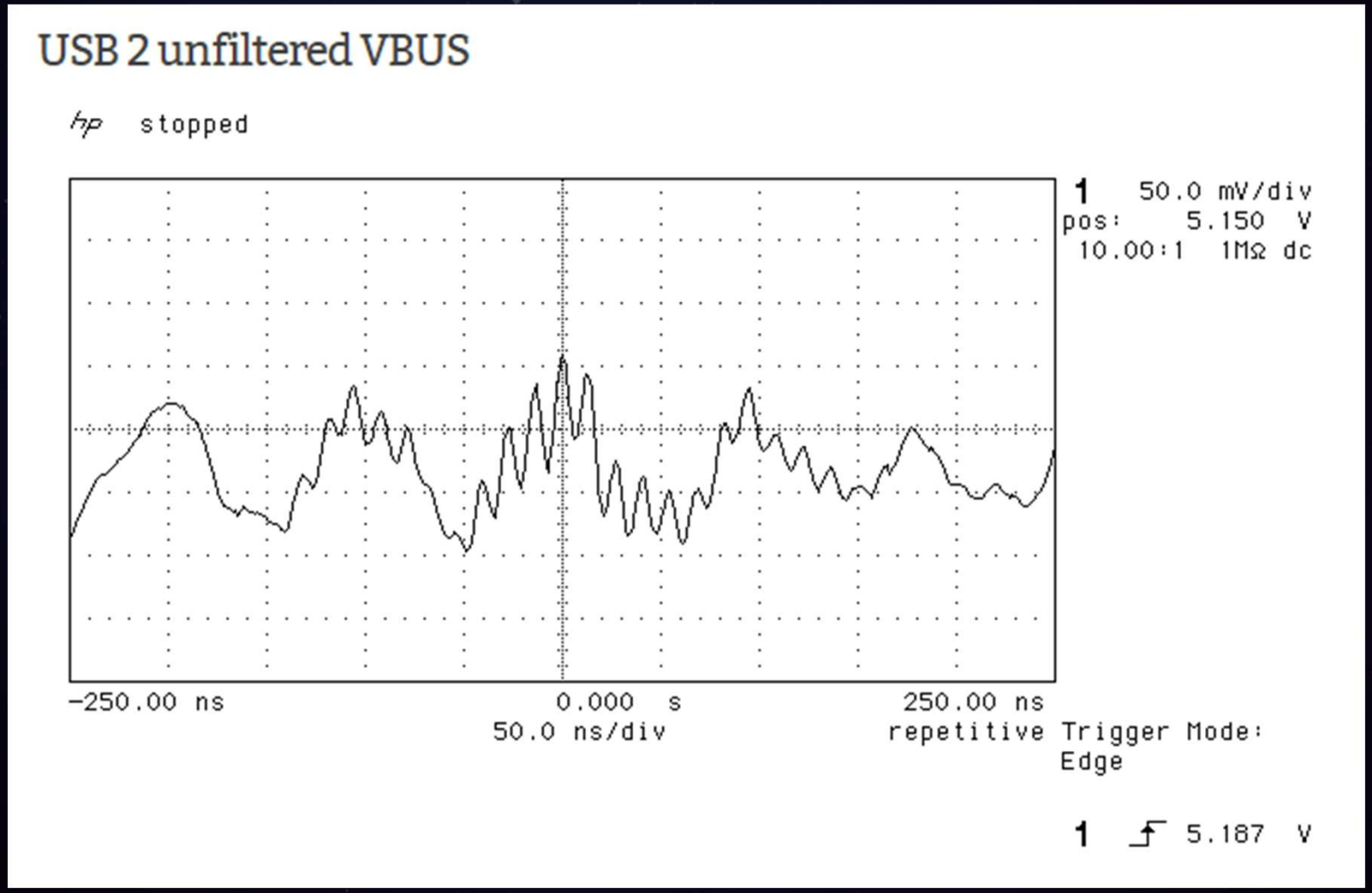
up to 6 GHz

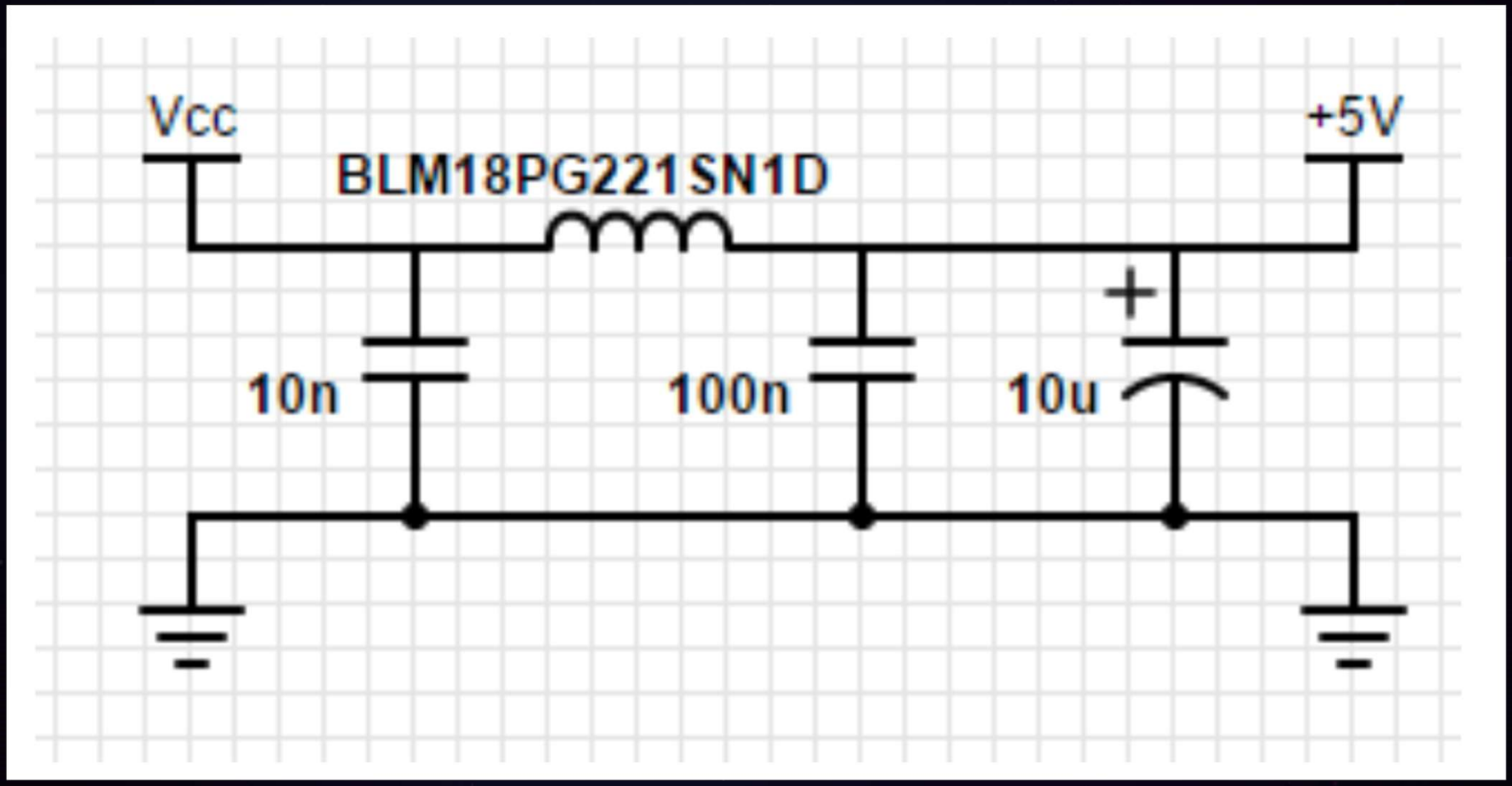
RTL-SDR

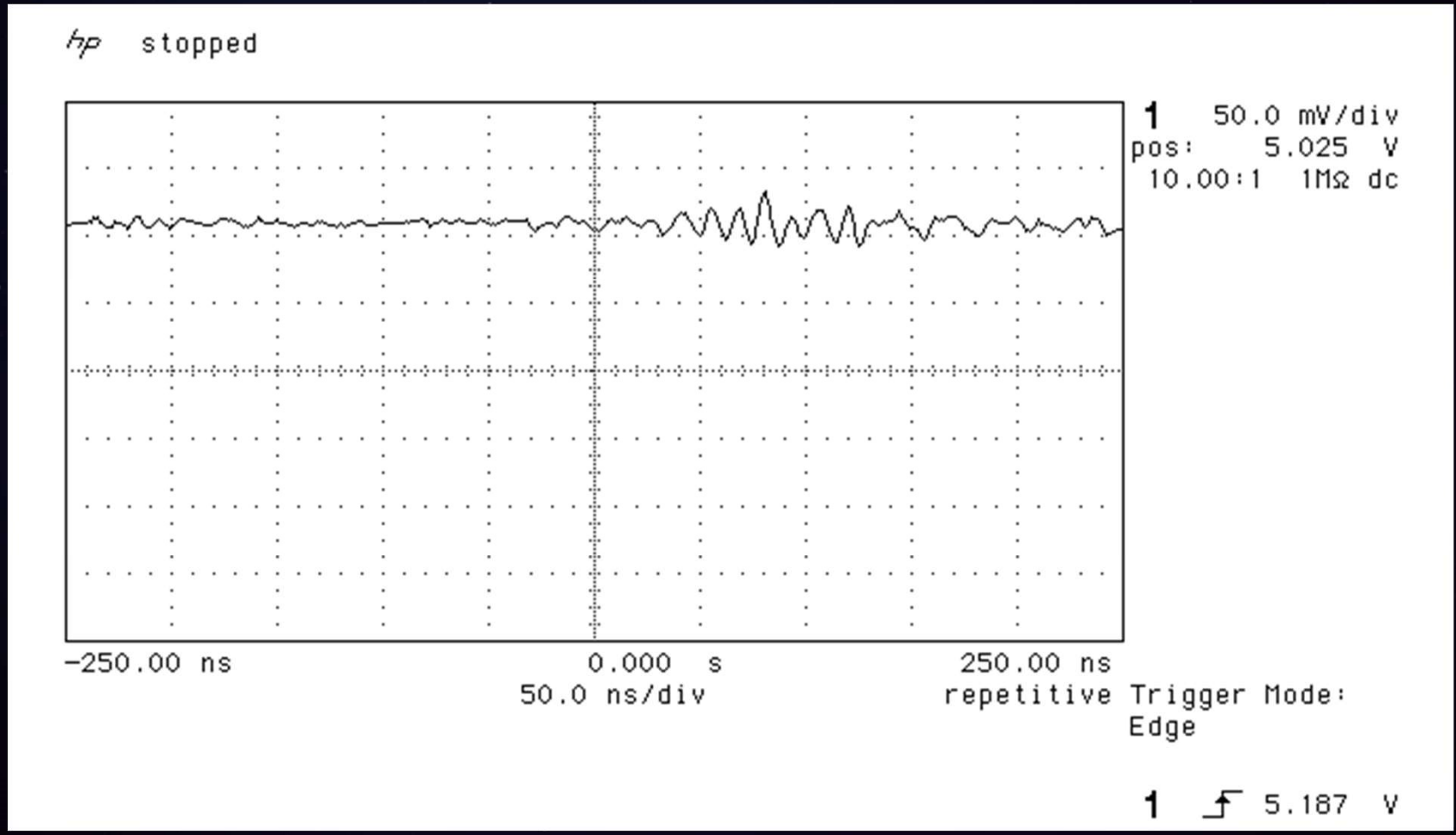

RTL-SDR.COM
QUICKSTART SETUP GUIDE: RTL-SDR.COM/QSG
DVB-T+DAB+FM+SDR
RTL2832U R820T2 TCXO+BIAS T+HF
V.3


RSPduo
Dual Tuner
SDRplay
USB
REFERENCE
IN
OUT
Tuner 1
HIGH Z
P N GND
50Ω
Tuner 2
50Ω
BIAS T

USB Filtern


USB 2 unfiltered VBUS
hp stopped
1 50.0 mV/div
pos: 5.150 V
10.00:1 1MΩ dc
-250.00 ns
0.000 s
250.00 ns
50.0 ns/div
repetitive Trigger Mode:
Edge
1 5.187 V


Vcc
BLM18PG221SN1D
+5V
10n
100n
10u
+


hp stopped
1 50.0 mV/div
pos: 5.025 V
10.00:1 1MΩ dc
-250.00 ns
0.000 s
250.00 ns
50.0 ns/div
repetitive Trigger Mode:
Edge
1 5.187 V