10MHz frequency source

Possible sources

All sources exist in ResLab.

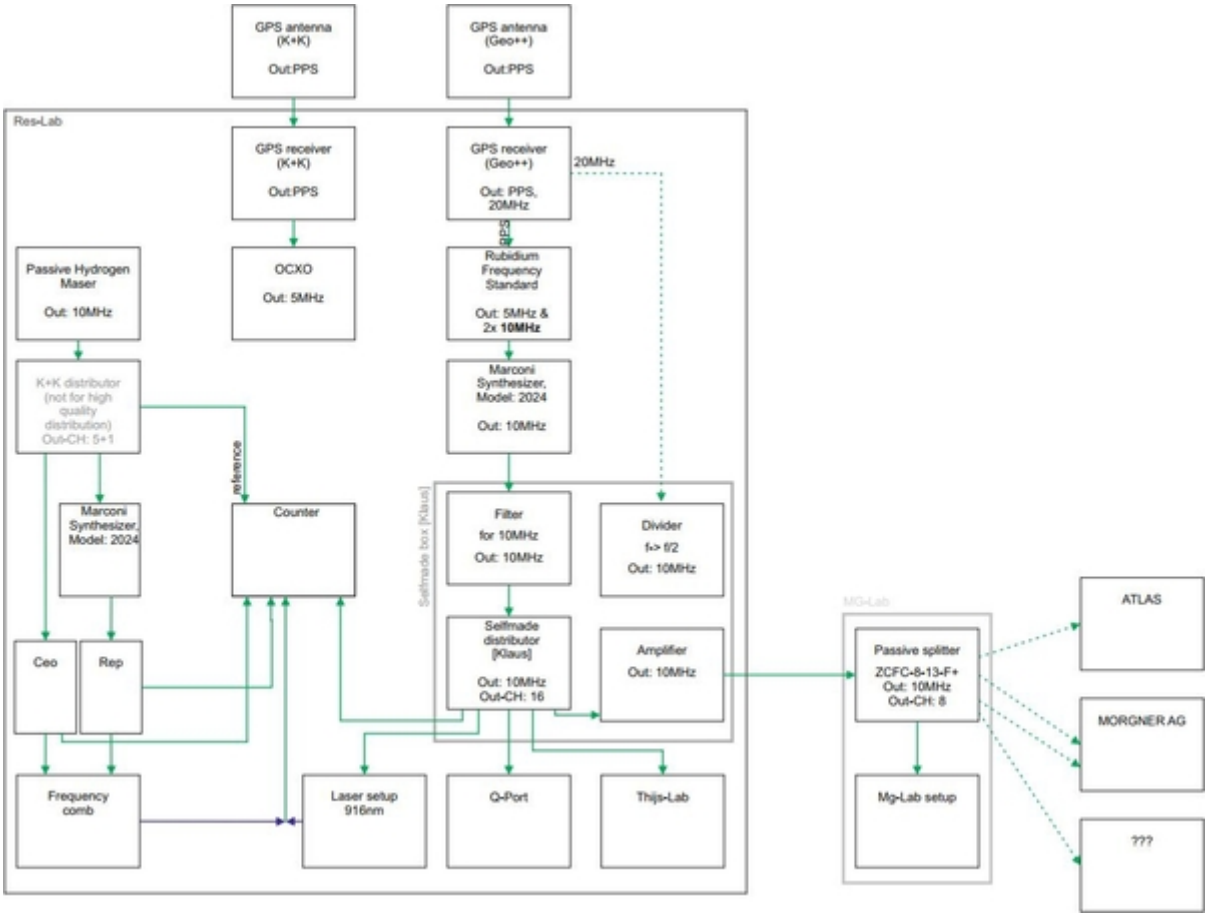
1. Passive Hydrogen Maser
2. OCXO
    1. OXCO 5 MHz
    2. OXCO 10 MHz (broken)
3. Rubidium Frequency Standard

1. GPS receiver
2. Marconi Synthesizer, Model: 2024
3. <color #ff00ff>Andere Syntheziszer</fc>
4. Selfmade distributor [Klaus]
5. K+K distributor (not for high quality distribution)
6. HighTec Fiber ???

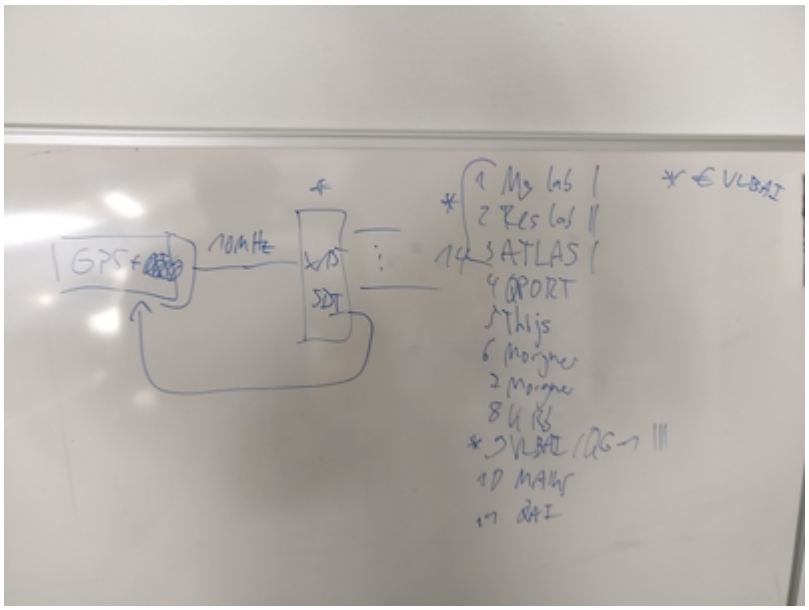
1. CSAC Chip für stabile 10MHz Referenz

Current Setup [30.05.2017]

Current 10MHz setup.pdf



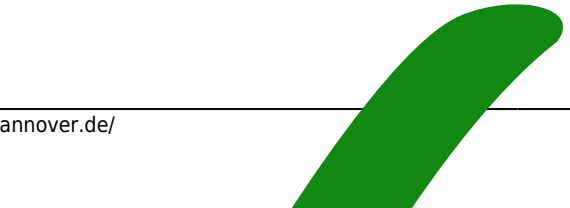
Future Setup

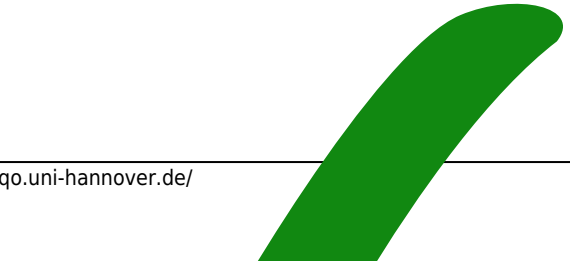


- Ansprechpartner für Löcher in der Uni: Miehlbradt, Marion (Tel.: 2258)
  - Raumpläne IQO
  - 10_MHz_Verlegung_IQ_08_2017
  - Schadstoffuntersuchungsbericht

: Negativ auf Aspest von Firma Wessling!

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable** **Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable** **Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
ResLab S. Sauer S. Sauer	D215	2 [] 16 [	2 (16)	1 (OXCO-Mean distributor) + 1 (Mean distributor - Reslab distributor) + 16*5	1, Ø=?, Reslab-Q-Port	-

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable** 2 [] 8 [	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
Atom-Lab-Mg S. Sauer W. Friesen	D320		1 (16)	2*[25(Reslab - Mg-Lab) + 10(Mg-Lab)] + 8*5	1, Ø=5-10cm, Q-Port-Atom-Lab-Mg	-

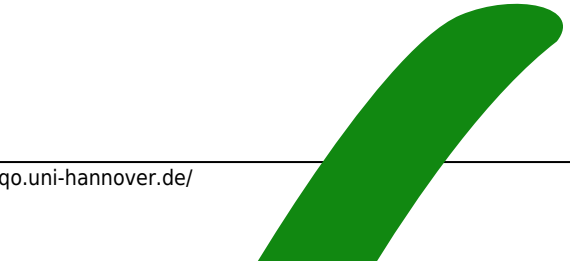
Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable** 1 + ? []	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
KRb J. Peise A. Igel	E311		1 (16)	25(Reslab - Mg-Lab) + 20(Mg-Lab) + 60(Mg-Lab-KRB)	-	* KRB_10MHz_Kabel_08_2017 * Die Durchführungen sind alle groß genug, nur auf höhe des Elektroniklabors liegen die Kabel in der Nähe von Heizungsrohren. * Im Flur befindet sich ein offener Kabelkanal.

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable** 1 + ? []	**Number of distributors (Number of outputs)**	**Cable length + "Lab cable Length" [m]**	**Holes [Number, size, place]**	**Notes**
QAI,EPR J. Peise C. Pür	D313 → D315		1 (16)	25 (Reslab - Mg-Lab) + 20(Mg-Lab) + 25(Mg-Lab-QAI) + 25(QAI-EPR)	-	-

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
ATLAS H. Albers H. Albers	D330	1 + ? []	1 (16)	25(Reslab - Mg-Lab) + 25(Mg-Lab) + 50 (Mg-Lab-ATLAS) + 5(ATLAS-Lab)	?, Ø=10cm, ?	* ATLAS_10MHz_Habel_08_2017 * Gibt keine Information wie es über den Seminarraum verlegt ist → Neue Löcher bohren oder zusätzlicher Durchgang zu VLBAI

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
VLBAI E. Wodey ?	D323	1 []	1 (16)	25(Reslab - Mg-Lab) + 25(Mg-Lab) + 20 (Mg-Lab-VLBAI) + 5 (VLBAI)	-	-

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable** **Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
Quantengravi J. Mathias ?	D323	1 []	1 (16)	25(Reslab - Mg-Lab) + 25(Mg-Lab) + 20 (Mg-Lab-VLBAI) + 5 (VLBAI)	-	-

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable** 1 [] 2 [	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
AG S.& C. Ospelkaus Mirko Sierke S. Grondwoski	E304A → E104A		2 (min. 8)	25(Reslab - Mg-Lab) + 25 (Mg-Lab) + 100 (Mg-Lab - E-Trakt = vorhanden!) + E-Trakt	-	* AG_Ospelkaus_10MHz_Habel_08_2017 * Das vorhandene Kabel ist 100 Meter lang und hat bei 10 MHz eine Dämpfung von etwa 4,3 dB. * Kabelnanfang im Mg-Labor ist mit “CW Tiemann” und das Ende im E-Trakt ist mit “MG ERT” beschriftet

Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable** **Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + “Lab cable Length” [m]**	**Holes [Number, size, place]**	**Notes**
Q-Port S. Bode ?		1 []	-	-	-	Vorhandene Kabel ist verlegt, muss noch getestet werden

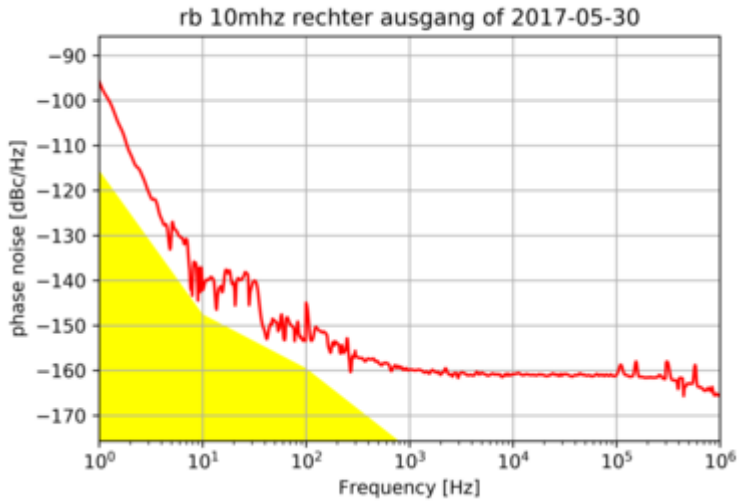
Experiment Ansprechperson Experiment Ansprechperson Kabelverlegeung	**Raumnummer**	**Number of cables [new =**  **, old =**  **]** **Mean cable Lab cable**	**Number of distributors (Number of outputs)**	**Cable length + "Lab cable Length" [m]**	**Holes [Number, size, place]**	**Notes**
Lasus Thejs ?	D220	1 []	-	-	-	* Vorhandene Kabel ist verlegt, Aircell 7, muss noch getestet werden * Sein vorhandener Verteiler ist ein SRS FS710
Maius D. Becker		keine Antwort	keine Antwort	-	-	-
AG Morgner B. Kreipe		0	0	-	-	-
Gesamt			**7 (16) 2 (min 8)**	**622**		

To Do

1)

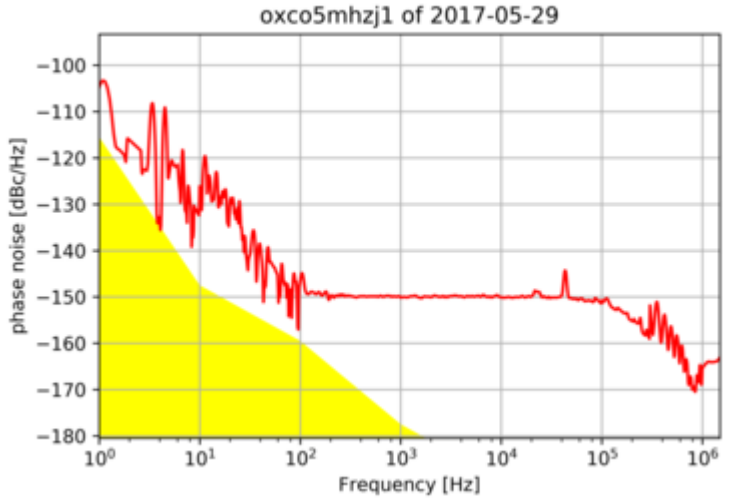
☐ FSWP-8 refernced to Maser
☐ FSWP-8 running 1 day ahead of measurement
☐ Measure: 100mHz-10MHz PN Rb-clock

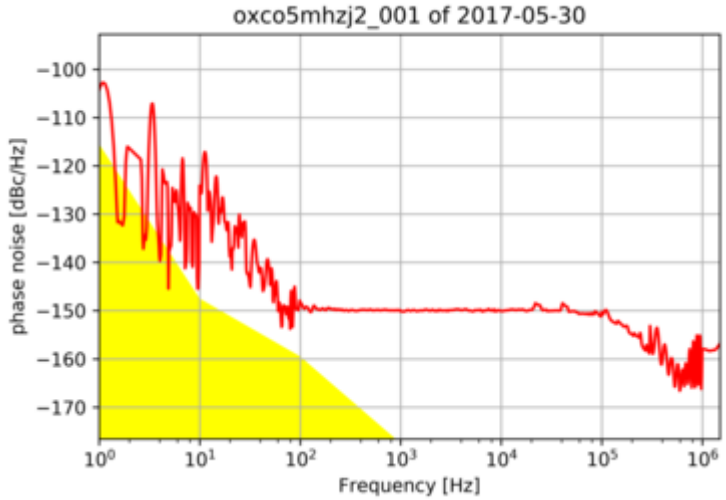
- “GPS →” Rb-10Mhz [right Output] → BNC cable → BNC-I-connector → BNC-SMA-connecotor → long cable → PNA



☐ Measure: -"- -"- OCXO

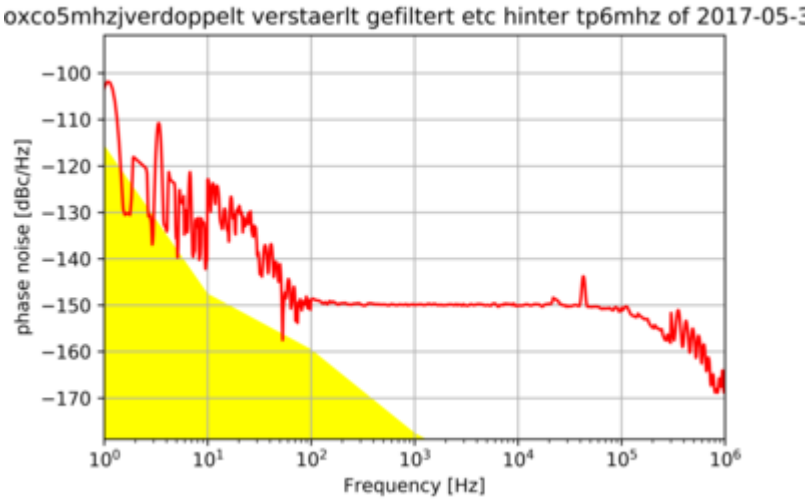
- Channel J1 and J2: OCXO → short cable → SMA-I-connector → long cable → PNA



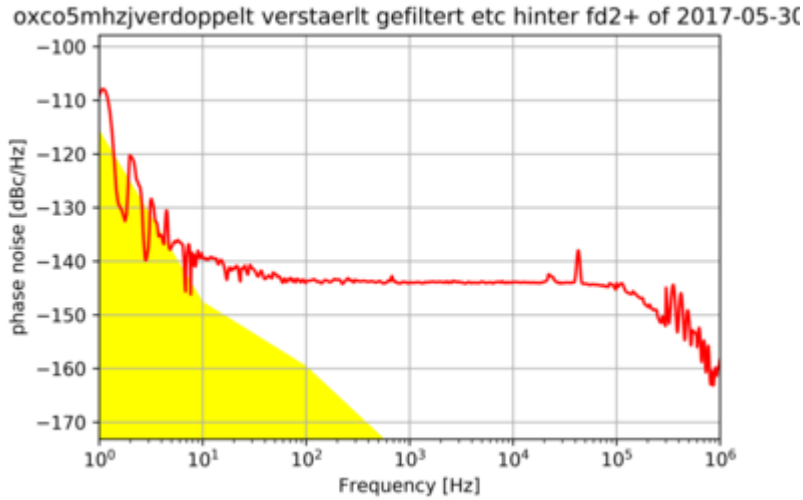


☐ Measure: -"- -"- OCXO 5MHzx2 (passive)

- J1 → short cable → SMA-BNC-connector → TP [6MHz] → long cable → PNA

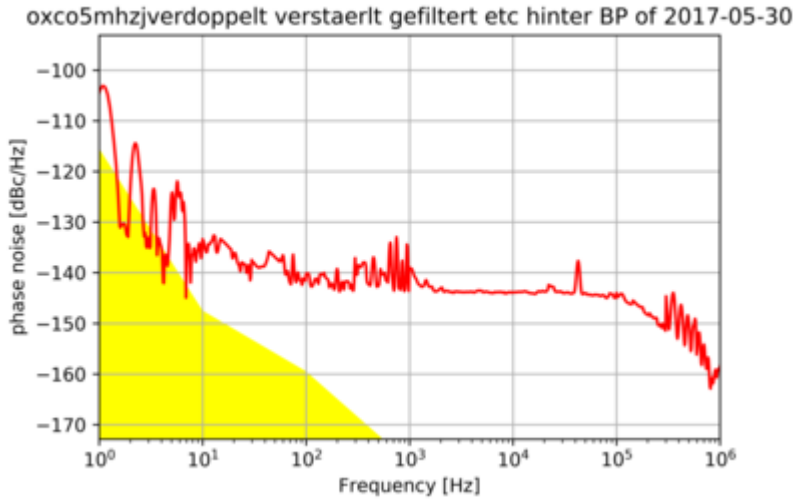


- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → long cable → PNA

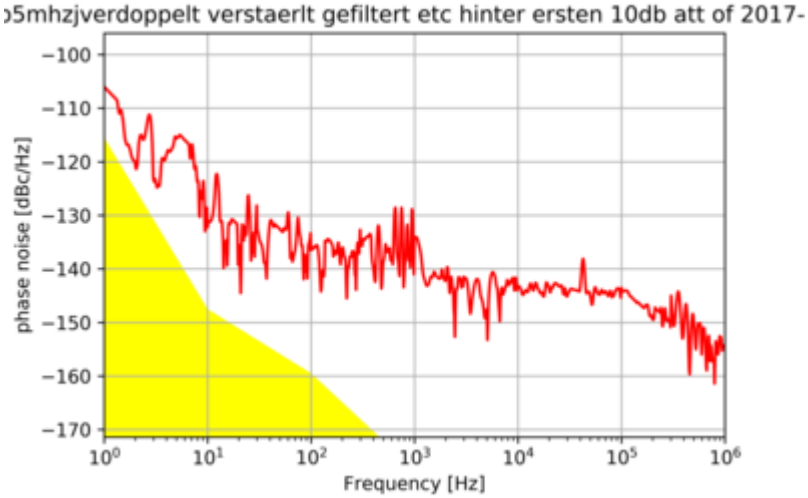


- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector →

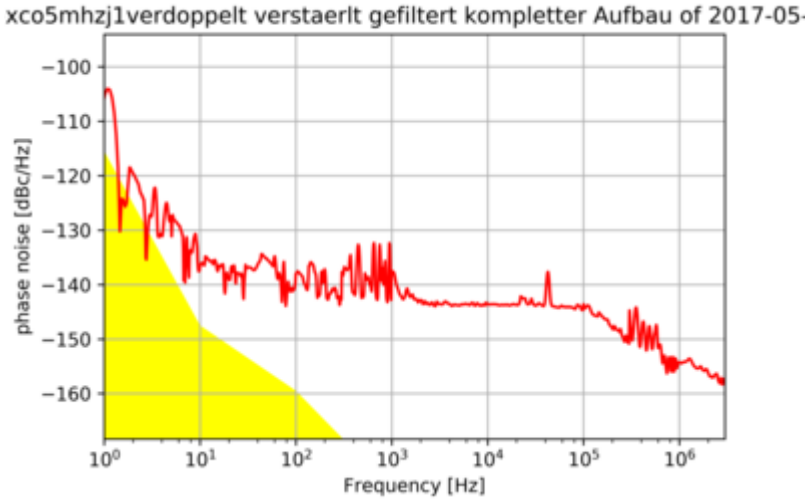
BP [SBP-10.7+] → long cable → PNA

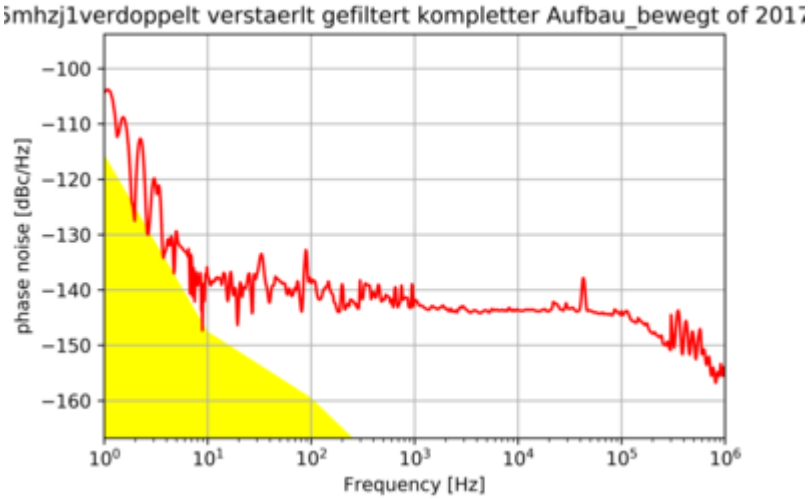


- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → BP [SBP-10.7+] → BNC-SMA-connector → Att. [10dB] → BNC-SMA-connector → long cable → PNA



- Overall setup: J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → BP [SBP-10.7+] → BNC-SMA-connector → Att. [10dB] → short BNC-cable → Amplifier [ZFL-500LN-BNC+] → LP [BLP-15] → Att. [20dB] → Att. [3dB] → BNC-SMA-connector → long SMA cable → PNA





☐ Measure: -"- -"- OCXO 5MHzx2 (DDS?)

- Currently not possible.

2)
☐ Propagate K+K manuals
3)
☐ Repair K+K box
4)
☐ Compare PN Marconi vs. ampfiers (which?)
5)
☐ Compare Specs Timetech & Spectra dynamics -> (PN, Channel/CHannel isolation, Groundloops, min input power @ 10MHz)

Distibution

- Timetech distributor:
  - Gibt es für Eco (Isolation: 120dB bei 10MHz / only BNC) und High Performance (Isolation: 150dB / only SMA)
    - ECO Variante: Timetech distributor_datasheet
    - High Variante: Timetech distributor_datasheet

- Spectra dynamics distributor: HPDA-15RMi

Datasheet_HPDA-15RMi

Feature	**TimeTech [Eco-Version]**	**Spectra dynamics HPDA-15RMi**
Phase Noise [dBc]	@ 10MHz 1Hz -148 10Hz -160 100Hz -165 1000Hz -166 10000Hz -166	@ <hi #ed1c24>???</hi> MHz 1Hz -155 (max -150) 10Hz -165 (max-160) 1000Hz -170 (max 168) 10000Hz -171 (max -170)
Channel/Channel isolation [dB]	5 MHz / 10 MHz / 100 MHz Np clipping below: +12 dBm / +12 dBm / +12 dBm Reverse Isolation [dB]: > 140 (145 typ.) / > 120 (128 typ.) / > 110 (118 typ.) Output / Output Isolation [dB]: > 100 (108 typ.) / > 90 (100 typ.) / > 75 (83 typ.) Ch-A / Ch-B Isolation [dB]: > 110 (117 typ.) / > 100 (110 typ.) / > 90 (98 typ.) Harmonics [dBc] (1st, 2nd, 3rd) +10 dBm input: -76 -76 -80 / -70 -57 -65 / -44 -46 -60 +13 dBm input: -73 -69 -82 / -65 -55 -65 / -42 -40 -55	Out-out: 130 (min 130)\\Out-in: 140 (min 145)
Groundloops	<hi #ed1c24>???</hi>	<hi #ed1c24>???</hi>
RF-Bandwidth [MHz]	5 to 100 MHz sine wave useable from 100kHz to 200 MHz	+/- 1 dB 0.5-65 (min 1-50)
Input Level [dBm]	Input level working: +6 to +17 (+14 dBm @ 100 MHz) Input level nominal: +13	1 dB compression 18 (min 17) @ <hi #ed1c24>???</hi> MHz
Output Level [dBm]	<hi #ed1c24>???</hi>	+18 @ <hi #ed1c24>???</hi> MHz
Gain [dB]	Gain: 0 (+0.15/-0.1 dB, 1 – 100 MHz, +0.15 to –0.5 dB @ 200 MHz) Gain variation: < 0.1, output vs. output	@5MHz 0.2 (max 0.5)
Impedance [Ω]	Input: 50, nominal Output: 50, nominal	Input: 50 Output: 50
Return loss [dB]	Input: >45 @5MHz and 10 MHz, >30 @100 MHz Output: >50 @5MHz and 10 MHz, >30 (typ –35) @ 100 MHz	Input(S11): -35 (max -30) Output(S22): -35 (max -30)
Distortion [dBc]	<hi #ed1c24>???</hi>	+13 dBm: -48 (max -45) +17 dBm: -42 (max -40)
Temp. Delay Coefficient	+15…+30°C 1K pp with maximum slopes 0.5K/h	0-50°C 1.2 (max 1.5) [ps/ºC]
Connectors	only BNC <hi #ed1c24>???</hi>	SMA for input and output
Power connectors	Power Consumption (all outputs loaded): AC: < 0.2 A Priority on AC supply input DC: < 0.9 A, Stand-By: < 50 mA DC is used as back-up supply Supply voltage AC: 100 to 240 V AC, 50/60 Hz, LED indicating AC voltage Supply voltage DC: 18 to 36 V DC, DC isolated, LED indicating DC voltage 2 redundant DC power input connectors, automatic switchover	AC Operation: 100-240 VAC, 47-63Hz DC Operation: 12-36 VDC- Available for some models
Number of Outputs	16 or 15	5-15

Feature	TimeTech [Eco-Version]	Spectra dynamics HPDA-15RMi
Number of Inputs	1 or 2	1-3
More	Noise figure < 22.0 dB, (21 dB typ. 1 – 100 MHz) Group delay absolute, 1 – 100 MHz 4.7 ns ± 0.2 ns Group delay flatness, 1 – 100 MHz < 0.1 ns pp Group delay variation, channel vs channel < 0.1 ns Group delay variation versus temperature < 6 ps / K	-

6)
☐ HiTec: where is to 10MHz RF
7)
☐ Cable, Connector choice

Which cables?

- Best choise (cost-effectiveness) < 150 MHz:
  RG223 - Datasheet
  RG223 - conrad
- Aircell 5 for > 100 MHz
  - Low attenuation for higher frequecies (also for 10MHz compared to RG223)
  - Aircell 5 - Datasheet
  - Aircell 5 - conrad
  - Kai-Martin-Quelle: Aircell 5 - ssb
- For high frequencies <10 GHz:
  accuphasebrochure.pdf
- **Testing cable:**
  - Offenes Ende vermessen, dann sollte es Hochohmig sein
  - Auf einer Seite mit 50 Ohm verbinden und vermessen: 50 Ohm+Kabelwiderstand (<3-4 Ohm ist ok)
    - Wenn der Kabelwiderstand höher ist, dann wurden vermutlich beim Crimpen (Luft-)Übergangswiderstände erzeugt

Connectors typ

- BNC-Connector, male crimp: Part No. 7721 von SSB-electronics.com
- SMA-Connector, crimp male: Part No. 7750 von SSB-electronics.com

8)
☐ More cables for counter RF-Signals in the resLab?

9)
☐ Which mains filter and cold-device plug?

- PTB is using this model: 521062-21 HARTU
  - Datasheet:

    521062-21 HARTU
  - https://www.reichelt.de/Entstoerfilter/FEH-2101/3/index.html?ACTION=3&GROUPID=7485&ARTICLE=7655

> E-Mail-Antwort der Firma Hartu zu dem Model 521062-21 HARTU es handelt sich bei 521062-21 um ein 50/60 Hz Netzfilter. Die Sicherheitsnormen schreiben Luft- und Kriechstrecken und eine 100% Hochspannungsprüfung vor. Die Isolation der eingebauten Stromkompensierten Drossel wird über einen Trennsteg aus Kunststoff zwischen den Phasen und die Kernisolation sichergestellt. Es wird eine Hochspannungsprüfung zwischen den Phasen von 1,41kV/50Hz/2s durchgeführt. Gegen Erde wird mit 2KV/50Hz/2s geprüft.
> Daten über die Isolation bei anderen Frequenzen liegen nicht vor.

- I contacted Schürter to find a mains filter with high isolation at low frequencies and low current (1A):
  - Model: 5123 G-STECKER FILTER 1A, Konfigurations-Code: 5123.0000.0
  - Datasheet:

    5123 Schürter

Mor isolation between ports?

- Zur Vermeidung von Masseschleifen
- Use: FTB-1-1*A26+
- Datasheet: FTB-1-1*A26+
- Aufbau:
- Transformator in den jeweiligen Nutzerlaboren einbauen, damit das Kabel noch geschirmt ist und nicht hoch-Ohmig
- Kabel kommend vom ResLab an Isolierter Port des Transformators
  - Transformator-Gehäuse irgendwo dranschrauben
    - Gehäuse hat Masse des Nutzerlabors

OCXO

- Frequency double, how?
  - Read Phase-Lock-Loop page

Filters

- 5MHz
- 10MHz