

# 10MHz frequency source

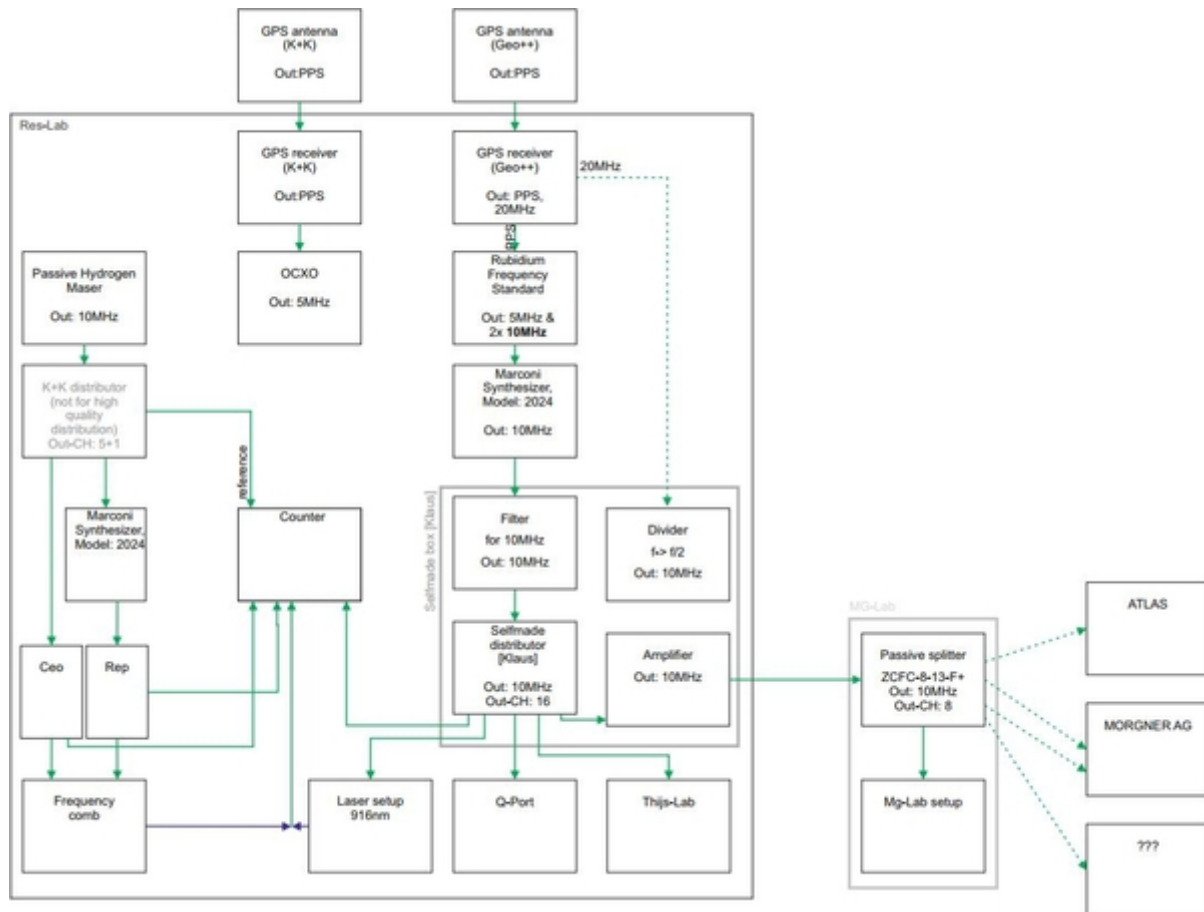
## Possible sources

All sources exist in ResLab.

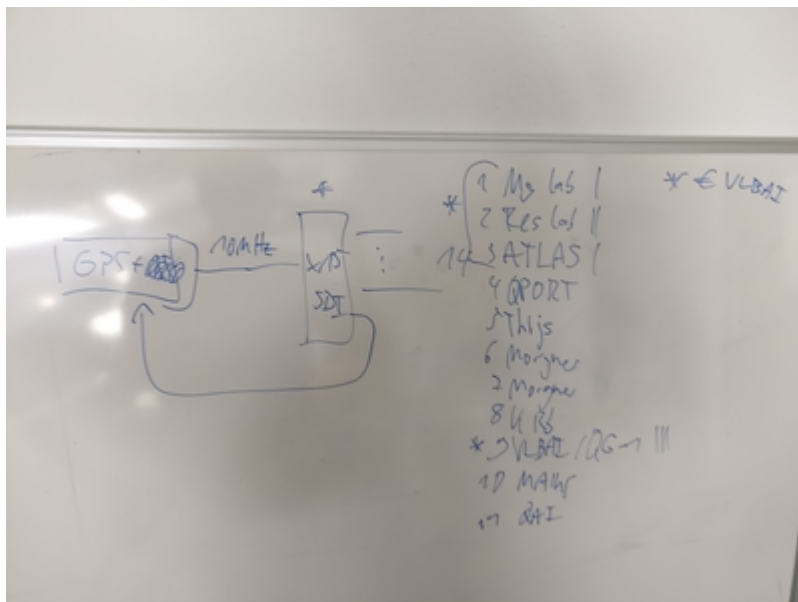
1. [Passive Hydrogen Maser](#)
2. [OCXO](#)
  1. OXCO 5 MHz
  2. OXCO 10 MHz (broken)
3. [Rubidium Frequency Standard](#)
  1. [GPS receiver](#)
  2. [Marconi Synthesizer](#), Model: 2024
  3. Selfmade distributor [Klaus]
  4. K+K distributor (not for high quality distribution)
  5. HighTec Fiber ???
1. CSAC Chip für stabile 10MHz Referenz

## Current Setup [30.05.2017]

Current 10MHz setup.pdf



## Future Setup

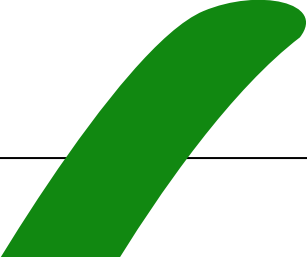


- Ansprechpartner für Löcher in der Uni: Miehlebradt, Marion
  - Raumpläne IQO
  - 10\_MHz\_Verlegung\_IQ\_08\_2017
  - Schadstoffuntersuchungsbericht

: Negativ auf Aspest!

|                                                                                                                           |                       |                                                                                                                                                                          |                                                       |                                                  |                                        |                  |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------|----------------------------------------|------------------|
| <div>Experiment</div> <div>Ansprechperson</div> <div>Experiment</div> <div>Ansprechperson</div> <div>Kabelverlegung</div> | <div>Raumnummer</div> | <div>Number of cables [new =</div> <div></div>                                          | <div>Number of distributors (Number of outputs)</div> | <div>Cable length + "Lab cable Length" [m]</div> | <div>Holes [Number, size, place]</div> | <div>Notes</div> |
|                                                                                                                           |                       | <div>, old =</div> <div></div> <div>1</div> <div>Mean cable</div> <div>Lab cable</div> |                                                       |                                                  |                                        |                  |

|                                                                                       |                             |
|---------------------------------------------------------------------------------------|-----------------------------|
| <a href="https://iqwiki.iqo.uni-hannover.de/">https://iqwiki.iqo.uni-hannover.de/</a> | Printed on 2025/07/05 11:53 |
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|                                                                                                                           |                       |                                                                                                                                                                      |                                                                  |                                                                                         |                                                        |                  |
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|                                                                                                                           |                       | <div>Number of cables [new =</div> <div></div> <div>, old =</div>                   |                                                                  |                                                                                         |                                                        |                  |
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| <div>Atom-Lab-Mg</div> <div>S. Sauer</div> <div>W. Friesen</div>                                                          | <div>D320</div>       | <div></div> <div>1</div> <div>8 [</div>                                           | <div>1 (16)</div>                                                | <div>2*[ 25(Reslab -</div> <div>Mg-Lab)</div> <div>+ 10(Mg-Lab)]</div> <div>+ 8*5</div> | <div>1, Ø=5-10cm, Q-</div> <div>Port-Atom-Lab-Mg</div> | <div>-</div>     |
|                                                                                                                           |                       | <div></div>                                                                       |                                                                  |                                                                                         |                                                        |                  |

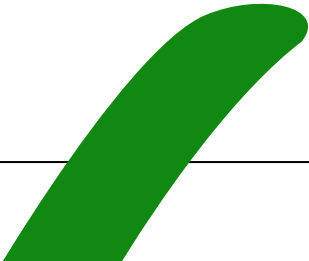
|                                                                                                                           |                       |                                                                                                                                                                                                                                                                                                                  |                                                                  |                                                                                                            |                                                   |                                                                                                                                                                                                                                                                                                                 |
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| <div>KRB</div> <div>J. Peise</div> <div>A. Igel</div>                                                                     | <div>E311</div>       | <div></div>                                                                                                                                                                                                                   | <div>1 (16)</div>                                                | <div>25(Reslab - Mg-</div> <div>Lab)</div> <div>+ 20(Mg-Lab)</div> <div>+ 60(Mg-Lab-</div> <div>KRB)</div> | <div>-</div>                                      | <div>*</div> <div><a href="#">KRB_10MHz_Kabel_08_2017</a></div> <div>* Die Durchführungen sind alle groß</div> <div>genug, nur auf höhe des</div> <div>Elektroniklabors liegen die Kabel in</div> <div>der Nähe von Heizungsrohren.</div> <div>* Im Flur befindet sich ein offener</div> <div>Kabelkanal.</div> |

|                                                                                                                           |                        |                                                                                                                                                                                                                                                                                                                |                                                       |                                                                                                              |                                        |                  |
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| <div>QAI,EPR</div> <div>J. Peise</div> <div>C. Pür</div>                                                                  | <div>D313 → D315</div> | <div></div>                                                                                                                                                                                                                 | <div>1 (16)</div>                                     | <div>25 (Reslab - Mg-Lab)</div> <div>+ 20(Mg-Lab)</div> <div>+ 25(Mg-Lab-QAI)</div> <div>+ 25(QAI-EPR)</div> | <div>-</div>                           | <div>-</div>     |

|                                                                                                                           |                       |                                                                                                                                                                                                                                                                                                                  |                                                       |                                                                                                                 |                                        |                                                                                                                                                                                                                            |
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| <div>ATLAS</div> <div>H. Albers</div> <div>H. Albers</div>                                                                | <div>D330</div>       | <div></div>                                                                                                                                                                                                                   | <div>1 (16)</div>                                     | <div>25(Reslab - Mg-Lab)</div> <div>+ 25(Mg-Lab)</div> <div>+ 50 (Mg-Lab-ATLAS)</div> <div>+ 5(ATLAS-Lab)</div> | <div>?, Ø=10cm, ?</div>                | <div><div>*</div><div><a href="#">ATLAS_10MHz_Habel_08_2017</a></div><div>* Gibt keine Information wie es über den Seminarraum verlegt ist</div><div>→ Neue Löcher bohren oder zusätzlicher Durchgang zu VLBAI</div></div> |

|                                                                                                                           |                       |                                                                                                                                                    |                                                                  |                                                                                                              |                                        |                  |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------|
|                                                                                                                           |                       | <div>Number of cables [new =</div> <div></div> <div>, old =</div> |                                                                  |                                                                                                              |                                        |                  |
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| <div>VLBAI</div> <div>E. Wodey</div> <div>?</div>                                                                         | <div>D323</div>       | <div></div>                                                     | <div>1 (16)</div>                                                | <div>25(Reslab - Mg-Lab)</div> <div>+ 25(Mg-Lab)</div> <div>+ 20 (Mg-Lab-VLBAI)</div> <div>+ 5 (VLBAI)</div> | <div>-</div>                           | <div>-</div>     |

|                                                                                                                           |                       |                                                                                                                                                                                                                                                                                               |                                                                  |                                                                                                                                      |                                                   |                  |
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| <div>Quantengravi</div> <div>J. Mathias</div> <div>?</div>                                                                | <div>D323</div>       | <div></div>                                                                                                                                                                                                | <div>1 (16)</div>                                                | <div>25(Reslab - Mg-</div> <div>Lab)</div> <div>+ 25(Mg-Lab)</div> <div>+ 20 (Mg-Lab-</div> <div>VLBAI)</div> <div>+ 5 (VLBAI)</div> | <div>-</div>                                      | <div>-</div>     |

|                                                                                                                           |                                     |                                                                                                                                                    |                                                                  |                                                                                                                                                                 |                                                   |                                                                                                                                                                                                                                                                                                                             |
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| <div>AG S.&amp; C.</div> <div>Ospelkaus</div> <div>Mirko Sierke</div> <div>S. Grondwoski</div>                            | <div>E304A →</div> <div>E104A</div> | <div></div> <div>2 [</div>                                      | <div>2 (min. 8)</div>                                            | <div>25(Reslab - Mg-</div> <div>Lab)</div> <div>+ 25 (Mg-Lab)</div> <div>+ 100 (Mg-Lab -</div> <div>E-Trakt =</div> <div>vorhanden!)</div> <div>+ E-Trakt</div> | <div>-</div>                                      | <div>*</div> <div>AG_Ospelkaus_10MHz_Habel_08_2017</div> <div>* Das vorhandene Kabel ist 100 Meter</div> <div>lang und hat bei 10 MHz eine</div> <div>Dämpfung von etwa 4,3 dB.</div> <div>* Kabelanfang im Mg-Labor ist mit</div> <div>"CW Tiemann" und das Ende im E-</div> <div>Trakt ist mit "MG ERT" beschriftet</div> |
| <div>IQwiki - https://iqwiki.iqo.uni-hannover.de/</div>                                                                   |                                     | <div></div>                                                     |                                                                  |                                                                                                                                                                 |                                                   |                                                                                                                                                                                                                                                                                                                             |

|                                                                                                                           |                       |                                                                                                                                                    |                                                       |                                                  |                                        |                                                                    |
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|                                                                                                                           |                       | <div></div> <div>Mean cable Lab cable</div>                      |                                                       |                                                  |                                        |                                                                    |
| <div>Q-Port</div> <div>S. Bode</div> <div>?</div>                                                                         |                       | <div></div>                                                     | -                                                     | -                                                | -                                      | <div>Vorhandene Kabel ist verlegt, muss noch getestet werden</div> |

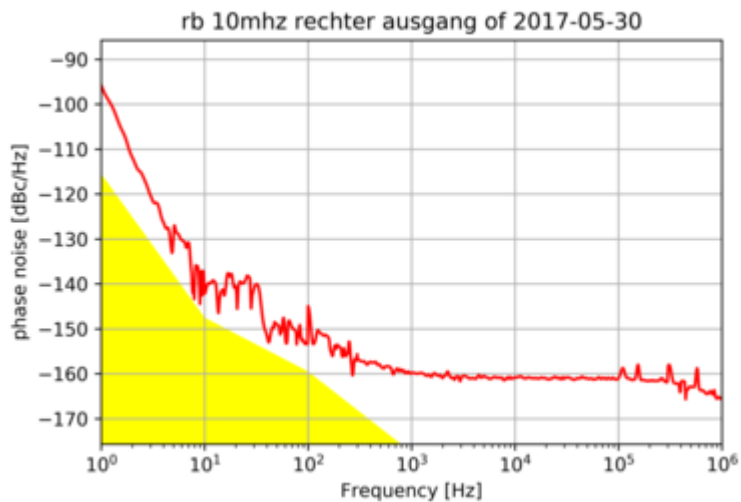
|                                                                                                                           |                       |                                                                                                                                                    |                                                                  |                                                                        |                                                   |                                                                                                                                                                 |
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| <div>Lasus</div> <div>Thejs</div> <div>?</div>                                                                            | <div>D220</div>       | <div></div>                                                     | <div>-</div>                                                     | <div>-</div>                                                           | <div>-</div>                                      | <div>* Vorhandene Kabel ist verlegt, Aircell</div> <div>7, muss noch getestet werden</div> <div>* Sein vorhandener Verteiler ist ein</div> <div>SRS FS710</div> |
| <div>Maius</div> <div>D. Becker</div>                                                                                     |                       | <div>keine Antwort</div>                                                                                                                           | <div>keine</div> <div>Antwort</div>                              | <div>-</div>                                                           | <div>-</div>                                      | <div>-</div>                                                                                                                                                    |
| <div>AG Morgner</div> <div>B. Kreipe</div>                                                                                |                       | <div>0</div>                                                                                                                                       | <div>0</div>                                                     | <div>-</div>                                                           | <div>-</div>                                      | <div>-</div>                                                                                                                                                    |
| <div>Gesamt</div>                                                                                                         |                       |                                                                                                                                                    | <div>7 (16)</div> <div>2 (min 8)</div>                           | <div>622</div>                                                         |                                                   |                                                                                                                                                                 |

# To Do

## 1)

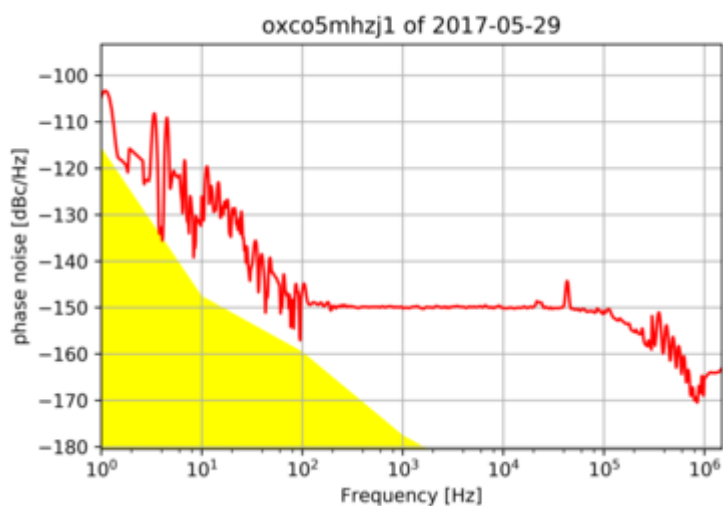
- ☐ FSWP-8 refernced to Maser
- ☐ FSWP-8 running 1 day ahead of measurement
- ☐ Measure: 100mHz-10MHz PN Rb-clock

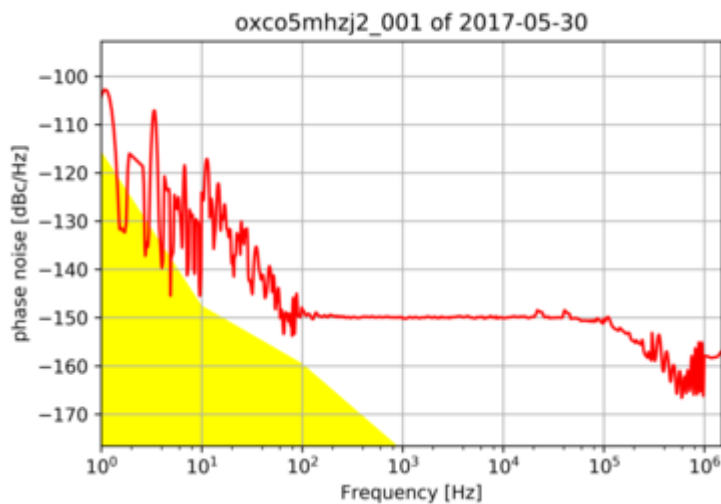
- "GPS →" Rb-10Mhz [right Output] → BNC cable → BNC-I-connector → BNC-SMA-conneccotor → long cable → PNA



- ☐ Measure: "- -" OCXO

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

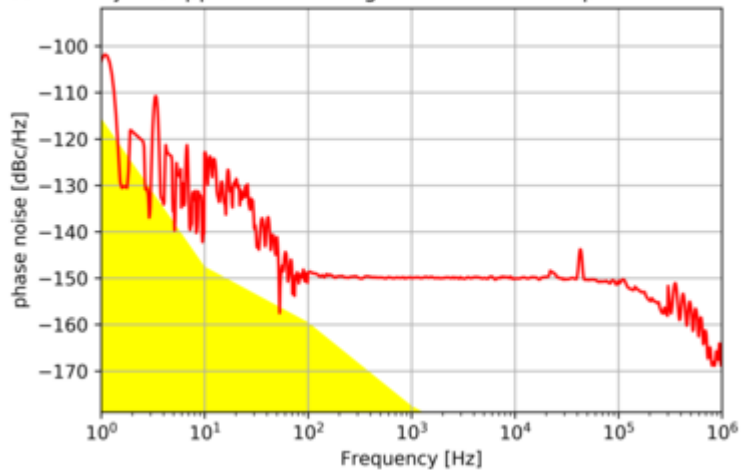




□ Measure: -"- -"- OCXO 5MHzx2 (passive)

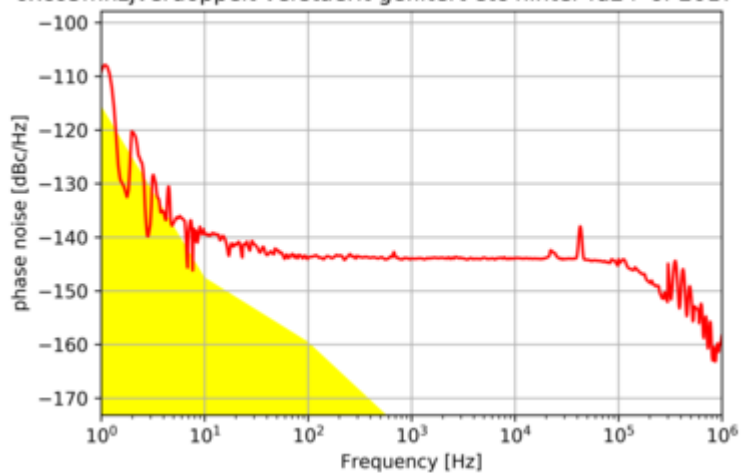
- J1 → short cable → SMA-BNC-connector → TP [6MHz] → long cable → PNA

oxco5mhzjverdoppelt verstaerlt gefiltert etc hinter tp6mhz of 2017-05-30



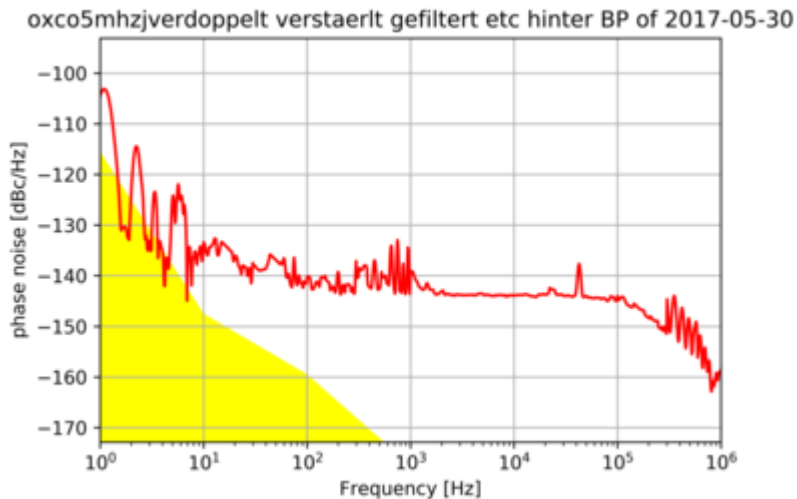
- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → long cable → PNA

oxco5mhzjverdoppelt verstaerlt gefiltert etc hinter fd2+ of 2017-05-30

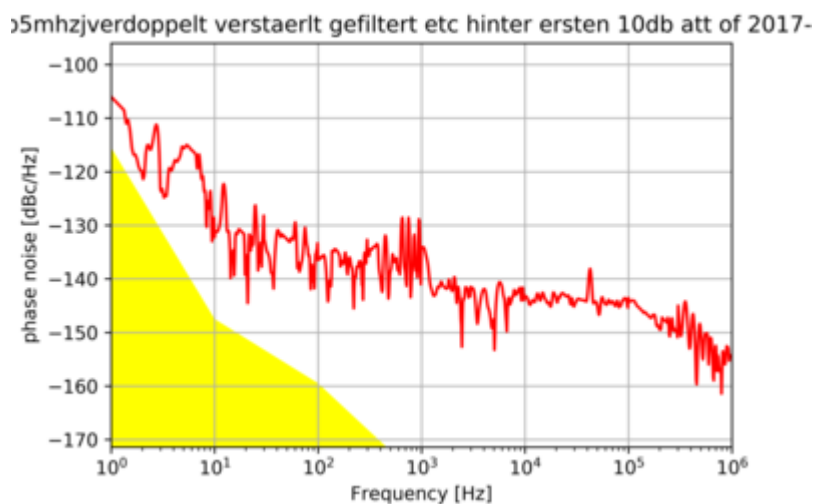


- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → long cable → PNA

BP [SBP-10.7+] → long cable → PNA

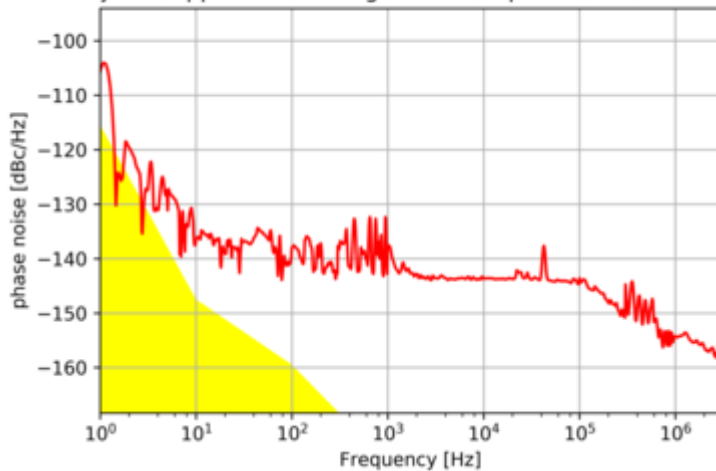


- J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → BP [SBP-10.7+] → BNC-SMA-connector → Att. [10dB] → BNC-SMA-connector → long cable → PNA

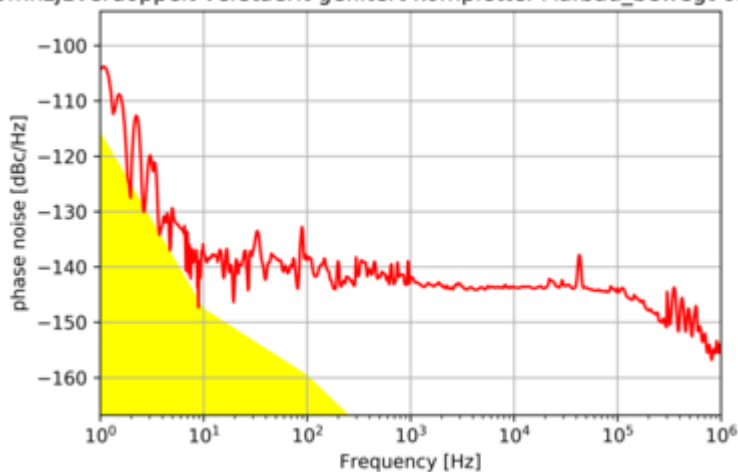


- Overall setup: J1 → short cable → SMA-BNC-connector → TP [6MHz] → Doubler [FD-2+] → BNC-SMA-connector → BP [SBP-10.7+] → BNC-SMA-connector → Att. [10dB] → short BNC-cable → Amplifier [ZFL-500LN-BNC+] → LP [BLP-15] → Att. [20dB] → Att. [3dB] → BNC-SMA-connector → long SMA cable → PNA

xco5mhzj1verdoppelt verstaerlt gefiltert kompletter Aufbau of 2017-05.



5mhzj1verdoppelt verstaerlt gefiltert kompletter Aufbau\_bewegt of 2017



☐ Measure: -"- -"- OCXO 5MHzx2 (DDS?)

- Currently not possible.

2)

☐ Propagate K+K manuals

3)

☐ Repair K+K box

4)

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

| Feature | TimeTech [Eco-Version]                    | Spectra dynamics<br>HPDA-15Rmi      |
|---------|-------------------------------------------|-------------------------------------|
| More    | Noise figure                              | < 22.0 dB, (21 dB typ. 1 – 100 MHz) |
|         | Group delay absolute, 1 – 100 MHz         | 4.7 ns $\pm$ 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 choice (cost-effectiveness) < 150 MHz:

RG223 - Datasheet

[RG223 - conrad](#)

- Aircell 5 for > 100 MHz, low attenuation for higher frequencies: [Aircell 5 - Datasheet](#) [Aircell 5 - conrad](#)

- 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

## Which connectors?

- BNC or SMA?

8)

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

## Mor isolation between ports?

- Use: FTB-1-1\*A26+
- Datasheet: [FTB-1-1\\*A26+](#)

## OCXO

- Vibration isolation for the OXCO?
- Frequency double, how?

## Filters

- 5MHz
- 10MHz

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Last update: **2018/01/17 09:22**

