An improved Harmonic Phase Reference for LSNA capabilities up to 50 GHz

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NMDG Engineering
Leading beyond S-parameters

Outline

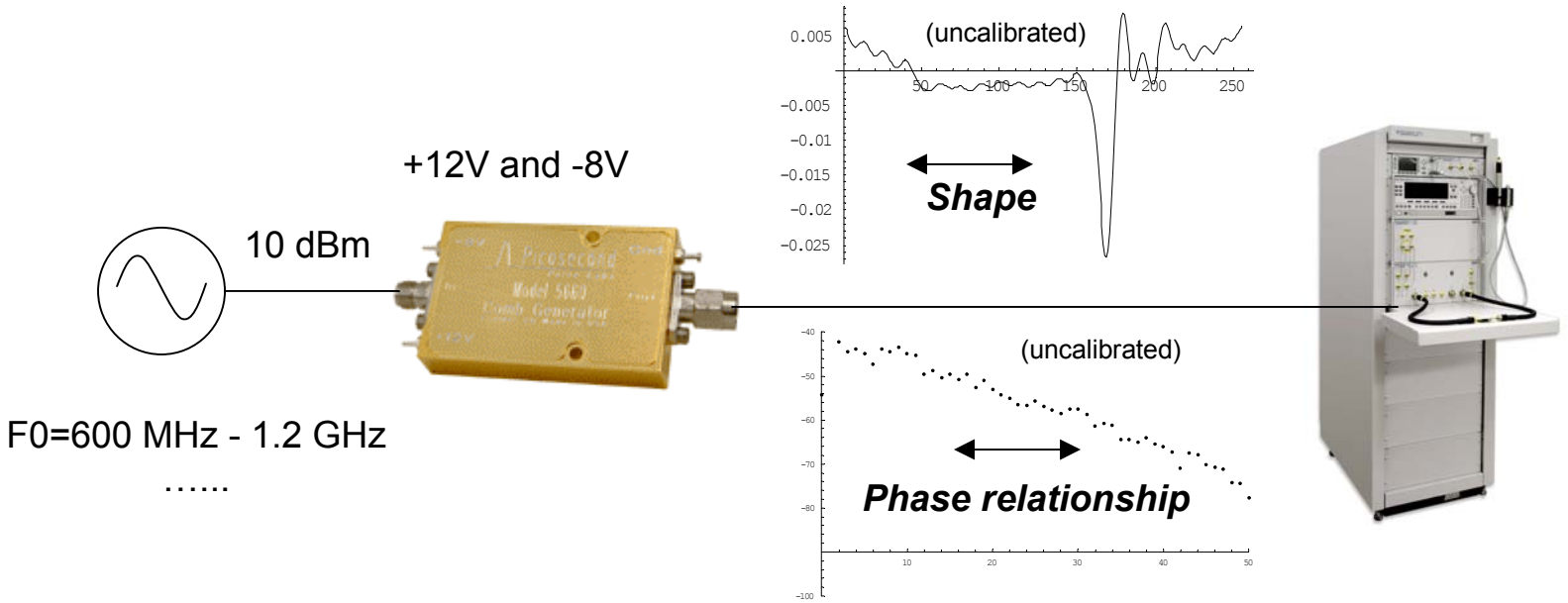
- Introduction
- Improved HPR
- Stability and Sensitivity
- Effect of Mismatch
- The Calibration Process
- Acknowledgement
- Conclusion

Introduction

- The goal: Phase calibration of a large-signal network analyzer up to 50 GHz using an accurate and traceable characterized pulse generator at different drive frequencies
- Identification and study of an adequate pulse generator up to 50 GHz
- Calibration process up to 50 GHz (Dylan Williams)

Improved HPR

Based on Model 5660 Comb Generator from PicoSecond Pulse Lab



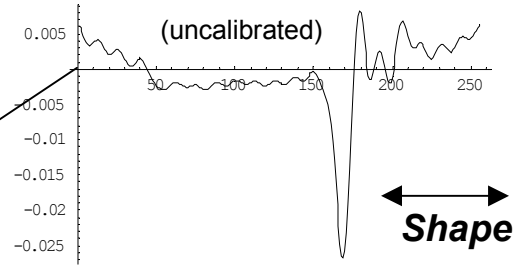
Using uncalibrated MT4463A to study most characteristics of the HPR

Stability

Sensitivity

- power
- DC
- temperature
- load termination (calibrated)

Stability and Sensitivity Study (1 sample)



Pulse alignment and amplitude correction

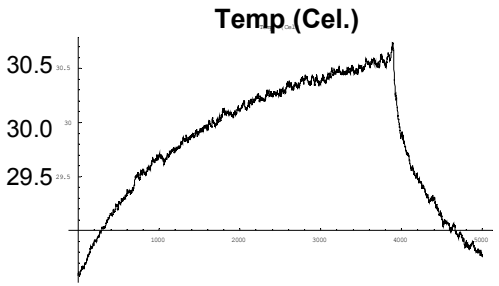
- Time
- Cold Start (DC/RF)
- Cold Start (RF only)
- Input power
- DC supplies
- Temperature *monitoring*

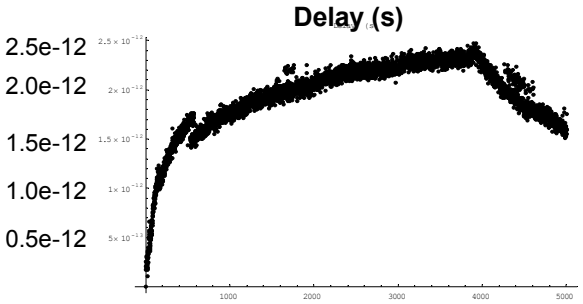
DC : +12V and -8V

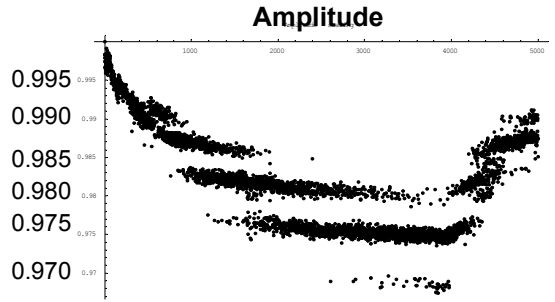
RF: 10 dBm

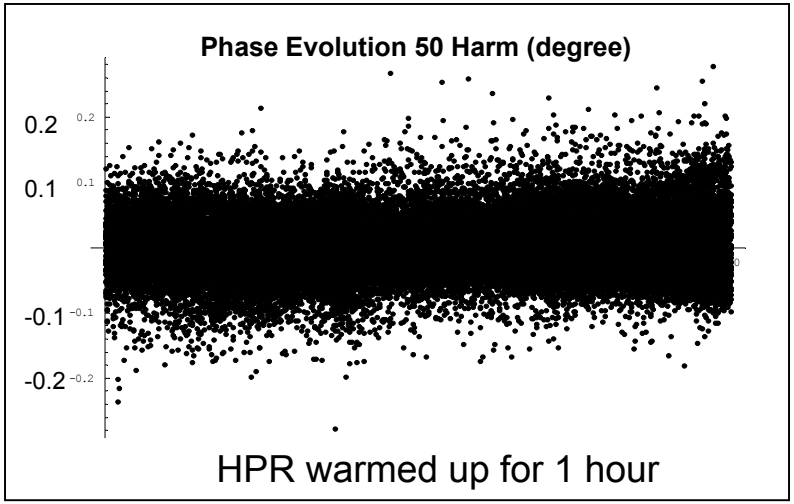
Stability

MT4463A warmed up for > 1 day (Res BW appr. 100 Hz)
Cold start of HPR (DC/RF)
Drive: 1 GHz + 50 Harmonics
Power: Min 9.985 - 10.025 dBm ……Tijd



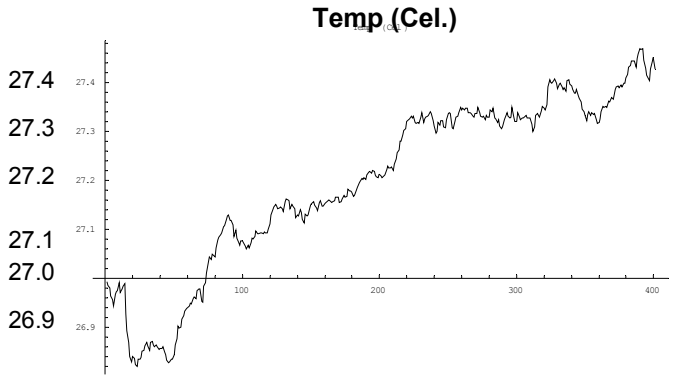


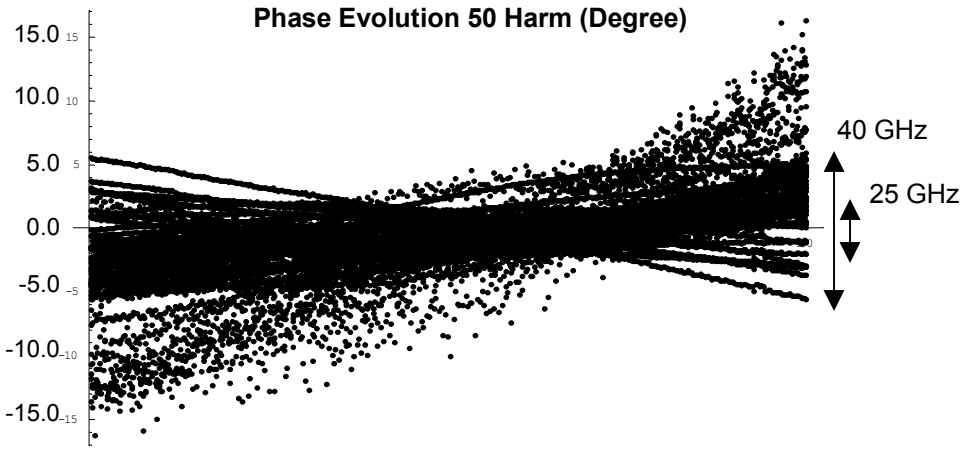




Sensitivity

MT4463A warmed up for > 1 day (Res BW appr. 100 Hz)
HPR warmed for one hour
Drive: 1 GHz + 50 Harmonics
Power stepped : Min 9.0 - 11.0 dBm (5 sec / point - 400 pts)





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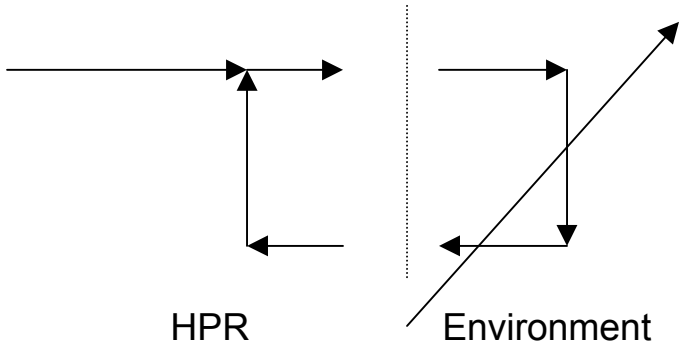
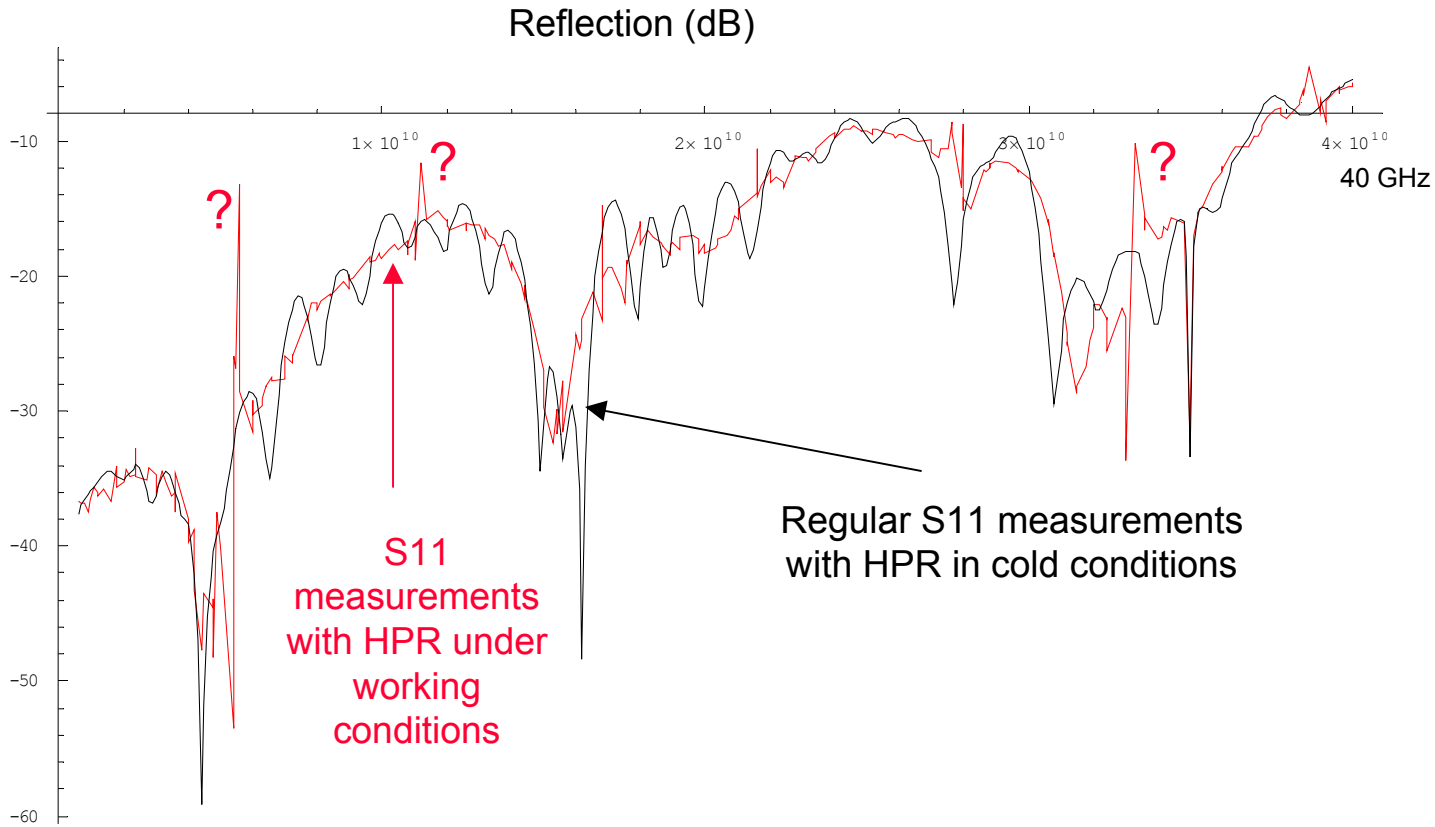
Influence of Mismatch

Studied with LSNA under different load conditions (active and passive)



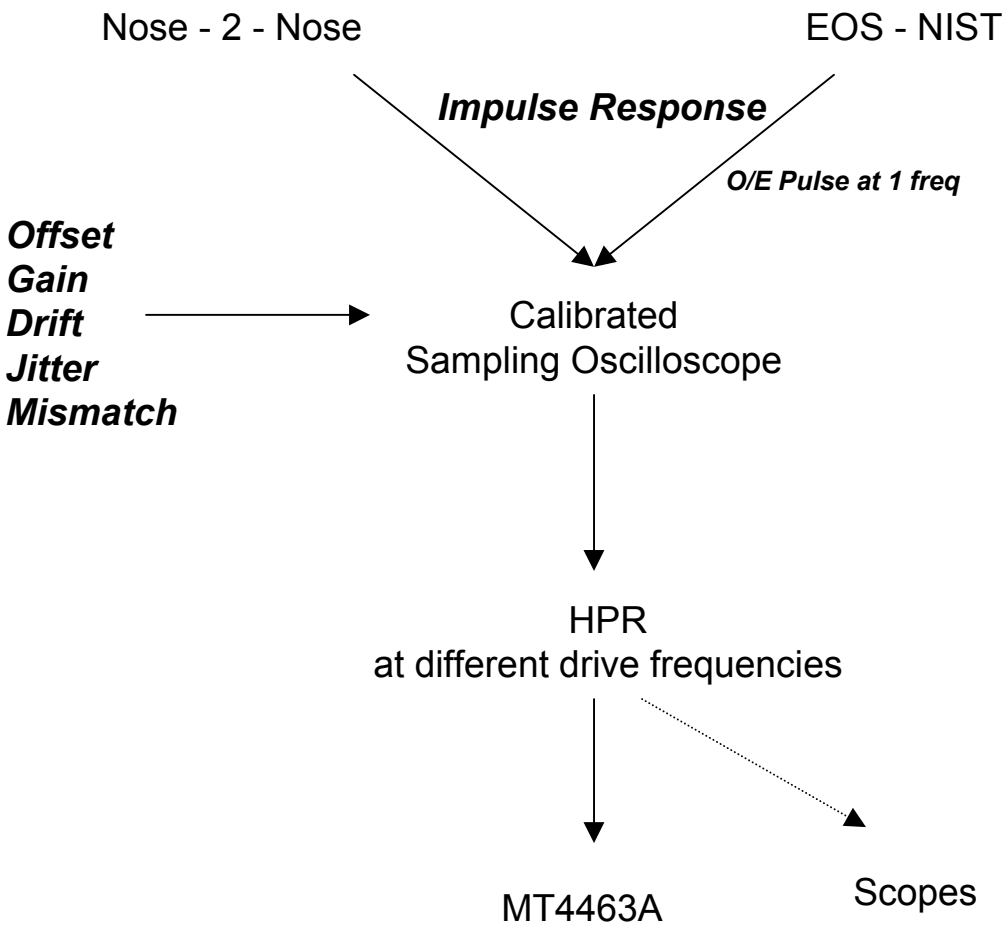
Reasons: Impact on pulse shape of different loads
Correction for mismatch

Mismatch measurements



⇨ More characterization work is required

Calibration Process



Acknowledgement

- Picosecond Pulse Lab for their support and contribution to this work
- NIST for fruitful discussions and support during the 50 GHz characterization work and EOS calibration

Conclusion

- The study of PSPL comb generator indicated a valid candidate as part of an improved HPR up to 50 GHz
- More work is required related to the mismatch characterization

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