# Large Signal Network Analyzer

*An affordable PXI-based microwave non-linear characterization platform*

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## Introduction

- The goal of this research is to integrate microwave-frequency Large Signal Network Analysis capabilities with commercially available National Instruments' PXI modular instrumentation and LabVIEW environment.
- The Microwave Research Group at the University of Colorado has decades of experience in UHF through millimeter-wave transmitters, including recent X-band (10-GHz) MMIC implementations in GaN. Our aim is to extend the frequency range and capabilities of available commercial instrumentation provided by NI.
- The proposed instrumentation development will enable new types of measurements such as those required for harmonically-terminated PAs, various transmitter architectures (Doherty, outphasing and supply modulated PAs), as well as microwave transistor rectifiers. The time-domain characterization is expected to provide dramatic improvement in RF circuit design capabilities.

## Bar-Hillel Theorem

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## Generalized LL

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## Linear input parsing

- Classical
- Multilexem
- Error recovery

## Graph parsing

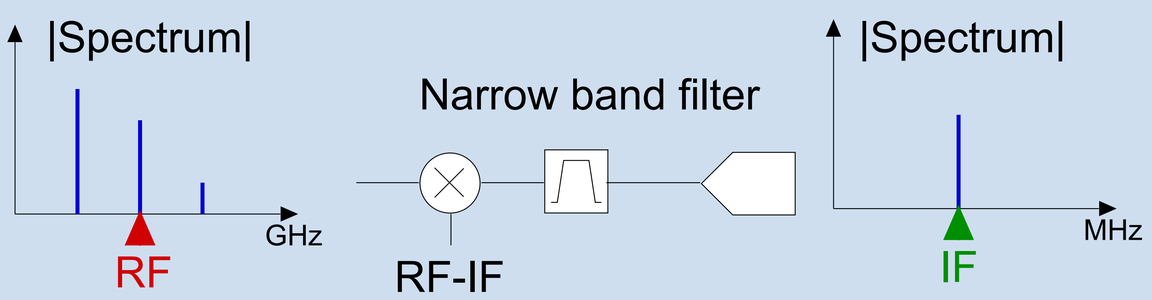
Graph DB, metagenomic assemblies etc.

## CF compression

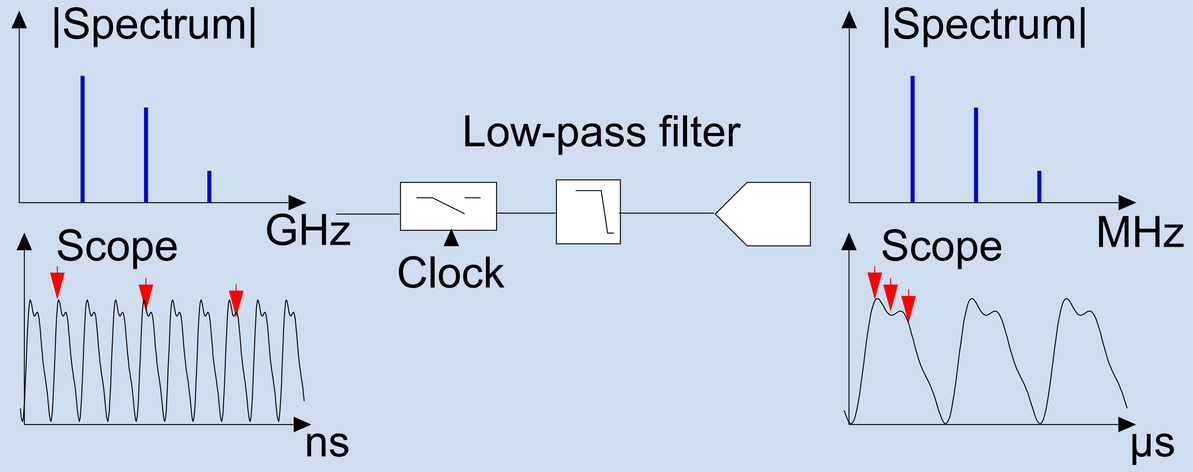
Compressed data processing

## Generalized LL generalization

**Mixer approach: frequency domain**

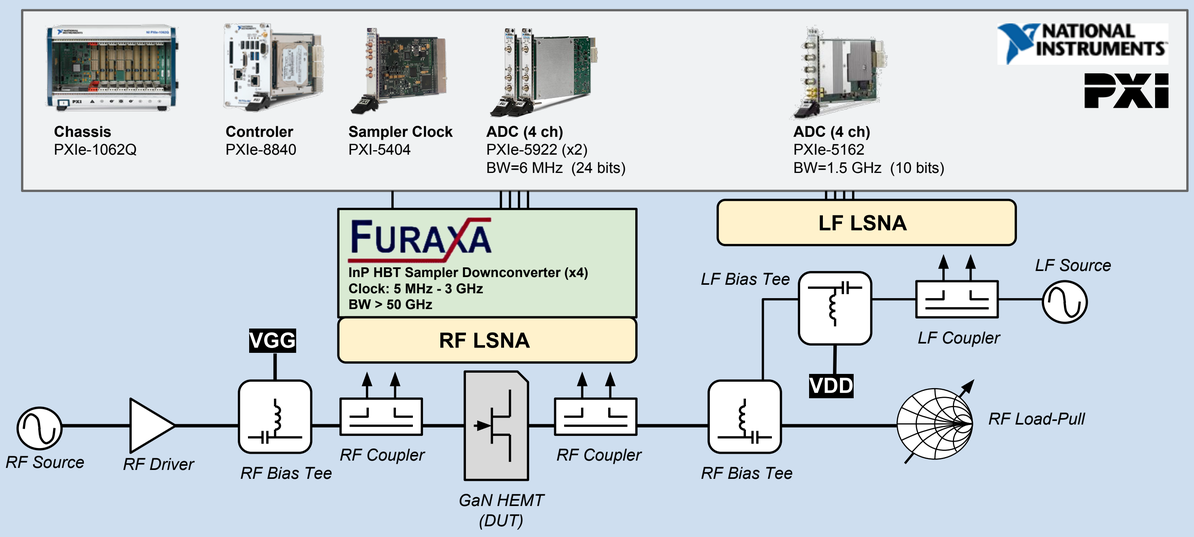



**Sampler approach: subsampling**




## Measurement Setup for Envelope Tracking Application

The setup includes **two LSNAs simultaneously**. One is dedicated to RF (sampler based downconversion), the other one samples directly the LF stimulus. The purpose is to investigate **low-frequencies** $S_{22}$ of the DUT under RF large signal conditions.




*Low-frequency measurement of drain supply envelope-bandwidth impedance for supply-modulated PAs*

## Conclusion

This new project will enable a new RF measurement capability by enabling an instrument that currently does not exist on the market. Some additional benefits include:

- frequency range extension of NI RF instrument products currently available;
- sampler architecture offers a unique multi-scale time analysis possibility (e.g. signal and carrier domains);
- can be implemented with various ADCs and downconverters (e.g.