High Speed Impedance Tuning

Faster Measurements = Faster Time to Market

LXI Tuner Control

Swept-Adaptive Tuner Characterization

Mixed Signal Active Load Pull

OBJECTIVE

Objectives -

Spend less time measuring DUTs and more time analyzing data

Faster cycle = faster time to market

Solutions –

Passive measurements

- Faster tuners
- Faster characterization methodologies

High speed active load pull systems

LXI TUNER CONTROL

.TUN and .S2P files stored on memory

Embedded microprocessor with onboard mathematics and de-embedding

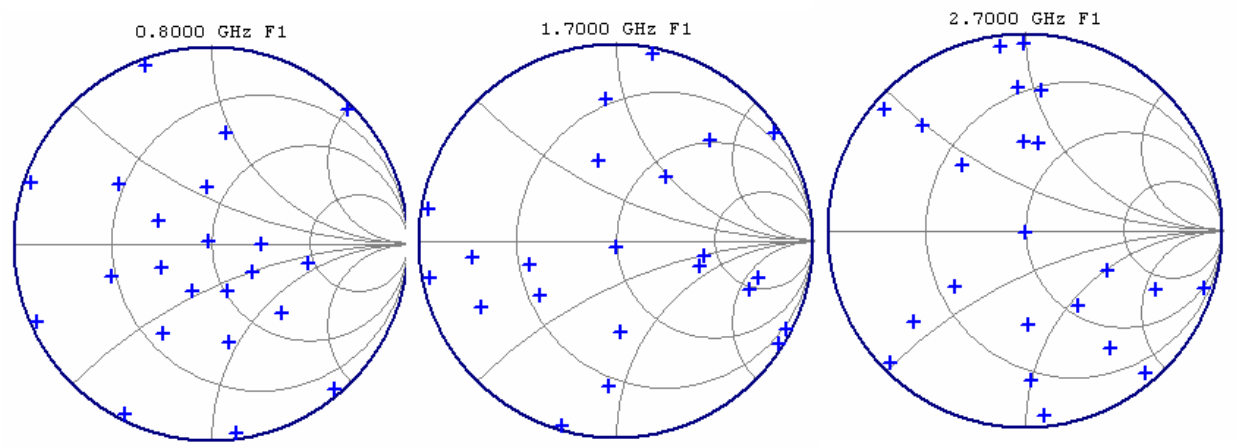
High-speed Ethernet and USB interfaces

USB MT- series tuner – 10 degree phase movement @ 2 GHz = 2.17s

LXI MT-series tuner – 10 degree phase movement @ 2 GHz = 0.55s

SWEPT-ADAPTIVE TUNER CHARACTERIZATION

- Characterize one set of impedance states
- Point selection – based on non uniform phase spacing
- Sweep frequency at each state



Adaptive – 9-30 minutes per frequency (# points and VNA dependent)

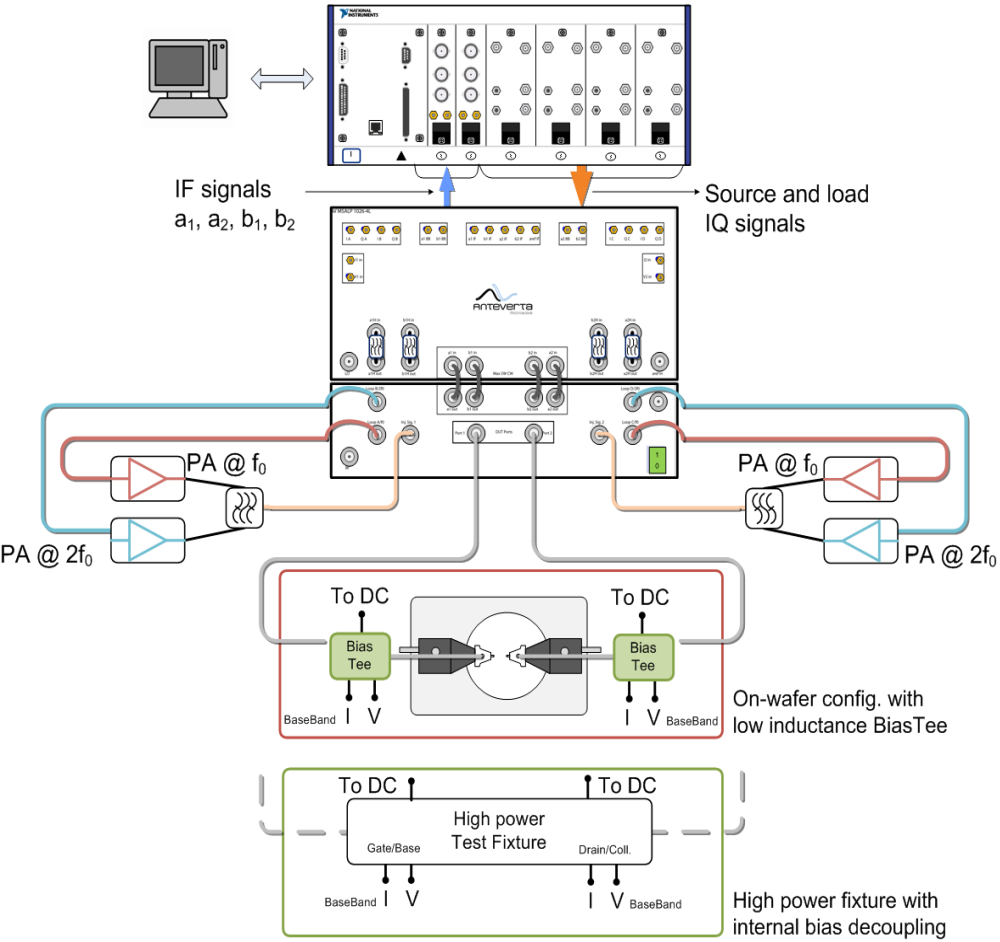
Swept Adaptive – 11-45 minutes for all frequencies! (# points and VNA dependent)

PASSIVE TUNER SUMMARY

Characterization Method	Tuner	Time for 600 point characterization
Adaptive	MT-series USB tuner	15 minutes per freq (0.8 GHz, PNA)
Adaptive	MT-series LXI tuner	11 minutes per freq (0.8 GHz, PNA)
Swept-Adaptive	MT-series USB tuner	16 minutes for all freq (5 freq, PNA)
Swept-Adaptive	MT-series LXI tuner	12 minutes for all freq (5 freq, PNA)

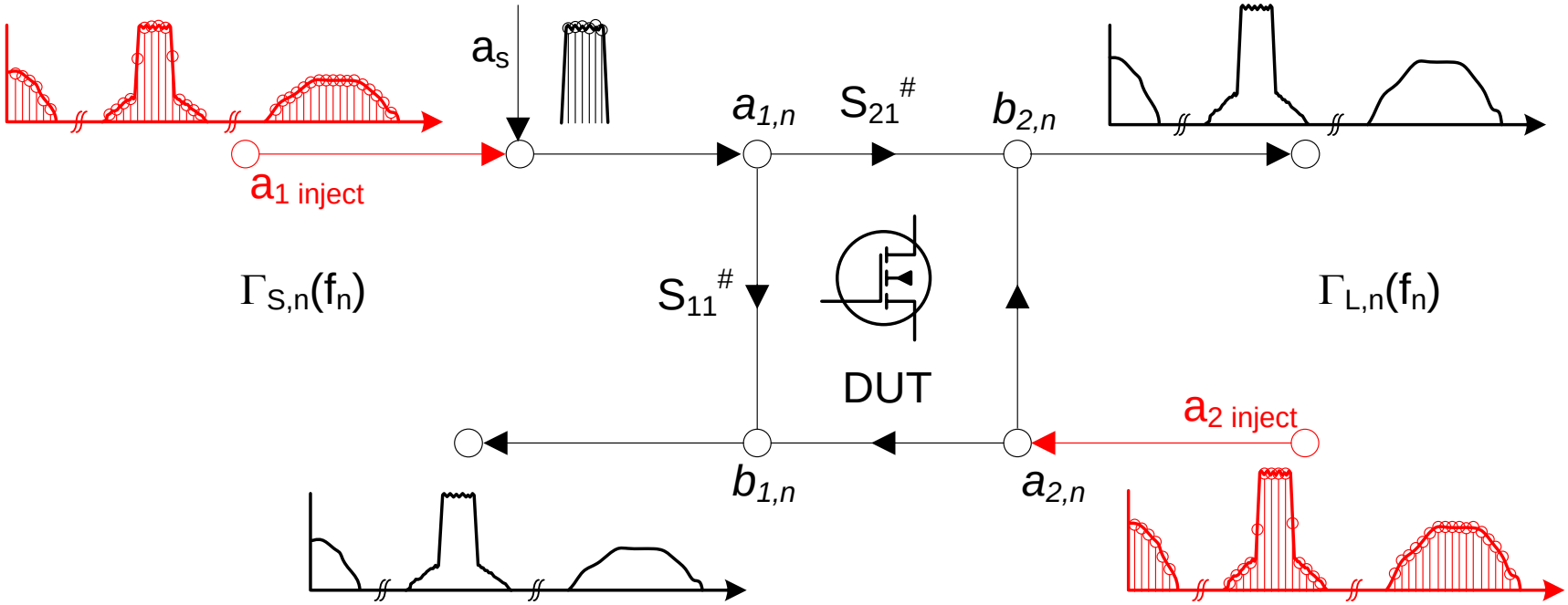
Tuner	10° step (avg pp)	20° step (avg pp)	40° step (avg pp)
MT-series USB	2.17s @ 2 GHz	2.26s @ 2 GHz	2.42s @ 2 GHz
MT-series LXI	0.55s @ 2 GHz	0.60s @ 2 GHz	0.66s @ 2 GHz

MT2000 SYSTEM



- Wideband AWGs to generate wideband signals
- Wideband A/D converters + digital signal processing to measure wideband reflection coefficients
- Up to 240 MHz modulation bandwidth.
- The RF test-set up-converts the baseband signals to RF frequency and down-converts the a and b waves for S-parameters measurements
- Available in 0.4 – 18 GHz , 0.5 – 26 GHz and 0.8 – 40 GHz frequency bands.

MT2000 ALGORITHM



$$a_{x,n}(f_n) = b_{x,n}(f_n) \cdot \Gamma_{x,n}(f_n)$$

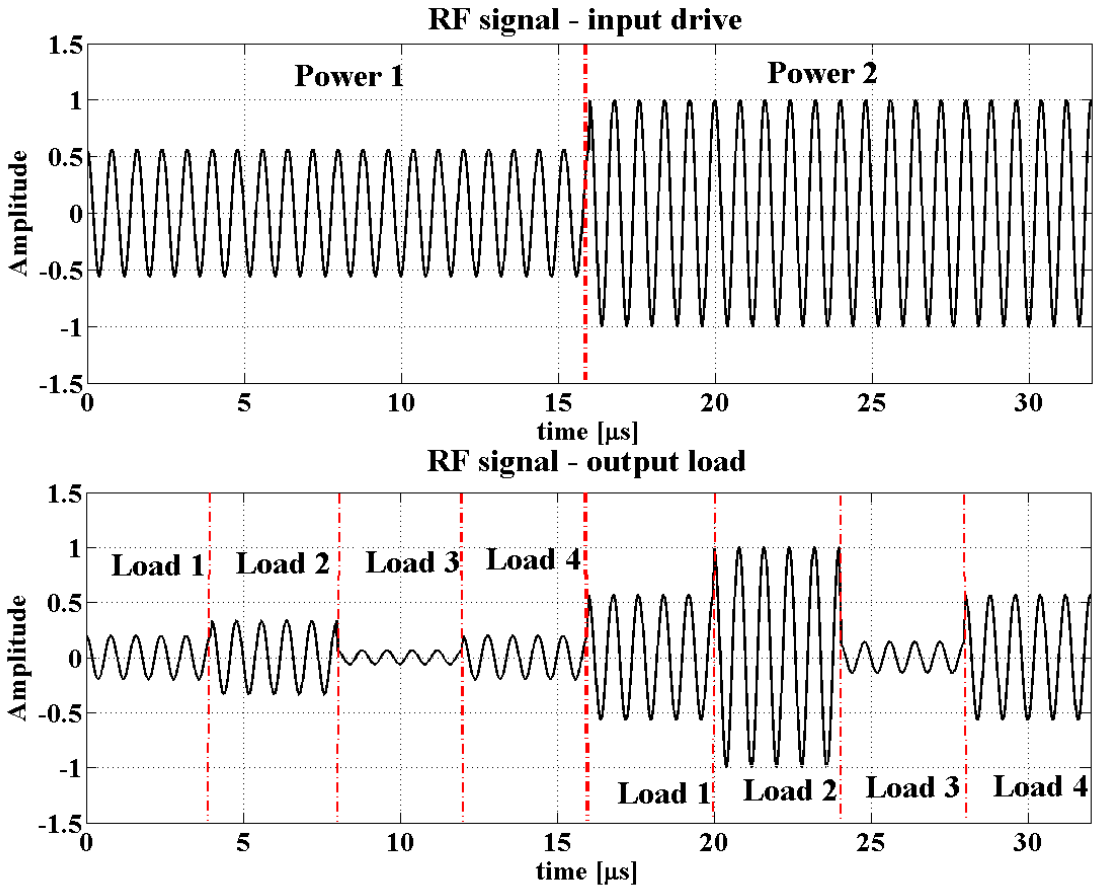
x = source (*s*) or load (*l*)

n = frequency band, e.g. baseband (0), fundamental (1) and harmonic (2 and up)

$\Gamma_{x,n}(f_n)$ = user defined reflection coefficient vs. frequency

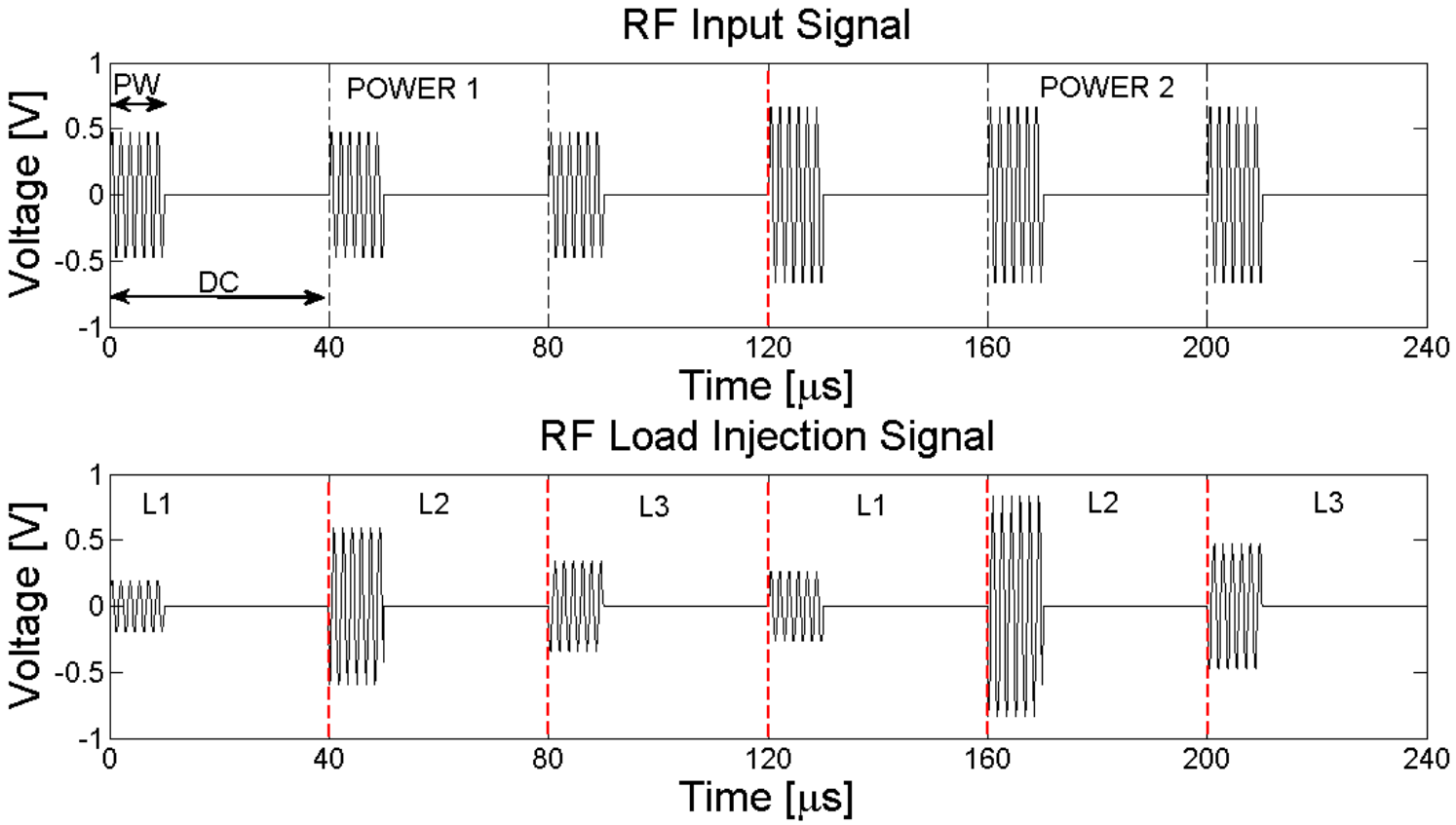
HIGH-SPEED LOAD PULL

- Multiple powers and terminations can be measured at once, by using multiple time-segments with different amplitude and phase information
- Full synchronization between measurement and signal generation is used to track the info embedded in each wave segment



HIGH-SPEED LOAD PULL

- One waveform contains multiple loads and power levels
- The iterations to achieve the desired Gammas are performed on each individual segment



MEASUREMENT RESULTS – HIGH SPEED

10 mm GaN device

- peak output power ~ 10 W

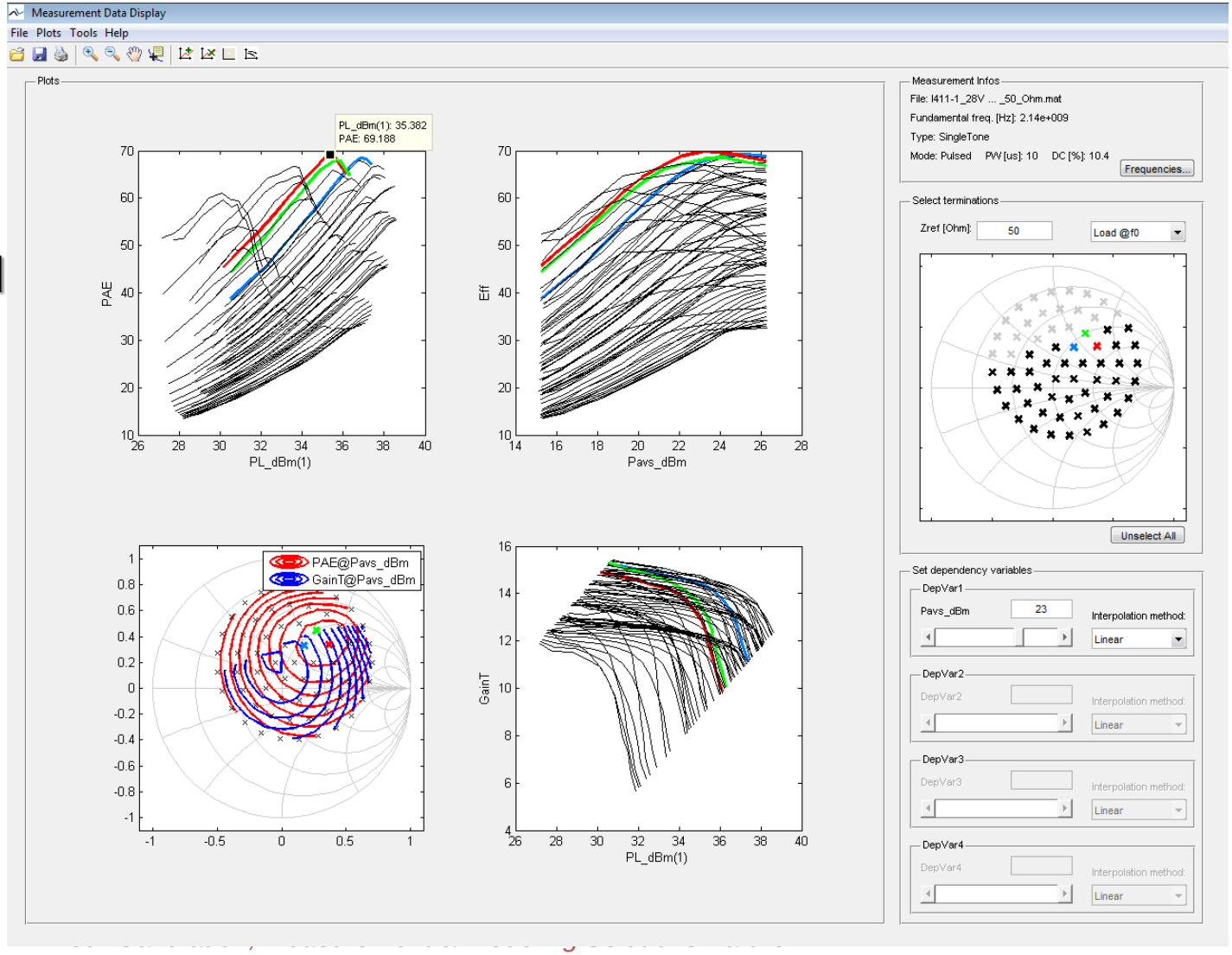
- Measurement conditions
  - Swept available power:
    - 15 to 27 dBm (1 dB step)
  - Swept load fundamental :
    - 64 load impedances

768 measurement points in 30 sec!

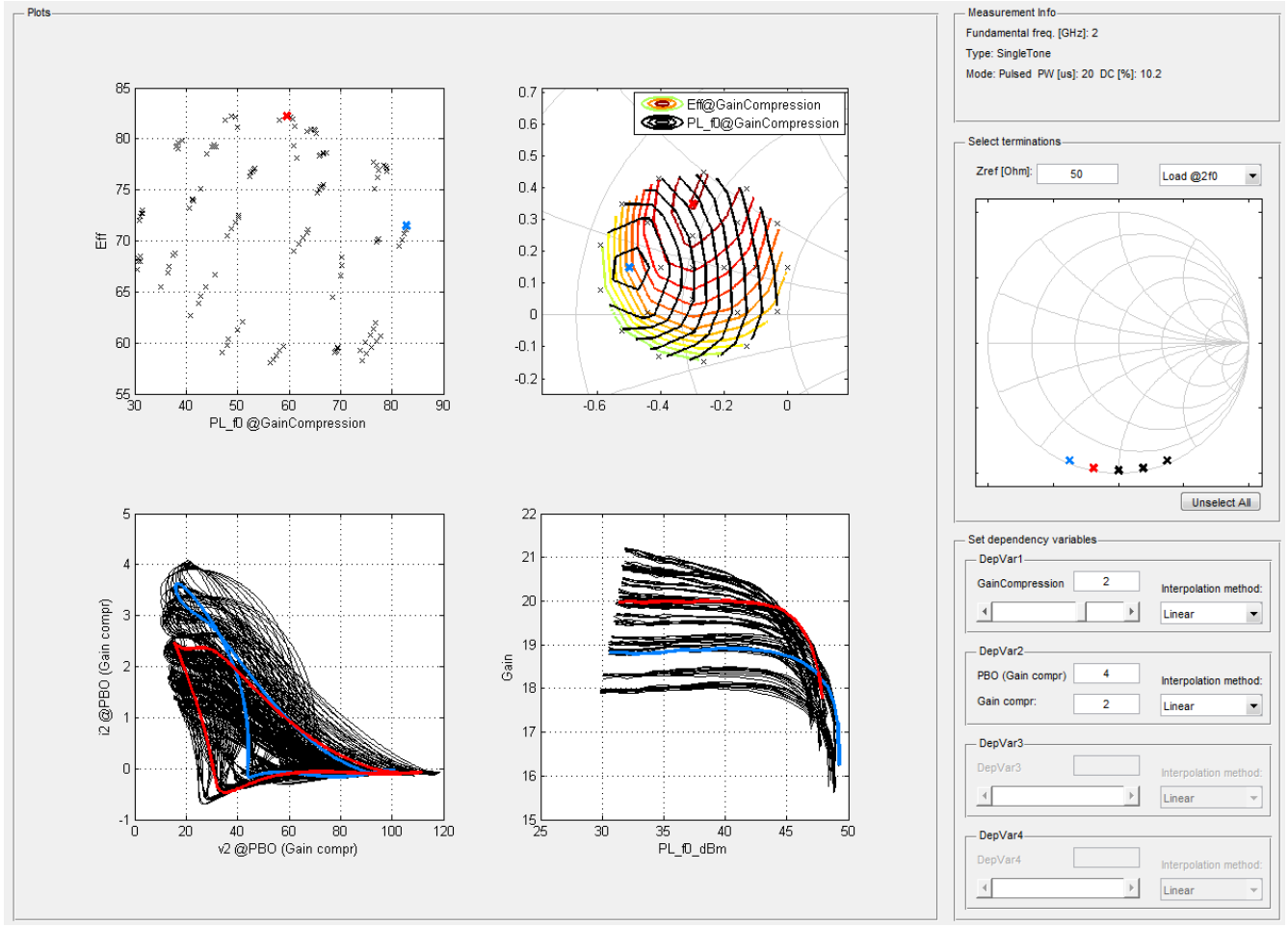
MEASUREMENT RESULTS – HIGH SPEED

Optimum fundamental load

69.2 % PAE @ 35.3 dBm



MEASUREMENT RESULTS – HIGH SPEED



- 50 W GaN HEMT
- 25 fundamental loads
- 5 2nd harmonic loads
- Source 2nd harmonic short
- NVNA
- Les than 1 minute!

For the most up-to-date information regarding Maury's high-speed impedance tuning solutions, please visit

www.maurymw.com