

Application Note 50

Upgrade *ATS*¹ Load Pull Systems Using Focus *ULPS*² Soft- and Hardware

Powerful Load-Pull Software is key to characterizing and optimizing power transistors. Focus Microwaves' Universal Load Pull Software offers this advantage to existing *ATS* users.

ULPS is an integrated package for complete device characterization based on the familiar WinPower software platform. *ULPS* is configured as an upgrade to existing *ATS* load pull systems. Because of the similarities of the RF hardware, implementation is simple: *ULPS* handles *ATS* tuners as another GPIB instrument via their GPIB controller. Software operation is fully transparent to the user.



Figure 1: Mixed Harmonic Load Pull setup using: •ATS source tuner and controller •Focus Harmonic load tuner (PHT) and •Focus load Prematching tuner (PMT).

⁽²⁾ *ULPS*, Universal Load Pull Software.

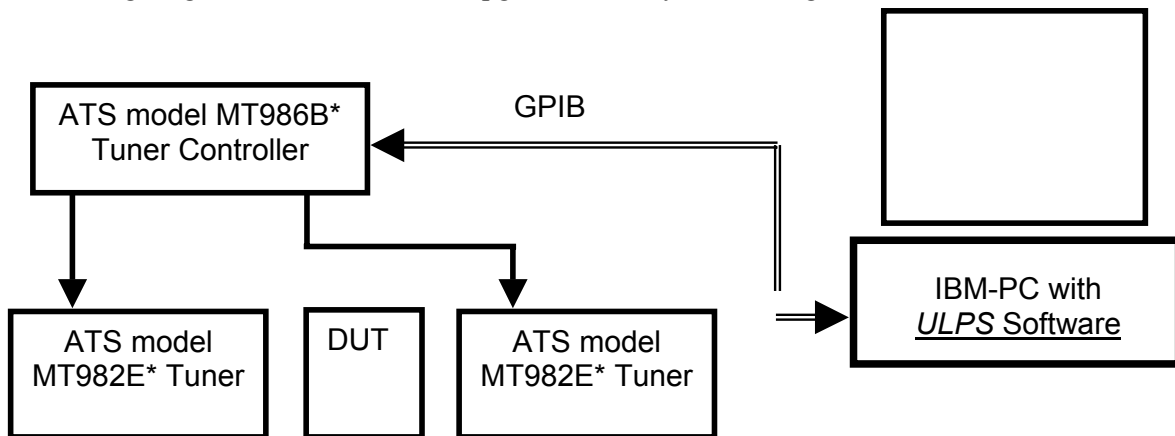
System Description and Configuration

Focus' latest load pull measurement software is the "tool of choice" for most test engineers, because of its maturity and wealth of application-specific options. Version *ULPS* of this software allows existing users of ATS systems to benefit of Focus software advantages without discarding their ATS hardware. *ULPS* makes mixed setups, including any combination of ATS and Focus tuners (including harmonic and prematch tuners, see figure 1) possible.

An upgraded ATS setup keeps all existing hardware in place and can be controlled, as is, by *ULPS* software. In case other Focus hardware is added (harmonic or prematch tuners for example) an extra *ULPS* controller card (ISA or PCI) is inserted in the control PC and runs conflict-free in parallel with the existing ATS hardware. The ATS tuner controller is considered by *ULPS* as another GPIB instrument with a GPIB address assigned to.

Because of the total compatibility of RF hardware between Focus and ATS tuners, all calibration, interpolation and tuning routines of the CCMT system are fully functional with ATS tuners to the maximum of their frequency and tuning range.

The following diagram shows a software upgraded ATS system configuration.



* or other.

Figure 2: ATS system upgraded using *ULPS* software

In this setup *ULPS* software is installed in the original PC controller and runs independently on other ATS software. National Instruments, CBI or Focus GPIB card interfaces are supported by *ULPS*. This system will operate exactly as a corresponding Focus *ULPS* system, bearing all the advantages of Focus load pull software.

ULPS software can be used for hardware system expansion by adding harmonic tuning capability. or high SWR tuners (see figure 1). In this case an additional Focus tuner controller card in ISA or PCI format will have to be installed as shown in the following block diagram.

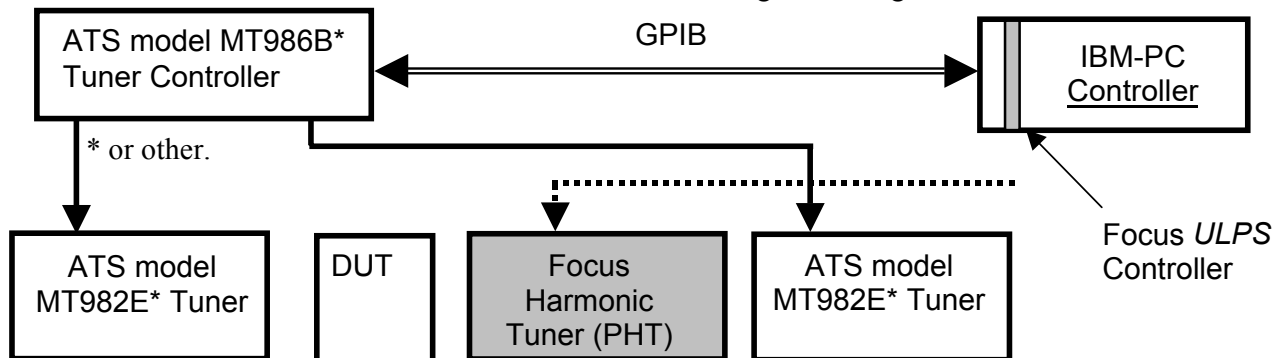


Figure 3: ATS load pull system upgraded using Focus load harmonic tuner (PHT). A source harmonic tuner can be added as well

Software Features and Advantages of *ULPS* Load Pull Software

1. Hardware

- Integrated Harmonic and Prematch Tuner Operation
- Replacement of any ATS tuners with standard or prematching Focus tuners
- PC integrated ISA or PCI controller in parallel with ATS controller
- Integrated on-wafer solutions (extension bend lines, tuner positioners, prematching modules)

2. Calibration Test Fixture and S-parameter Software

- Very fast Tuner Calibration (2-4 minutes per frequency)
- Generic FOCUS TRL Test Fixture Calibration
- IV-curves with Auto Bias
- S-parameter with Test Fixture De-embedding and Adapter Removal

3. Load Pull Software

- Continuous high resolution "mouse" tuning to millions of Tuner Impedances (not only calibrated points)
- Fast Gradient and Fine Peak Search
- L/P for constant Pout, IMD, PAE, ACPR, Id
- Advanced Macro File Operation and Editor (nested loops, if-else etc.)
- Macro files can be used as measured parameters to control the operation
- Design Window with \pm Tolerance
- Configurable fast action Tool Box
- Multiple Measurement Lists
- Automatic Oscillation Detection during L/P
- Auto-protection routines against oscillations, breakdown etc
- Temperature stabilization routines
- Temperature vs. any Parameter Measurements
- User defined "Figure of Merit" usable also in Peak Search
- 2D, 3D Contours and combined Saturation plots
- On line Help and Service Manual
- "HP-VEE" and "LabView" drivers
- Over 150 fully integrated GPIB Instrument Drivers
- User Created GPIB drivers in ASCII form (no compiler needed)

Examples of Measured Data

The following representative contours and plots have been measured using the mixed harmonic load pull setup shown in figure 1.

Figure 4: IV characteristic of power FET. A right click on the curves allows automatic biasing to the selected conditions (*Auto-Bias*)

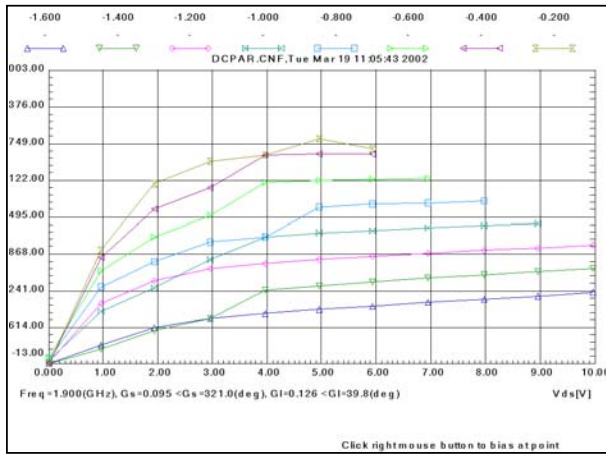
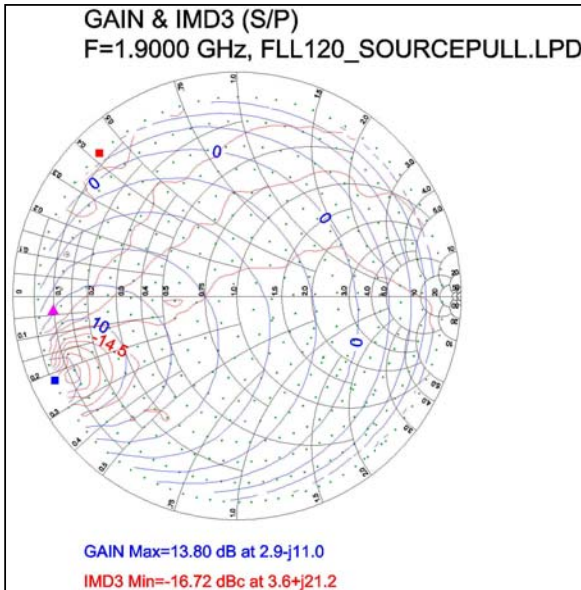
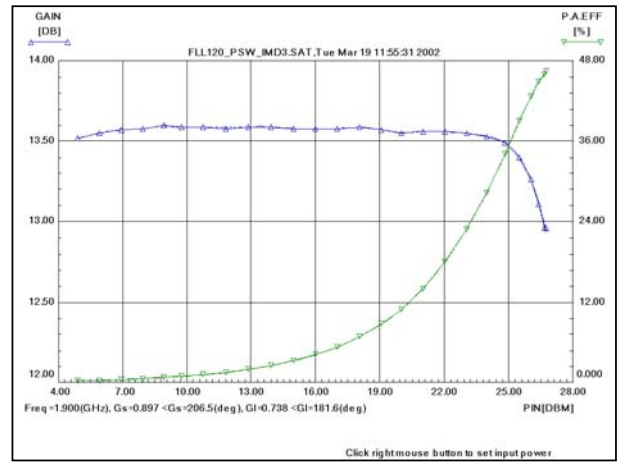


Figure 5: Saturation plot of Gain and PAE. automatic source power setting to the selected



A right click on the gain curve allows auto-compression point (*Auto-Power*)

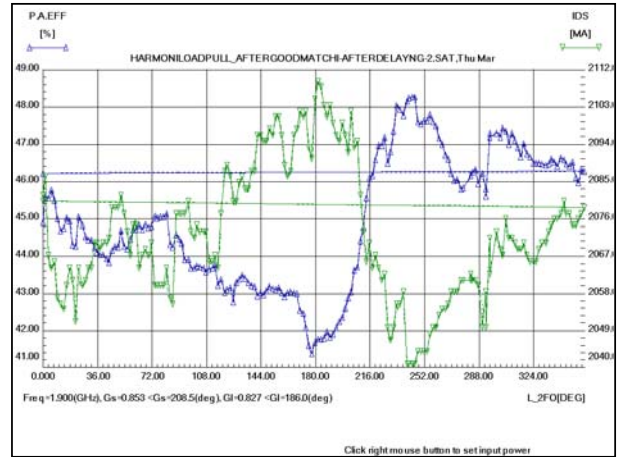


Figure 7: Harmonic load pull plot: Effect of second harmonic phase on DC current and PAE (*Harmonic Sweep*)

Figure 6: ISO source pull contour plots of Gain and Intermod