Power Added Efficiency

Can a passive load pull system measure Power added Efficiency ?

The answer is: NO. A passive load pull system measures the power injected (available) into the input of the DUT and the power delivered by the DUT to the load. If a directional coupler is used to measure the power returned by the DUT to the source, in order to assess the really absorbed power by the DUT, then the loss of the input tuner and the coupler can only be calculated if we know the large signal input impedance of the DUT.

Determining this impedance however requires another setting of the input tuner, in which case the power injected into the DUT changes and so changes its input impedance.

However: If the DUT is input matched and only then, the Efficiency measured equals the Power Added Efficiency defined as:

PAE = (Power delivered to load - Power delivered to DUT) / (DC power);

and the Gain measured becomes Power Gain

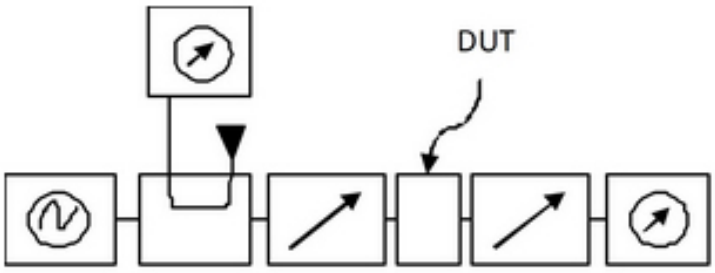
Gp = Pout.del / Pin.del

But one has to be carefull: If the DUT is tuned at the input so that the reflected power to the source (measured via the 4rth port of the input coupler or the third port of a circulator) becomes zero, this does not mean the DUT is “input matched”, it means that the setup is matched at the intersection between tuner and circulator, not tuner and DUT.

On this please see also “How do we measure the DUT Large Signal Input Impedance”.

(1) We understand as a “passive” system, one that uses two power meters to measure injected and delivered power.

If a bidirectional coupler is used at the Input of the DUT and a VNA to measure injected (a1) and reflected (b1) power waves at the input, then the delivered power to the DUT can be calculated as Pdel = |a1|2- |b1|2 in which case PAE can be calculated for all tuner impedances.



Traditional LP Setup using 2 power meters