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***December 18, 2013 Prof. Viviana Vladutescu***

***" Load-Pull Systems "***

This article presented the load-pull concept and its usefulness in modern wireless power amplifier design. It subsequently reviewed the most common load-pull techniques along with their advantages and limitations. A section on the latest advancements in load-pull setup configurations presented some of the most popular approaches adopted by the users of load-pull systems. The article discussed two of the latest developments in load-pull configurations which have either brought or have the potential to bring a paradigm shift in power amplifiers design techniques.

According to M. H. Hashmi and F. M. Ghannouchi,. a load pull system is composed of an active or passive impedance-tuner, the controlling mechanism to precisely set the tuner impedance to achieve desire impedance, and equipment to measure the traveling wave at the input and output port of the DUT (device under test). They are two types of system used by load pull applications. These are the active load pull system and the passive load pull system. These two applications have different properties and using them depends of the type of issue we need to solve, more precisely, it depends of the type of impedance tuner used. An active load pull system is usually used for applications requiring high reflection coefficient value. While the passive load pull is used for application that required high-speed measurements. Also active and passive load pull can be combined to create a hybrid load pull that it is used to achieve the desired load pull functionality.

A passive tuner based load-pull is a technique used in applications that require high speed measurements. An active tuner is commonly used in applications that require high reflection coefficient. In a passive technique the moving the probe of the tuner vertically changes the magnitude of the reflection coefficient and when moving the tuner horizontally it changes the phase of the reflection coefficient. So by moving the tuner vertically and horizontally we get the desired matching impedance (ZL). From the advancement of the load-pull system is having the passive load-pull get a maximum achievable reflection coefficient and for the active load-pull technique the requirements of the setup of the loop amplifier gain are reduced. There are a few differences between the passive and active load pull systems. Passive load pulls systems are easy to use, low implementation and maintenance costs, and they don’t have any oscillation. Standard passive load pull is usually unable to synthesize reflection coefficients near the boundary of the Smith chart. Where, active load pull techniques synthesize reflection coefficients near and on the boundary of the Smith chart, and therefore can synthesize extremely small impedances for matching DUTs.

The pre matching technique is limited and requiring impedances less than one Ohm. Quarter wave transformer technique is a special case of pre matched systems, where pre matching is fixed. The quarter wave transformer moves the matched impedance environment from 50Ohm to some other smaller value, resulting in enhanced tuning range, and reduced Smith chart coverage.

According to the article two advancements in both the active and the passive load-pull systems are enhanced loop passive load-pull and envelope load-pull. The enhanced loop passive load-pull is made up of an impedance tuner and a passive loop combined together. The impedance tuner is a low-loss passive tuner and the passive loop is a high circulator and a coupler. Both contribute to achieve a high reflection coefficient. The passive loop generates the reflection coefficient and the impedance tuner synthesizes to get a high reflection at the load. The envelope load-pull is a closed-loop load-pull system that overcomes oscillation and works as a high selective filter which eliminates the requirement of additional filters in the loop.

In conclusion the systems of Load-Pull can bring more efficiency in the performance of transmission lines by eliminating or diminishing undesired phenomenon such as negative propagating wave in the lines, and it is very important and indispensable in transmission line. Load pull was created more than 40 years ago, but still they are commonly used in our time. The paper also allowed us to see a practical example of the Smith chart in real life.