Swept_Load_Pull_Measurements

Where To Find This Example

Select **Help > Open Examples...** from the menus and type either the example name listed above or one of the keywords at the bottom of this page.

You can also open the project directly from this page using this button. Make sure to select the **Help > Enable Guided Help** from the menus before clicking this button.

Open Install Example

Design Notes

Swept Load Pull Measurements

NOTE: FOR A MUCH MORE COMPLETE EXAMPLE OF WORKING WITH SWEPT LOAD PULL DATA SEE THE "Swept_Load_Pull_Measurements_Complete.emp" EXAMPLE

Overview

This example is intended to show the functionality of the Load Pull Measurements utilizing the swept load pull file format, otherwise known as Generalized MDIF (GMDIFD). This project is setup such that the Circuit Schematics node in the Project Browser has specific data displays, where related graphs and measurements are grouped together. The data displays are numbered 1 through 4 and should be worked through in this same sequence. Each number schematic contains notes to guide you through the operation of the marker defined reference.

A full listing of measurements' functionality and intended use is listed at the end of the document. A list of measurements used per data display is also provided in the following sections to aid you in future setup of these same coupled measurements.

Data Display Schematics

1_Contours

This schematic contains three graphs that are tied together through the use of a defined marker reference.

Input Power vs Index plots the input power in dBm against the input power's sweep index. A marker m1 is defined on this graph for use in the **Output Power and Efficiency Contours** and **Output Power and Efficiency Contours Rectangular** graphs.

Output Power and Efficiency Contours uses several different Load Pull measurements, plotting different PAE and Pload data. The maximums of PAE and Pload (G_LPCMMAX), as well as general stepped contours for each measurement (G_LPCM) are also plotted. Displaying contours at specific values (G_LPCM_V) is also shown, as well as the over lapping region between PAE and Pload at specific values (G_LPCM_C2).

Output Power and Efficiency Contours Rectangular shows the same data as the **Output Power and Efficiency Contours** graph but on a rectangular real/imag graph

List of Load Pull Measurements Used:

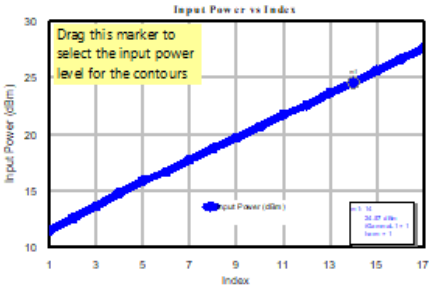
G_LPCMMAX

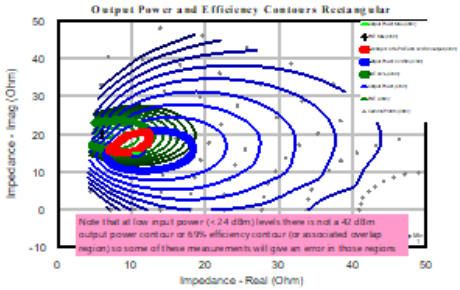
G_LPCM

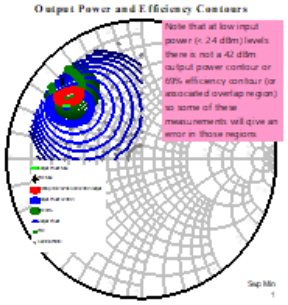
G_LPCM_C2

G_LPCM_V

PlotMD_R







2_Rectangular_Plots

This data display schematic begins with a Smith Chart titled **Gamma Points**, which displays all of the gamma points present in the swept load pull data file (G_LPGPM). A marker reference is also defined on this graph which is tied to every other plot present in this display. Moving the marker will change the impedance point, which will update the mismatch circle on **Gamma Points** while also updating the current trace accordingly in each of the other graphs.

Gain Compression vs Output Power at a Specified Gamma shows the compression from linear gain in dB plotted vs output power (PlotMD_R), where the active (blue) trace is defined by the marker position in **Gamma Points**.

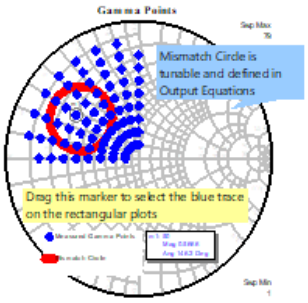
PAE vs Output Power at a Specified Gamma shows the power added efficiency on percent vs output power (PlotMD_R), where the active (blue) trace is defined by the marker position in **Gamma Points**.

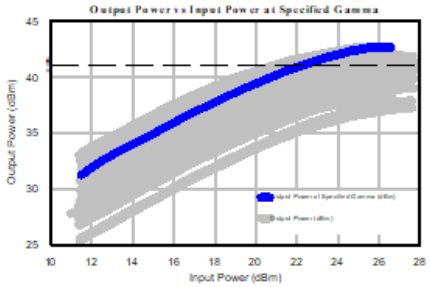
Output Power vs Input Power at a Specified Gamma shows the device output power vs its input power (PlotMD_R), where the active (blue) trace is defined by the marker position in **Gamma Points**.

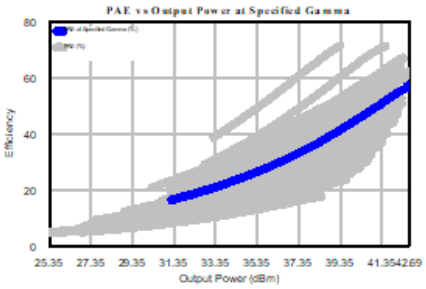
List of Load Pull Measurements Used:

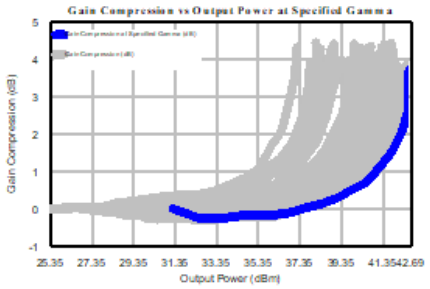
G_LPGPM

PlotMD_R









3_Aligned_Plots

This data display is meant to show the functionality of the alignment based load pull measurements. Aligning is the process of adjusting the load pull data such that all the values that achieve a given metric are aligned at the same x-axis index. In other words, data aligning allows the user to plot contours at a fixed output power level, PAE, compression, drain current, etc.

Gamma Points and 4 dB Compressed Contour displays all of the impedance points swept for the load pull (G_LPGPM), the impedance points at which the specified Gain Compression from Max Gain was achieved (G_LPGPM_A), and also has a Gain Compression from Max Gain (G_CompressMG) contour at 4dB (G_LPCM_V). A marker is defined in order to create a usable marker reference for the **Gain Compression From Max Gain for Aligned Comparison** and **Gain Compression from Max Gain Aligned to 4dB Compressed** rectangular plots.

Gain Compression From Max Gain for Aligned Comparison displays gain compression (defined from max gain) vs. output power for every load impedance (PlotMD_R). The active (blue) trace is defined by the marker position in the **Gamma Points and 4 dB Compressed Contour** graph. The horizontal line marks 4 dB compression and shows that not all impedance points allow the power sweep to reach this compression level.

Gain Compression from Max Gain Aligned to 4 dB Compressed displays gain compression (defined from max gain) aligned to 4 dB versus sweep index (PlotMD_R_A). The active (blue) trace is defined by the marker position in the **Gamma Points and 4dB Compressed Contour** graph. This graph shows that the data is nicely aligned at index = 14 and that contours (or any other plots) made at that iPower point will be the equivalent of a load pull done at a fixed 4 dB compression.

PAE and Output Power Contours at 4dB Compressed displays the output power and PAE contours at the specified gain compression level (G_LPCM_A). The bold output power contour shows a 42 dBm value (G_LPCM_VA) and the bold PAE contour shows a 65% value (G_LPCM_VA) and are also outlined with their intersection or overlap region represented in red (G_LPCM_C2A). Importantly note that the iPower selection for each measurement is set to **Auto Align**. This means the correct iPower index will be set automatically, corresponding to the value chosen in the **Align to specify value (dB)** box.

List of Load Pull Measurements Used:

G_LPGPM

G_LPGPM_A

G_LPCM_V

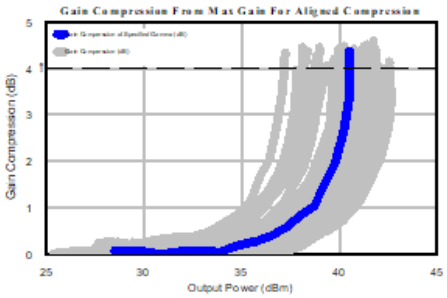
G_LPCM_VA

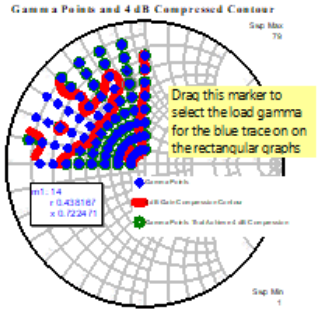
G_LPCM_C2A

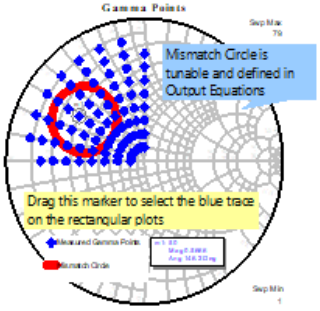
G_LPCM_A

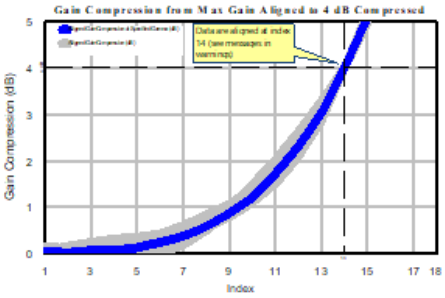
PlotMD_R

PlotMD_R_A









Reference Material - Graphically Viewing Load Pull Data

Load pull data can be viewed via measurements. These measurements are found under the "Load Pull" heading.

G_LPCM: This commonly used measurement plots the contours of the selected calculated quantity and is intended to be used with the Smith Chart. The data file, calculated value to plot, contour step size, max number of contours plotted, characteristic impedance and sweep reference must be specified.

G_LPCM_V: This commonly used measurement plots the contour of a selected calculated quantity at a specific value. The data file, calculated value to plot, contour value, and characteristic impedance must be specified.

G_LPCM_A: This measurement allows for calculated value contours to be plotted from a consistent specification of a user-specified quantity (most commonly used is input power). The data file, calculated value to plot, contour step size, max number of contours plotted, characteristic impedance and sweep reference must be specified along with the calculated quantity and value used to align the contour data to.

G_LPCM_C2: This measurement will show the overlap or intersecting region of two calculated quantities specified at a specific contour value or threshold. This measurement requires two data sources or calculated quantities where each source needs a specified threshold and step size.

G_LPCMMAX: This measurement plots the maximum value of the selected calculated value and is intended to be used with the Smith Chart. The data file, calculated value to be plotted, and characteristic impedance must be specified along with a specified sweep reference.

G_LPGPM: This measurement allows you to view the reflection coefficient (impedance/gamma) points the swept load pull data was taken at. This measurement is used with the Smith Chart. The characteristic impedance with which the reflection coefficients are normalized must be specified (defaults to 50 ohms).

G_LPINT: This commonly used measurement allows for interpolation of a selected calculated quantity (PAE, output power, etc.). The user must specify the simulated or measured load pull data file, and a matching circuit.

PlotMD_R: This measurement allows the visualization a real-valued data from a swept load pull file. This includes calculated values, such as PAE, which can be selected from the measurement dialog.

PlotMD_R_A: This measurement allows the visualization of real-valued data from a swept load pull file aligned to a specific value of a calculated quantity, for example plotting efficiency aligned to the 1dB Compression point.

Note that this list is not complete but represents the most commonly used measurements.

Optimizer goals can be set up for this measurement to optimize on circuit parameters in the schematic for a desired measured data level (for example, optimizing the parameters of a matching circuit to obtain maximum power added efficiency).