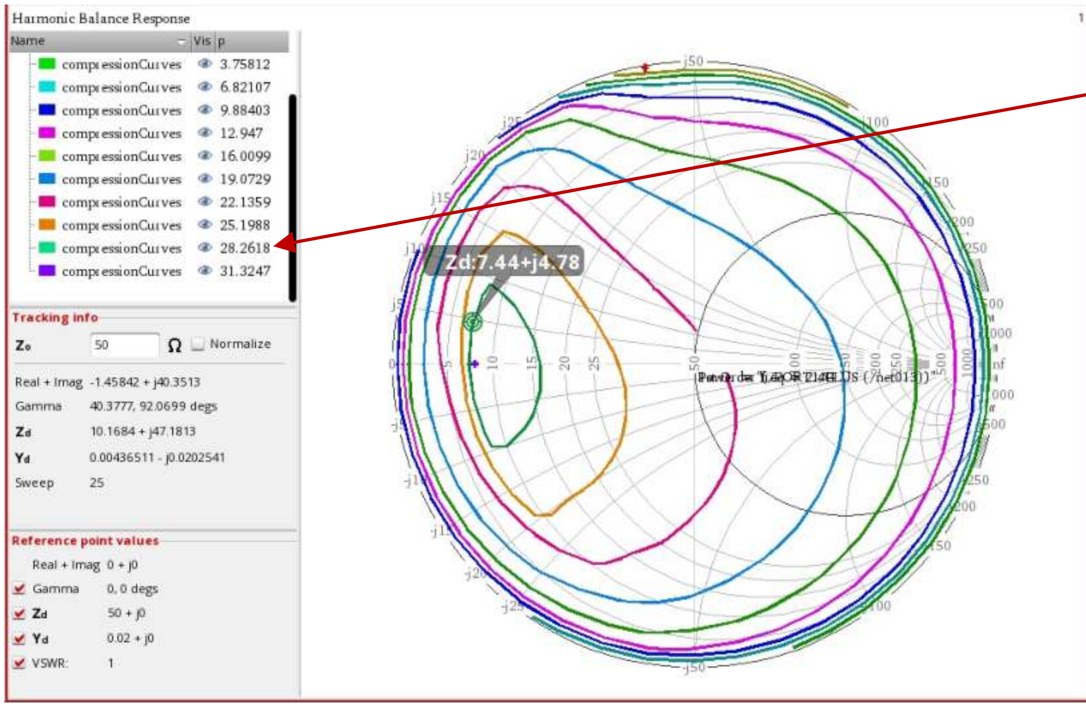
Observations by Mr. SkkyLee in Cadence Forum Post in [1]

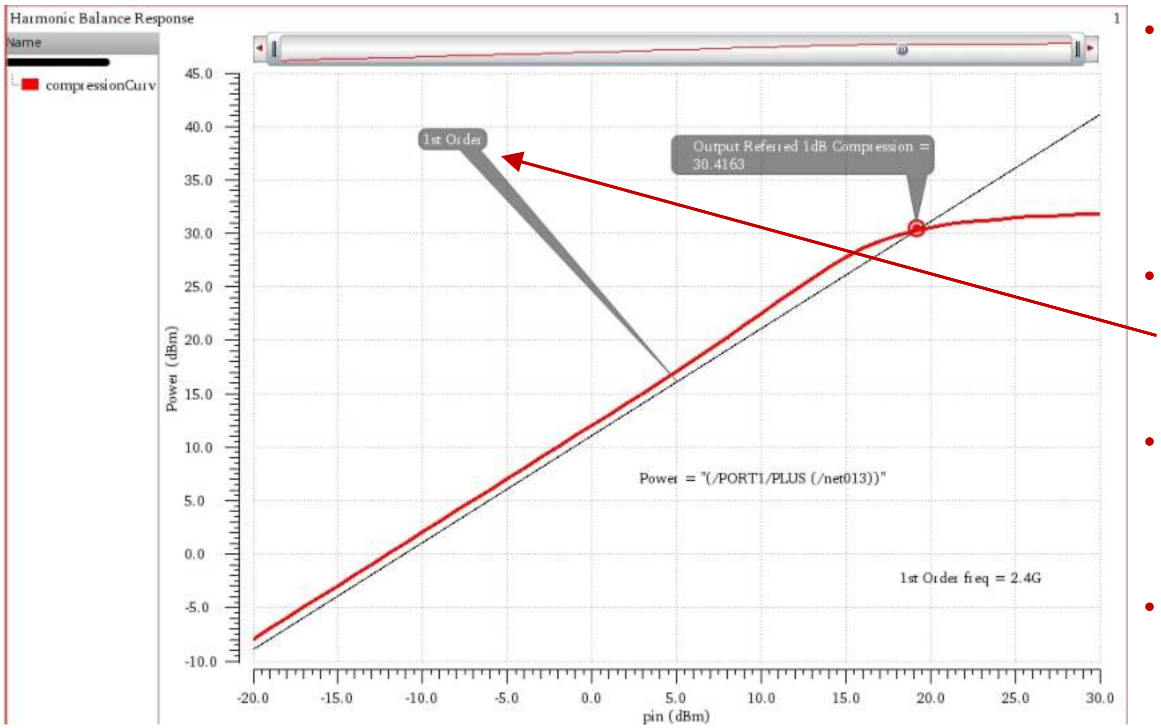


- A pss harmonic balance simulation was performed to estimate the 1 dB compression points for an amplifier operating at 2.4 GHz for input powers between -20 dBm and +30 dBm. The 1 dB compression results provided a set of load impedances that provide a 1 dB compression point whose output power is 28.26 dB
- Using the impedance from this contour of 7.44 + j4.78 ohms (7.44 ohms in series with 316.9 pH inductor at 2.4 GHz) a set of transient analyses were performed where the input power at 2.4 GHz was swept from -20 dBm to + 30 dBm.

$$
\begin{aligned}
imag\{Z_L\} &= \omega L \\
&= 4.78 \\
L &= \frac{imag\{Z_L\}}{\omega} \\
&= \frac{4.78}{2 * \pi * 2.4\,GHz} \\
&= 316.9\,pH
\end{aligned}
$$

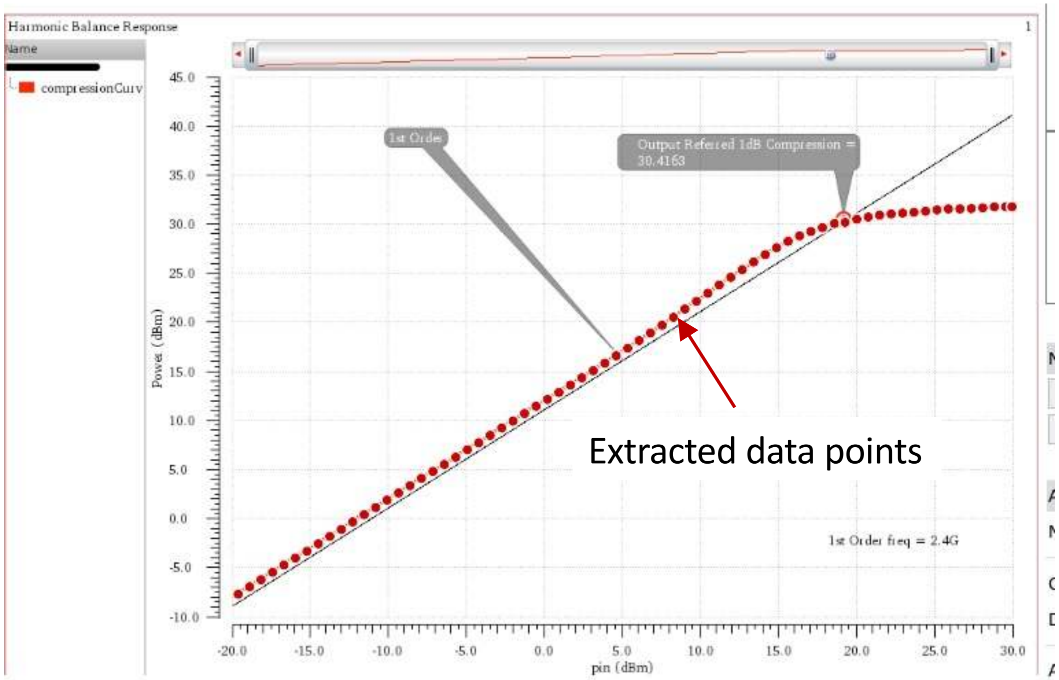
[1] https://community.cadence.com/cadence_technology_forums/f/rf-design/58535/loadpull-compression-point-impedance-using-xdb-analysis-in-harmonic-balance

Observations by Mr. SkkyLee in Cadence Forum Post (continued)



- Using the impedance from this contour of 7.44 + j4.78 ohms (7.44 ohms in series with 316.9 pH inductor at 2.4 GHz) a set of transient analyses were performed where the input power at 2.4 GHz was swept from -20 dBm to + 30 dBm.
- Using a slope of ≈1 for the transfer function between input and output, the 1 dB compression point was estimated as at an output power of 30.416 dBm
- Mr. SkkyLee did not expect to find such a large difference between the two estimates of 1 dB output power compression values
- A study of Mr. SkkyLee's transient results was performed to provide a possible reason for the two different simulated values of 1 dB compression

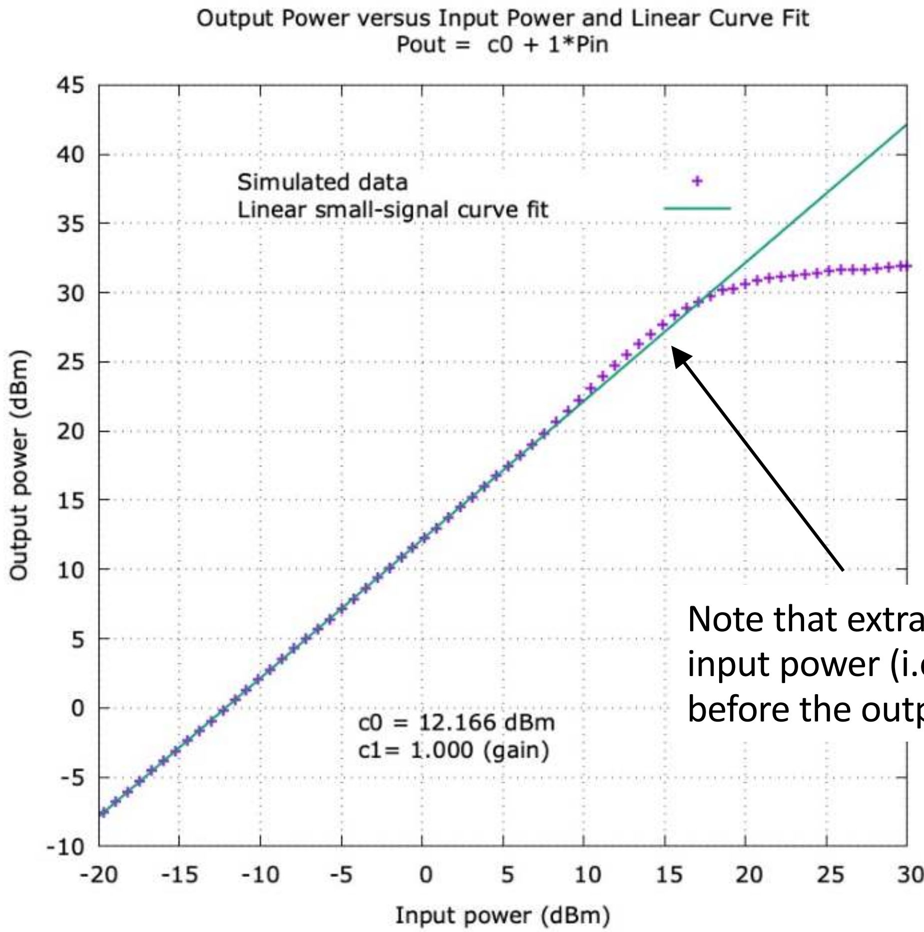
Outline and Summary of Author’s Study of Transient Simulation 1 dB Compression Results



- A tool, WebPlotDigitizer[2] was used to extract the 1 dB compression data from Mr. SkkyLee’s forum post Transient results (i.e., output power versus input power data points)
- The data was analyzed to study the sensitivity of the measured 1 dB compression point to the slope of the small-signal transfer characteristic from which the 1 dB compression point is identified
- SkkyLee did not expect to find such a large difference between the two estimates of 1 dB output power compression values
- A study of Mr. SkkyLee’s transient results was performed to provide a possible reason for the two different simulated values of 1 dB compression

[2] https://automeris.io/WebPlotDigitizer/

Extracted Input/Output Power Transfer Characteristic Case 1: gain = 1.00



- The data was analyzed using a linear curve fit to the small-signal power level data (input power << 0 dBm)
- The gain of the linear curve fit was set to 1.0 and the best intercept determined using a least squares algorithm

Note that extracted data shows a gain peak in this region of input power (i.e., its gain exceeds its small-signal gain value) before the output power starts to saturate

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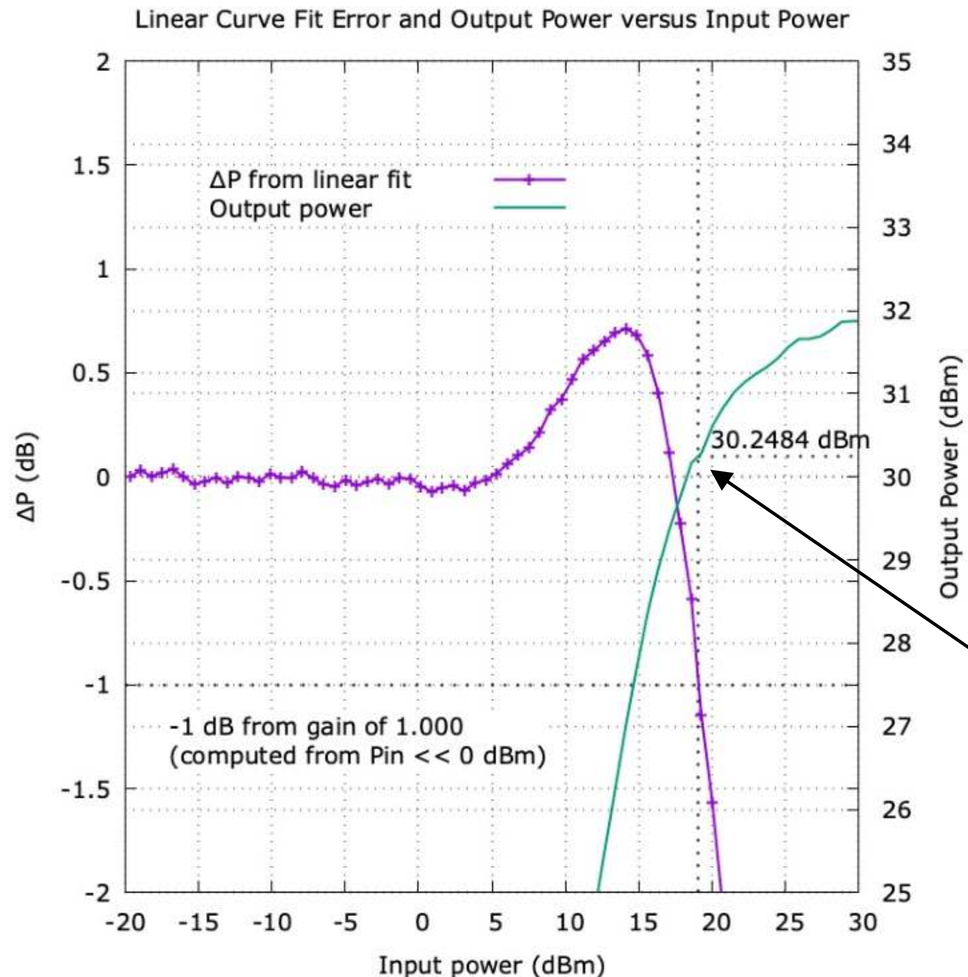
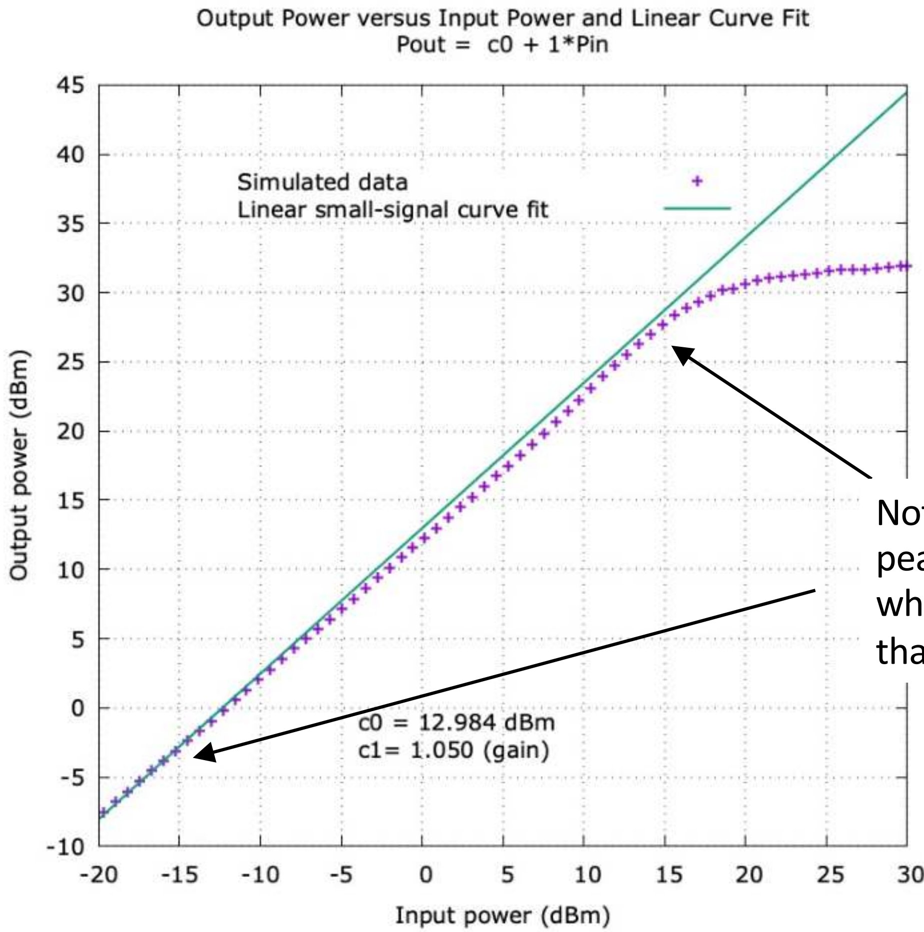
1 dB Compression Point with Small-signal Transfer Curve 1: gain = 1.00



1 dB compression point occurs at an output power of 30.35 dBm. This is consistent with Mr. SkkyLee's transient simulation result of 30.416 dBm

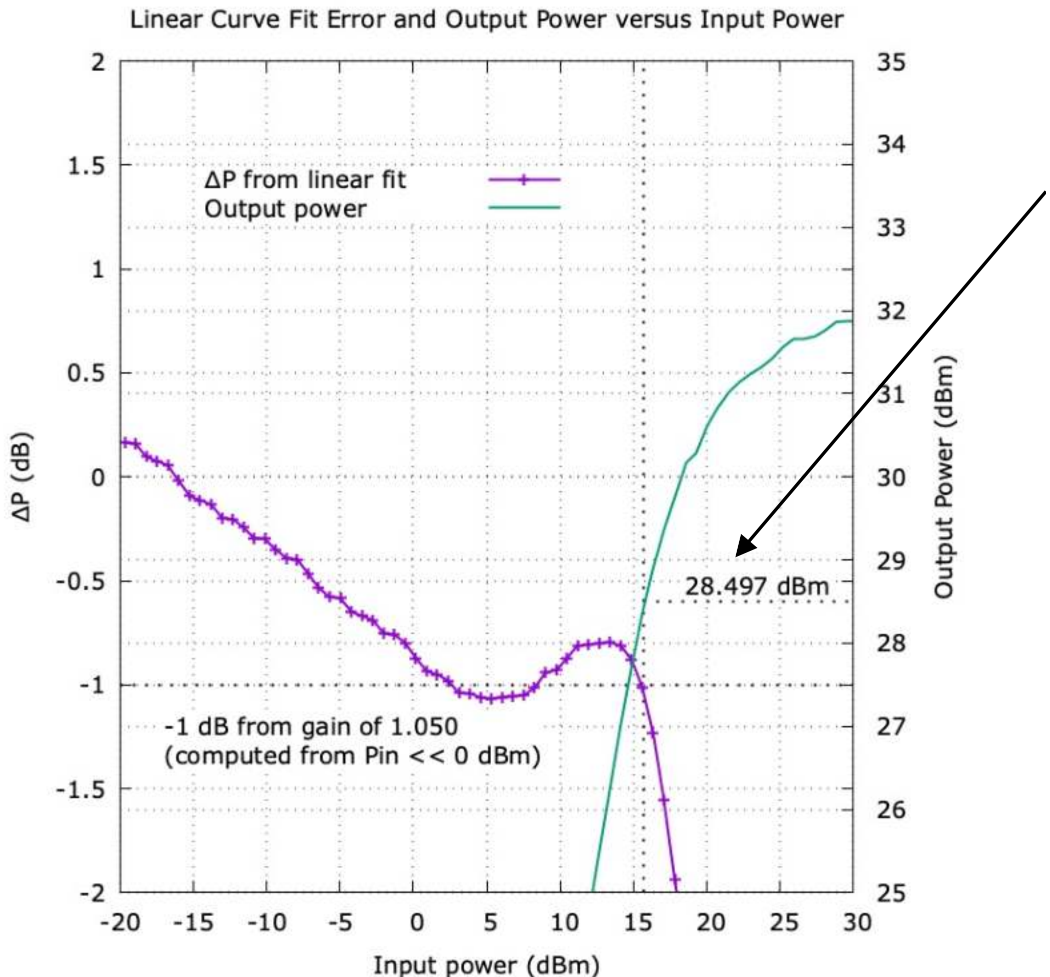
Extracted Input/Output Power Transfer Characteristic Case 1: gain = 1.05



- The extracted transient simulation data was re-analyzed using a linear curve fit to the small-signal power level data (input power << 0 dBm)
- The gain of the linear curve fit was set to 1.05 and the best intercept determined using a least squares algorithm

Note that extracted data no longer shows a gain peak in this region of input power (i.e., a region where the gain exceeds the small-signal gain) and that the linear fit at low power levels is still good

1 dB Compression Point with Small-signal Transfer Curve 2: gain = 1.05



1 dB compression point now occurs at an output power of ≈ 28.45 dBm. This is consistent with Mr. SkkyLee's PSS/harmonic balance result of 28.26 dBm

Summary and Potential Next Steps

- Analysis of Mr. SkkyLee's transient simulation results for the 1 dB compression point output power suggests the 1 dB compression point is a strong function of the small-signal transfer function gain
  - *The small-signal transfer function gain of Mr. SkkyLee's PSS/harmonic balance simulations is not provided*
  - *The small-signal transfer function gain of Mr. SkkyLee's transient simulation data appears to be 1.00 as this provides a 1 dB output power compression point consistent with his result*
  - *Re-analyzing Mr. SkkyLee's transient simulation data for the 1 dB output power compression point with a small-signal transfer curve of 1.05 suggests it is now consistent with his PSS/harmonic balance result*

- A possible hypothesis is that there is a difference between the small-signal transfer function gains in the PSS/harmonic balance and transient simulations
  - *It is noted Mr. SkkyLee chose a "moderate" setting for errpreset for his PSS/harmonic balance simulations. It is suggested he re-perform his simulations with an errpreset setting of "conservative"*
  - *The errpreset selected for Mr. SkkyLee's transient simulations is unknown. It is proposed that the set of transient simulations also utilize an errpreset of "conservative" and be repeated if this selection was not chosen for his transient simulations*