Extending the Frequency Range of the HPMX-2005

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Introduction

The HPMX-2005 vector modulator is specified for operation over a 50 -250 MHz Frequency range. We have received many requests for information on the operation of the modulator at higher frequencies. Several tests were performed in response to these requests and the data is presented below.

The upper end of the operating frequency range is not precisely defined, but is dependent upon the tradeoff the circuit designer can make between the frequency and the required modulation accuracy, and the supply voltages available. The phase shifter in the HPMX-2005 is a passive R-C circuit that uses reversed biased Collector - Base junctions for the capacitors. The nominal voltage at the phase-adjust pin is 4.2V. If the voltage is increased to 5V as shown in the data sheet, the capacitance in the phase shifter is reduced. The reduced capacitance value in the phase shifter leads to reduced modulation error at frequencies above 140 MHz.

Tests:

We decided to extend both the voltage range applied to pin 9 and the operating frequencies to see just how far the operating frequency could be pushed. The tests were conducted over a voltage range of 4-9V on the phase-adjust pin (Vcc fixed at 5V) and the operating frequency range from 100-400 MHz. Figure 1 shows the resulting family of curves for the rms phase error. Figure 2 shows the rms amplitude error. Figure 3 shows the rms percent modulation error derived from the amplitude and phase error data.

As the voltage at the phase-adjust pin is increased, the current drain increases from about 100 uA at 5 Volts to about 2.5 mA at 9V. At the same time, the supply current drawn at the Vcc pin goes down. Figure 4 shows the supply current vs. the phase adjust voltage.

The power output from the IC varies with both the frequency and phase adjust pin voltages. Generally, as the phase adjust voltage increases, the power output increases. Figure 5 shows the family of power output curves.

All tests were performed at room temperature using an automated test system which provided rms data but not peak error data. The error measurements were made as described in the HPMX-2005 data sheet, with DC voltages applied to the Imod and Qmod inputs of the ICs. The graphs represent the performance of a "typical" device so slight variation from part to part should be expected.

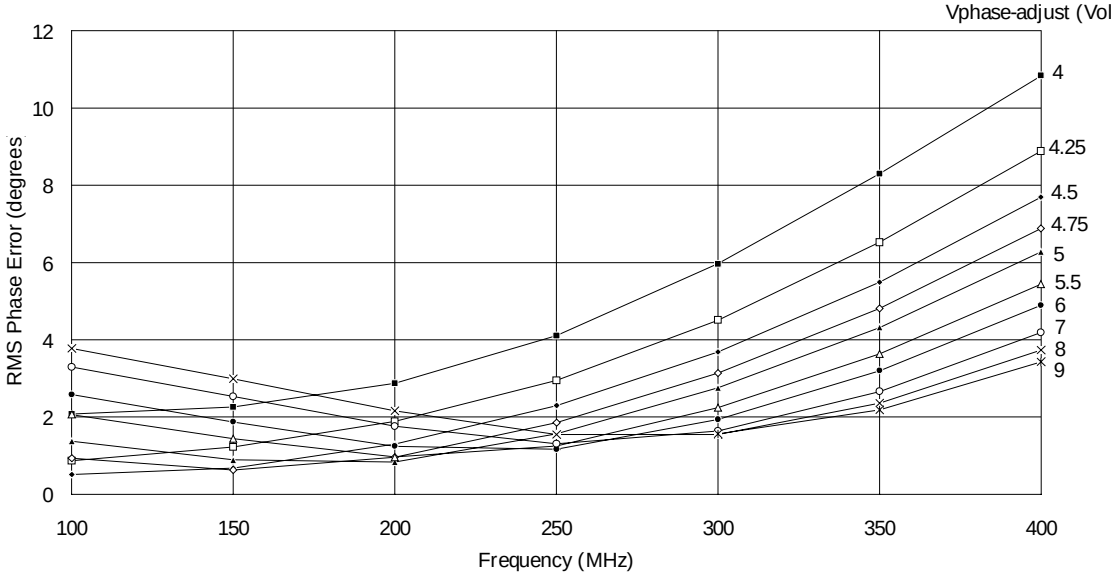

Figure 1. HPMX-2005 RMS Phase Error vs. Frequency and Vphase-adjust

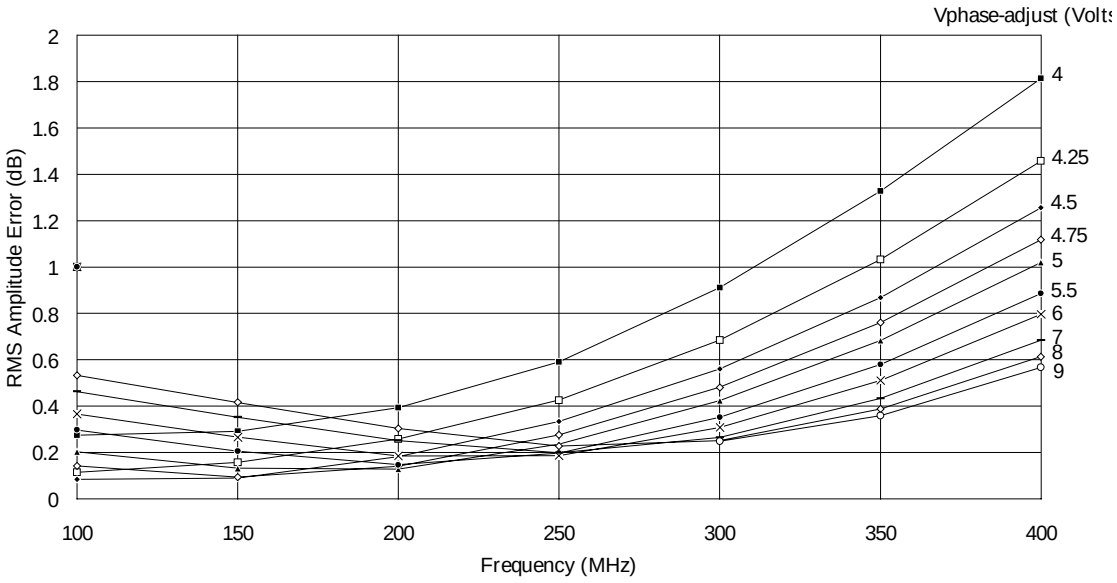

Figure 2. HPMX-2005 RMS Amplitude Error vs. Frequency and Vphase-adjust.

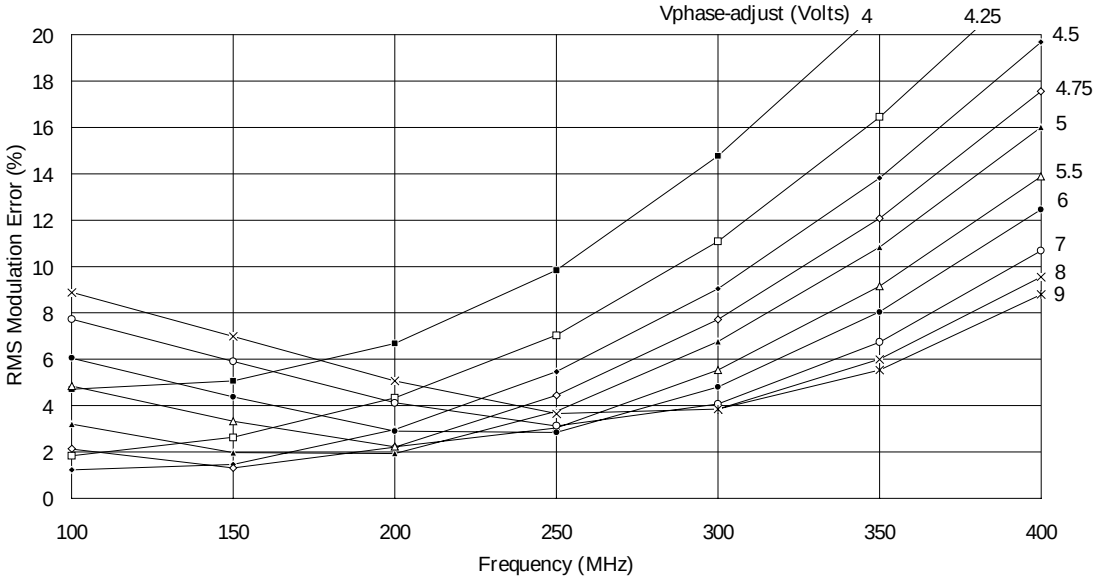

Figure 3. HPMX-2005 RMS Percent Modulation Error vs. Frequency and Vphase-adjust.

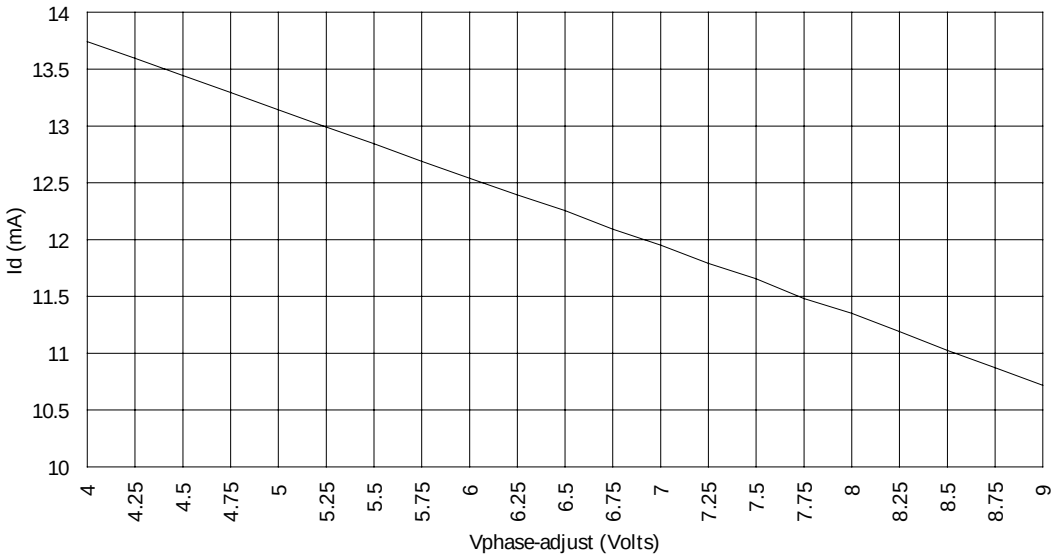

Figure 4. HPMX-2005 Device Current vs. Vphase-adjust

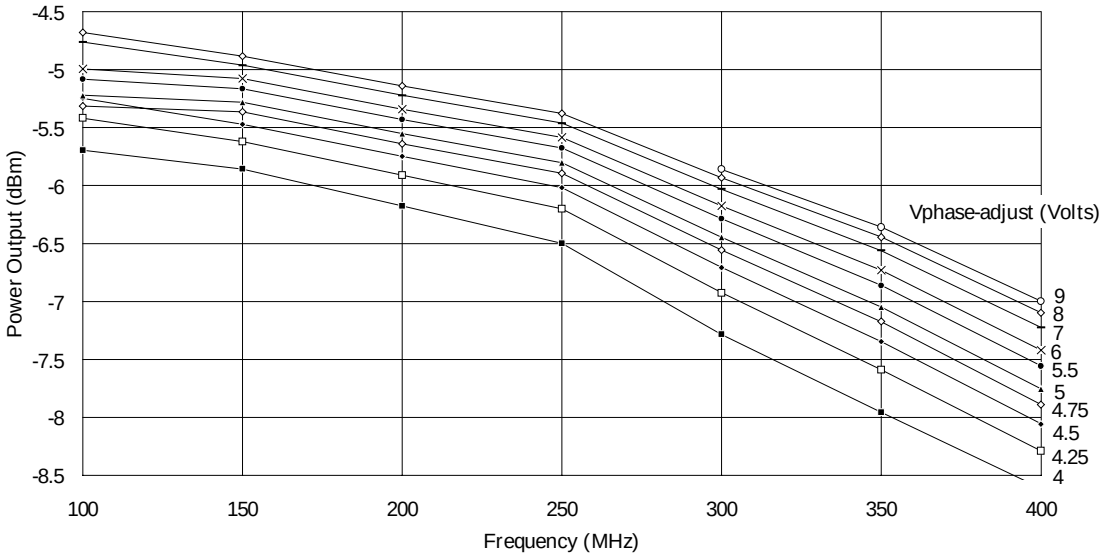

Figure 5. HPMX-2005 Power Output vs. Frequency and Vphase-adjust