

HMMC-5618 (6-20 GHz Amplifier)

- Power
- Harmonics
- Intermodulation Distortion

Application Note # 49 - Rev. B

**MWTC MARKETING
September 1995**

1.0 Introduction

The HMMC-5618 Amplifier is a cascable 2 stage MMIC gain block designed for 5.9 through 20 GHz applications.

This application note provides supplemental measured data typical of the amplifier's large signal performance characteristics.

Large signal gain, harmonic performance, and intermodulation distortion measurements were made on typical devices at MWTD's Measurement Service Center.

2.0 Large Signal Gain

Figure 1 and 2 are plots of the large signal gain and power conditions typical of the HMC-5618 amplifier. Three frequencies were chosen to cover the specified bandwidth of the amplifier. The plots illustrate the circuit's flat gain, broad-band frequency range and linear design.

Figure 3 and 4 show large signal gain and output power for three drain voltages at 12 GHz. 3 volts is the minimum recommended drain voltage, 5 volts is typical and 5.5 volts is maximum.

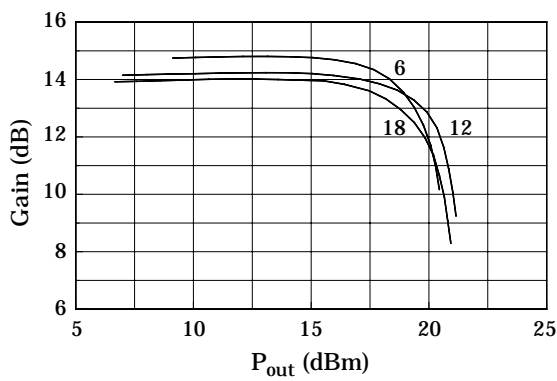


Figure 1.
Large Signal Gain @ 6, 12, 18 GHz
 $V_D = 5V$

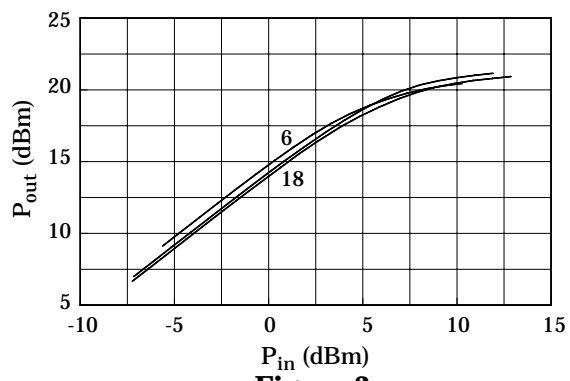


Figure 2.
Typical RF Power @ 6, 12, 18 GHz
 $V_D = 5V$

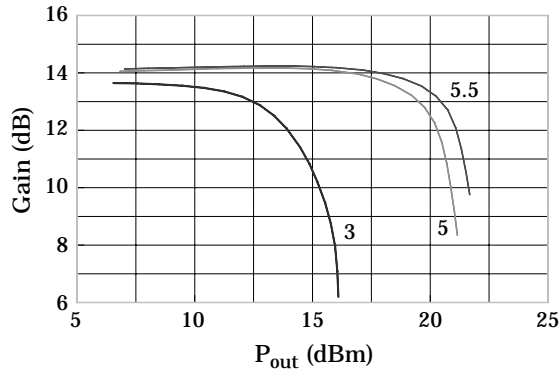


Figure 3.
Large Signal Gain @ 12 GHz
 $V_D = 3, 5, 5.5V$

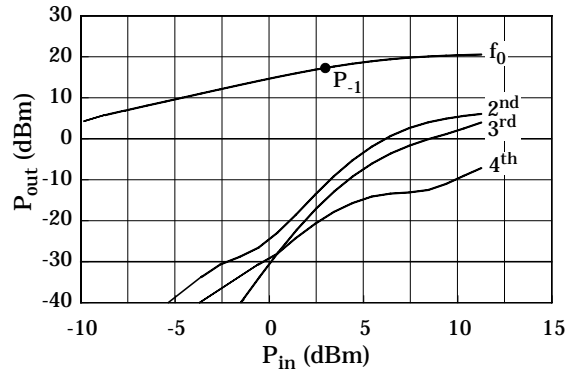


Figure 5.
6 GHz Harmonics
 $V_D = 5V$

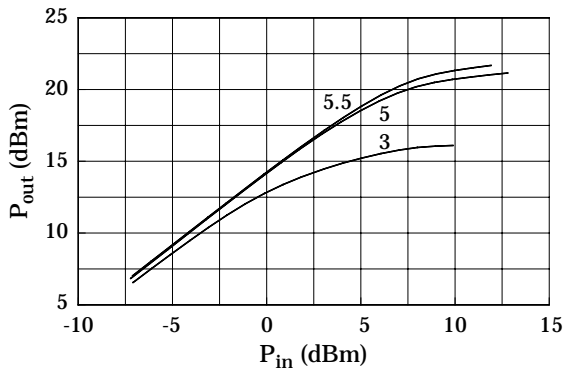


Figure 4.
RF Power @ 12 GHz
 $V_D = 3, 5, 5.5V$

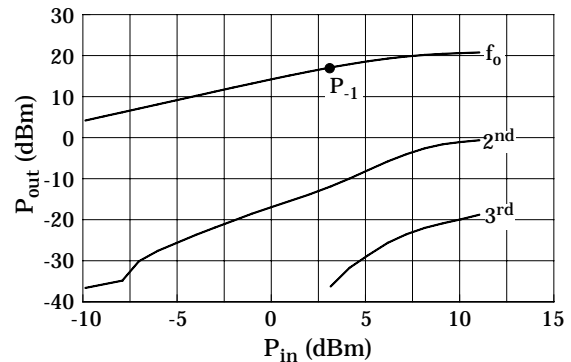


Figure 6.
12 GHz Harmonics
 $V_D = 5V$

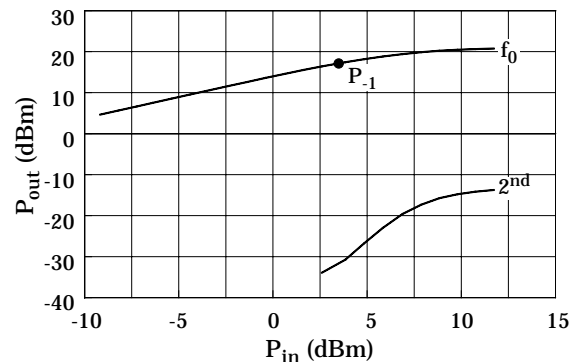


Figure 7.
18 GHz Harmonics
 $V_D = 5V$

3.0 Harmonic performance

Figures 5, 6, and 7 illustrate the HMMC-5618 amplifiers typical harmonic performance at 6, 12, and 18 GHz. For these plots the input power was swept from -10 dBm to more than +10 dBm, and the harmonic content was measured.

Figure 5 is the 6 GHz fundamental plot. At this frequency the second and third harmonic frequencies are in the passband of the amplifier and the fourth at 24 GHz is still in the gain region. In the linear gain region the amplifier maintains greater than 40 dBc of second harmonic suppression. At 1 dB of power compression there is still greater than 25 dBc, and greater than 15 dBc at saturation (20 dBm output power).

4.0 Intermodulation Distortion

Two tone intermodulation measurements were made on the HMMC-5618 through the linear region to saturation. Measurements were made at 6, 12, 18 GHz Tone spacings from 100 kHz, 1 MHz, 10 MHz and 100 MHz were used.

In the linear region the third order intercept (TOI) is nominally 28 to 30 dBm. Tone spacing and carrier frequency had little effect on the measurements needed to calculate TOI.

TOI is a figure of merit, it is a linear extrapolation of the point where the fundamental output power is at the same power level as the third order intermodulation products. Since power saturation occurs, the intercept point cannot be measured directly. TOI is extrapolated from the assumption that in a linear system the third order intermodulation products change by 3 db for each dB change in the input power. Figure 8 illustrates this definition of the TOI figure of merit.

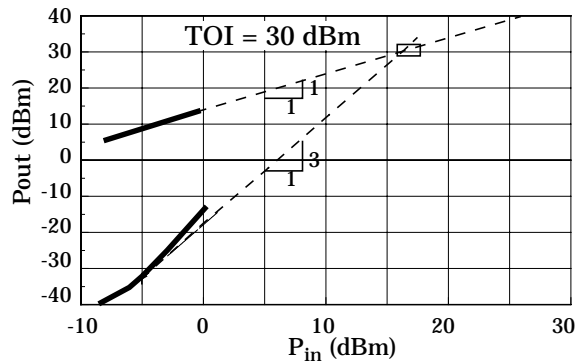


Figure 8.
Extrapolation @ $P_{in} = -5$ dBm

The utility of the TOI number is in comparing amplifier linear performance. In addition the relative suppression of a third order product can be calculated easily at a desired output power level (assuming the power level is in the linear region of the circuit). The formula for the third order modulation product's relative suppression is:

$$S_{dbc} = (3-1)(TOI - P_{out})$$

where: S_{dbc} = relative suppression (dBc)

TOI = Third order intercept (dBm)

P_{out} = the power level where it is desired to know third order suppression (must be in the linear region).

Intercept figure of merit is useful to predict performance in the small signal linear region. The HMMC-5618 is often used at higher output levels. For these applications, intercept parameters may not be sufficient to predict performance. Figure 9 represents typical measurements of the intermodulation distortion products through the linear range and up to saturation. The data is plotted for the third and fifth order intermodulation products.

For additional information please contact your local HP field sales office.

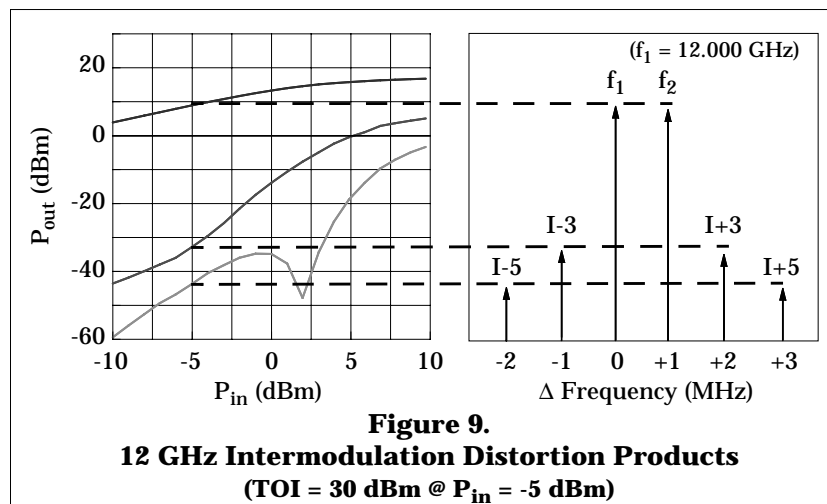


Figure 9.
12 GHz Intermodulation Distortion Products
(TOI = 30 dBm @ $P_{in} = -5$ dBm)

