Wan7com, Inc.

Wide Band IP_3 Measurement of WHM0010AE 1-150 MHz Power Amplifier IC

1. Introduction

WHM0010AE amplifier (DUT) is a low noise figure, wideband, and super high linearity amplifier IC with SMT package design. The amplifier offers typical P_{1dB} of 30 dBm and output IP_3 of 48 dBm at the frequency range from 1 MHz to 150 MHz. With WanTcom's advance technology, WHM0010AE has typical 18 dB differences between the IP_3 and P_{1dB}. The difference is in the 10 ~12 dB range for a traditional amplifier.

It becomes difficult to measure the IP_3 at 45 dBm to 50 dBm range. Any device in the test system may contribute worse third order intermodulation products than that of DUT itself. The correct calibration and setup of the IP_3 test system is essential to ensure the IMD_3 generated by the test system is lower than that of DUT.

This application note examines the signal combiner, power level settings, and the setup of the IP_3 test system for the wideband IP_3 measurement of WHM0010AE.

2. The IP_3 Test System

Figure 1 shows the block diagram of the test system. Two-tone signal is combined and fed to the DUT through a 6-dB fixed attenuator and a driver amplifier. The high linearity amplifier such as WBA0030A is used to boost the signal power level so that the signal generators are both in lower output power level. This is critical since low power level from the 2 signal generators will reduce the IP3 generated by each other due to imperfect isolation of the combiner. The output of DUT is connected to a spectrum analyzer (HP8594E).

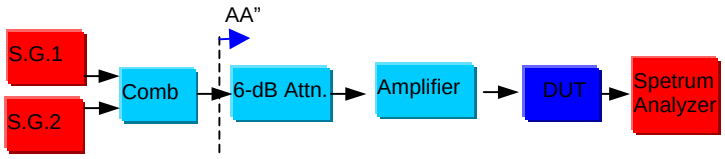

Fig. 1 The block diagram of the test system

Due to the difficult availability of isolators, the isolation between the two input ports of the combiner is critical. In order to maintain the good isolation, a fixed 6 dB coaxial attenuator is inserted between the output of the combiner and the input of the driver amplifier, due to the fact that the input VSWR of the DUT may not be ideal. With the active of all the test devices in the chain, the minimum return loss presented to the combiner output needs to be 28 dB or higher. In other words, the isolation of the combiner is depending on the load return loss to the combiner.

Fig. 2 shows the measured input return loss of the reference plan AA" for the load to the combiner. Better than 30 dB return loss is obtained after frequency higher than 20 MHz.

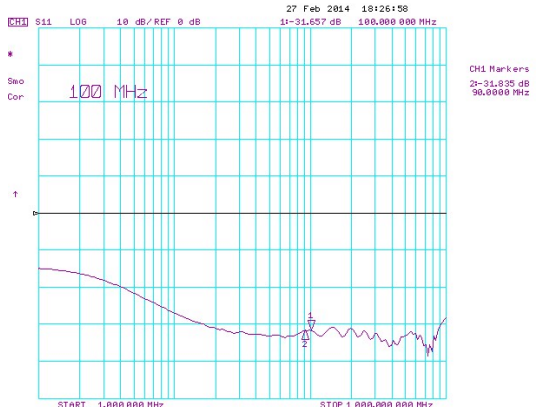

Fig. 2 Return loss to the combiner

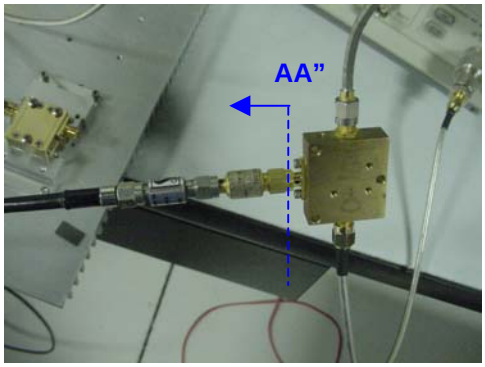

Fig. 3 Actual 6 dB attenuator to combiner

Fig. 3 presents the actual combiner and the 6 dB attenuator at the output port. The combiner is from Wavelex WPD0010A, 10 to 1000 MHz 2-way combiner.

Besides the combiner consideration, the spectrum analyzer settings are critical too to ensure the IMD_3 level generated by the spectrum analyzer is lower than that of the DUT itself.

a) Driver Amplifier

In order to keep the signal level from the signal generator below –20 dB, a high linearity amplifier is needed to boost the 2-tone signal after the combination of the signal. WanTcom WBA0030A wide band amplifier is used, as shown in **Fig. 4**. **Fig. 5** illustrates the driver connected to input of DUT, WHM0010AE demo.

Fig. 4 WBA0030A driver amplifier

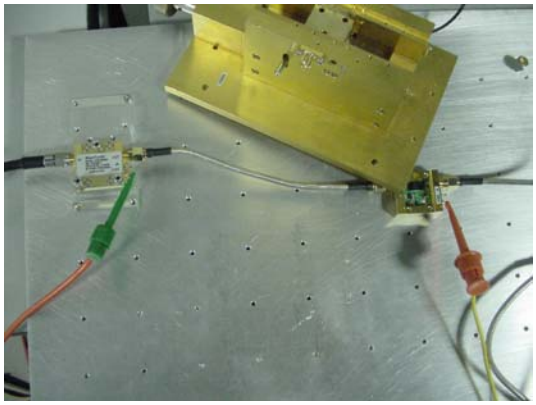

Fig. 5 Driver + DUT (WHM0010AE demo)

3. Test Example

WHM0010AE with lot 1310 is used for the demo. The demo has built-in DC-DC converter, sequencing bias circuit, and the 4 Amps switch. **Fig. 6** is the actual demo unit, or DUT. **Fig. 7** is the measured output 2-tone signal from the demo after the DC bias conditions have been optimized for best IP_3 performance:

V_{dd} = 8.5 ~ 9.0 V, I_{dd} = 220 mA;
10 dBm each tone;
f_1 = 100 MHz, f_2 = 101 MHz.

Fig. 6 WHM0010AE demo with 1310 lot

Fig. 7 Wideband view of the 2-tone signal

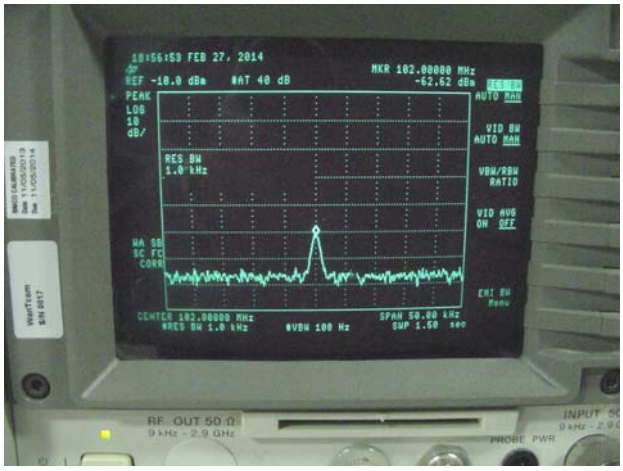

Fig. 8 The measured IMD_3

Fig. 9 The DC bias conditions

Fig. 8 is the actual measured IMD_3 components, -62.62 dBm, at 50 KHz span. Thus, the OIP_3 is

10 + [10 – (-62.62)]/2 = 46.31 dBm

For this lot of 1310 WHM0010AE, the V_{dd} higher than 9.5V produces lower IP_3 performance and thus is not desired.

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