

APPLICATION NOTE

**IM2 / IM3 measurements on
PR38991 demoboard**

AN99015

Abstract



Purchase of Philips I²C components conveys a license under the Philips I²C patent to use the components in the I²C system, provided the system conforms to the I²C specifications defined by Philips.

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**IM2 / IM3 measurements on
PR38991 demoboard**

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1. INTRODUCTION

This report describes the large signal handling measurement on Philips PR38991 demoboard according to MACO setup.

The following measurements are performed with the conditions given below, except when defined differently:

- $I_{Q_{baseband}}$ output level = 500 mV_{pp}
- TDA8060 prescaler disabled
- TSA5059 prescaler disabled
- F_{comp} = 500kHz
- I_{cp} = 120 uA
- $I_{Q_{baseband}}$ measurements performed with HP RF probe 54701A ($f < 2.5$ GHz) or HP 85024A ($300 \text{ kHz} < f < 3 \text{ GHz}$) connected to a spectrum analyzer, and an oscilloscope with 1:10 probe.

1.1 IM3 measurement according to MACO recommendation on PR38991

This three-carrier measurement is to verify if additional power applied to the TDA8060 results in a worse intermodulation product than without this additional power (applied outside the lowpassfilter characteristic).

1.1.1 Measurement setup

The measurement setup is shown in Figure 1:

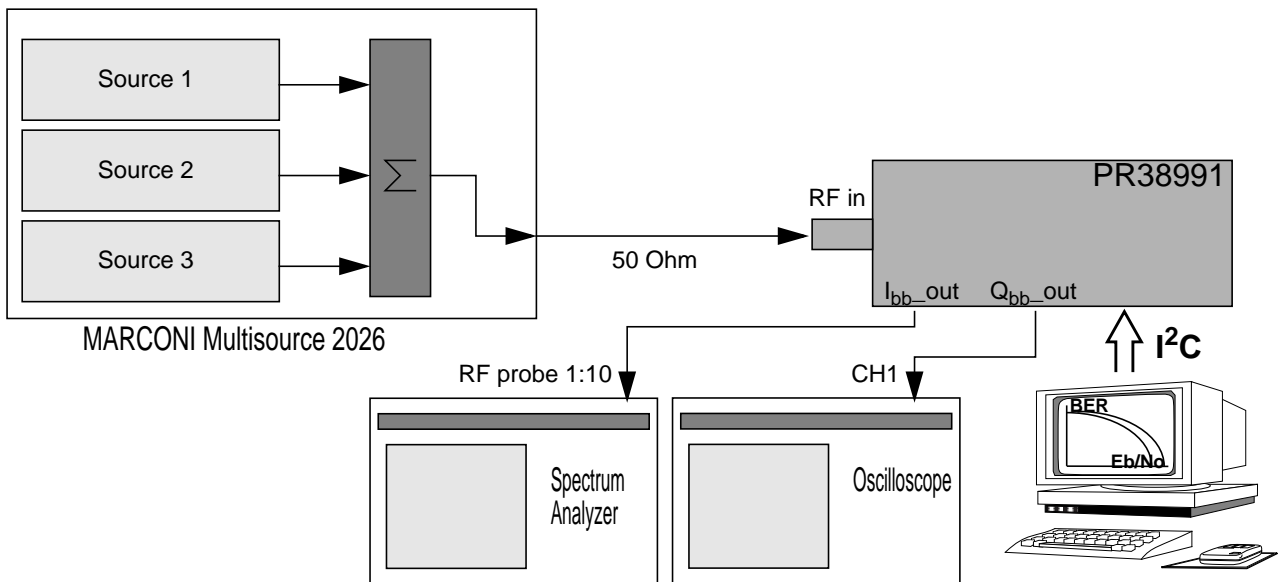


Fig.1 measurement setup IM2/IM3

1.1.2 Measurement procedure

- Setup measurement according to Figure 1
- Set the F_{VCO} to 1498 MHz in the software
- Apply f_1 ($f = 1500$ MHz, $P = -22$ dBm) to the tuner
- Adjust the AGC voltage to obtain an $I, Q_{baseband}$ output signal level of 500 mV_{pp}
- Apply f_2 ($f = 1501$ MHz, $P = -22$ dBm)
- On RF, the spectrum looks like figure 2.
- In baseband, the spectrum is shown in figure 3. It can be seen that on 1MHz IM2 and IM3 products overlap and on 4MHz the 2nd harmonic of f_{d1} and IM3.
- Measure the distance of $f(4\text{MHz}/3\text{MHz})$, $f(1\text{MHz}/3\text{MHz})$ which both consist of IM3 products.
- Measure the distance of $f(5\text{MHz}/3\text{MHz})$ for IM2.
- Apply $f_3 = 1400\text{MHz}$, $P = -22$ dBm and measure all distances again.
- Apply $f_3 = 1400\text{MHz}$, $P = -10.5$ dBm and measure all distances again.

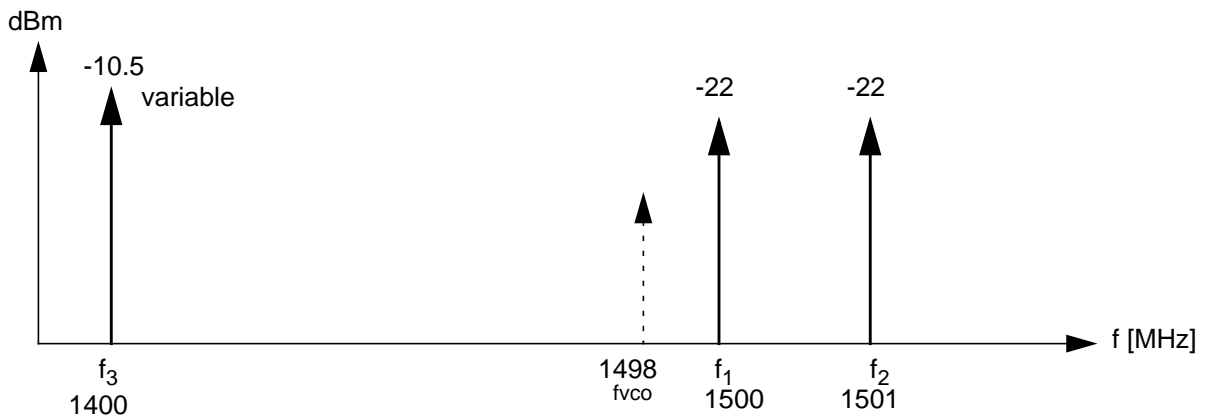


Fig.2 RF spectrum

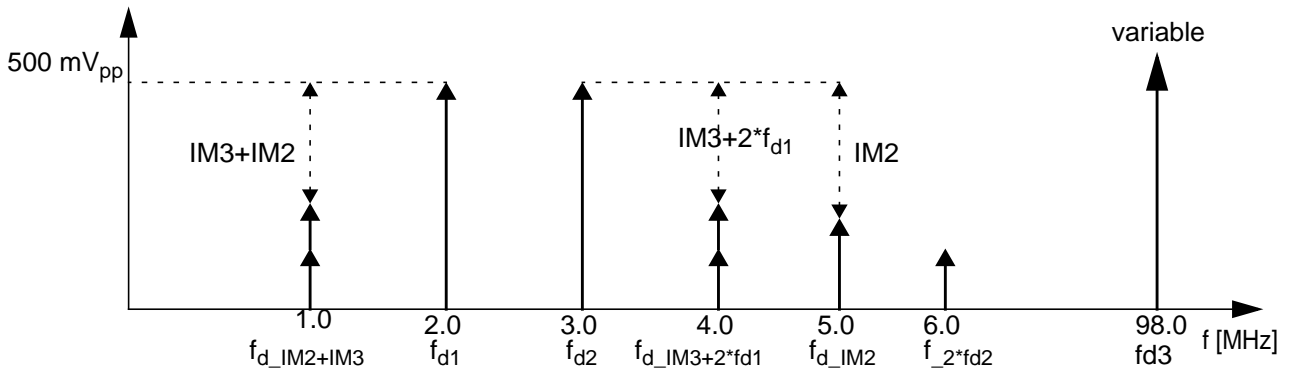


Fig.3 Baseband spectrum

1.1.3 Measurement results

The measurements are performed at $f=1500\text{MHz}$ as requested by MACO. In Table 1 the measurement results are shown.

The output of carrier f_3 is swept between off, -22 and -10.5dBm. Deterioration of IM3 distances could not be seen except for -10.5dBm f_3 input outside the low pass filter bandwidth frequency.

TABLE 1 IM2 / IM3 measurement results @ 1500MHz according MACO setup (with $f_{vco}=1498\text{MHz}$)

	f_3 off	$f_3=-22\text{dBm}$	$f_3=-10.5\text{dBm}$
IM3 (4MHz/3MHz) [dBc]	-41.8	-41.0	-34.0
IM3 (1MHz/3MHz) [dBc]	-45.0	-44.8	-35.0
IM2 (5MHz/3MHz) [dBc]	-42.0	-42.2	-41.8

In Figure 4 the baseband spectrum is shown. The f_{vco} is 1498MHz.

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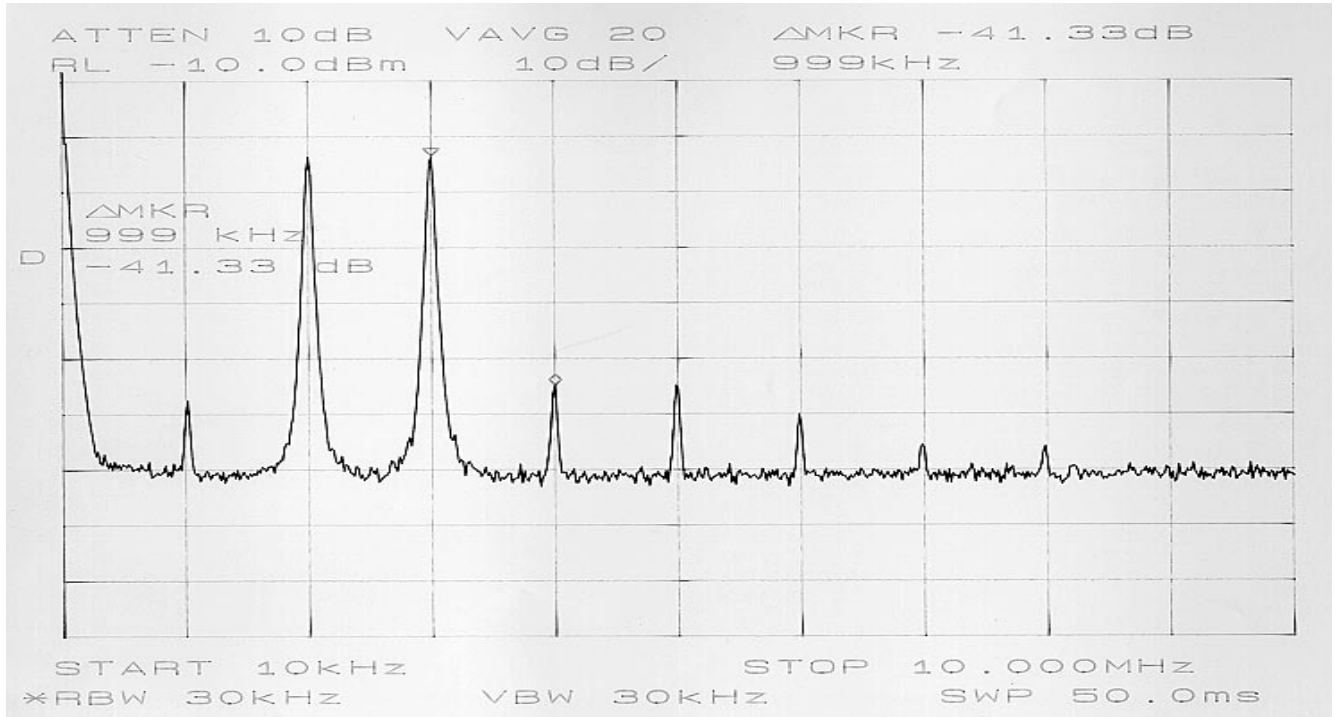


Fig.4 Measured baseband spectrum

2. Conclusions

- Deterioration of the products which also contain IM3 could not be seen outside the low pass filter bandwidth frequency, except for -10.5dBm input of the unwanted frequency. This deterioration mainly comes from the fact that on the PR38991 is only one attenuator stage, thus power reaching the TDA8060 is higher than on the MACO-tuner.
- The distance values at 1MHz and 4MHz are different, because they consist of different products. Therefore, to really measure IM3 performance, the frequencies should be chosen differently.