

Some more tests on IK4AUY -I4FAF 2X 2N5109 push-pull preampl. for HF with feedback transformers (see QEX magazine March April 2003 and IK4AUY website [http://ik4auy.xoom.it/qex\\_march\\_april\\_03.htm](http://ik4auy.xoom.it/qex_march_april_03.htm))



My recent email exchanges with Bob G300U gave to me the input to make some more tests on this preampl. focusing on lower range frequency, so I put up the proper setup in my home lab. for some more tests and let Bob continue from his side.

This was also an occasion to remember my father I4FAF, old timer OM, a keen expert and fast home builder and experimenter about amateur radio equipment and instruments, a friend in life and in the hobby, now a silent key since Jan 30, 2012.

I was happy to see Bob G300U interest on this project and his professional way to test closely it for which I encourage him to go ahead on this one.

My set up for the IMD measures is Marconi 2380-2382 Spectrum Analyzer, two Marconi 2019A RF generators, Mini-Circuits ZFSC-2-4 a 3 ports BNC 50Ohm combiner with a 3dB of insertion loss.

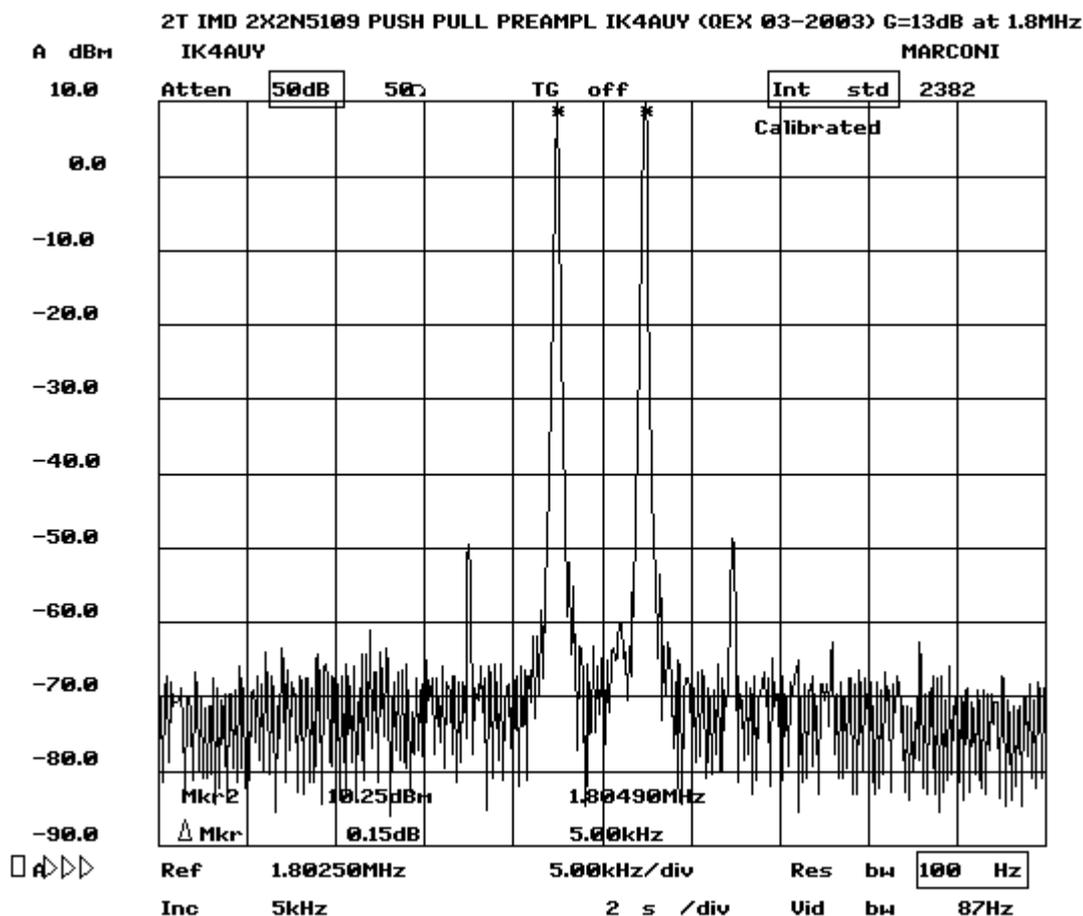
I basically compared IMD behavior at 14.2MHz and at 1.8MHz using a very high input power to show up on my spectrum analyzer the 3<sup>rd</sup> order IMD response a bit.

The preamplifier under test was assembled some years ago by my father Romano I4FAF for test purposes and personal knowledge of this 2X2N5109 transistors push pull circuit, with transformer rf feedback design, basically adapted from a professional article on Ham Radio magazine by Prof. Ulrich Rohde several years ago. Full references are in my March -April 2003 article in QEX magazine that you can even download from my website. Power supplied voltage was at 13.8V and about 110mA of total current for the unit.

I put in between the connection of each RF generator to the combiner a 10dB Mini-Circuits attenuator (a bnc type rated 2W) to increase isolation to the generators. The common combined output from the combiner is routed with a double shielded professional grade 50Ohm coaxial cable to the input of the preampl and from the preampl output to the input of the spectrum analyzer.

I captured the spectrum analyzer screen with an PROLOGIX - GPIB-USB unit to my PC and I used KE5FX software, a Win32-based emulator for the HP 7470A plotter, see his website at <http://www.ke5fx.com/gpib/7470.htm>

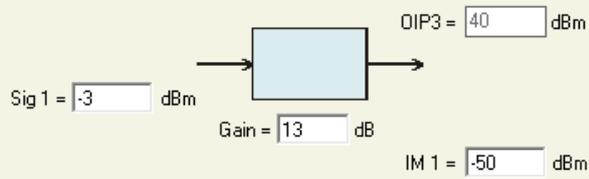
Here are the screen shots for the 1.8MHz 2T IMD test at a very high output level +10dBm, the gain is 13dB at this frequency (only 1dB increase in comparison to the gain at 14.2MHz which is 12dB), so the input power level was -3dBm, a very high one, since it equates 70dB over S9 for the standard reference of S9=-73dBm.



The two RF generators were set at 1.800MHz and 1.805MHz the 3<sup>rd</sup> order IMD should be, in this case, 5KHz below the lower generator freq and 5KHz above the second higher freq generator. With such an high input power level set at -3dBm to the input of the preampl under test and an output at +10dBm, the 2T 3<sup>rd</sup> order IMD response is shown at a level of about -50dBm.

To do easily calculations and to get a nice graphical output I use AppCad software vers 3.02 see <http://www.hp.woodshot.com/> with license of use to Avago Technologies.

# Intermodulation Calculator

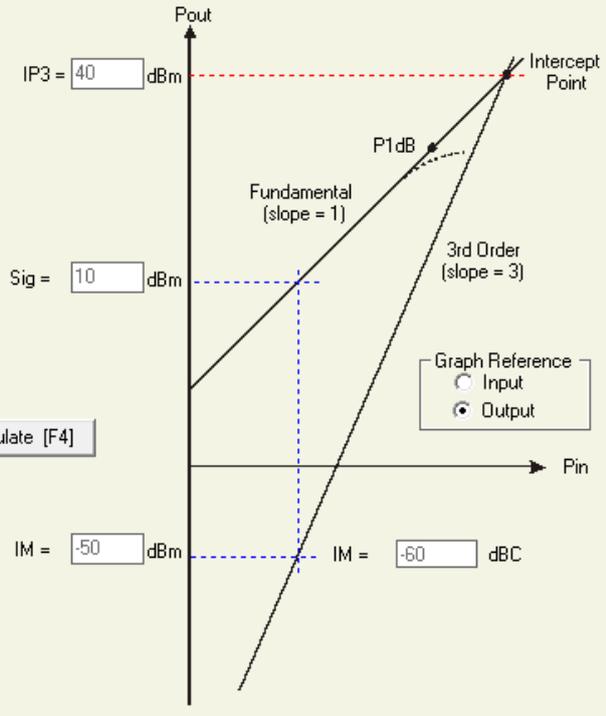


1. IP3 reference     Input     Output
2. Signal reference     Input     Output
3. IM reference     Input     Output

Note: Sig is level of each individual signal

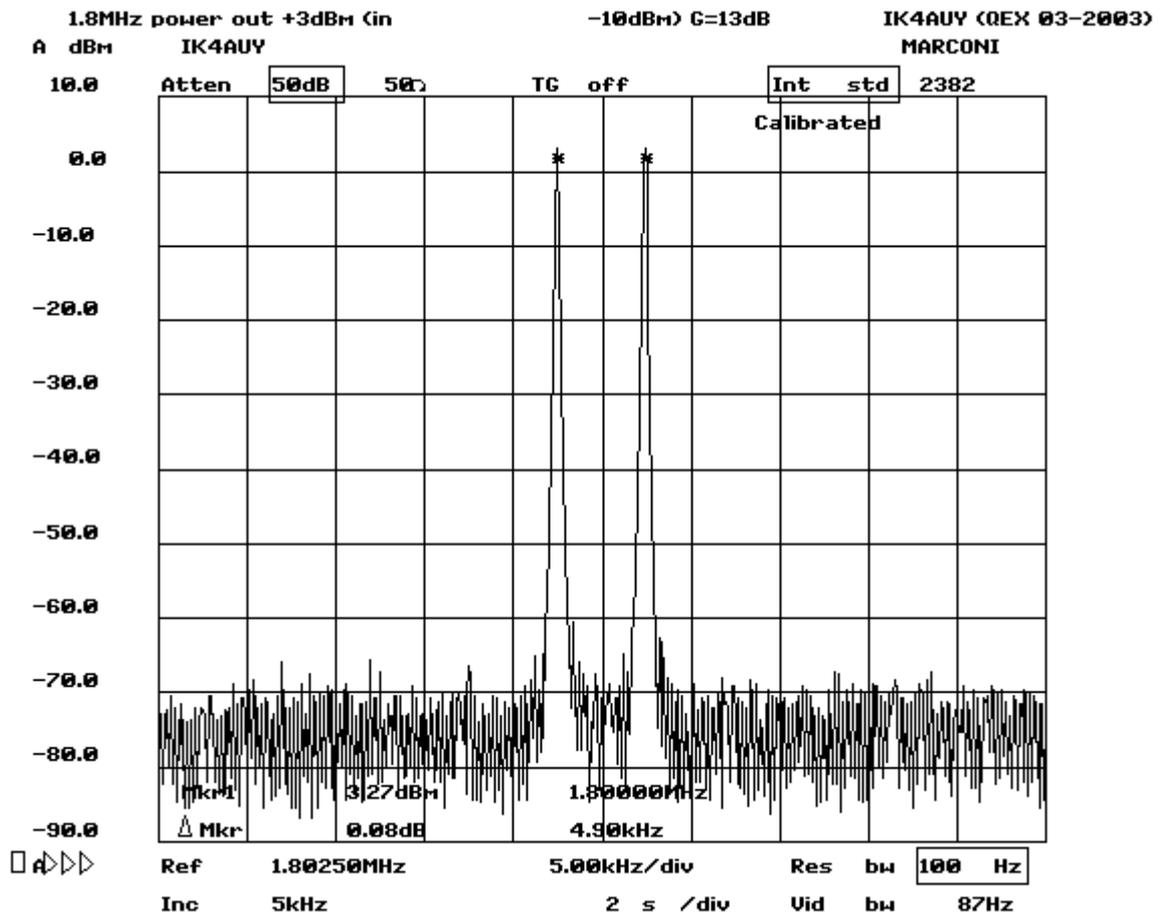
5. Calculate
- IP3      Given: P<sub>sig</sub> and IM level
  - IM level    Given: P<sub>sig</sub> level and IP3
  - P<sub>sig</sub> level    Given: IP3 and IM level

Calculate [F4]



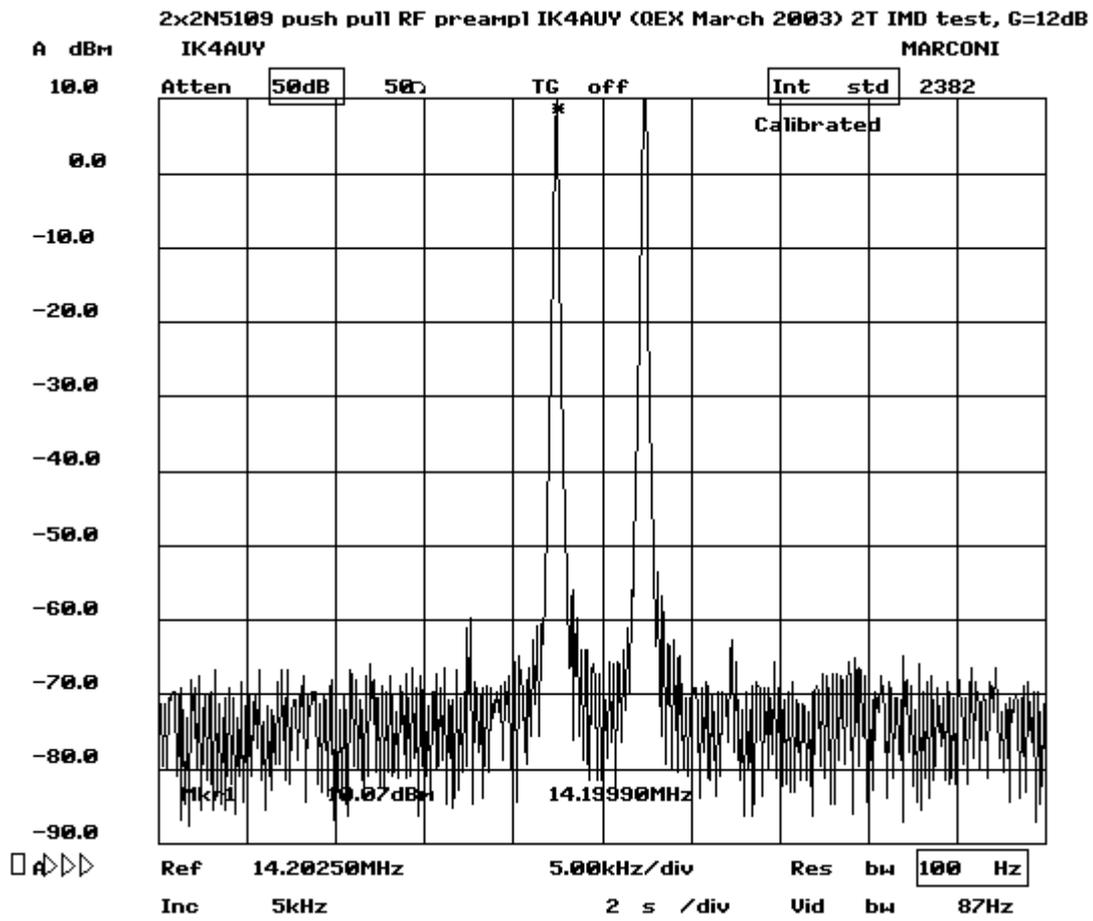
So OIP3 referenced to the output of the preamplifier is **+40dBm**, very nice.

I tried to lower a bit the input power of the 2 RF Generators and so for an input power of **-10dBm** and output power at **+3dBm** here is the spectrum analyser image:



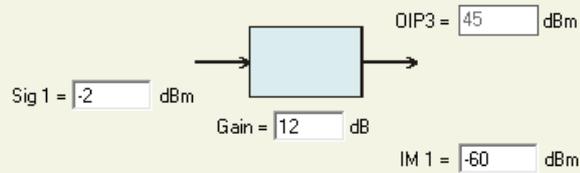
The 3<sup>rd</sup> order IMD response power out is way down may be about 15dB than before.

The same test as been performed at 14.2MHz. so here are the screen shots for the 14.2MHz 2T IMD test at the very high output level of +10dBm, the gain here is 12dB (only 1dB lower in comparison to the gain at 1.8MHz which was 13dB), so the input power level was -2dBm, a very high one, since it equates 71dB over S9 for the standard reference of S9=-73dBm.



We can see the power level response for the 3<sup>rd</sup> order IMD product at about -60dBm.

# Intermodulation Calculator

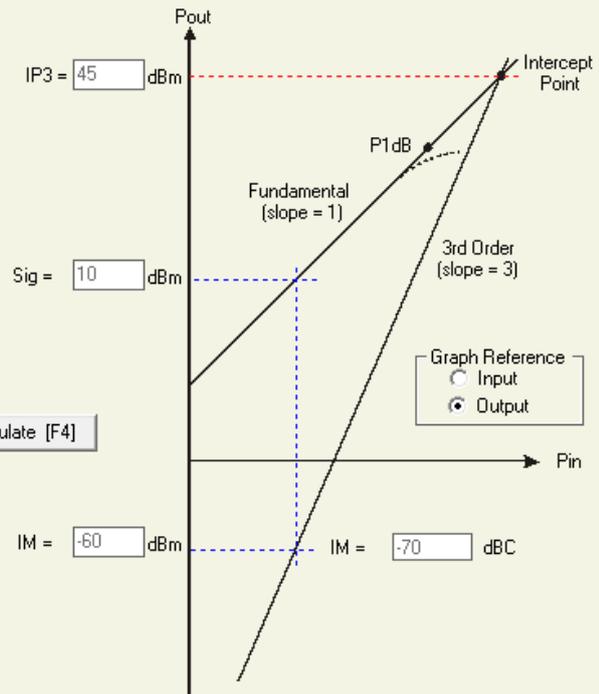


1. IP3 reference  Input  Output
2. Signal reference  Input  Output
3. IM reference  Input  Output

Note: Sig is level of each individual signal

5. Calculate
- IP3      Given: P<sub>sig</sub> and IM level
  - IM level    Given: P<sub>sig</sub> level and IP3
  - P<sub>sig</sub> level    Given: IP3 and IM level

Calculate [F4]



So OIP3 referenced to the output of the preamplifier is +45dBm at 14.2MHz, very very nice indeed.  
 Gain is within 1dB in the HF range.

Hope this short report has been of your interest. Best 73 de Sergio Cartoceti, IK4AUY.