

# **EVLA ELECTRONICS MEMO #147**

## **GAIN EXPANSION MEASUREMENTS OF THE UX CONVERTER**

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### **I. Abstract**

Since gain expansion can have adverse effects on system temperature, it has become necessary to test the EVLA UX converter. A test set was developed to directly measure gain expansion. The results show some small amount of expansion but not enough to cause concern.

### **II. Introduction**

Gain expansion is a phenomenon that occurs within FET amplifiers. The gain of the amplifier increases as the input power level is increased. This often results in higher 1dB compression points and higher inter-modulation products. This effect generally is the result of rectification of the RF on the gate of the FET changing the FET DC bias point. Some changes in system temperature have been seen on EVLA antennas and there is some concern that they may be due gain expansion effects within the UX converter. This memo describes the gain expansion tests made on one UX converter.

### **III. Tests and Setup**

The tests were performed on one UX converter. Only one CW IF frequency was used along with one LO frequency. Two different LO power levels were chosen because we were concerned that our LO drive levels may be too low and we were starving the mixers. The main goal was to see if any gain expansion existed. Figure 1 shows the test setup. The LO frequency was 12.1 GHz and the IF frequency was 16.0GHz. Power level of the LO was first set to 9.2 dBm and then set to 15.2 dBm. The IF power level was set to -31 dBm and increased in one dB steps to +10 dBm. The power meter was used to ratio the input and output power levels and an offset was added to put the reading near zero.

### **IV. Results and Conclusion**

The results are shown in Figure 2. The X-axis shows the varying power level in one dB steps from -31 dBm to +10 dBm and the Y-axis shows the change in gain through the UX converter. There are two separate plots shown in Figure 2 for the two different LO power settings. All settings except the LO power are the same for the two different plots. As one can see there is very little difference between the plots so I can conclude that changing the LO power has no effect on the UX converter output and the mixer is being operated normally. There is some slight gain expansion seen. The gain expands about .25 dB over an input power change of 30 dB. I conclude that gain expansion for the UX converter is not a serious issue.

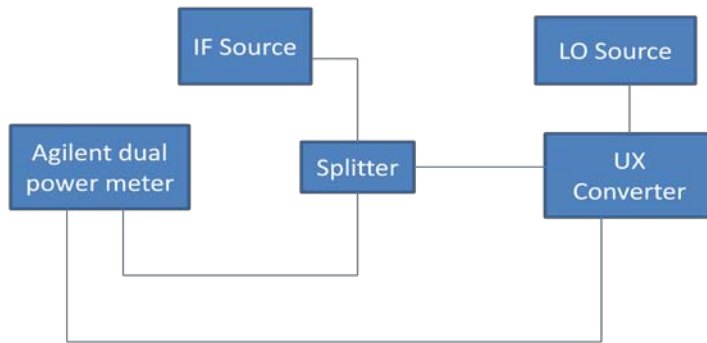


Figure 1 Test Setup

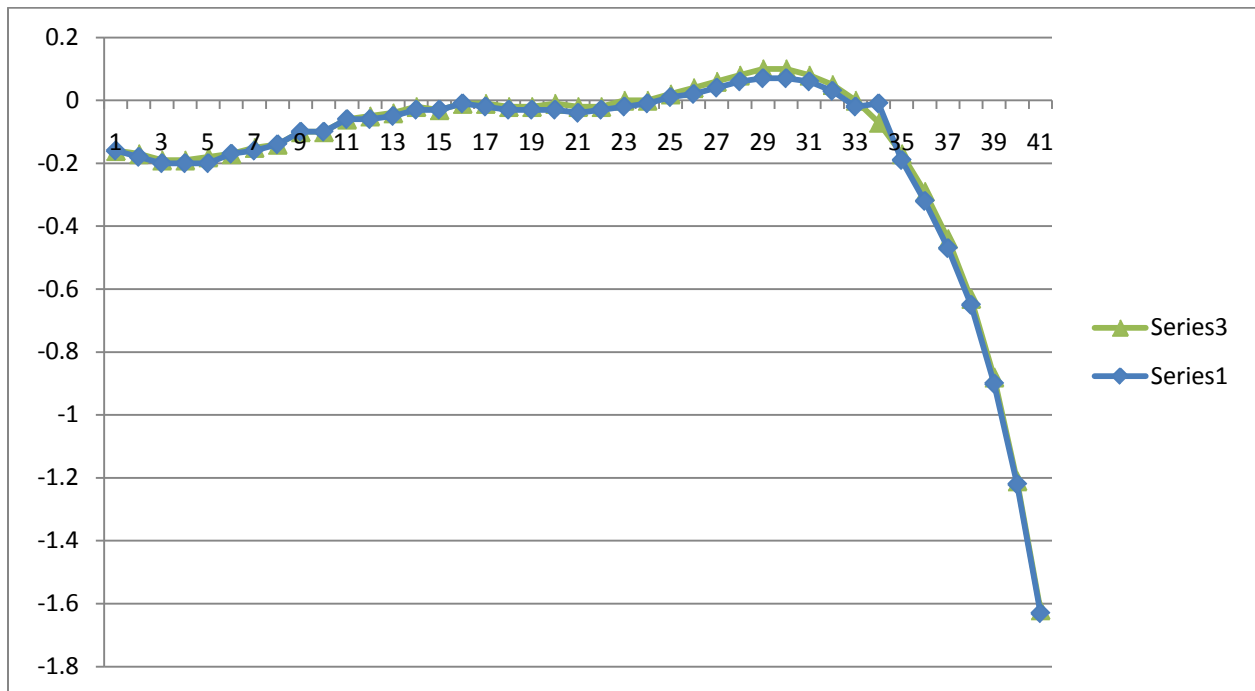


Figure 2 Results