Avalanche Transmission Line Pulse Generator – part II

Introduction

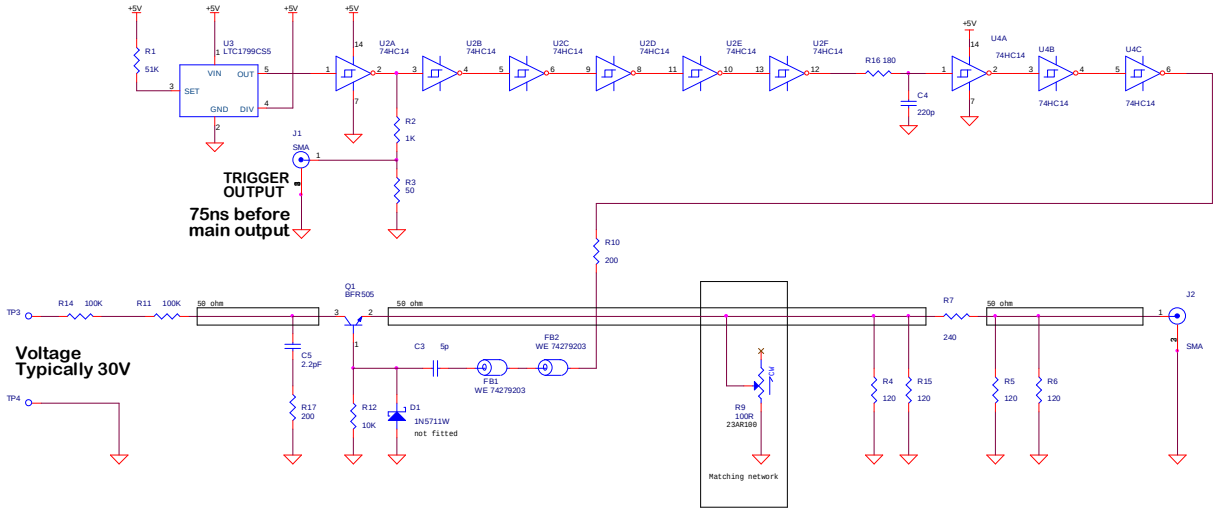
This document is a continuation of the original Avalanche Transmission Line Pulse Generator. Since the original report was created I have acquired a Tektronix 11801 mainframe and SD-24 sampling head. This is a bandwidth of 20 GHz.

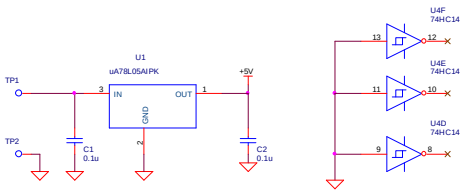
The sampling scope requires a pre-trigger signal at least 60ns before the pulse. There is no delay in a sampling scope so it is not possible to see the trigger event.

I have also switched to using a BFR505 SMD transistor, instead of the 2N2369A transistors popularized by Jim Williams. The BFR505 is faster and will also avalanche at lower voltages, around 30V.

Schematic

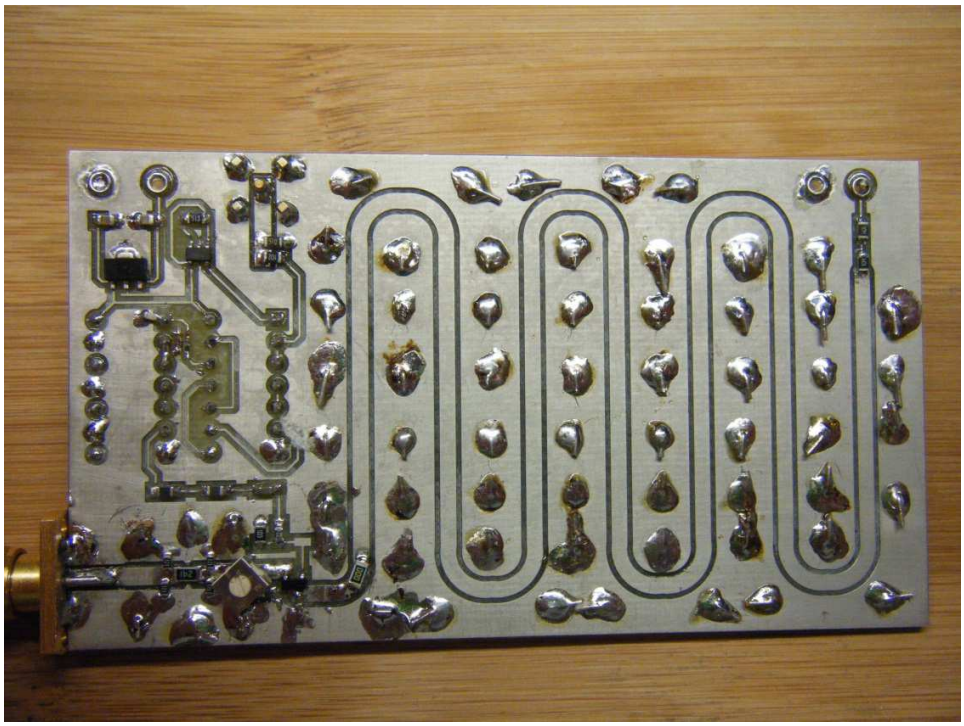
The schematic is pretty simple. A string of 74HC14 inverters is used to create the pre-trigger delay.



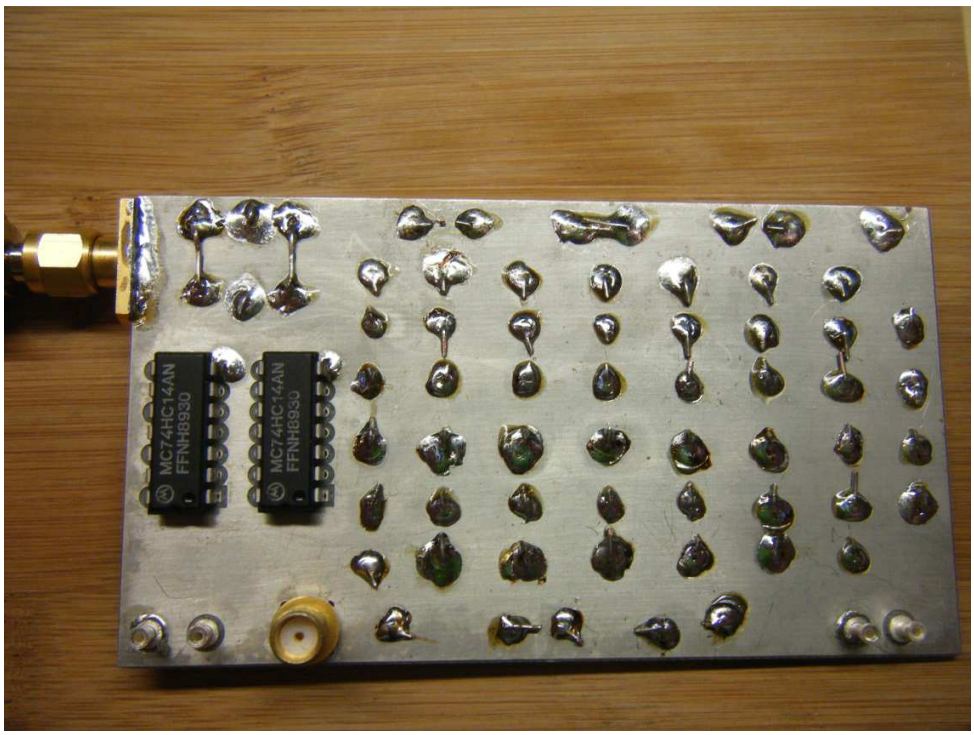


Transmission Line Avalanche Pulser

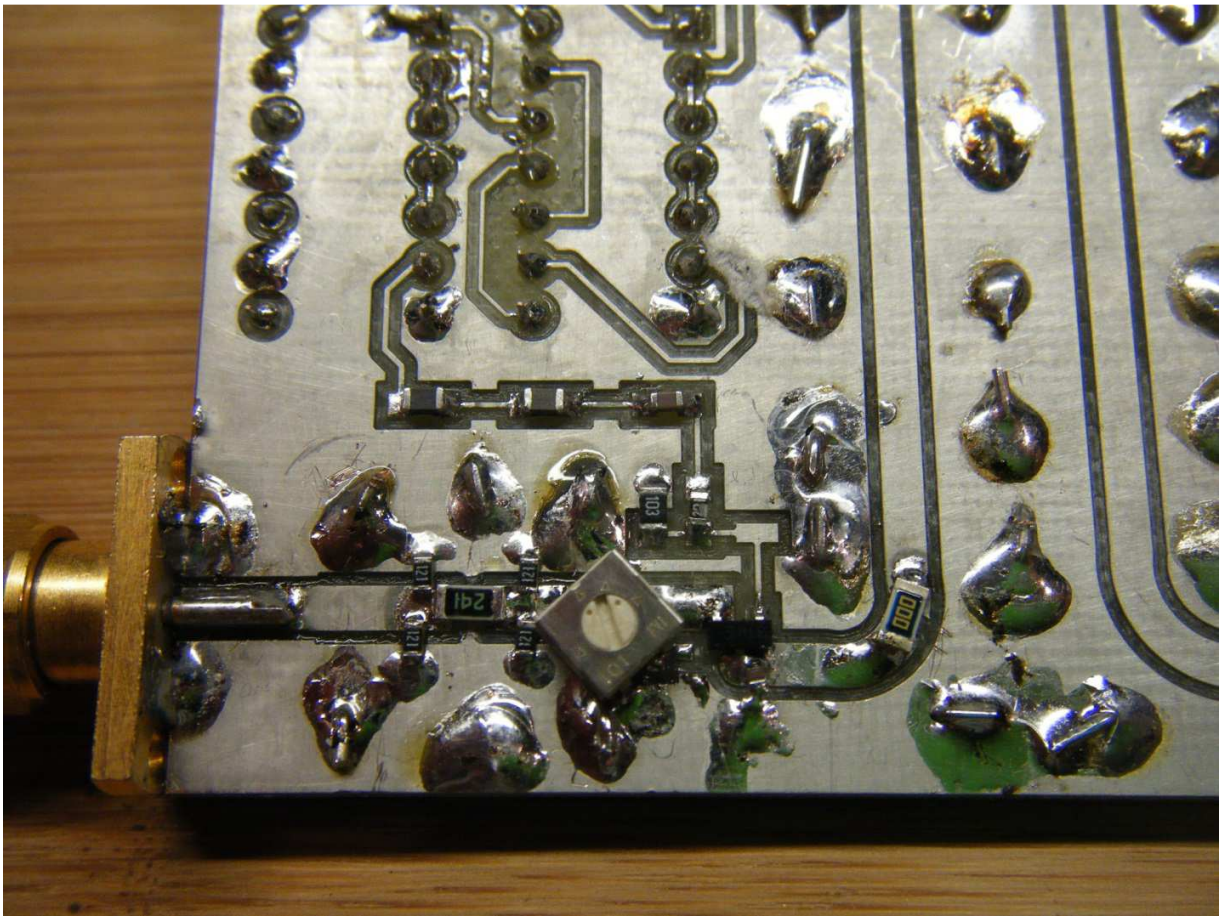
Construction



The coplanar waveguide is 80 thou track with 20 thou gaps.



Lots of short wires connect the top and bottom ground planes

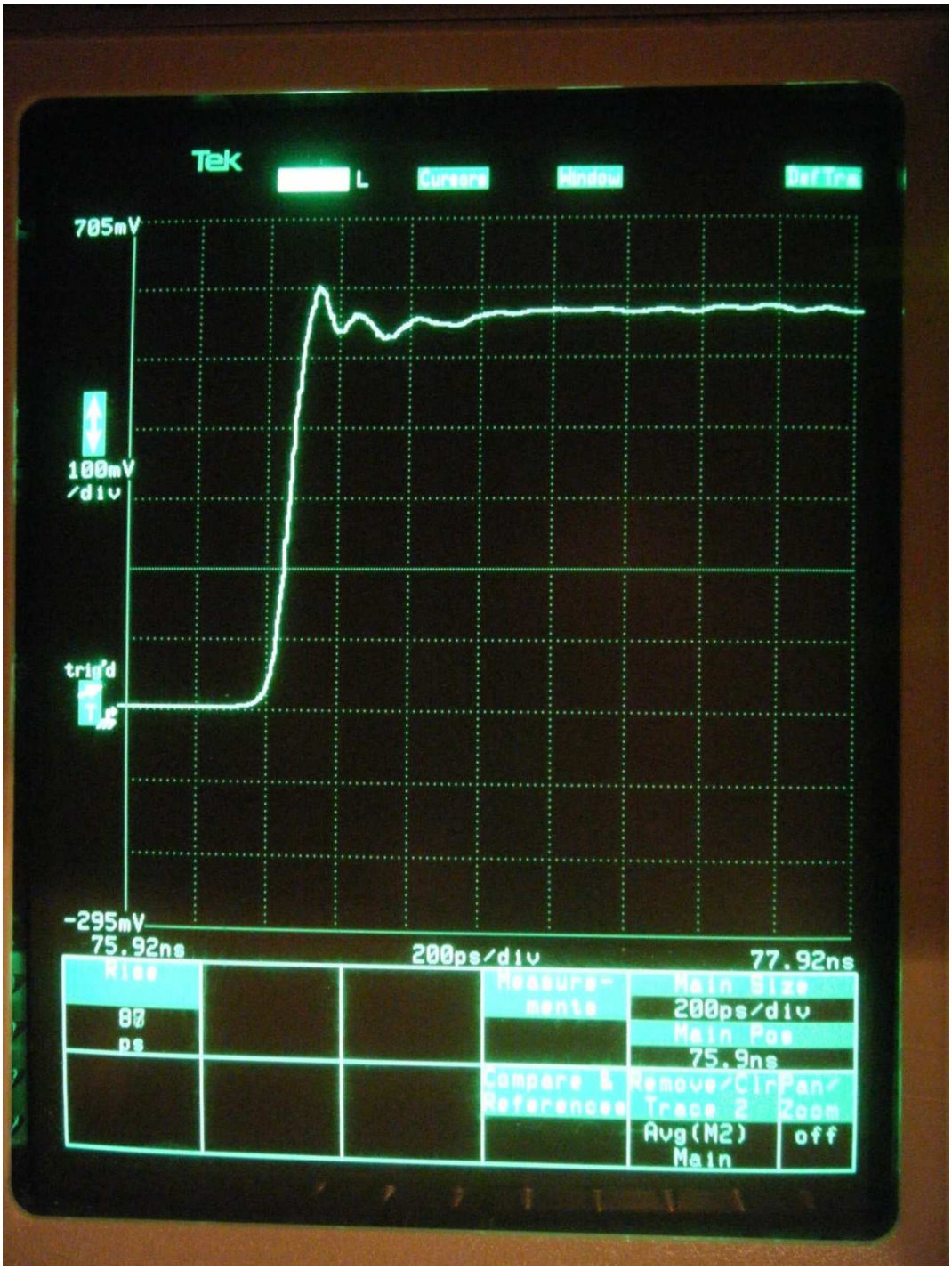


This is the important area of the board.

The zero ohm resistor on the right is not required, I had cut the track to do some TDR measurements on the line.

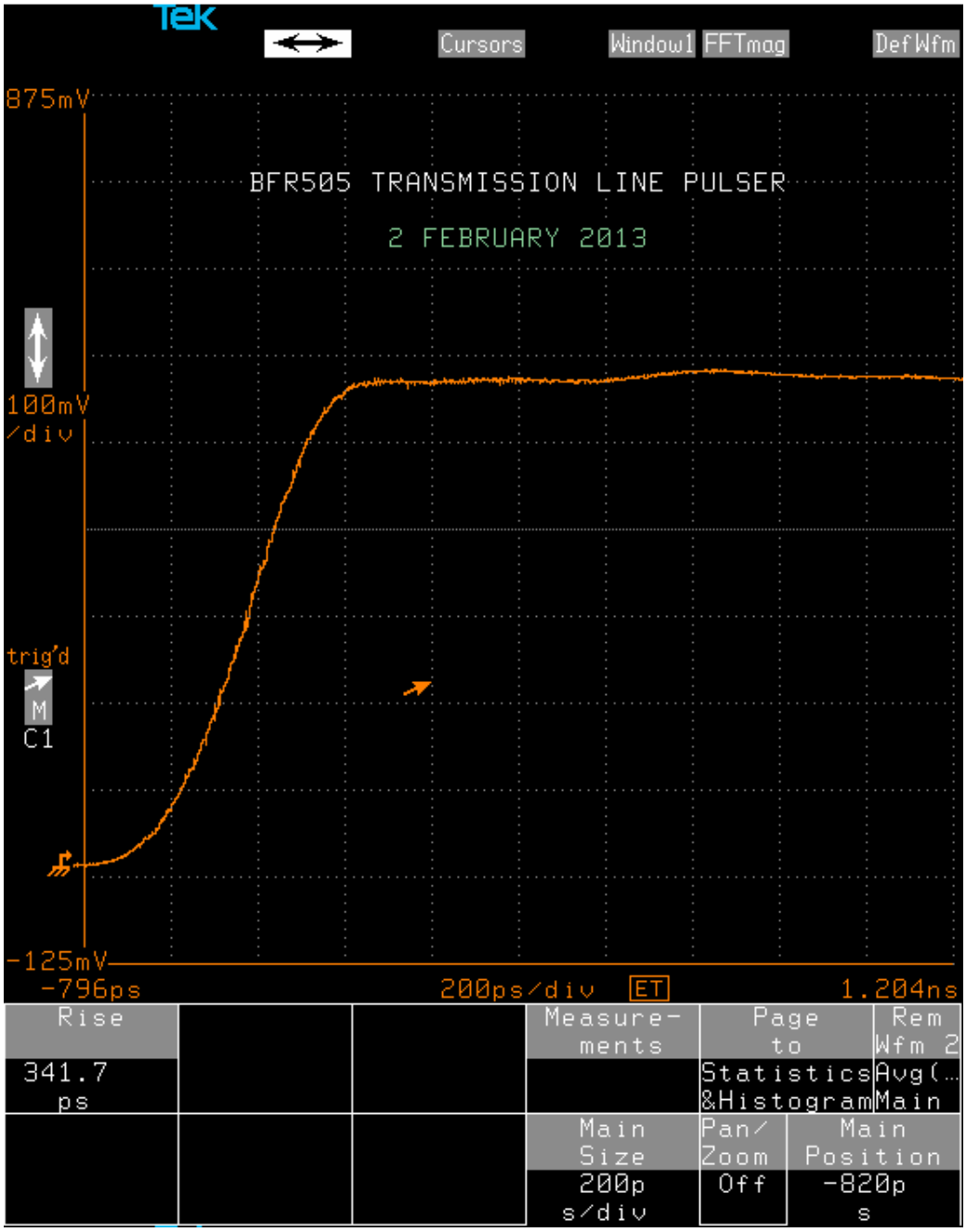
Results

Picture 1 - Measured with Tektronix SD-24 in 11801 mainframe 20 GHz sampling scope. Full pulse 1ns/div

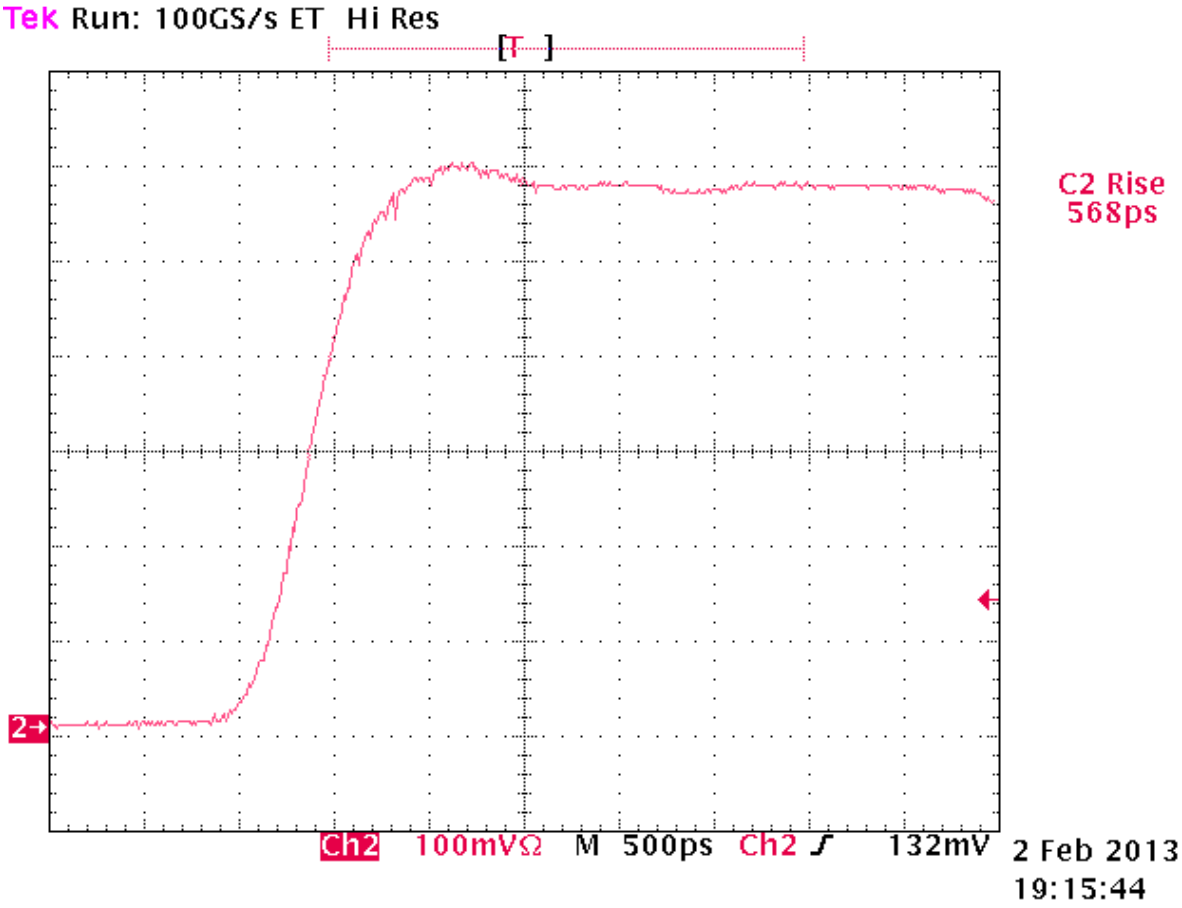


Picture 2 - Measured with Tektronix SD-24 in 11801 mainframe 20 GHz sampling scope. Risetime 200ps/div

Picture 3 - Measured with Tektronix SD-24 in 11801 mainframe 20 GHz sampling scope.
Risetime 100ps/div
Measured risetime is 78ps (light travels 25 mm in 78ps, a signal on the board about 17mm)



Picture 4 - Measured with Tektronix 11A71 in a DSA602A mainframe 1GHz scope. risetime 200ps/div



Picture 5 - Measured with Tektronix TDS754A 500MHz scope.
risetime 500ps/div

Measured risetime is consistent with measured bandwidth = 340 / .568 = 619 MHz.

Conclusion

I am reasonably happy with the results that I have obtained.

John

February 2, 2013