DQLPUR Prototype Testing

Initial Results:

- Thermal Tests
- Voltage Drop Off Tests

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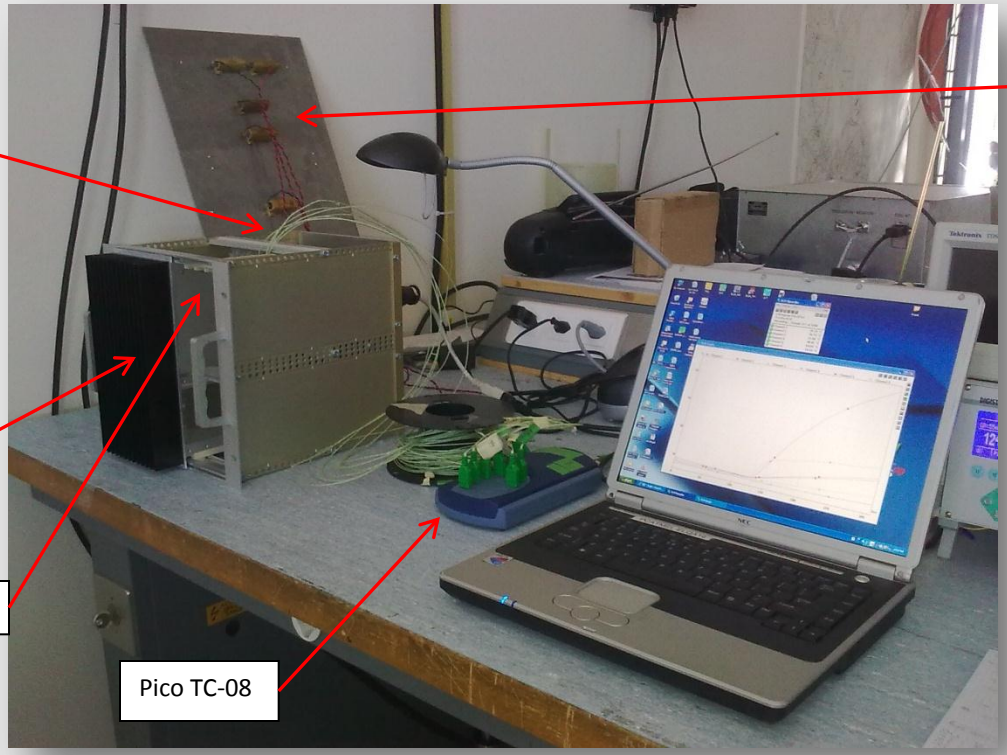
Thermal Testing

- This is an initial report into the thermal and voltage characteristics of the prototype DQLPUR unit.
- Twice the nominal current was pulled through one unit (to simulate the failure of one UPS) via a bank of power resistors and coupled up to eight, type ‘K’ thermocouples for temperature monitoring.
- These thermocouples were used in conjunction with a Pico TC-08 measurement device which relayed the data to a laptop.



Thermal Testing

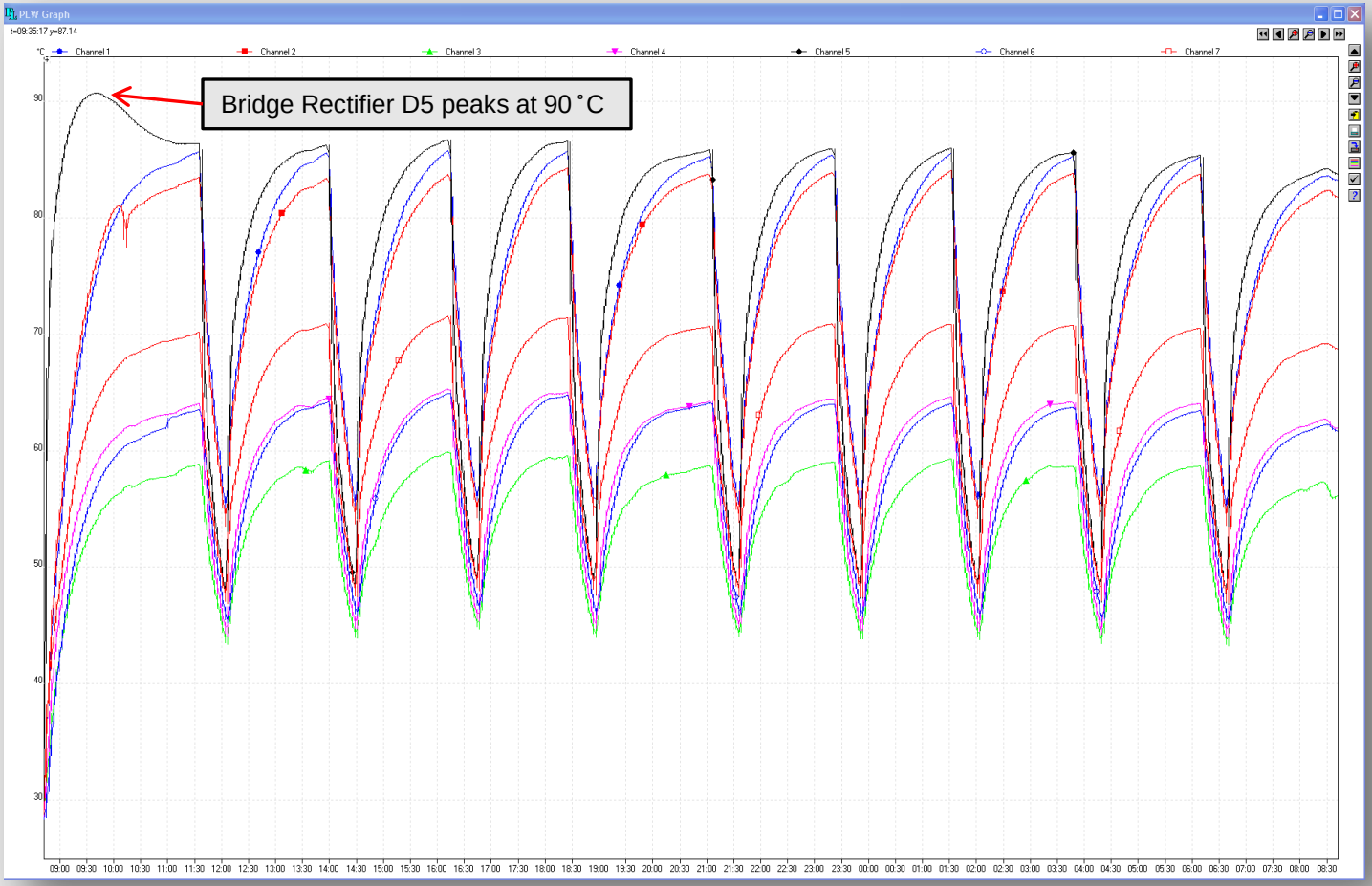
- The thermocouples were secured with heat resistant tape on various heat critical components.
- The channel distribution was as follows:

  Channel 1 = Toroidal Transformer (under rubber lip at center)
  Channel 2 = Toroidal Transformer (under rubber lip at center, opposing side to Ch1)
  Channel 3 = Regulator IC3
  Channel 4 = Regulator IC2
  Channel 5 = Bridge Rectifier D5 (on the card which is drawing the most current)
  Channel 6 = Connector at rear of Power Supply (for general internal temperature)
  Channel 7 = Bridge Rectifier D5 (on the card drawing the lower current)
  Channel 8 = Ambient temperature external to the power supply

- The temperatures were sampled at 1 sec intervals over the course of 24hrs.
- The Power Supply was switched on 60secs after the temperature logging commenced to observe the behavior of the supply when first switched on from cold.
- All components stabilized with respect to temperature after 2.5 hrs.

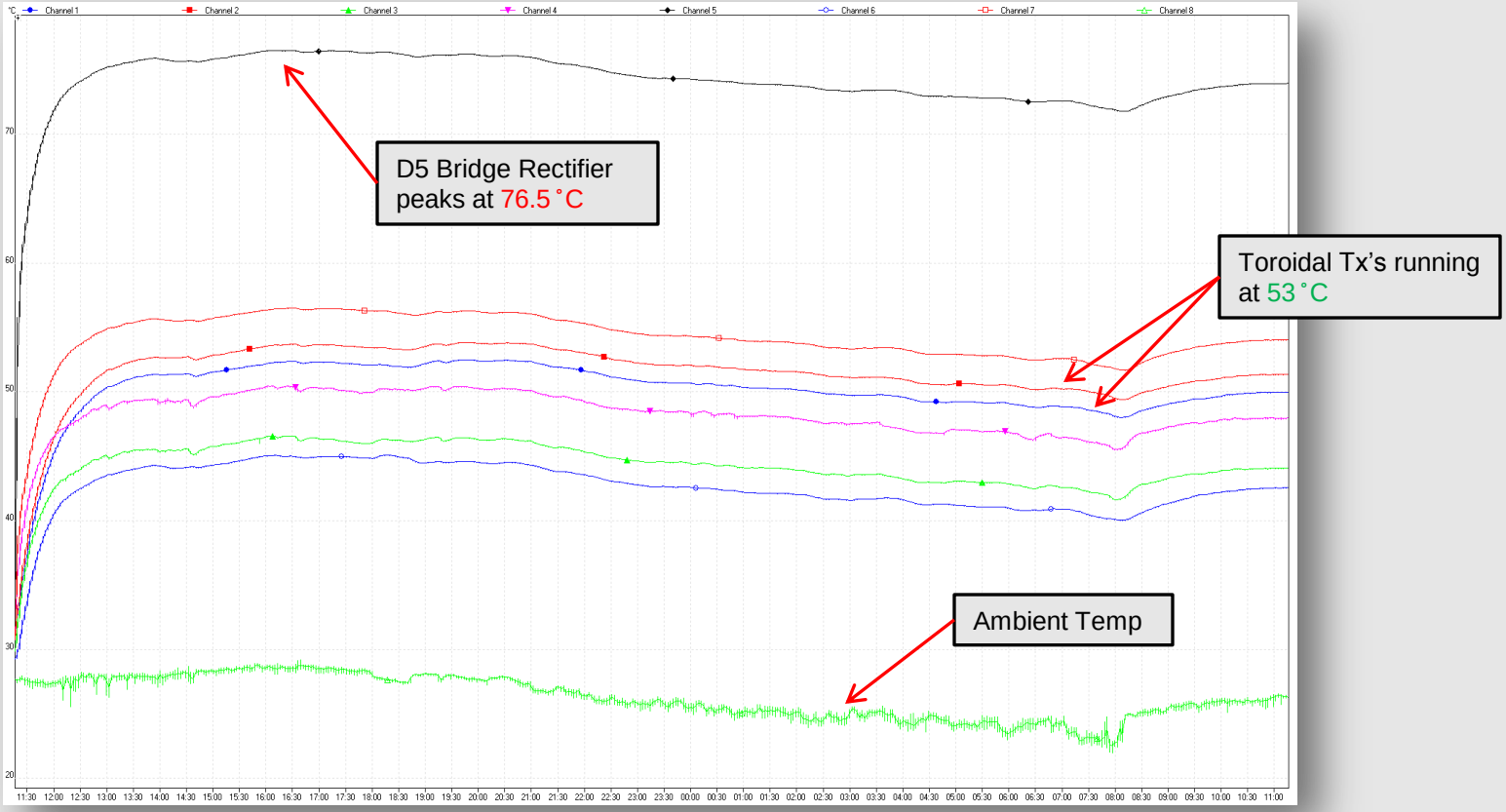
Results of the 1st Thermal Test

- The first 24hr Thermal test was performed with a power consumption of 65W, simulated via the resistor bank. As shown below, the test revealed the internal thermal switch of the torodial transformer was cutting out at around 85˚C. The maximum temperature displayed by any component was 90˚C. This was the Bridge Rectifier D5 on the PCB drawing the most current.



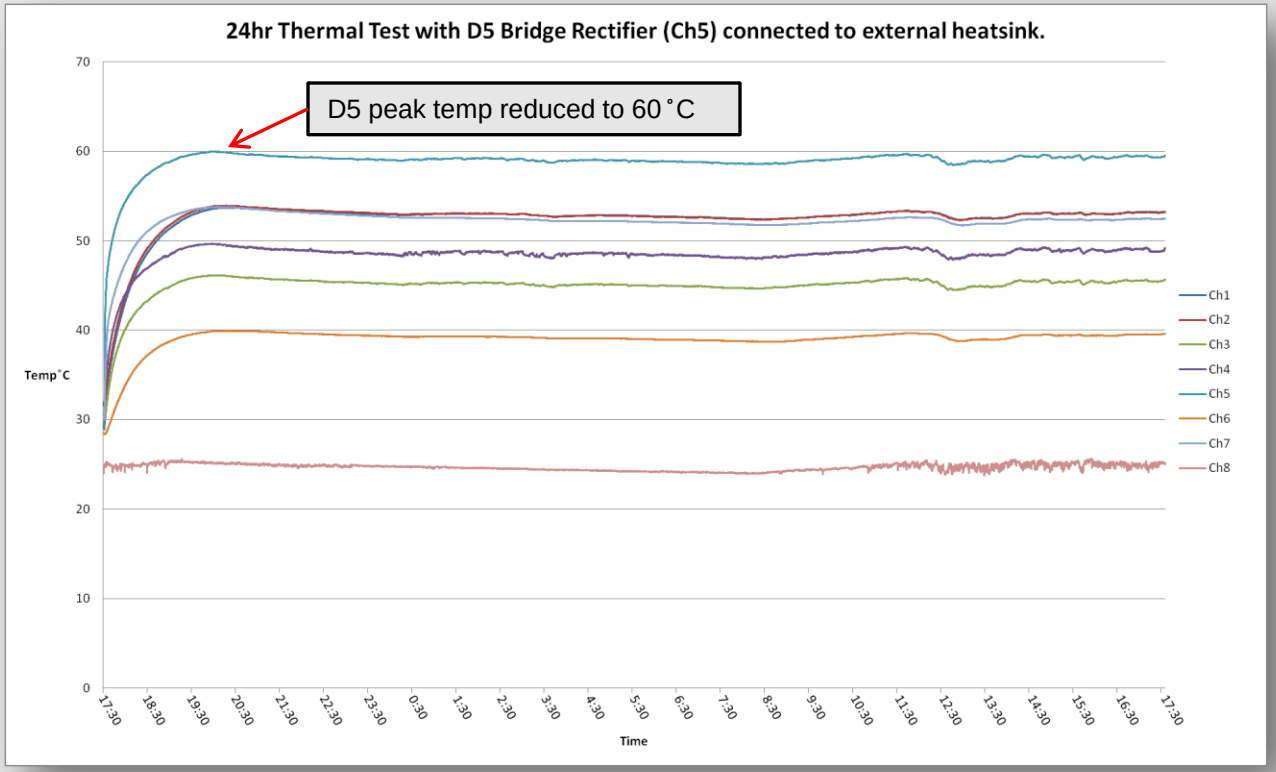
Results of the 2st Thermal Test

- Following the 1st thermal test the estimated power consumption was revised, with the new figure giving us a total maximum power of 40W including the bias current. This was drastically less than the previous estimate of 65W. With the difference in load we saw a sizable reduction in the overall temperatures. The Bridge rectifier D5 on the PCB drawing the most current was still operating above what would be considered a desirable operating temperature.



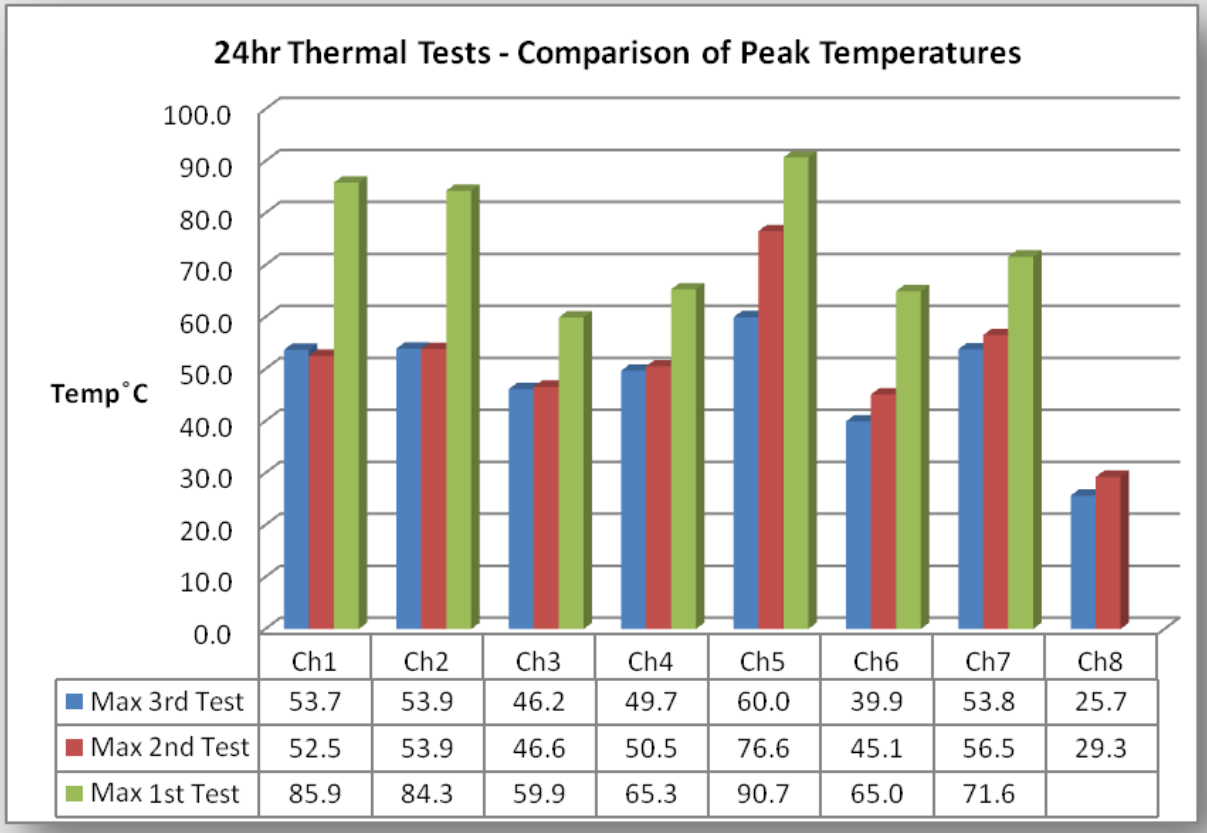
3rd Thermal Test

- Following the 2nd test a series of shorter (4hr) tests were performed with various types of internal heatsinks attached to the D5 Bridge Rectifier.
- During these tests the D5 Bridge rectifier temperature was only reduced by a maximum of 3˚C thus confirming an internal heat sink would not provide an adequate means of heat dissipation.
- For the 3rd 24hr Thermal Test we attached the D5 Bridge Rectifier to the large external heat sink via jumper cables.



3rd Thermal test

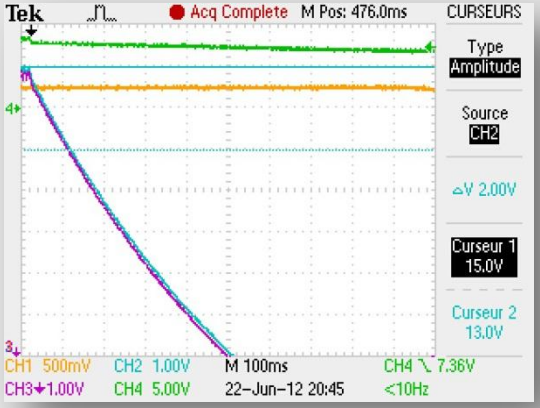
- By attaching the D5 Bridge Rectifier to the external heatsink we gained a reduction in temperature of 16.6˚C when compared to the 2nd test.
- The table below shows the evolution of the temperature measurements over the 3 tests due to the reduction in estimated power consumption and the repositioning of the D5 Bridge Rectifier.

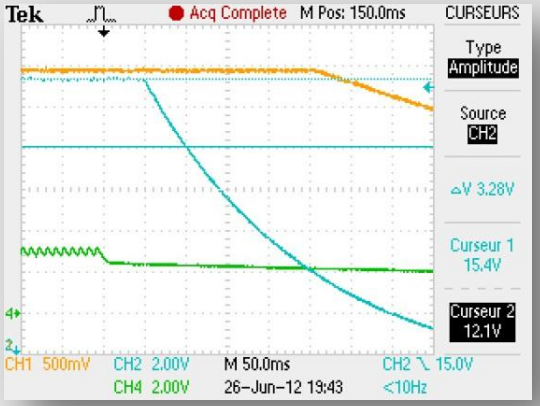


	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8
Max 3rd Test	53.7	53.9	46.2	49.7	60.0	39.9	53.8	25.7
Max 2nd Test	52.5	53.9	46.6	50.5	76.6	45.1	56.5	29.3
Max 1st Test	85.9	84.3	59.9	65.3	90.7	65.0	71.6	

Initial tests of voltage decay after loss of power

- With the first DQLPUR prototype Joaquim performed a series of tests to measure the evolution of the six main DC voltages following a mains power cut.





Isolated voltages (nominal load)

	At t = 0	At t = 100 ms	At t = 1 s
$U_{5.6V\_CH1}$	5.53 V	5.53 V	5.5V
U_{15V_CH2}	14.96	13.0 V	
U_{-15V_CH3}	14.96	13.0V	

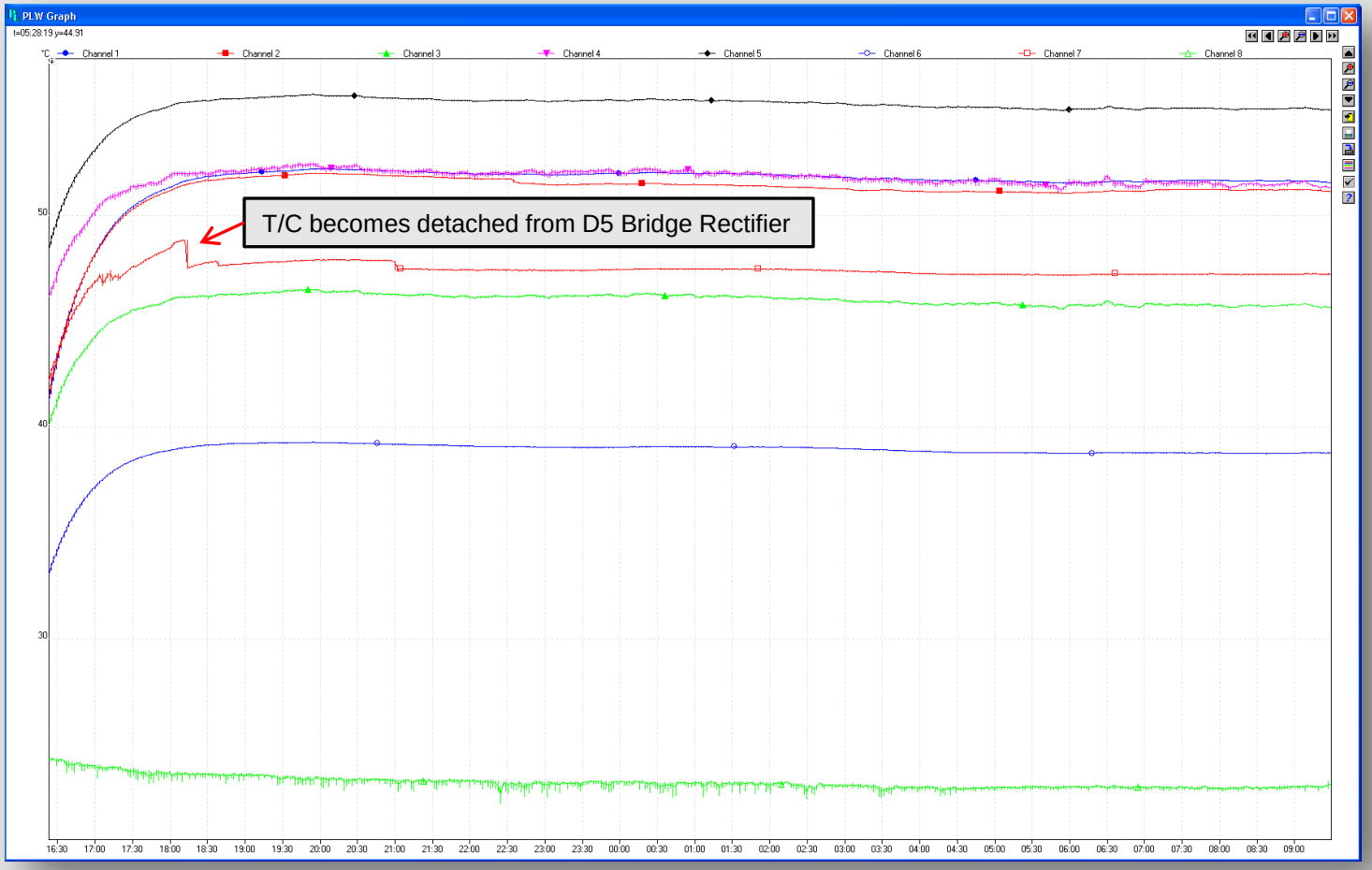
Common voltages with $U_{5.6V}$ with I_{nom} & U_{15V} with 2 × I_{nom}

	At t = 0	At t = 100 ms	At t = 250 ms
$U_{5.6V\_CH1}$	5.52 V	5.52 V	5.52V
U_{15V_CH2}	15.4	12.1 V	

Courtesy of Joaquim Mourao

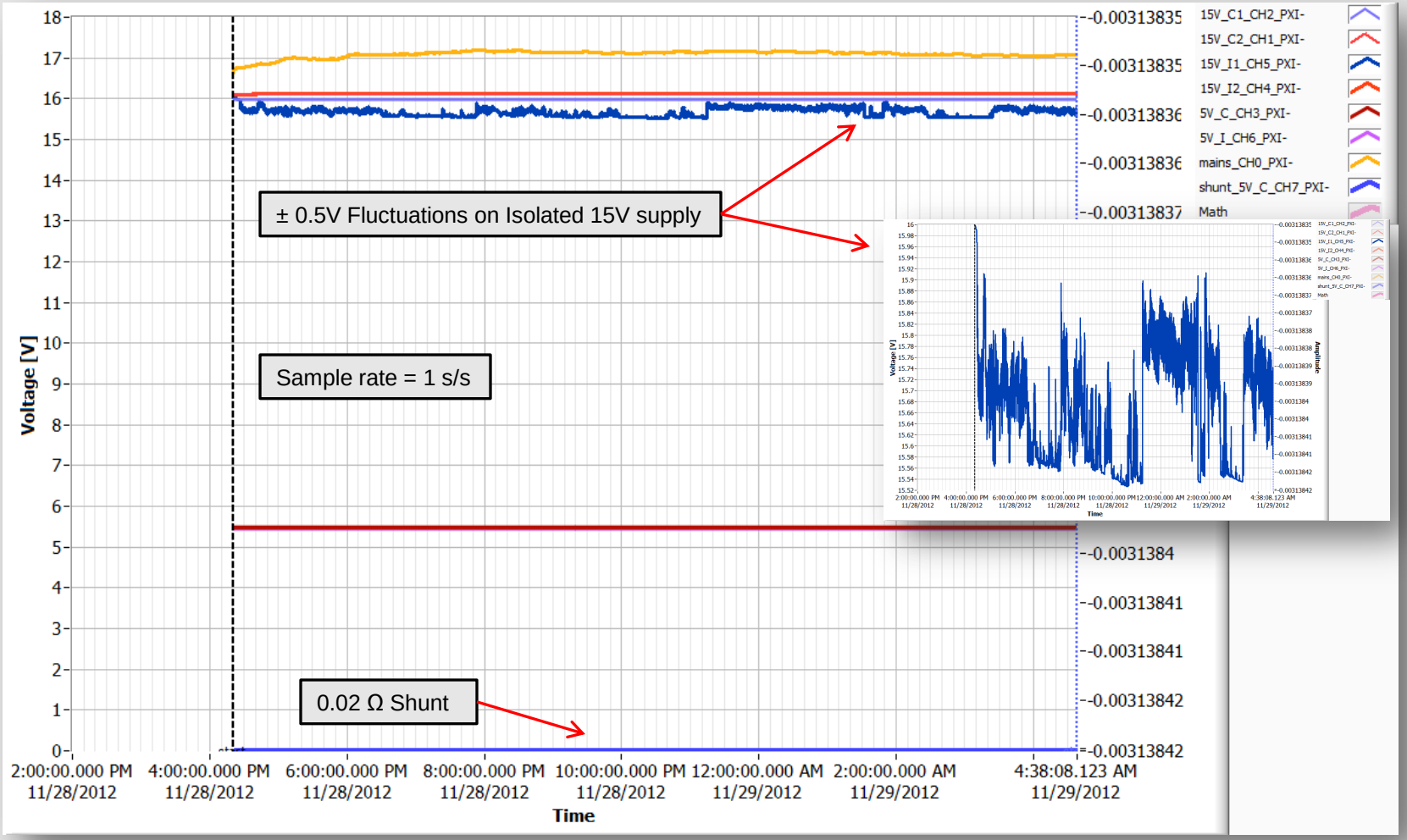
2nd Prototype Testing

- Following the production of the second prototype power supply a new series of tests have begun.
- We have performed a 12 hour run with the thermal measurement system whilst simultaneously measuring the output voltages with a PXI. All tests are performed with **2 × I_{nom}.**



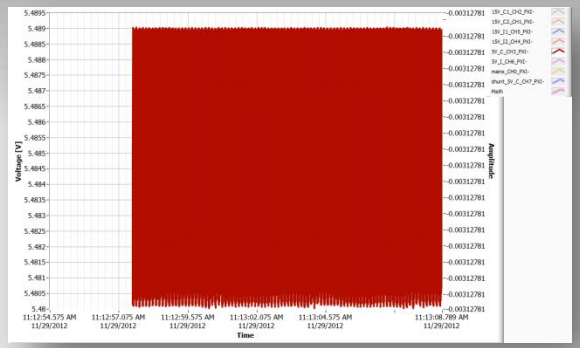
2nd Prototype Testing

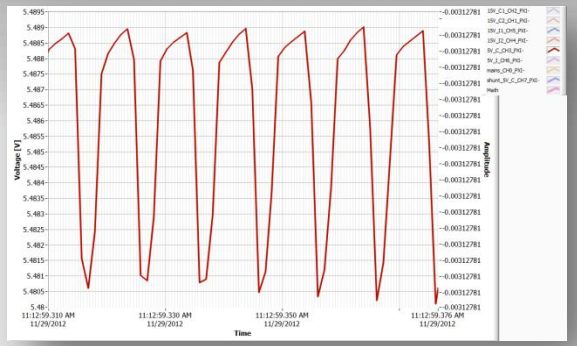
- The PXI results show that 5 of the DC outputs were stable over the 12hr run, however, it showed an instability with the isolated 15V supply.



Initial Ripple Testing Measurements

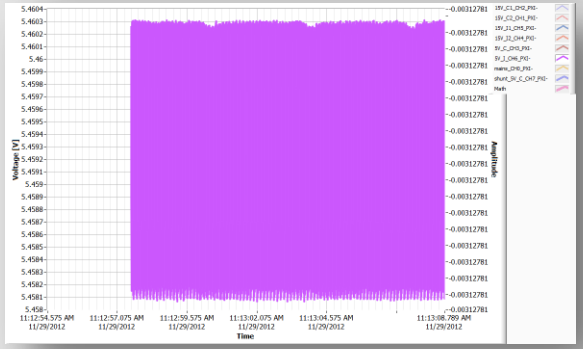
O/P = 5.6V Common
(2A)
± = 9mV ripple

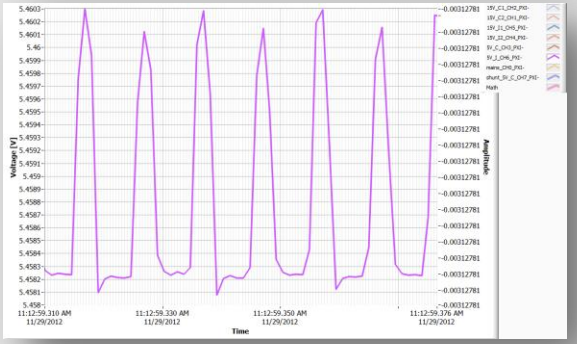




O/P = 5.6V Isolated

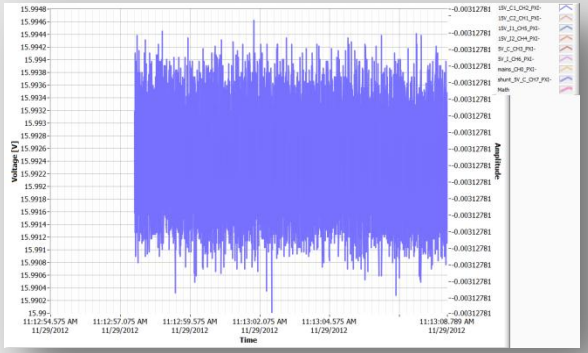
± = 2mV ripple

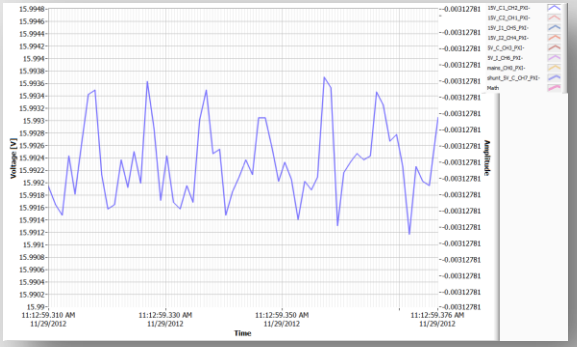




O/P = 15V Common 1

± = 3.5mV ripple

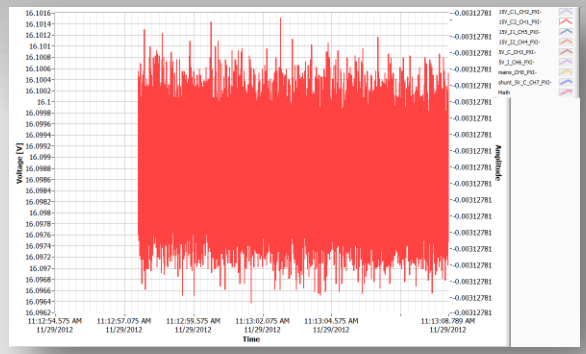


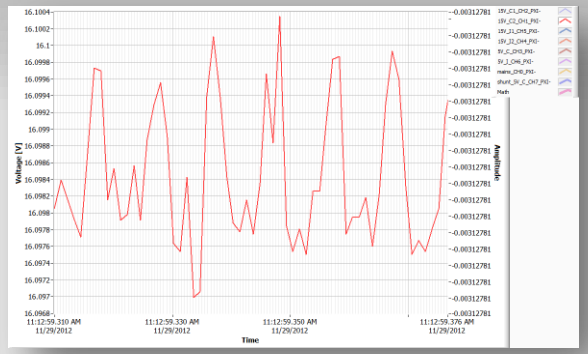


Initial Ripple Testing Measurements

O/P = 15V Common 2

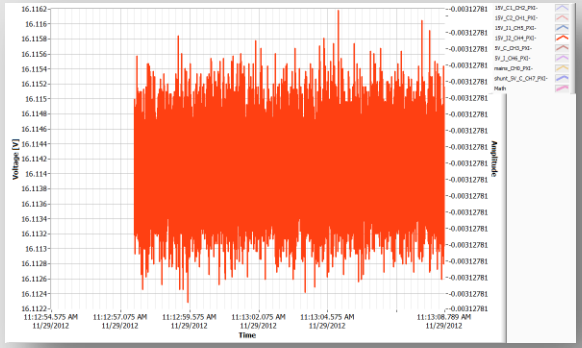
± = 3mV ripple

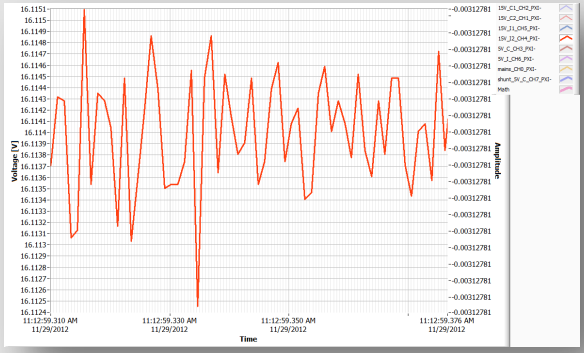




O/P = 15V Isolated 2

± = 3mV ripple





- The measurements for the 1st isolated 15V supply are not shown as testing is ongoing to establish the cause of the instability.
- We are currently running the supply with additional measurement points directly soldered to the O/P of the regulator as we suspect a connection or wiring issue within the O/P circuit.

Further Testing

- Once we have rectified the instability with the 15V supply a retest of the 24hr thermal and voltage measurements will be done.
- Mains cut off testing will be done using the current test set-up.
- We will also be performing some short-circuit testing of the supply.