

# WRS-FL TEMPERATURE TEST REPORT

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## INTRODUCTION

The WRS-FL is based on the open-source design of WRS, with improved heat dissipation to remove the two FANs by optimizing the power circuit and PCB layout. This report shows the temperature measurement results of WRS-FL.

## EQUIPMENTS

- 1、NAPUI TR230X-56 Temperature Recorder with 16 channels



- 2、Victor 470 Power Meter



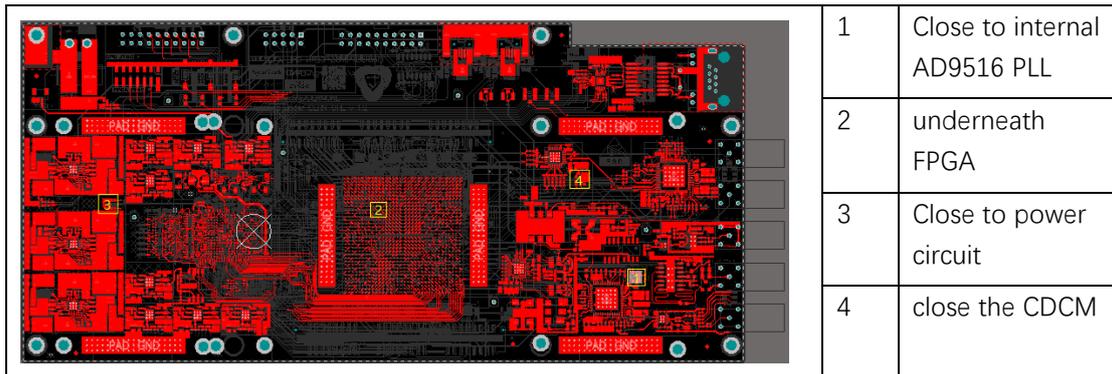
- 3、WRS-FL v1.2



## TEST SETUP

In each test, the thermocouple probes are fixed to interested locations with thermal-conducting tapes, the NAPUI device is set to record temp. at 3 second interval, The probes are stick on different places in each test setup.

The four temperature sensors mounted on WRS-FL SCB are sampled and recorded ( wr\_mon – t >> temp\_rec.log ). Since the sensors are soldered onboard thus the results among different test setups can be compared. The locations of the four sensors are shown below:



The power consumption of the WRS-FL is measured with Victor 470 power meter.

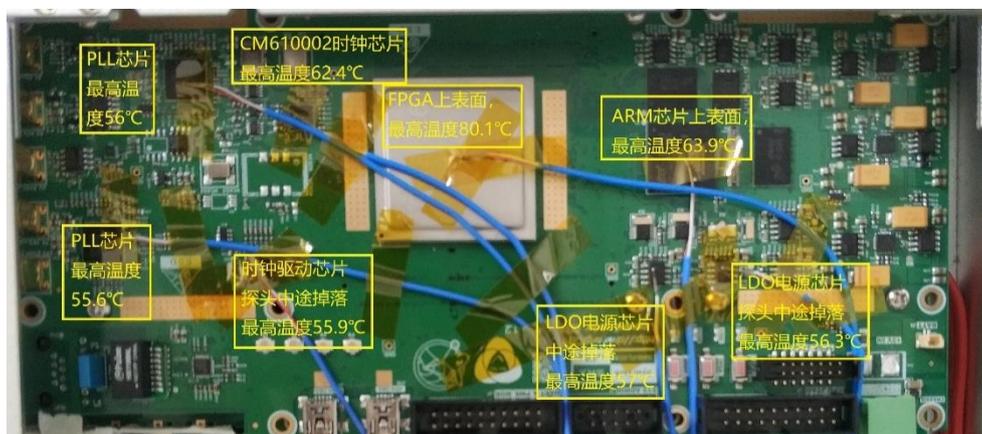
Initial phase after power up	<b>5.7W</b>
Normal Operation (without SFP)	<b>12.1W</b>
Normal operation (with 18 SFPs) *	<b>25.2W</b>

\*: More LDOs have been added on the backplane for the SFP circuit that consume more power.

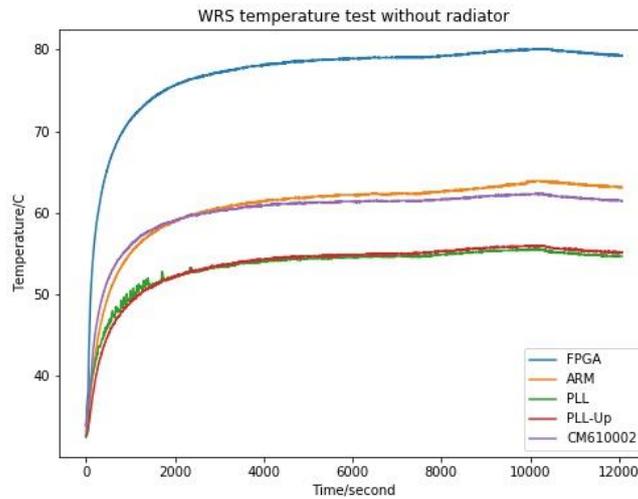
## TEST RESULTS

### 1: WRS-FL W/O HEATSINK UNDER ROOM TEMP.

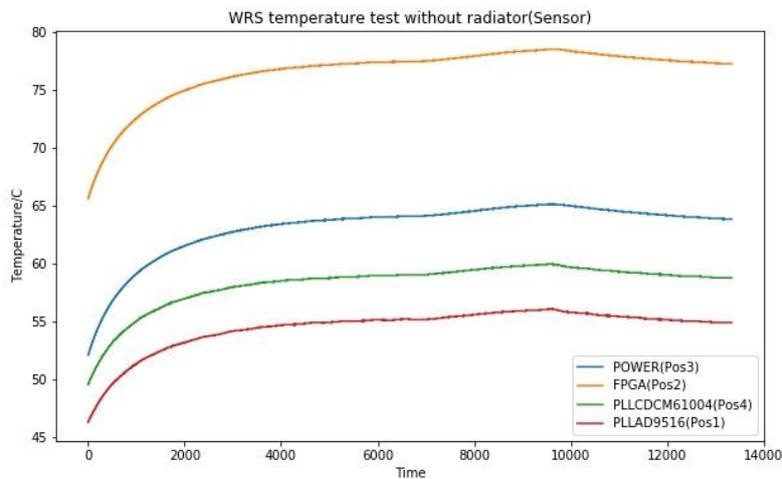
The WRS-FL is placed in room temperature, the heatsink is NOT mounted. The room temperature is about 25°C.



The temperature recorded by the NAPUI TR230X-56 are shown below:



The temperature recorded by the WRS-FL are shown below:

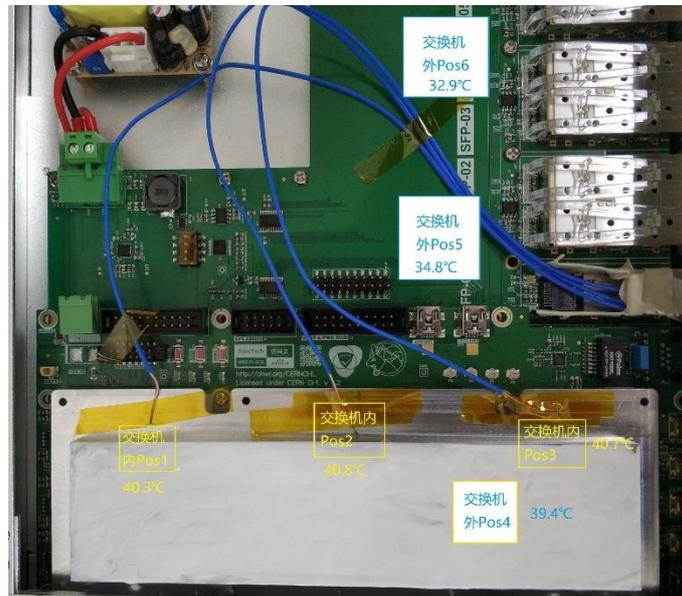


The results of NAPUI and WRS-FL are consistent to each other. The FPGA is the hottest spot and the power and clock circuit are relatively lower.

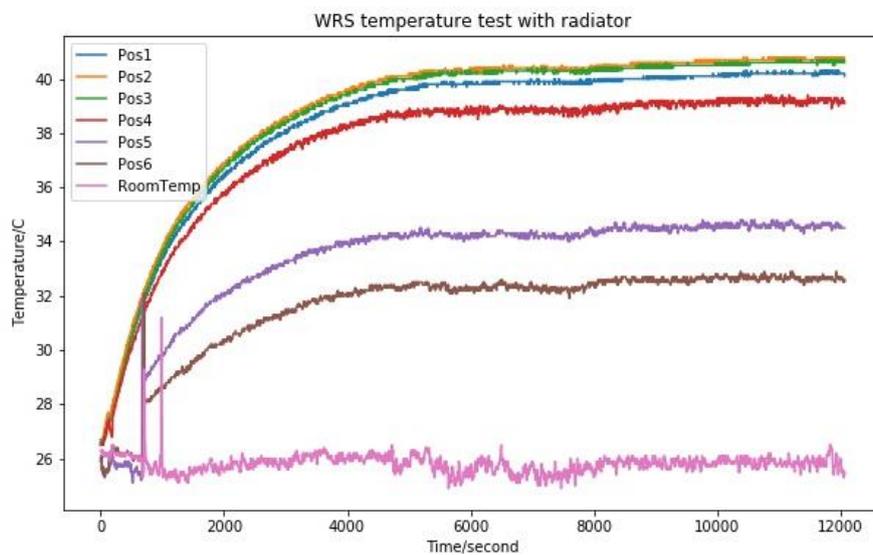
## 2: WRS-FL WITH HEATSINK UNDER ROOM TEMP.

Then the heatsink, an aluminum block that is CNC customized for the WRS-FL, is installed. The heatsink attached to the components with thermal grease. The thickness of grease is between 5mm to 10mm to cope the height difference of the components. The top surface of the heatsink attaches the top cover of the box with another large grease.

Three thermocouple probes are fixed on the heatsink, another three on the top cover with different distance to the SCB location.

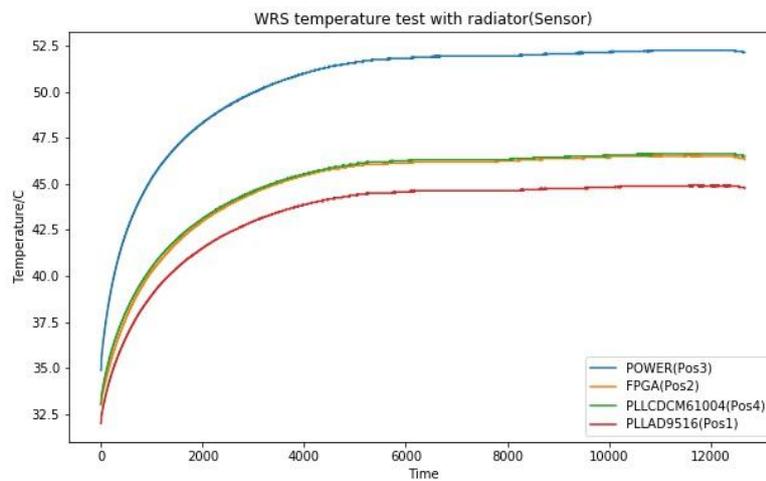


The temperature recorded by the NAPUI TR230X-56 are shown below:



(pos1-3 are probes on the heatsink, pos4-6 are probes on the top cover)

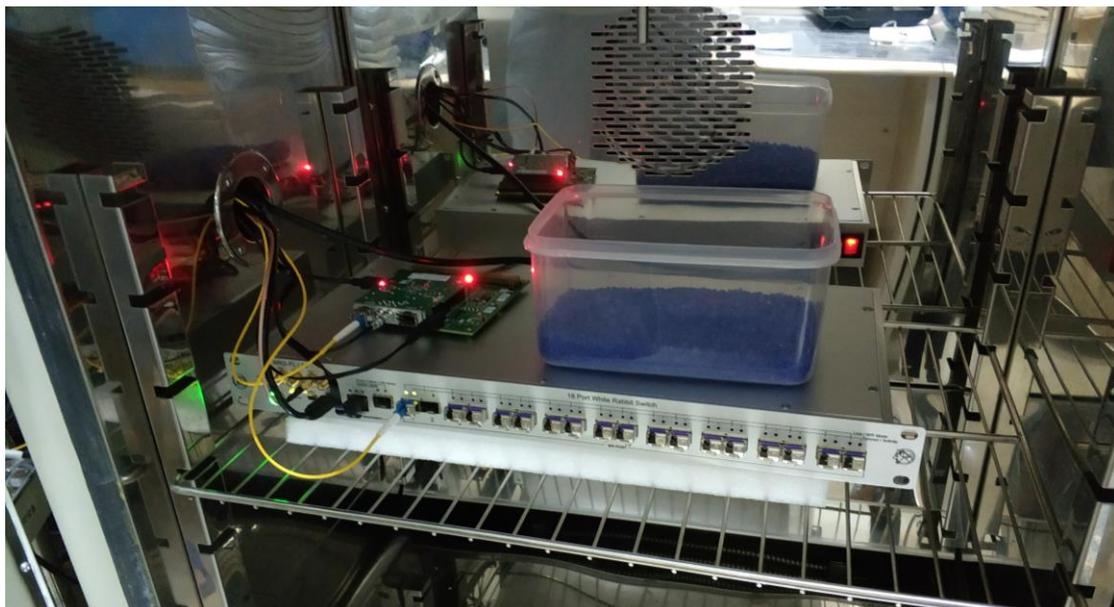
The temperature recorded by the WRS-FL are shown below:



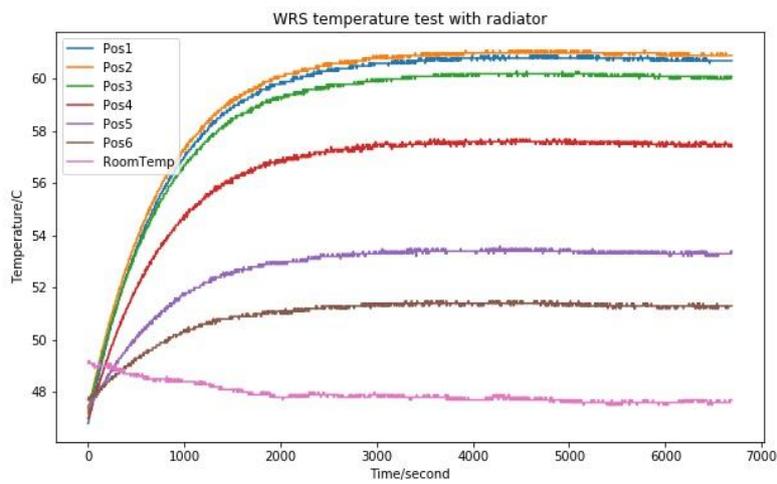
With heatsink, the temperature of the FPGA drops about 30°C, the other parts drop about 10°C. There are still about 6°C temp. difference between FPGA and heatsink which indicates the grease can still be improved. Since the SCB is located on the left side of the box, temperature spread can be observed on the top cover, Material and surface processing of the box should be carefully studied.

### 3. WRS-FL WITH HEATSINK IN ENVIRONMENTAL CHAMBER

Then the WRS-FL is placed inside an environmental chamber. The chamber is set to 50°C and kept steady for 4 hours before the WRS-FL is powered up.

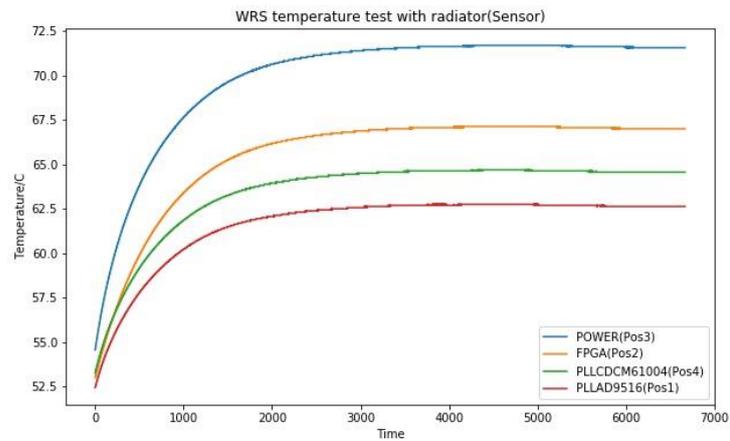


The temperature recorded by the NAPUI TR230X-56 are shown below:



(pos1-3 are probes on the heatsink, pos4-6 are probes on the top cover)

The temperature recorded by the WRS-FL are shown below:



All measurement channels are similar with additional temperature raise of 25°C from the environment.

## SUMMARY

The temperature test of WRS-FL shows that with the redesigned PCB layout and heatsink, the temp. rise of FPGA can be controlled to below 25°C. There are still spaces for improvement from the thermal grease attachment between the components/heatsink/box.