	
HIND RECTIFIERS LTD	DATE : 08.07.2021

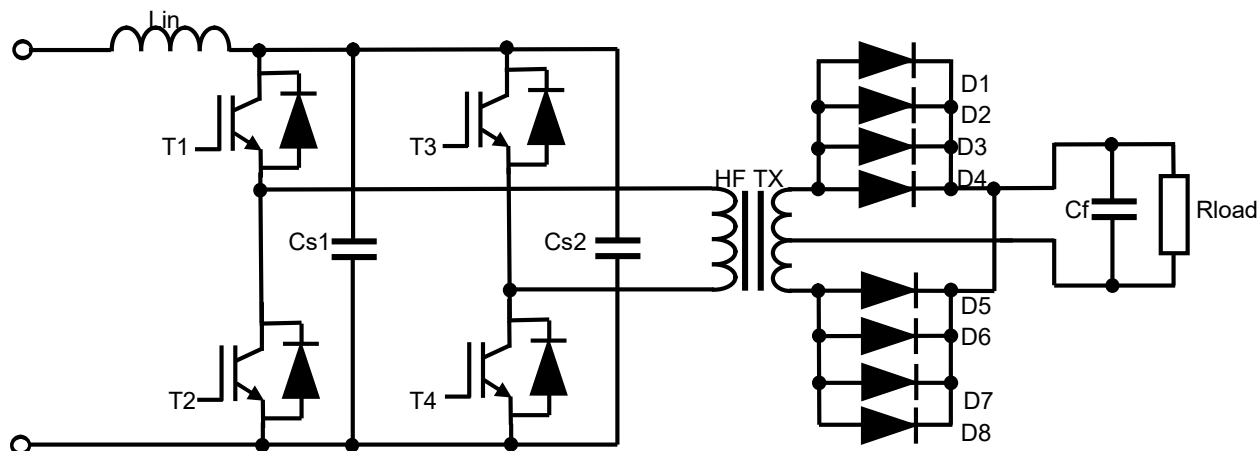
Doc. No.	
Equipment Type	9 kW SMPS Low Power Test Setup

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Introduction:


The following circuit was established in low power in the shop floor located in the ground floor of the R&D building to test the feasibility of a current fed converter. Since, components from the 4.5kW RBC cum 2.5kW EBC were easily available, these components were used to realize this setup.



The following components were used:

- 1 x DSP Main Control Card – Hirect HRT 1302
- 1 x Interface Card – Hirect HRT 1301
- 4 x Gate Driver Card – Semikron Skyper 32
- 2 x Zener Protection Card – Hirect HR - 333/R1
- 1 x Regulated DC Power supply – Aplab LD3202 (0-32Vdc, 0-2A)
- 1 x Input Choke – Hirect TDA-6520 (40 μ F, 25A @ 15kHz)
- 2 x IGBT – Semikron Semitrans SKM75GB063D (600V, 75A)
- 2 x Snubber Capacitors – El-Ci-Ar MP71 (1 μ F, 1250V)
- 1 x High Frequency Transformer – Hirect TDA-6523 (2.5kW, 2:1, 15kHz)
- 4 x Fast Diode – IXYS DSEI2X101-12A (1200V, 99A, 40ns trr)
- 1 x DC Filter Capacitor – Hirect HRL/RBC/OFP/01 RBC Output Filter Card (4.4mF)
- 2 x Load Resistor – KWK KHA100 (50 Ω & 500 Ω each)

The converter was switched at 15kHz square wave pulse in the same way as mentioned in the simulation document. It was supplied 10V from the regulated dc power supply. As soon as it was loaded, the input voltage fell to 6.2Vdc and remained the same. The voltage across the load was measured to be 6.573Vdc throughout this condition. The current sourced from the regulated dc power supply was observed to figure out if the converter could load higher amount of current with higher overlapping of the top and bottom switches of the same leg. The Semikron Skyper 32 gate driver is a dual channel gate driver and it was forcing to turn off the bottom switch as soon as the both the switches turn on at the same time. This was bypassed by using 4 separate gate drivers, using only 1 channel and completely turning off the other channel.

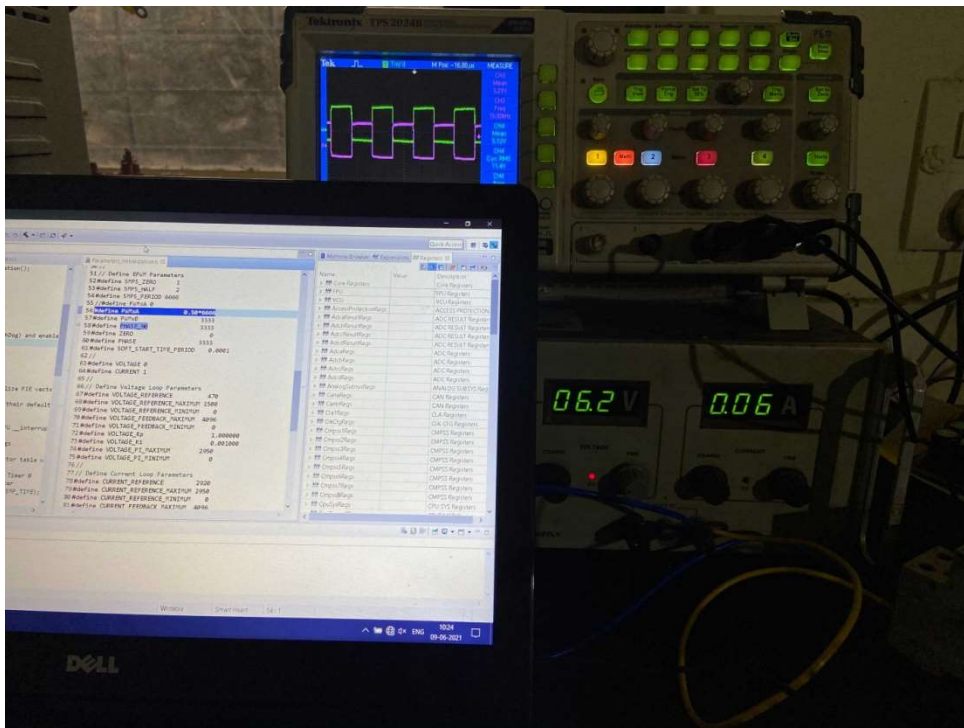
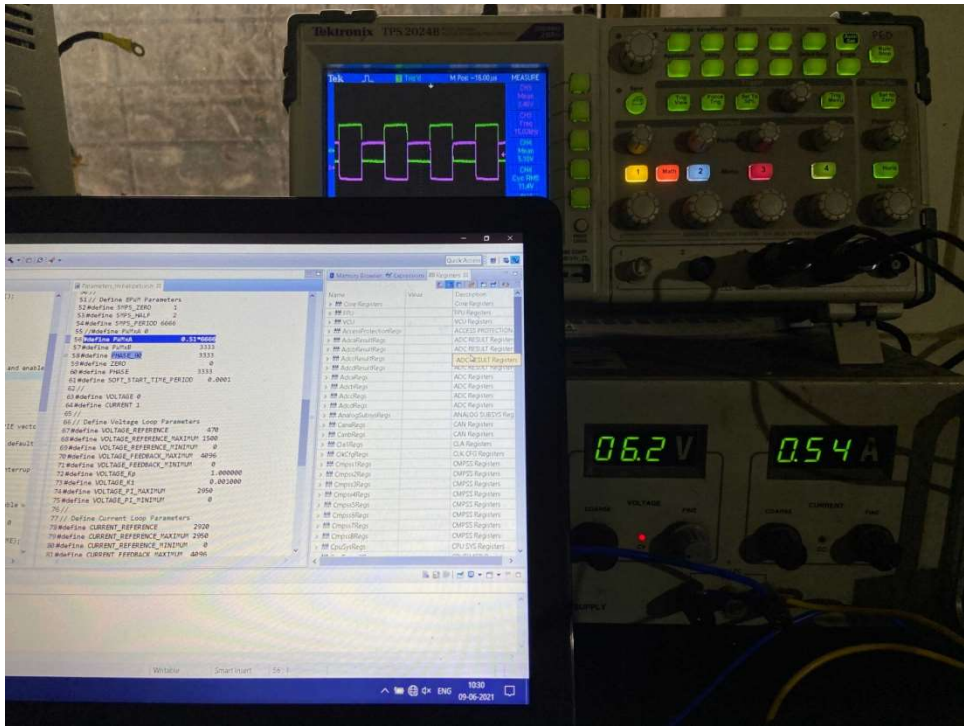
	
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Result Data Table:

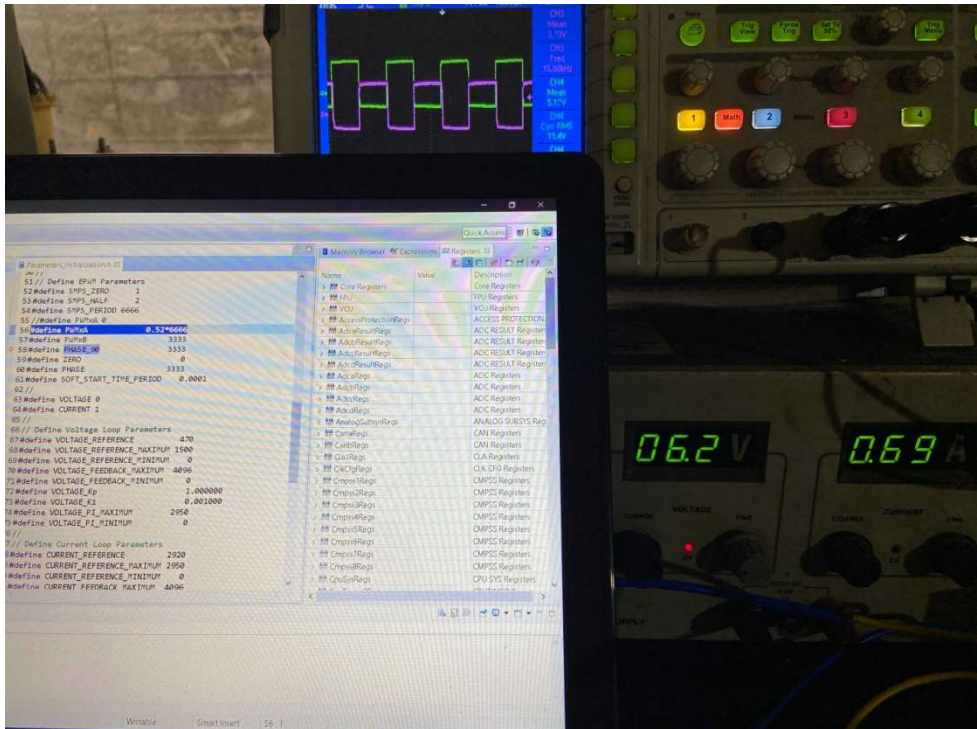

Sr. No.	Duty Cycle	Input Voltage	Input Current
1.	50%	6.2V	0.06A
2.	51%	6.2V	0.54A
3.	52%	6.2V	0.69A
4.	53%	6.2V	0.69A
5.	54%	6.2V	0.69A
6.	55%	6.2V	0.68A
7.	56%	6.2V	0.68A
8.	57%	6.2V	0.68A
9.	58%	6.2V	0.68A
10.	59%	6.2V	0.68A
11.	60%	6.2V	0.69A
12.	61%	6.2V	0.69A
13.	62%	6.2V	0.69A
14.	63%	6.2V	0.70A
15.	64%	6.2V	0.72A
16.	65%	6.2V	0.77A
17.	66%	6.2V	0.82A
18.	67%	6.2V	0.87A
19.	68%	6.2V	0.93A
20.	69%	6.2V	0.99A
21.	70%	6.2V	1.06A
22.	71%	6.2V	1.14A
23.	72%	6.2V	1.23A
24.	73%	6.2V	1.33A
25.	74%	6.2V	1.44A
26.	75%	6.2V	1.57A
27.	76%	6.2V	1.71A
28.	77%	6.2V	1.87A
29.	78%	6.2V	2.06A
30.	79%	6.2V	2.28A
31.	80%	6.0V	2.44A

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Result Data Pictures:

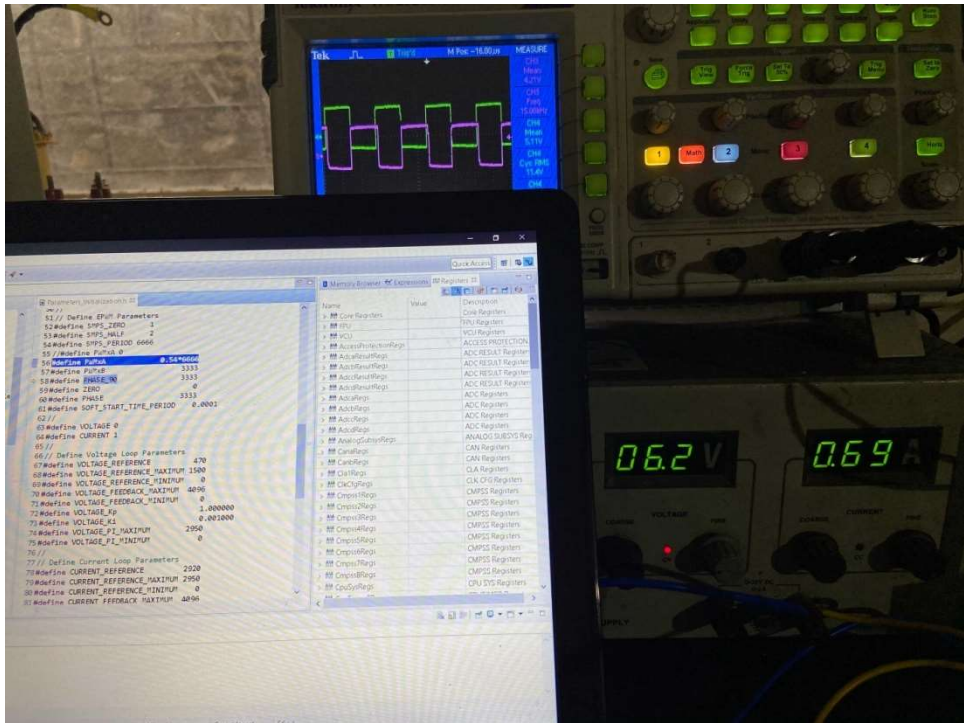

<p>Duty = 50%, Vin = 6.2V, Iin = 0.06A</p> 	<p>Remark</p>
<p>Duty = 51%, Vin = 6.2V, Iin = 0.54A</p> 	<p>Remark</p>

	
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<p>Duty = 52%, Vin = 6.2V, Iin = 0.69A</p>  <p>The image shows a power supply unit (PSU) with two digital displays. The left display shows 06.2 V and the right display shows 0.69 A. Below the displays is a control panel with several knobs and buttons. To the left of the PSU is a laptop screen displaying a software interface. The interface has a 'Parameters' tab on the left and a 'Memory Browser' tab on the right. The 'Parameters' tab shows a list of parameters with values. The 'Memory Browser' tab shows a list of memory addresses with values. The parameters include:</p> <ul style="list-style-type: none"> 51 // Define EPW Parameters 52 #define SPS_ZERO 1 53 #define SPS_HALF 2 54 #define SPS_FIR200 6000 55 // #define PwrM 0 56 #define PwrM 0.524000 57 #define PwrM 3333 58 #define PwrM 3333 59 #define PwrM 0 60 #define PwrM 3333 61 #define SPS_START_TIME_PERIOD 0.0001 62 // 63 #define VOLTAGE 0 64 #define CURRENT 1 65 // 66 // Define Voltage Loop Parameters 67 #define VOLTAGE_REFERENCE 470 68 #define VOLTAGE_REFERENCE_MAXIUM 1500 69 #define VOLTAGE_REFERENCE_MINIUM 0 70 #define VOLTAGE_FEEDBACK_MAXIUM 4096 71 #define VOLTAGE_FEEDBACK_MINIUM 0 72 #define VOLTAGE_Fp 1.000000 73 #define VOLTAGE_Fs 0.001000 74 #define VOLTAGE_F1_MAXIUM 2960 75 #define VOLTAGE_F1_MINIUM 0 76 // 77 // Define Current Loop Parameters 78 #define CURRENT_REFERENCE 2920 79 #define CURRENT_REFERENCE_MAXIUM 2950 80 #define CURRENT_REFERENCE_MINIUM 0 81 #define CURRENT_FEEDBACK_MAXIUM 4096 	<p>Remark</p>
<p>Duty = 53%, Vin = 6.2V, Iin = 0.69A</p>  <p>The image shows a power supply unit (PSU) with two digital displays. The left display shows 06.2 V and the right display shows 0.69 A. Below the displays is a control panel with several knobs and buttons. To the left of the PSU is a laptop screen displaying a software interface. The interface has a 'Parameters' tab on the left and a 'Memory Browser' tab on the right. The 'Parameters' tab shows a list of parameters with values. The 'Memory Browser' tab shows a list of memory addresses with values. The parameters include:</p> <ul style="list-style-type: none"> 51 // Define EPW Parameters 52 #define SPS_ZERO 1 53 #define SPS_HALF 2 54 #define SPS_FIR200 6000 55 // #define PwrM 0 56 #define PwrM 0.534000 57 #define PwrM 3333 58 #define PwrM 3333 59 #define PwrM 0 60 #define PwrM 3333 61 #define SPS_START_TIME_PERIOD 0.0001 62 // 63 #define VOLTAGE 0 64 #define CURRENT 1 65 // 66 // Define Voltage Loop Parameters 67 #define VOLTAGE_REFERENCE 470 68 #define VOLTAGE_REFERENCE_MAXIUM 1500 69 #define VOLTAGE_REFERENCE_MINIUM 0 70 #define VOLTAGE_FEEDBACK_MAXIUM 4096 71 #define VOLTAGE_FEEDBACK_MINIUM 0 72 #define VOLTAGE_Fp 1.000000 73 #define VOLTAGE_Fs 0.001000 74 #define VOLTAGE_F1_MAXIUM 2960 75 #define VOLTAGE_F1_MINIUM 0 76 // 77 // Define Current Loop Parameters 78 #define CURRENT_REFERENCE 2920 79 #define CURRENT_REFERENCE_MAXIUM 2950 80 #define CURRENT_REFERENCE_MINIUM 0 81 #define CURRENT_FEEDBACK_MAXIUM 4096 	<p>Remark</p>

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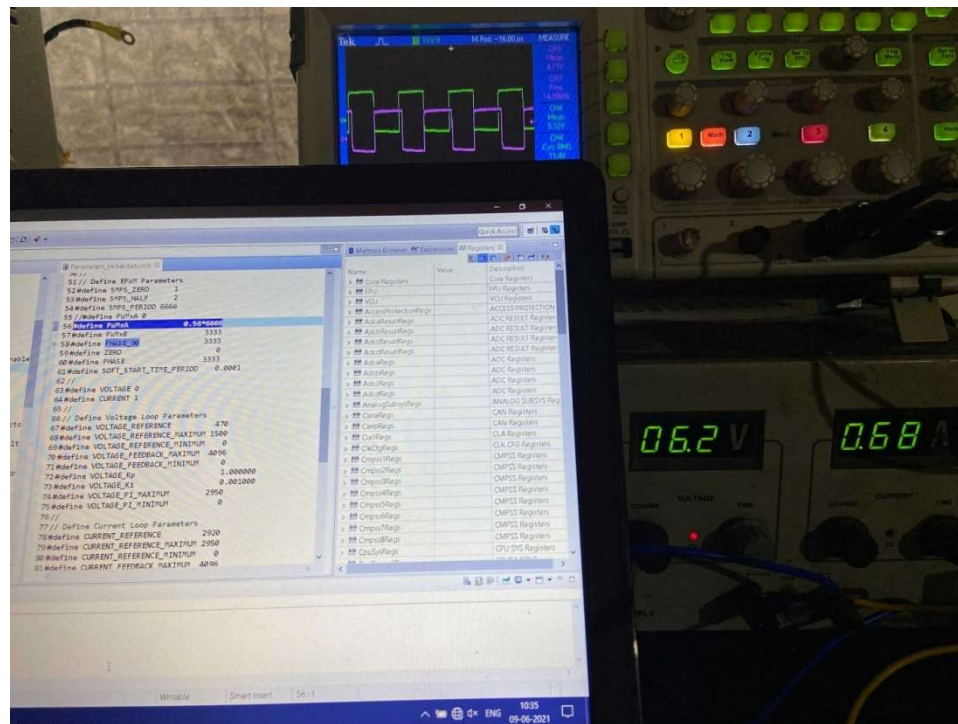
Duty = 54%, Vin = 6.2V, Iin = 0.69A	Remark
	
Duty = 55%, Vin = 6.2V, Iin = 0.68A	Remark
	

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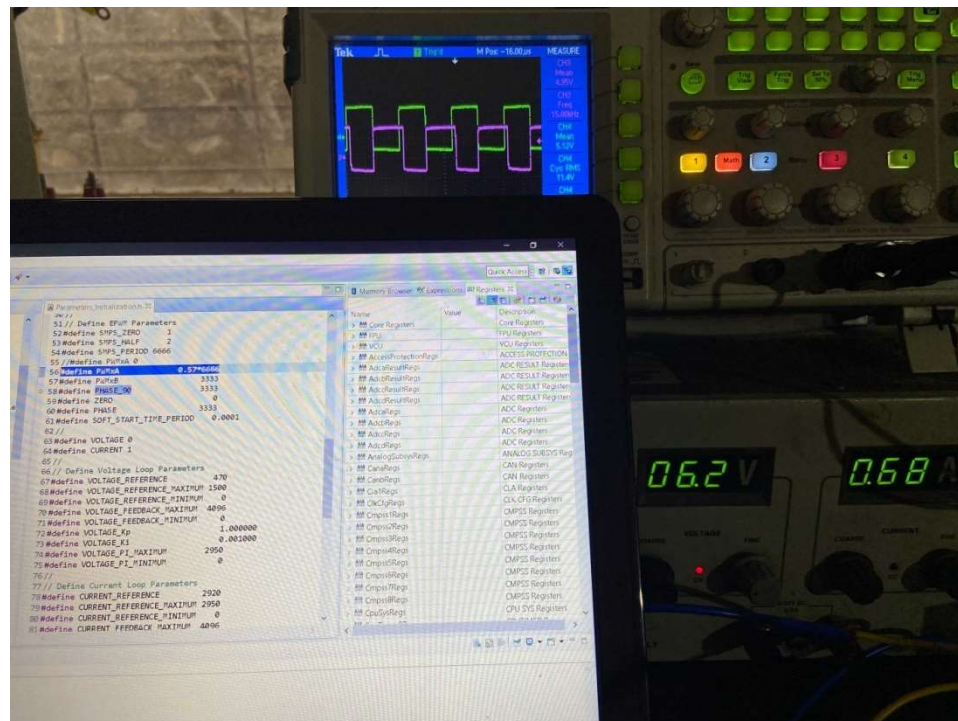
Duty = 56%, Vin = 6.2V, lin = 0.68A

Remark



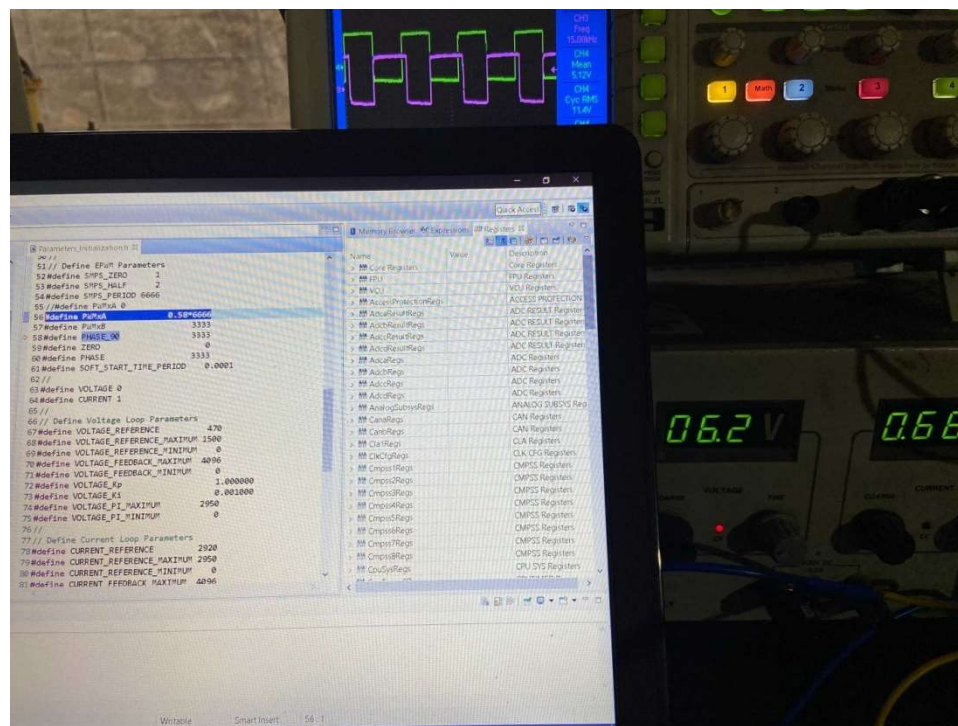
Duty = 57%, Vin = 6.2V, lin = 0.68A

Remark



Duty = 58%, $V_{in} = 6.2V$, $I_{in} = 0.68A$

Remark



Duty = 59%, $V_{in} = 6.2V$, $I_{in} = 0.68A$

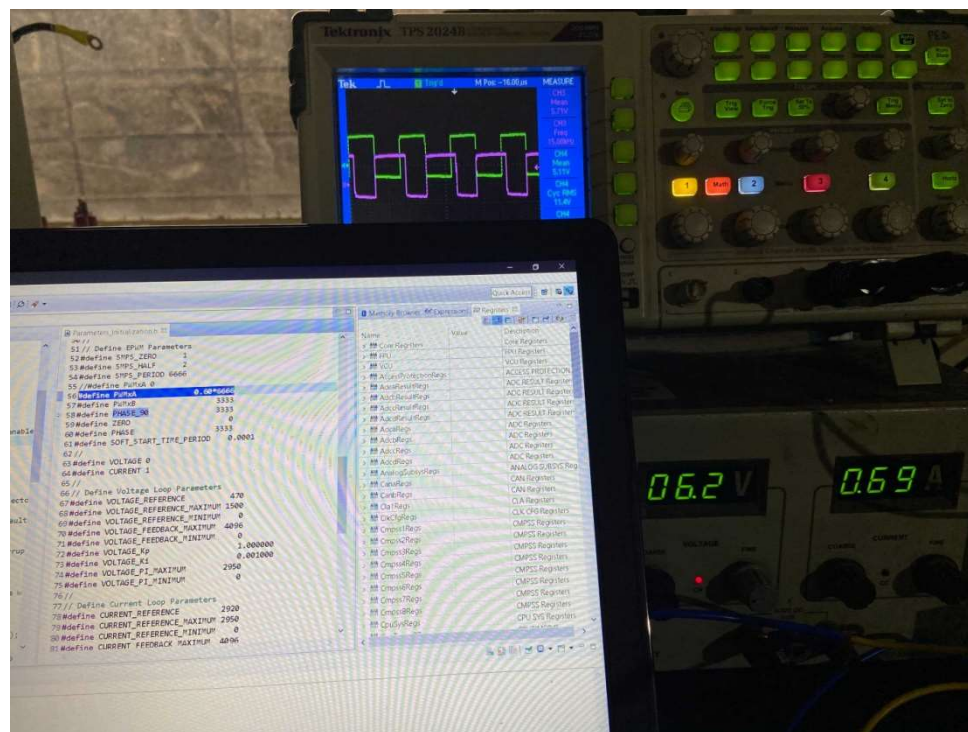
Remark





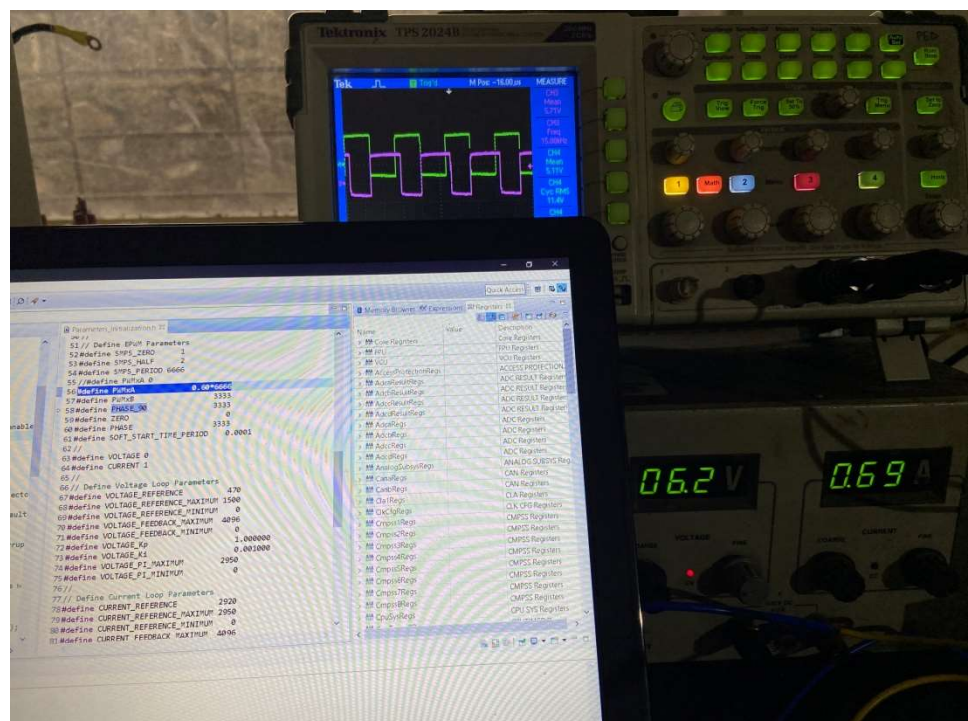
Duty = 60%, Vin = 6.2V, lin = 0.69A

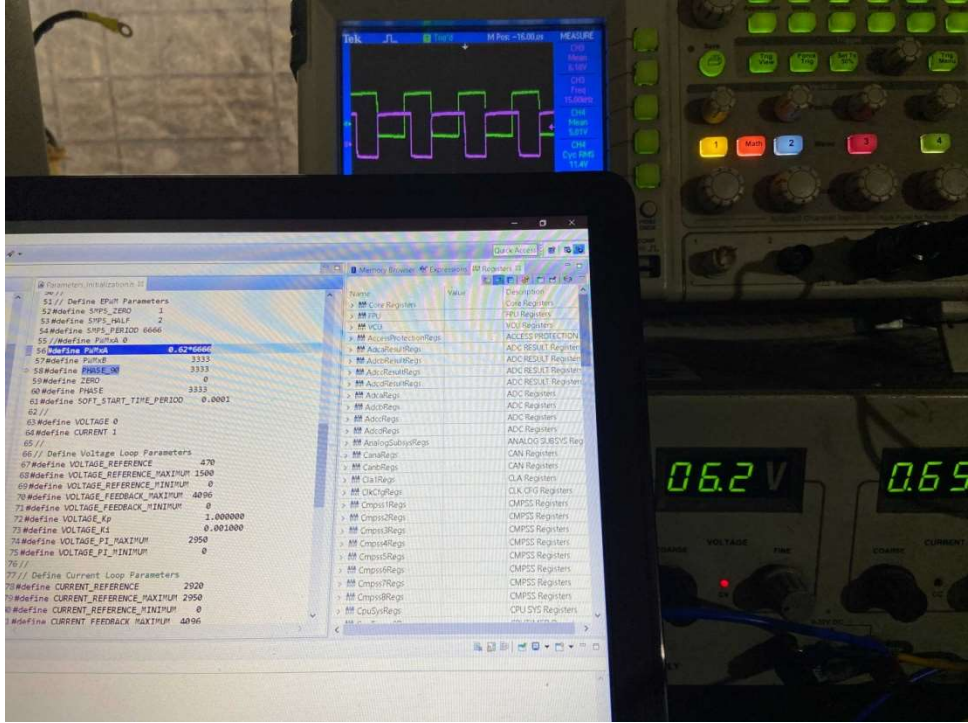
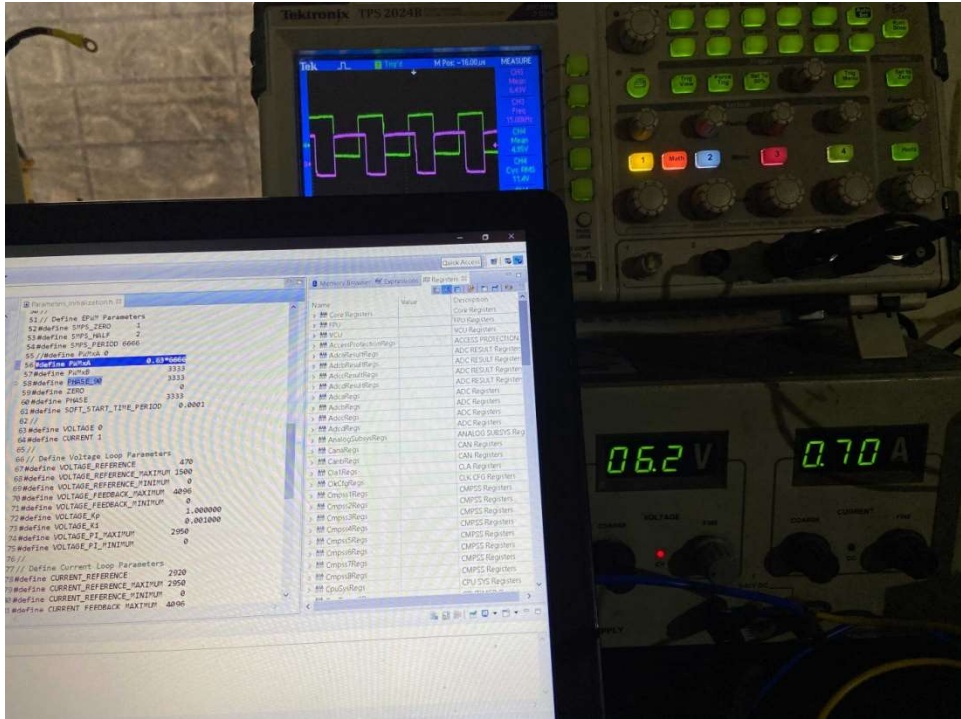
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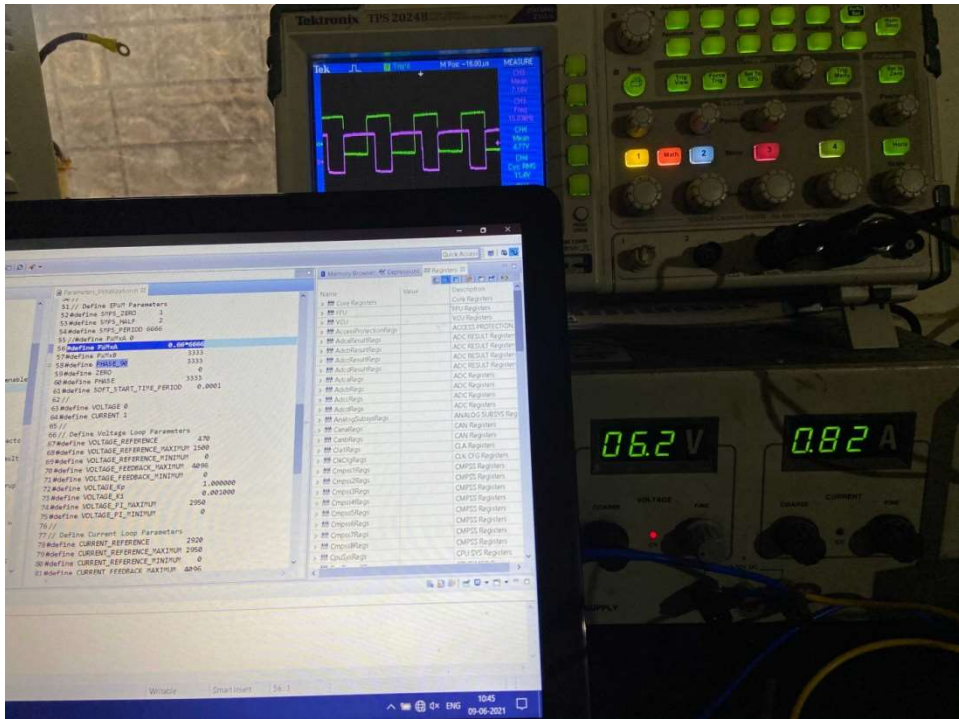

Duty = 61%, Vin = 6.2V, lin = 0.69A

Remark



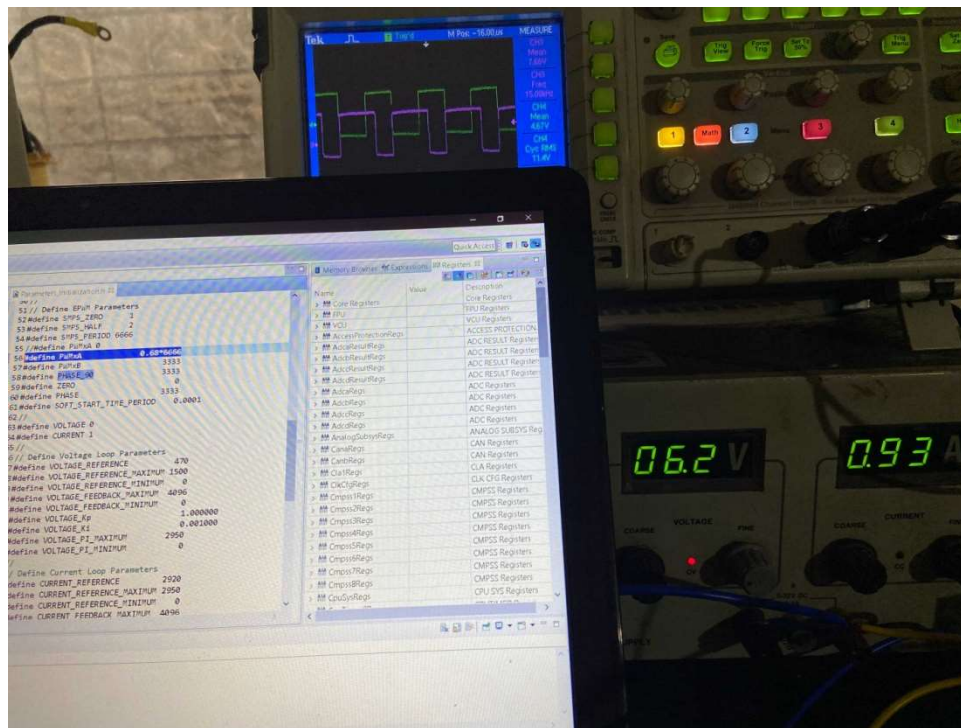
Duty = 62%, Vin = 6.2V, Iin = 0.69A	Remark
	
Duty = 63%, Vin = 6.2V, Iin = 0.70A	Remark
	

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Duty = 66%, Vin = 6.2V, Iin = 0.82A	Remark
	
Duty = 67%, Vin = 6.2V, Iin = 0.87A	Remark
	

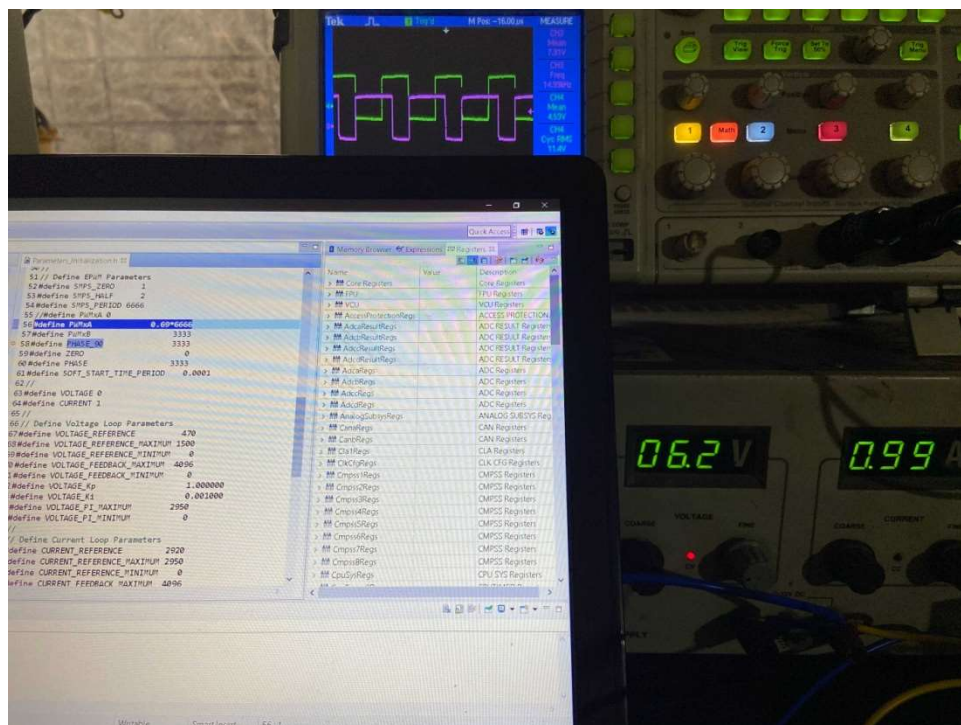
Duty = 68%, $V_{in} = 6.2V$, $I_{in} = 0.93A$

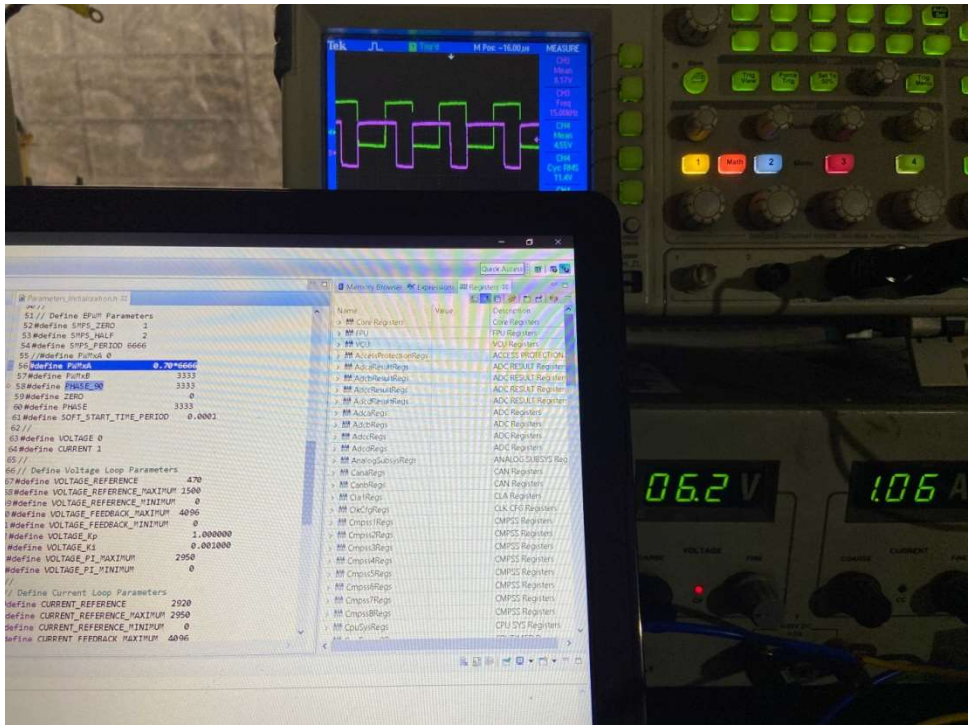
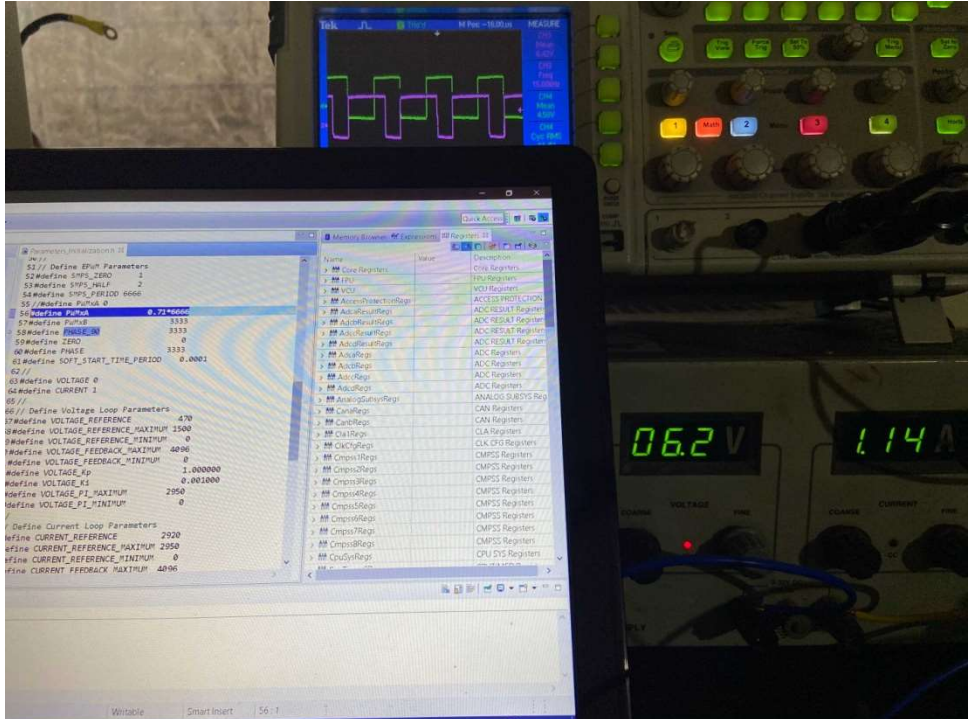
Remark	
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Duty = 69%, $V_{in} = 6.2V$, $I_{in} = 0.99A$

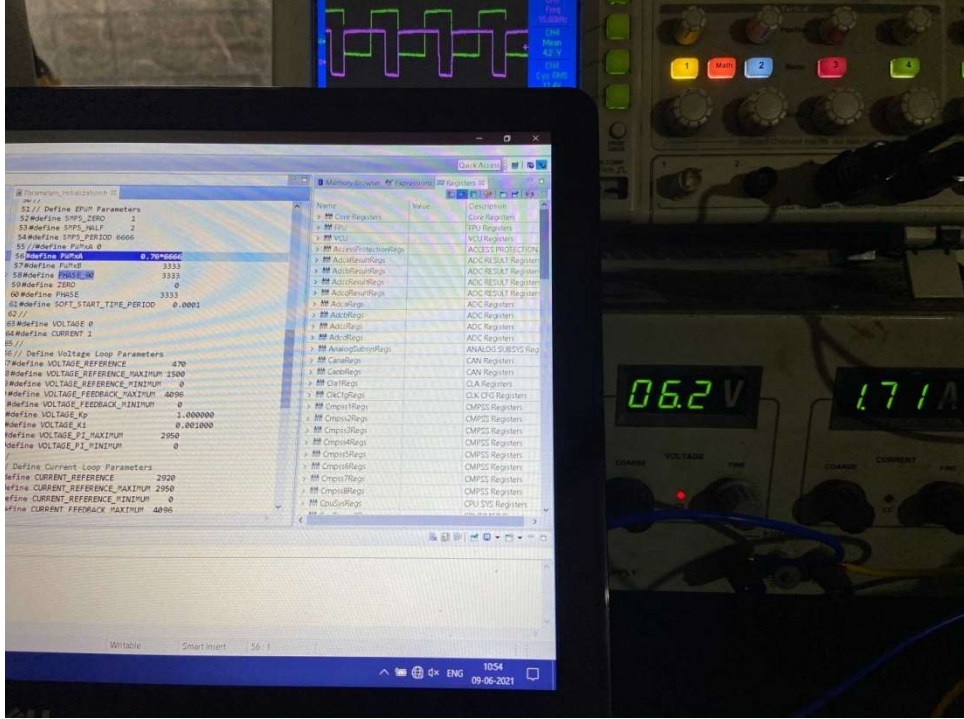
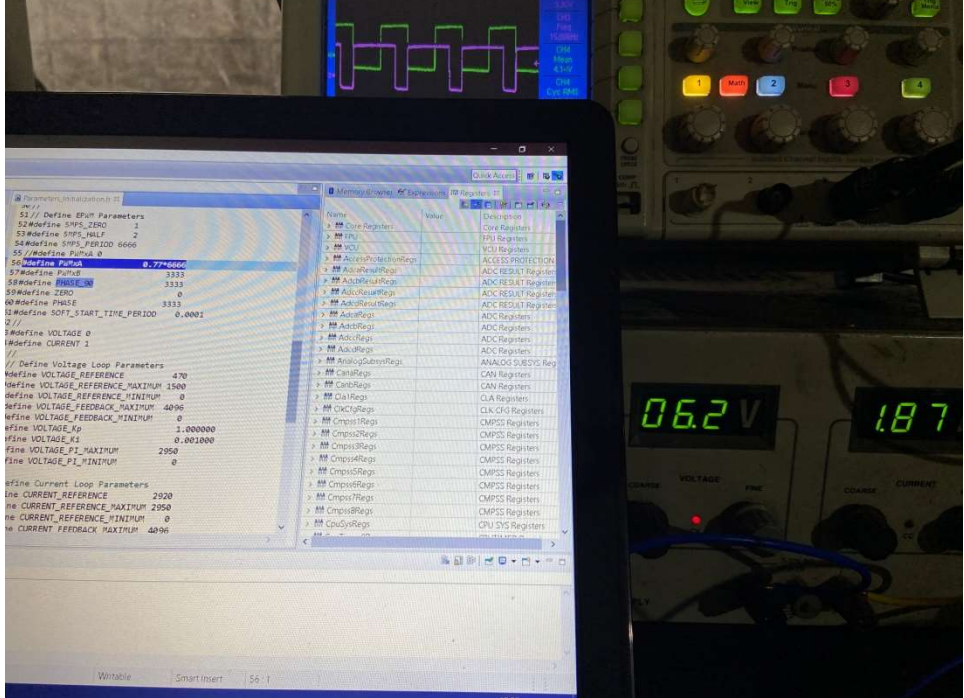
Remark




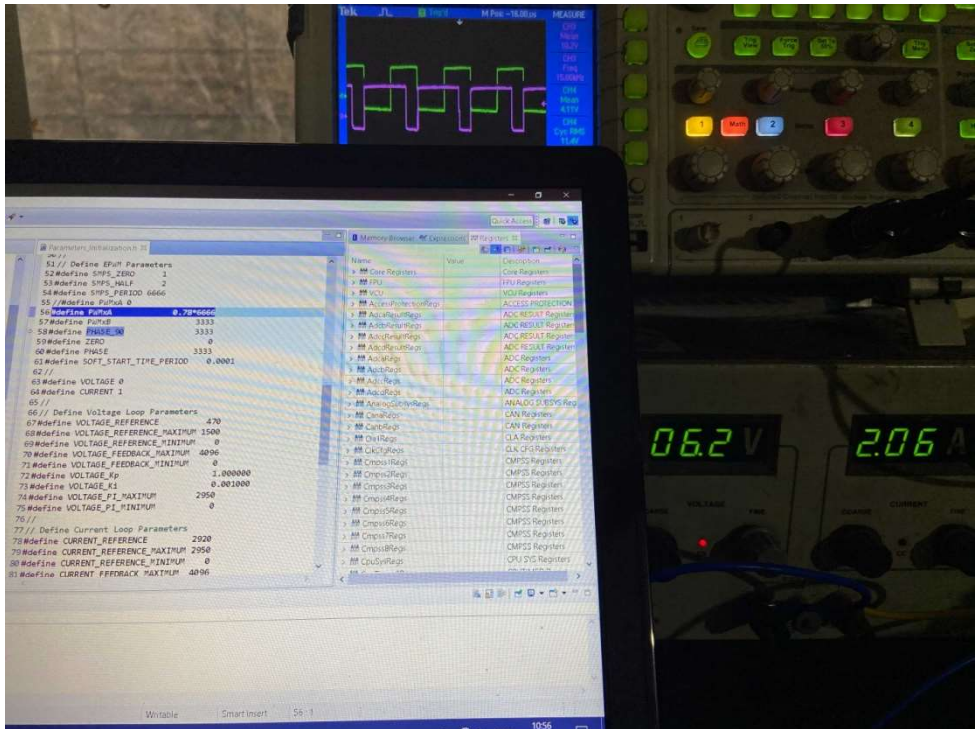
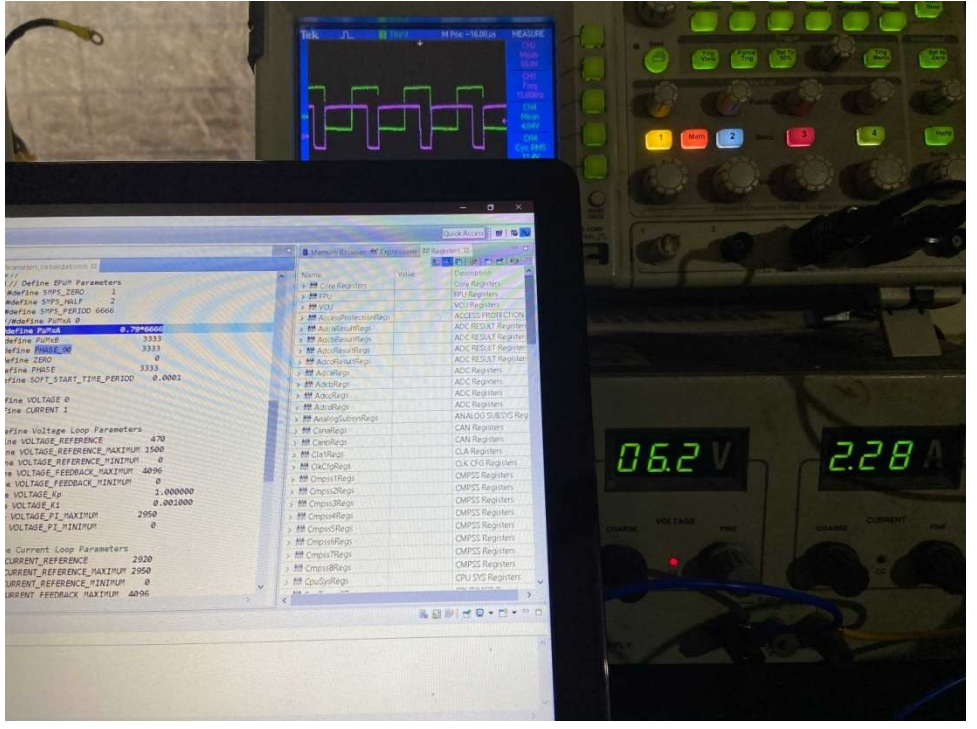
Duty = 70%, Vin = 6.2V, Iin = 1.06A	Remark
	
Duty = 71%, Vin = 6.2V, Iin = 1.14A	Remark
	

[illegible]

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Duty = 76%, Vin = 6.2V, Iin = 1.71A	Remark
	
Duty = 77%, Vin = 6.2V, Iin = 1.87A	Remark
	

	
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<p>Duty = 78%, Vin = 6.2V, Iin = 2.06A</p> 	<p>Remark</p>
<p>Duty = 79%, Vin = 6.2V, Iin = 2.28A</p> 	<p>Remark</p>

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