TFM – Status Report

7/15/2020

Mircea Bogdan

TFM – Status Report

- J1 connector and total power test
- J2 connector and TFM/TP communication testing
- Power rail noise testing
- Power rail dynamic load testing

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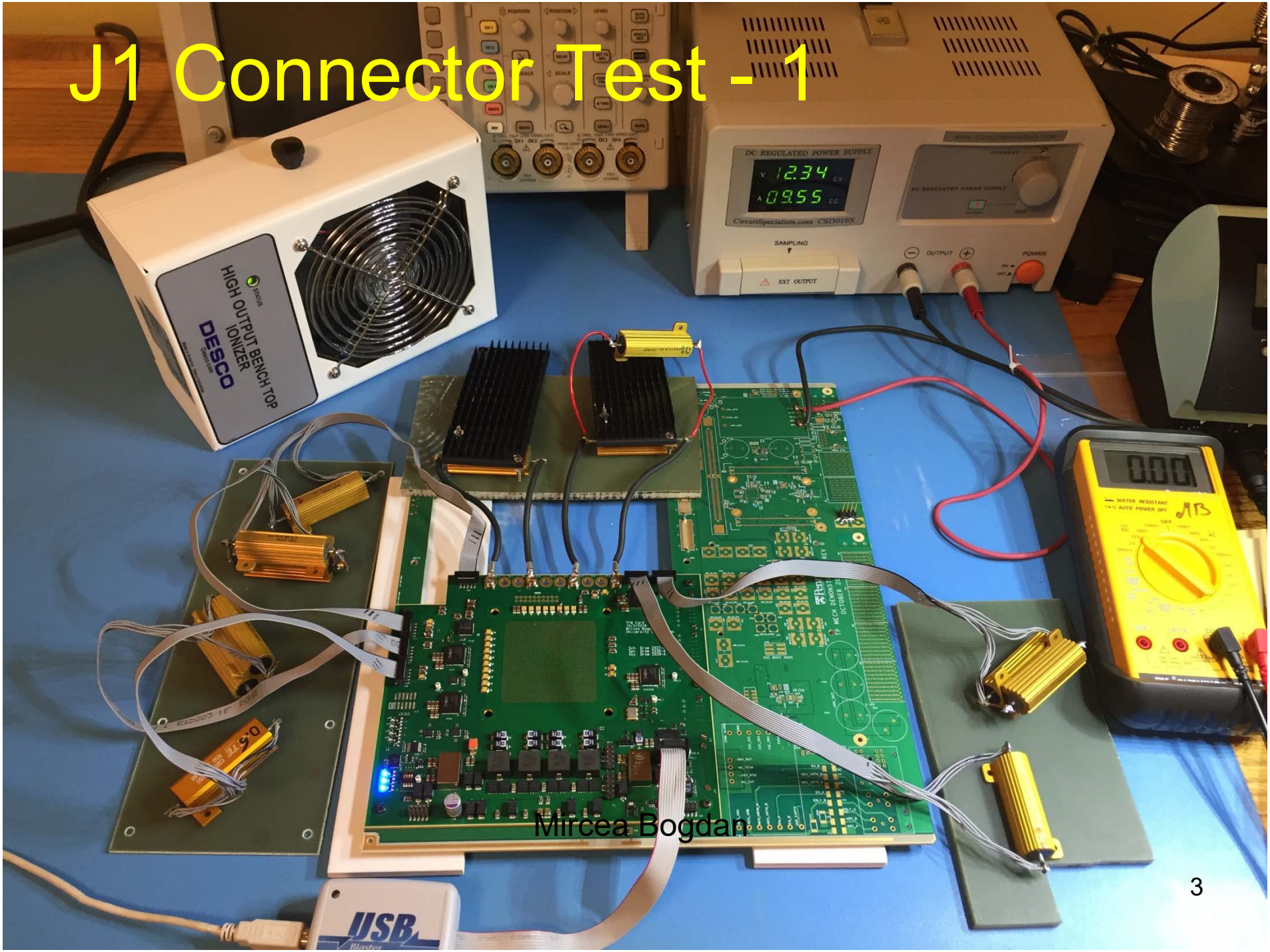
J1 Connector Test - 1



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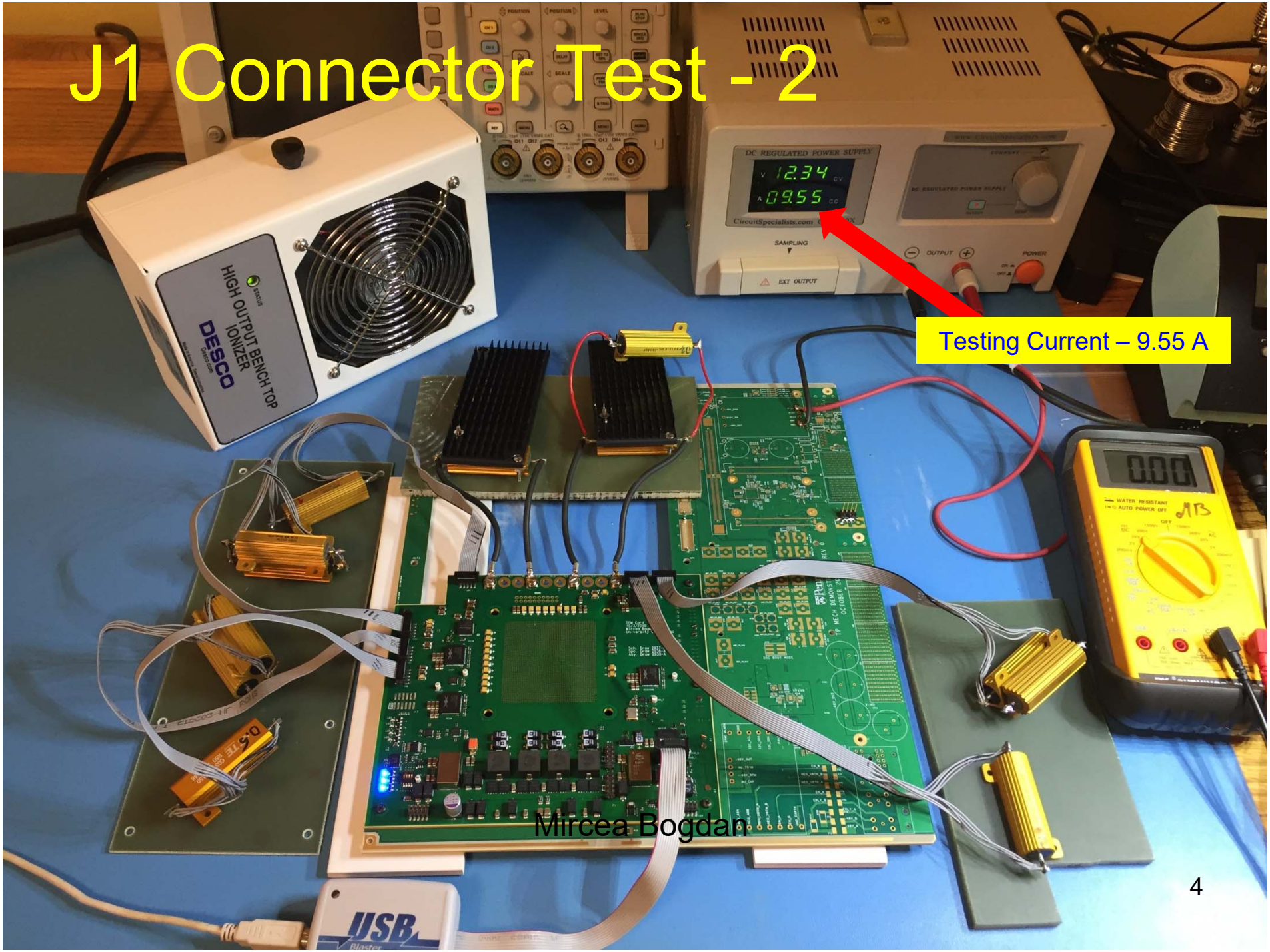
J1 Connector Test - 2



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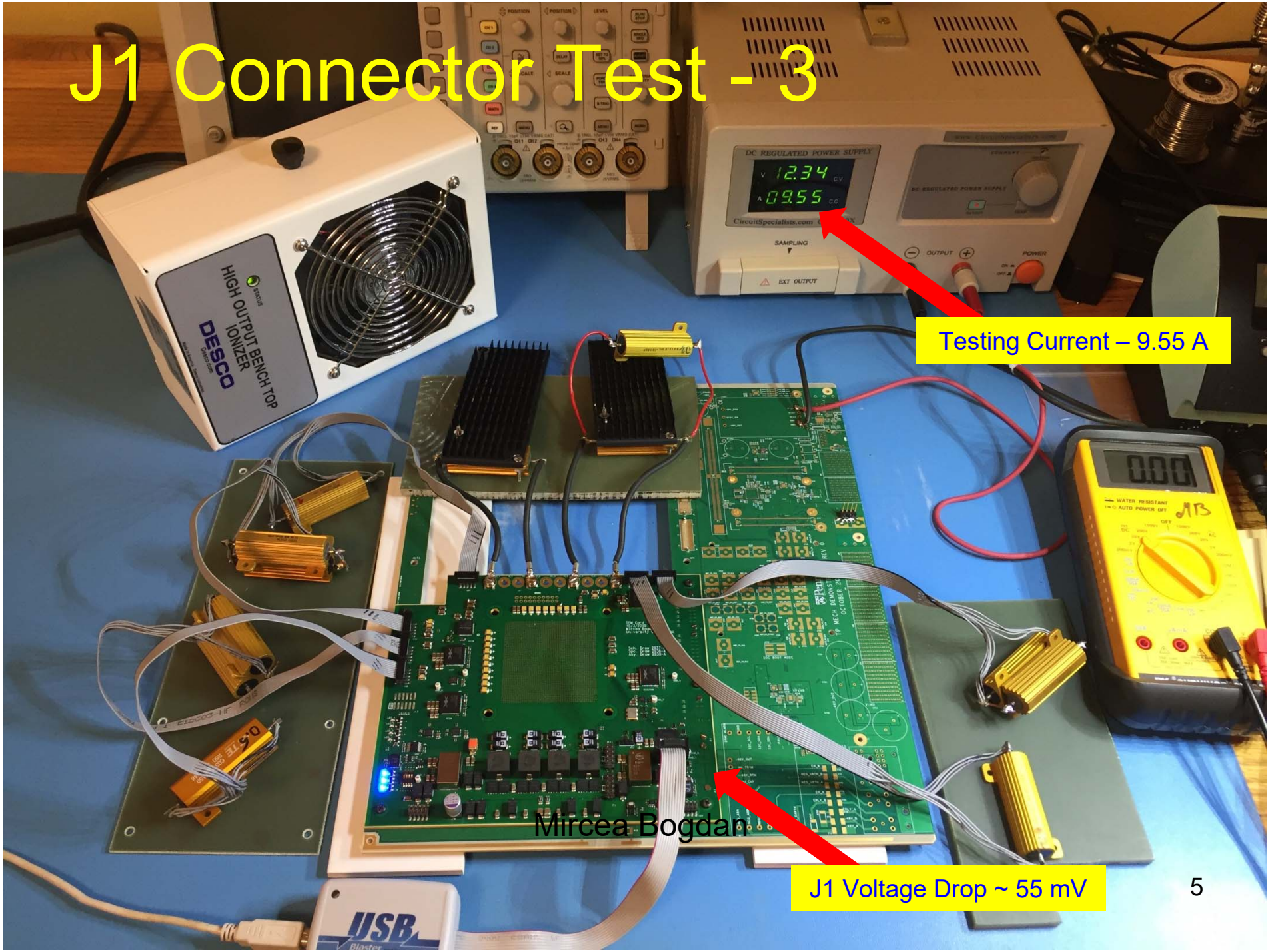
J1 Connector Test - 3



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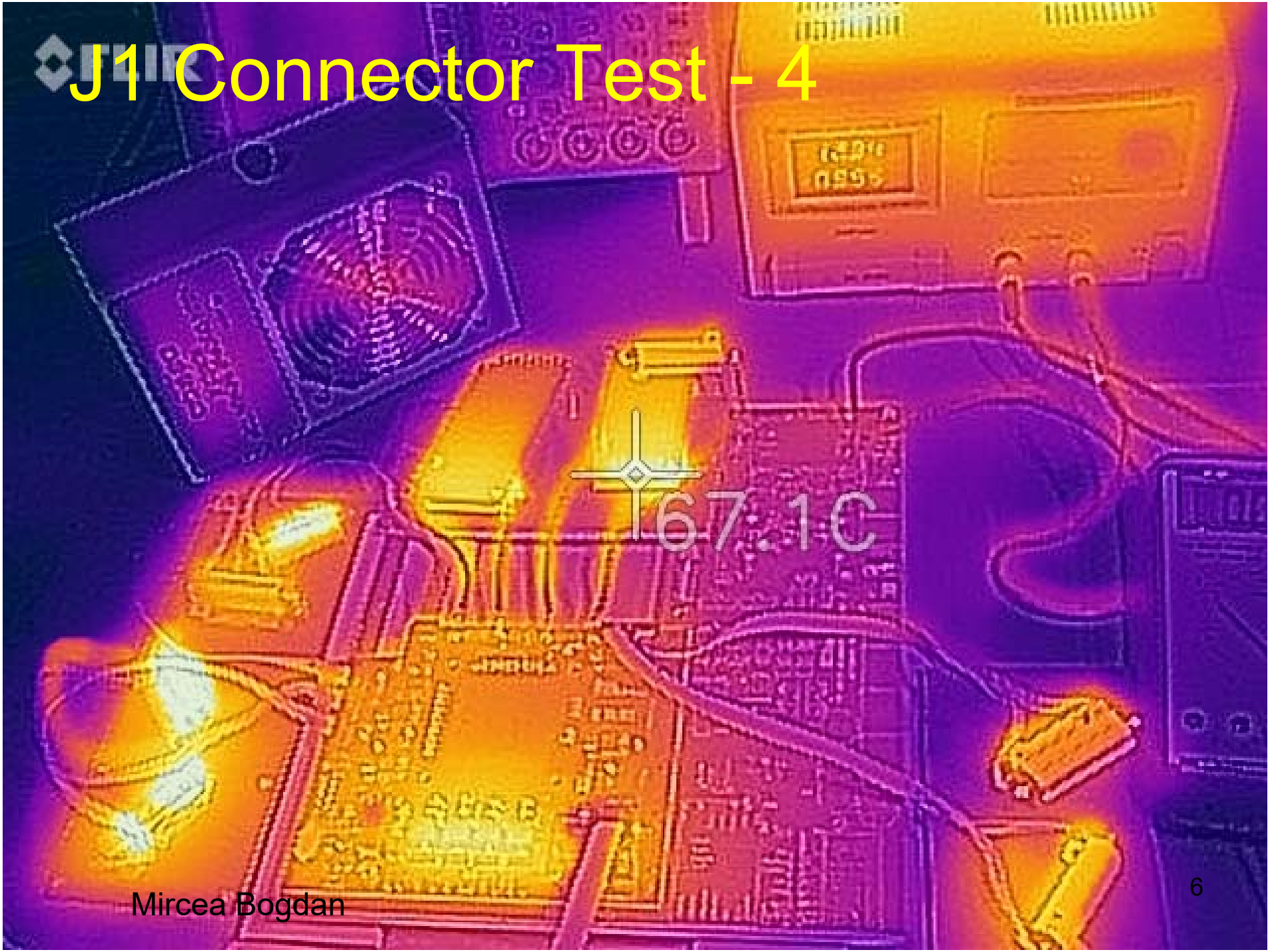
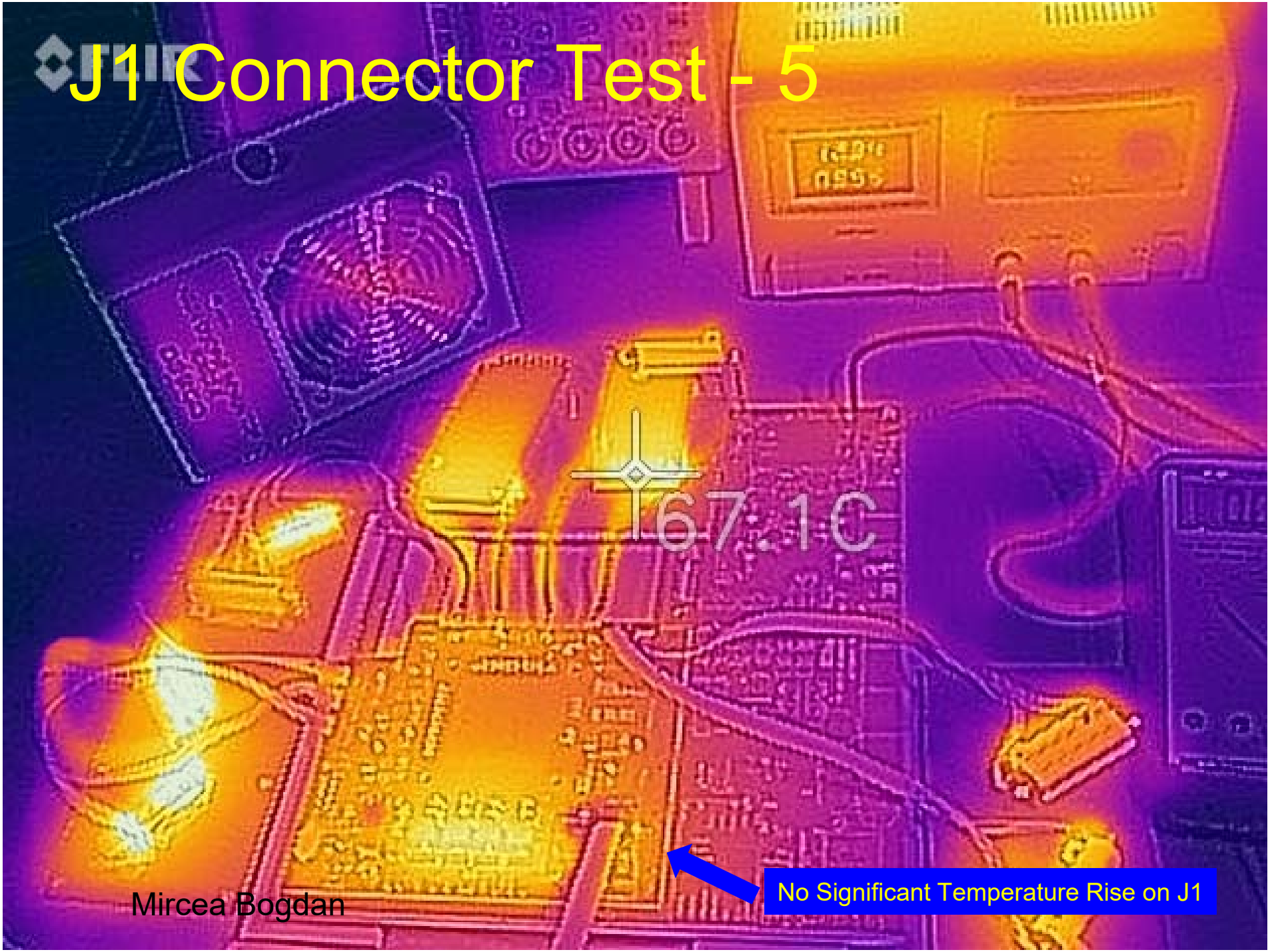
J1 Connector Test - 4



J1 Connector Test - 5



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TFM/TP - J1 Testing Summary

Voltage	EPE Current	Testing Current	Power
Core VCC - 0.9 V	66 A	70 A	63 W
VCCERAM - 0.9 V	4 A	4.33 A	3.9 W
VCCRL - 1.03 V	3 A	4.35 A	4.5 W
VCCT – 1.03 V	2A	2.81 A	2.9 W
VCCIOUIB – 1.2 V	8 A	8.7 A	10.5 W
VCCH_GXB – 1.8 V	2 A	3.3 A	5.9 W
VCCM – 2.5 V	2 A	2.4 A	6 W
Total FPGA Power			96.7 W
Total TFM Input Power			12Vx9.55A = 115W

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TFM/TP – J2 Testing

TFM/MAX10 generated signals pass through J2 and are are observed on TP

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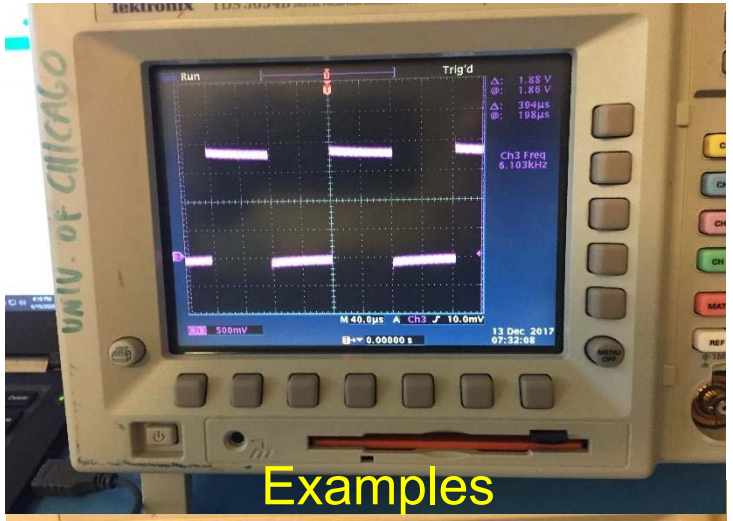
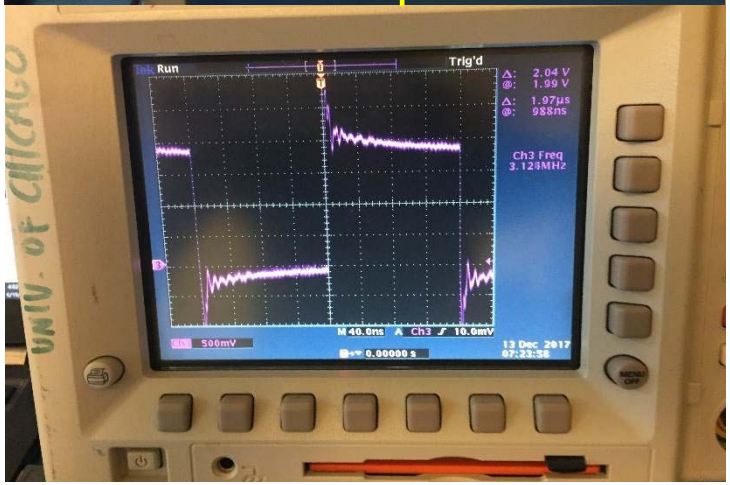
TFM/MAX10 Signals on TP:

- RDY_OUT -> J2_B14 -> TP_JT40_84
- RESET_DONE_OUT -> J2_C14 -> TP_JT40_86
- PWRGD_OUT -> J2_B15 -> TP_JT40_90
- PWROFF_OUT -> J2_D15 -> TP_JT40_94





TFM – Power Rail Noise Testing - 1

Current Estimates – 2019 EPE Results
Testing with Dynamic Load Tool: ROA 128 5552.

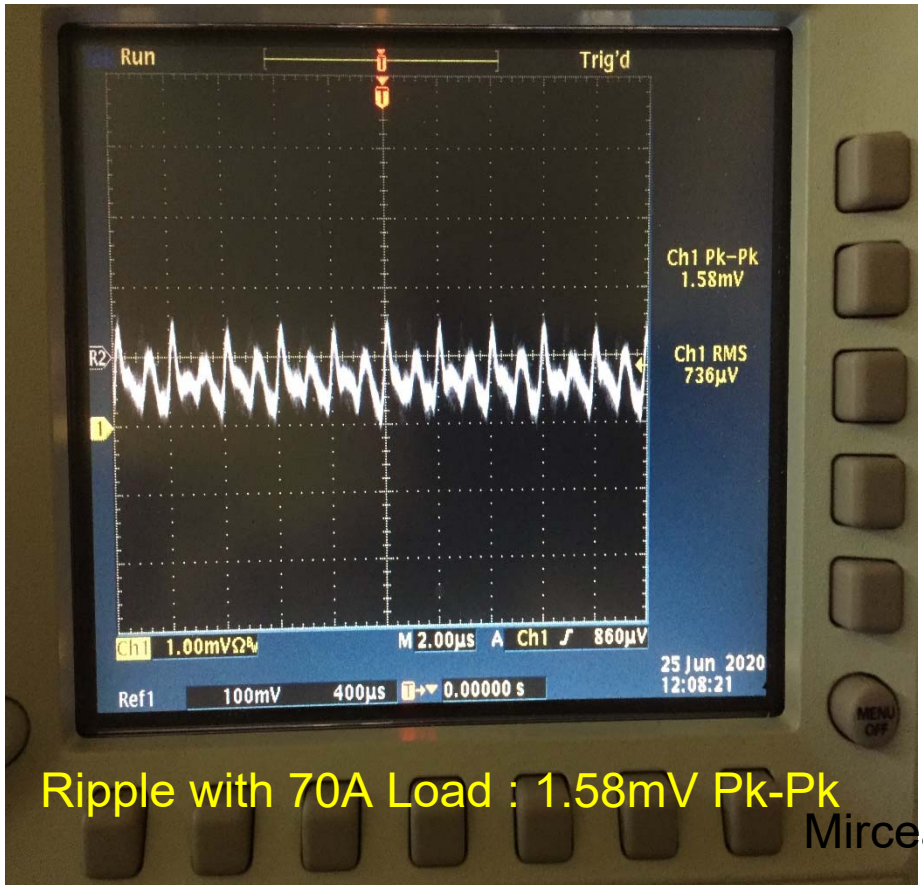
Power Rail Noise Requirements from PDN Design Tool 2.0

Rail Group Summary	Unit	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Voltage	V	0.80	1.80	0.90	1.03	1.03	2.50	1.20
Total Current	A	62.86	7.45	3.70	2.30	0.75	2.00	8.00
Dynamic Current Change		Calculate	Calculate	Calculate	Calculate	Calculate	Calculate	Calculate
	%	30%	36%	50%	30%	60%	71%	71%
Noise Tolerance		Calculate	Calculate	Calculate	Calculate	Calculate	Calculate	Calculate
	%	5%	3%	5%	3%	2%	5%	5%

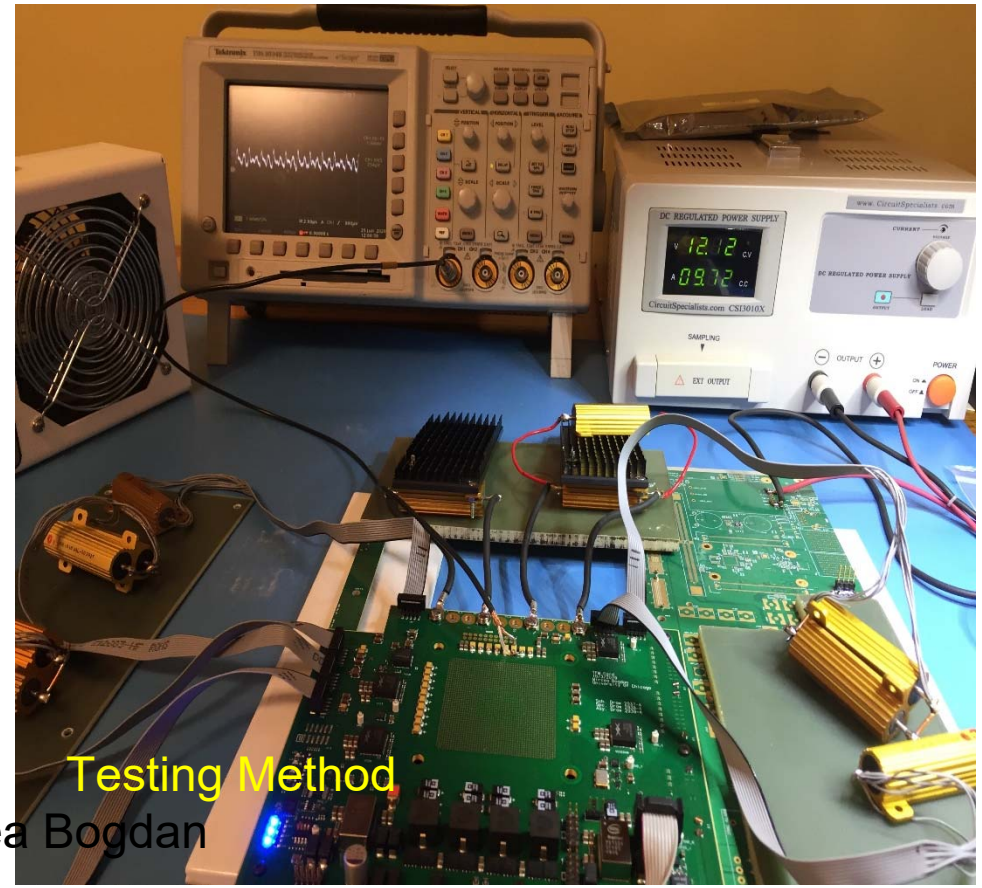
	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV

TFM – Power Rail Noise Testing – CORE 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 70A Load : 1.58mV Pk-Pk



Testing Method

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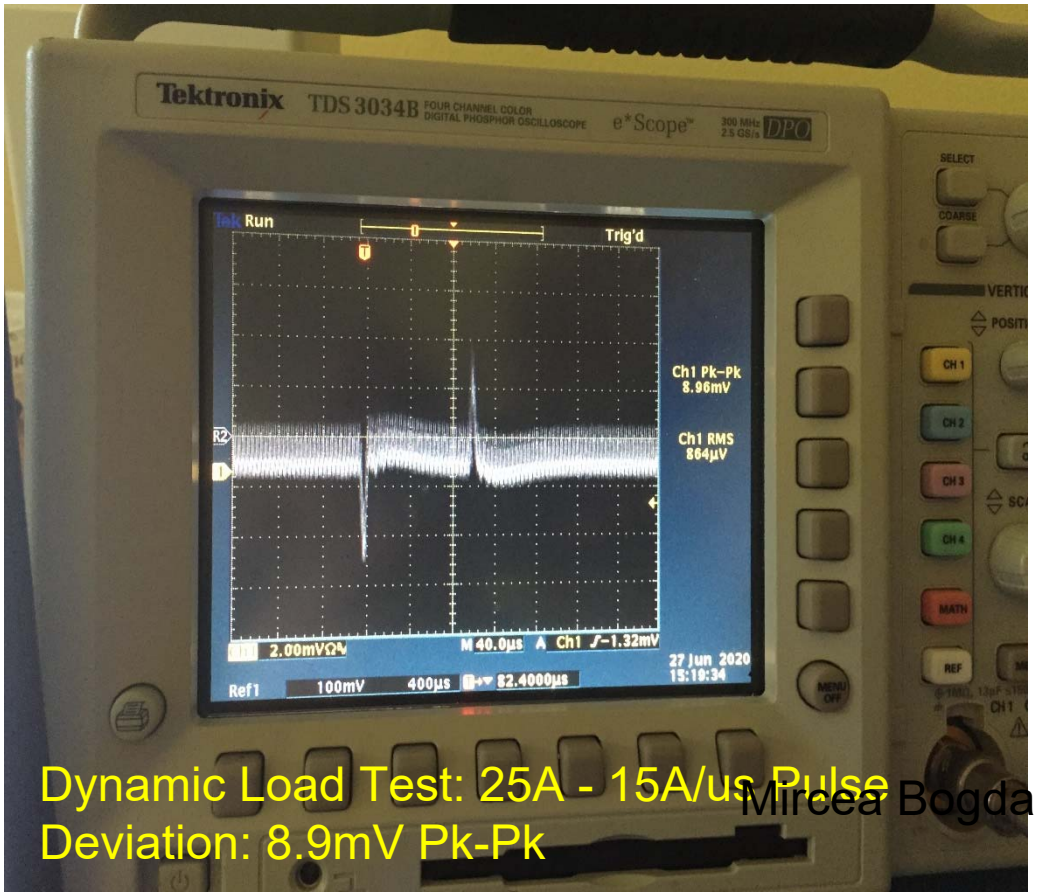
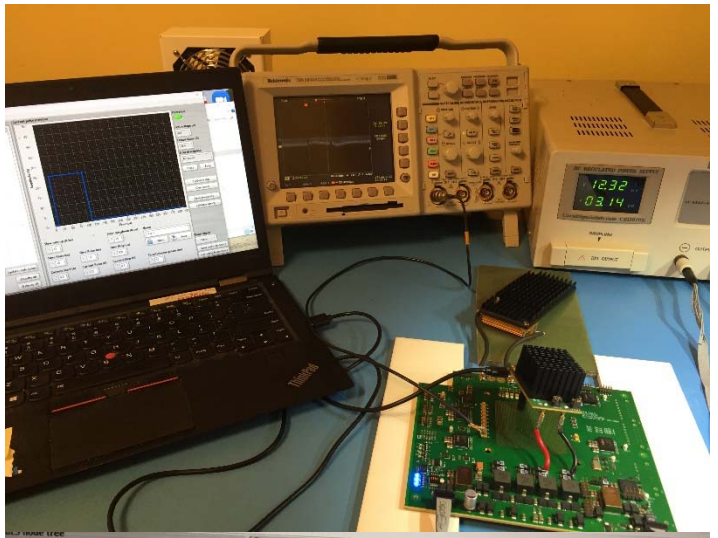
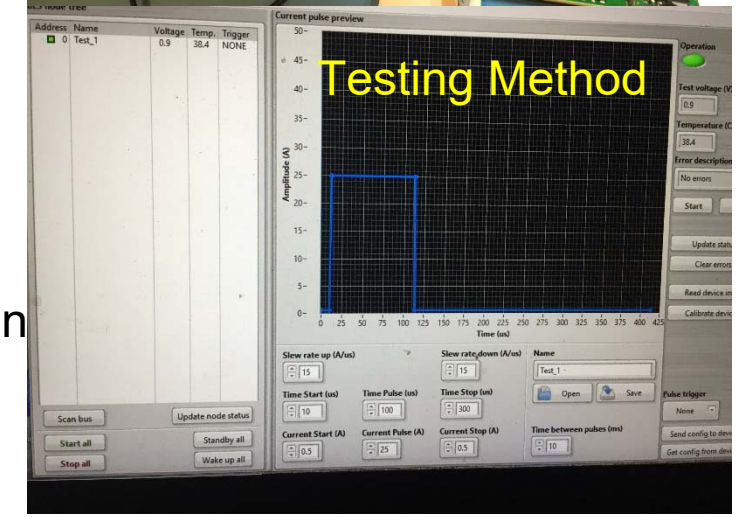
TFM – Power Rail Noise Testing – CORE 2

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 25A - 15A/us Pulse
Deviation: 8.9mV Pk-Pk





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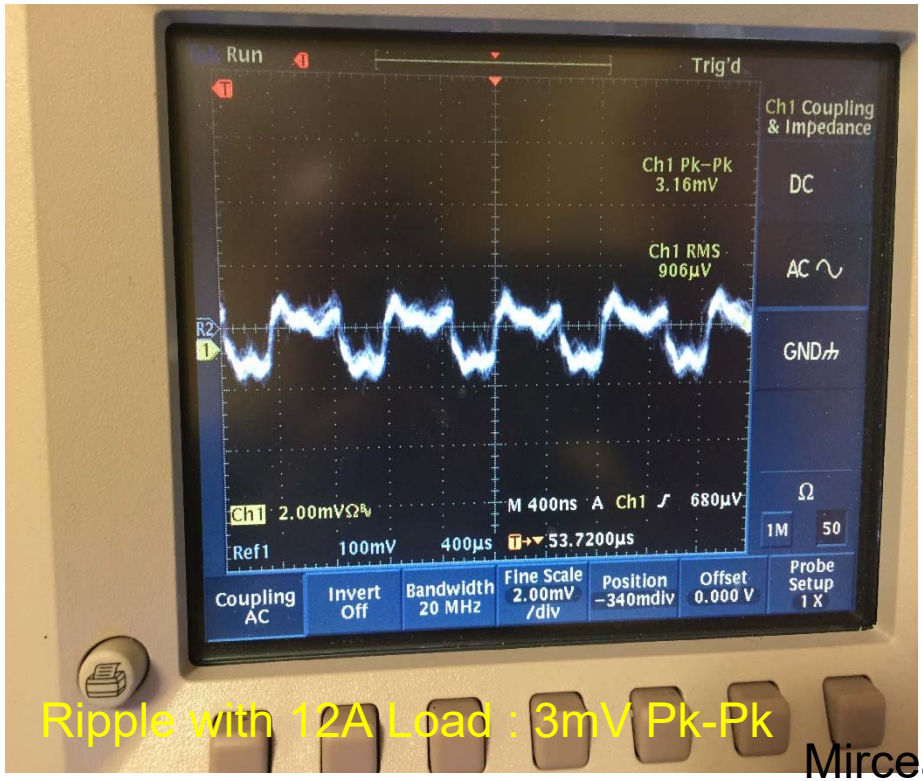
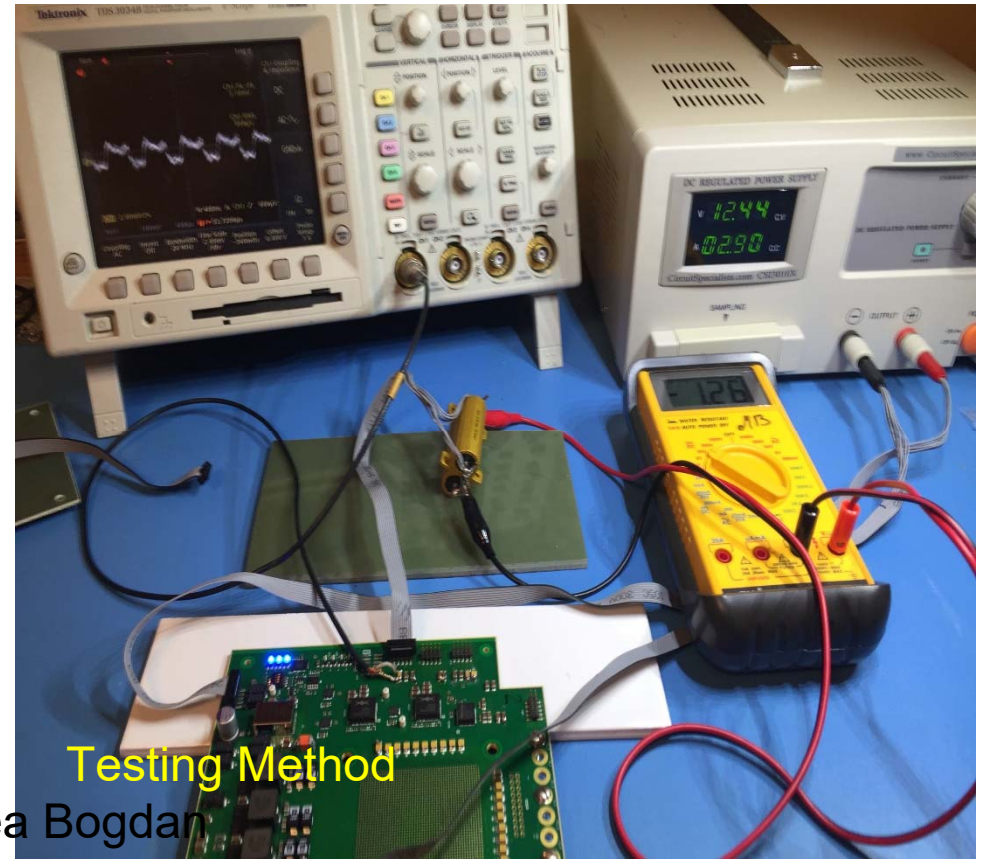
TFM – Power Rail Noise Testing – VCCH 1

CBULK = 660uF

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 12A Load : 3mV Pk-Pk



Testing Method

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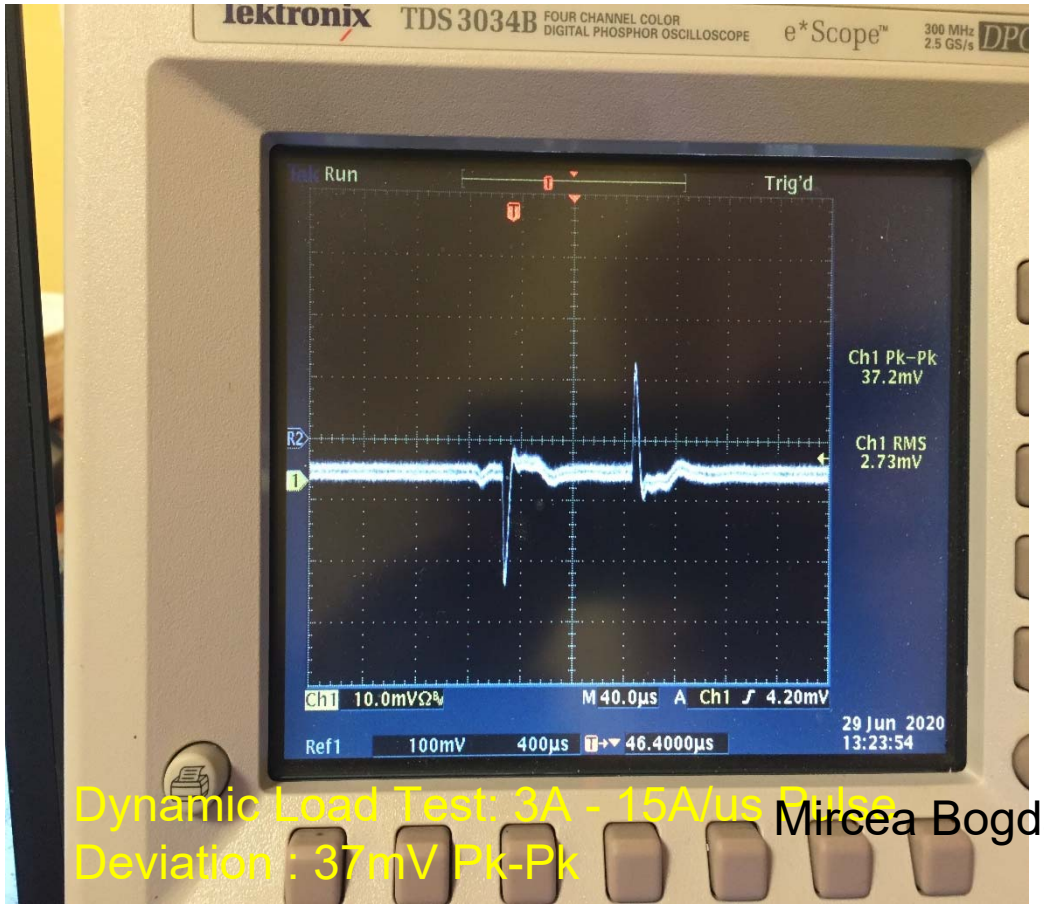
TFM – Power Rail Noise Testing – VCCH 2

CBULK = 600uF

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 3A - 15A/us Pulse
Deviation : 37mV Pk-Pk

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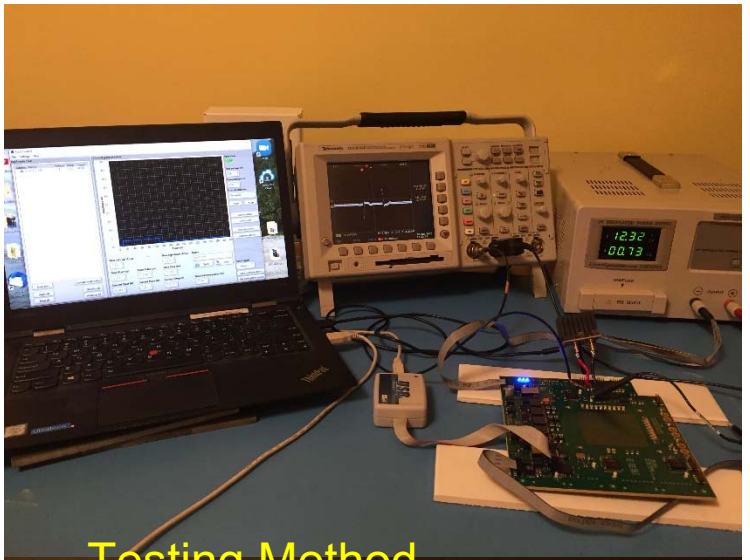
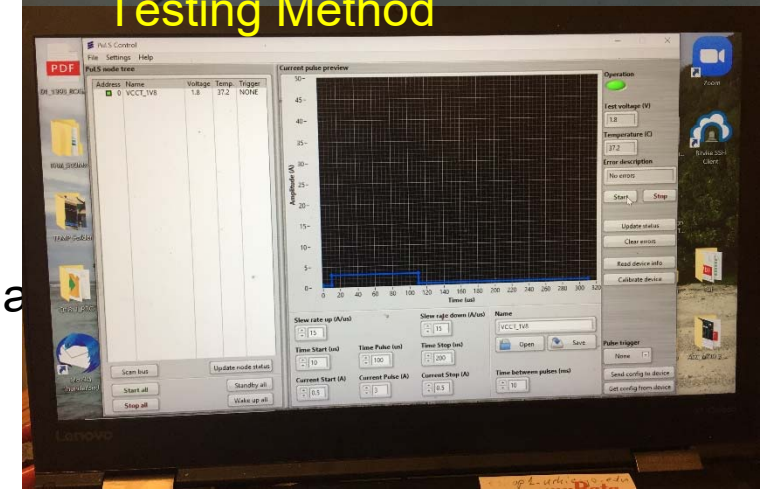


Testing Method

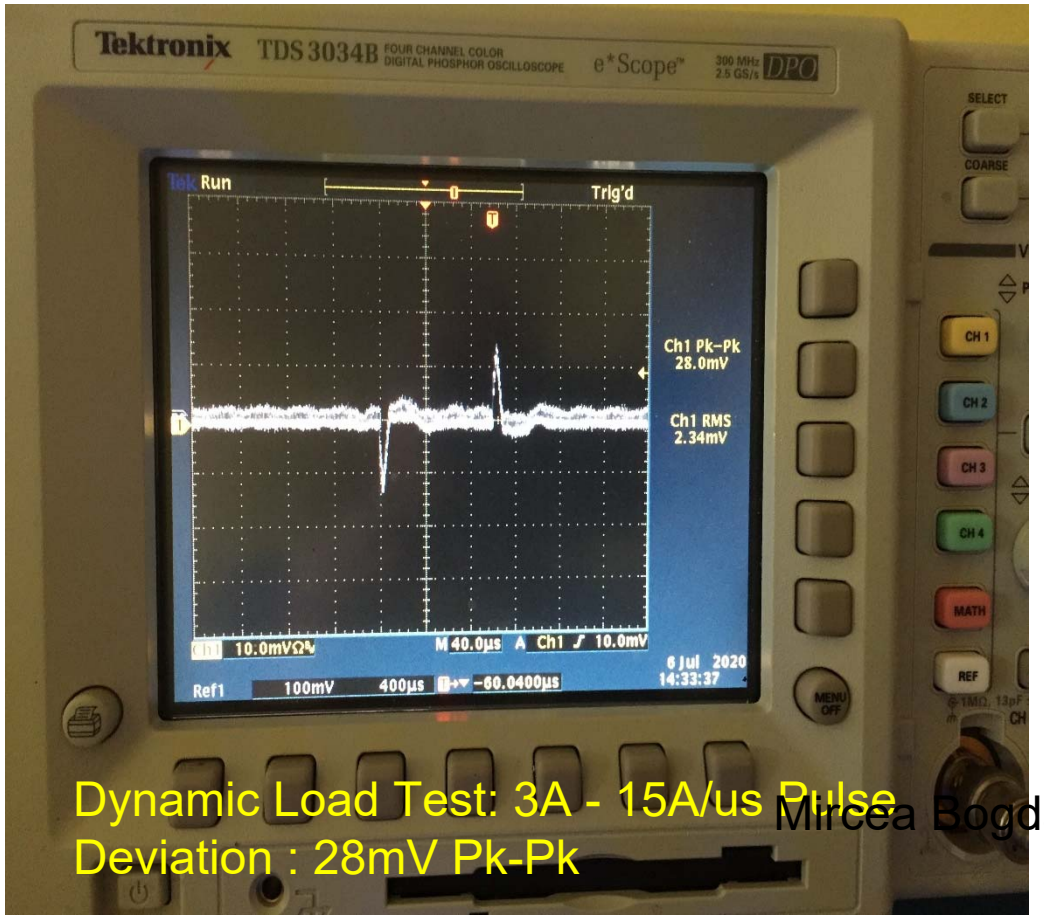


TFM – Power Rail Noise Testing – VCCH 2.1

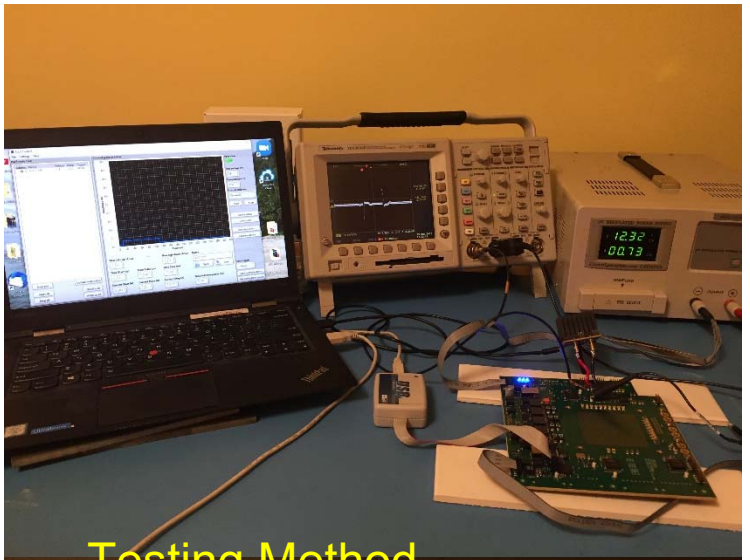
Better

C_{BULK} = 1,000uF (Add 2x 220uF)

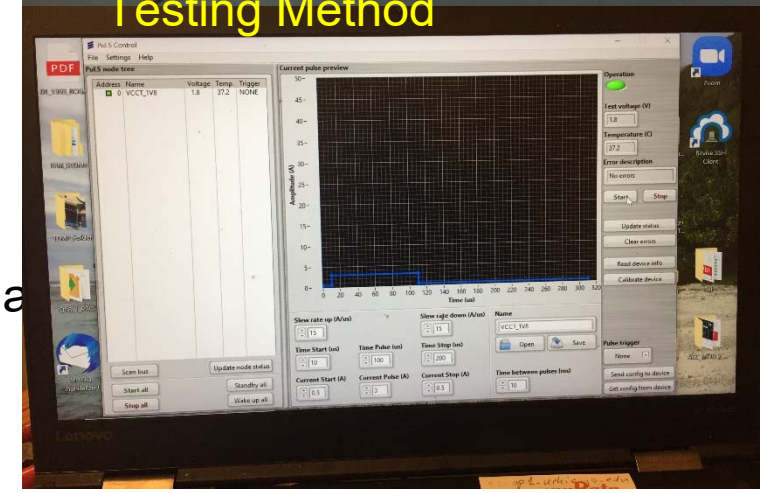
	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 3A - 15A/us Pulse
Deviation : 28mV Pk-Pk



Testing Method



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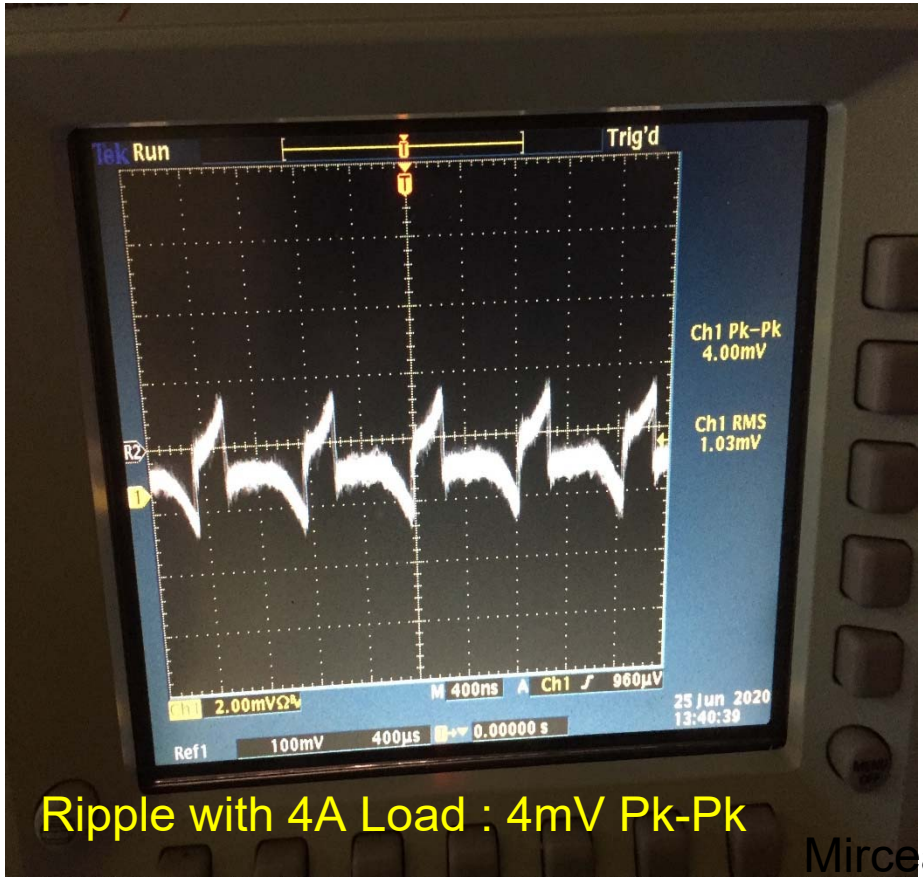
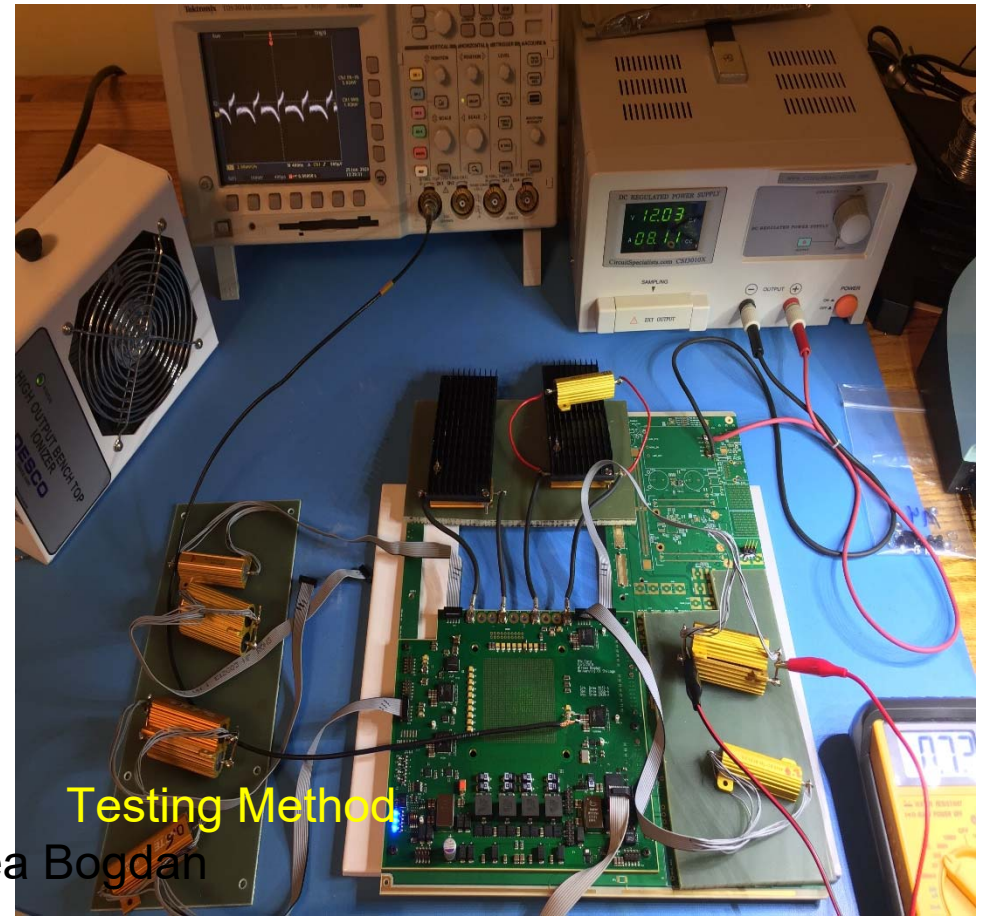
TFM – Power Rail Noise Testing – VCCERAM 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 4A Load : 4mV Pk-Pk


Testing Method

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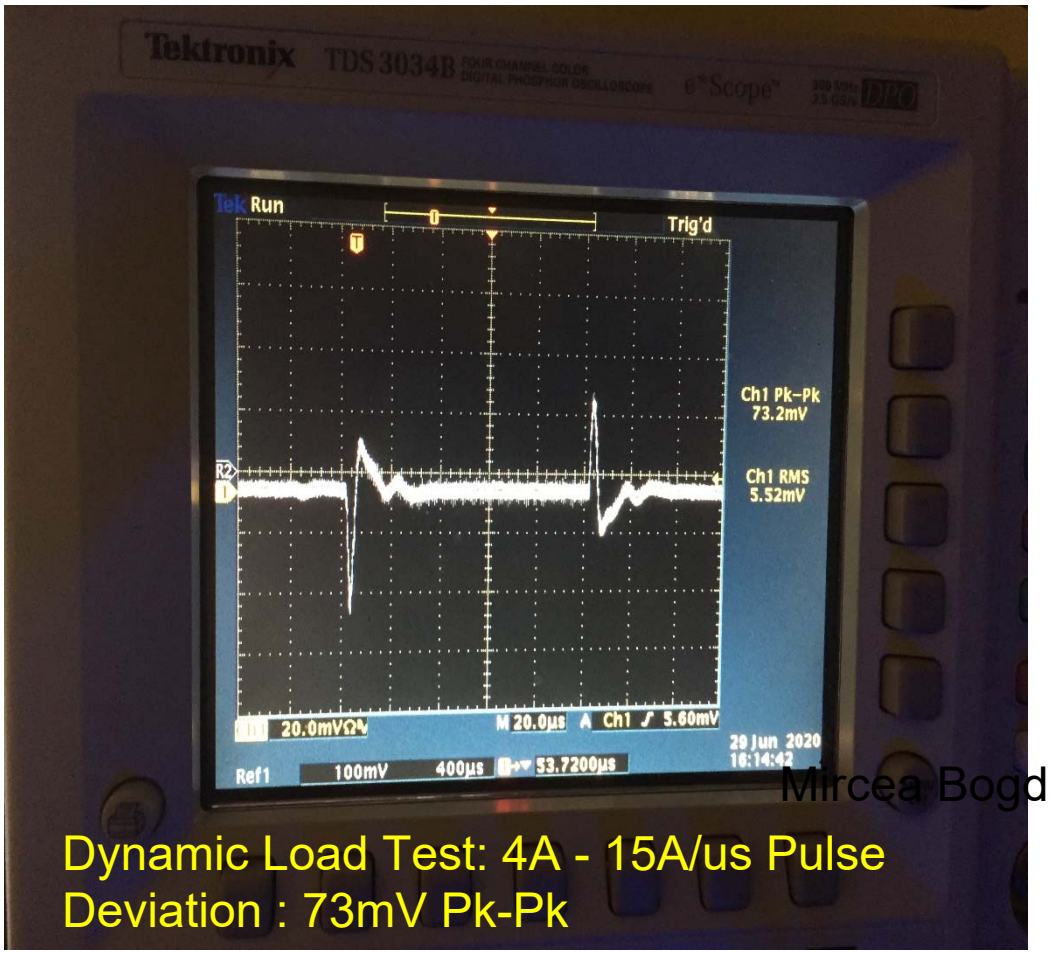
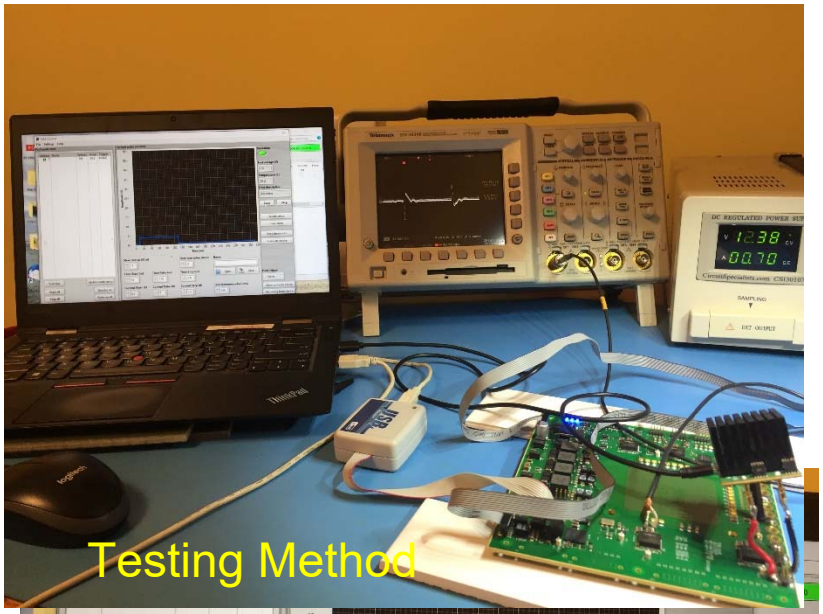
TFM – Power Rail Noise Testing – VCCERAM 2

CBULK = 250uF

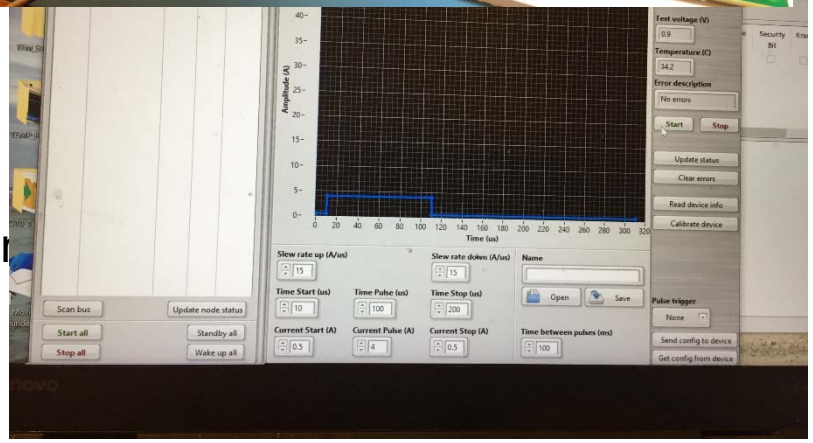
	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 4A - 15A/us Pulse
Deviation : 73mV Pk-Pk



Testing Method



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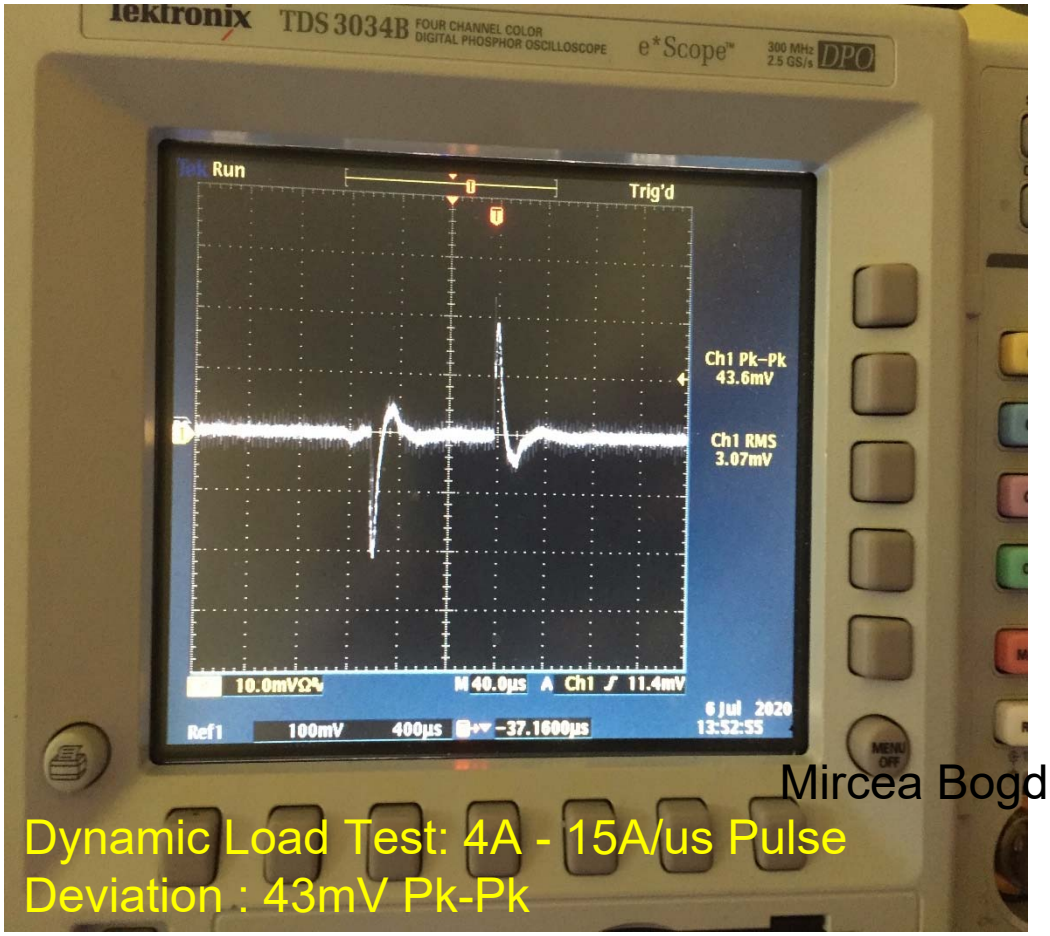
TFM – Power Rail Noise Testing – VCCERAM 2.1

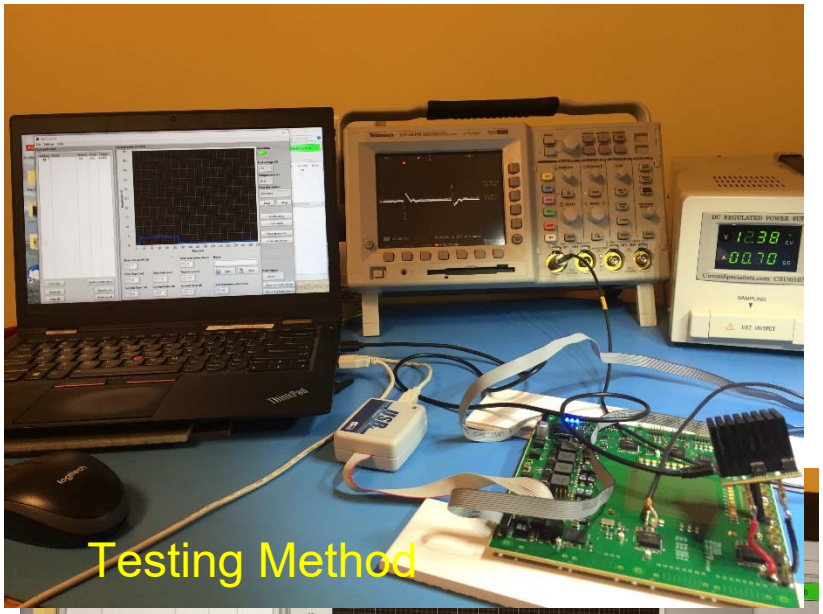
Better

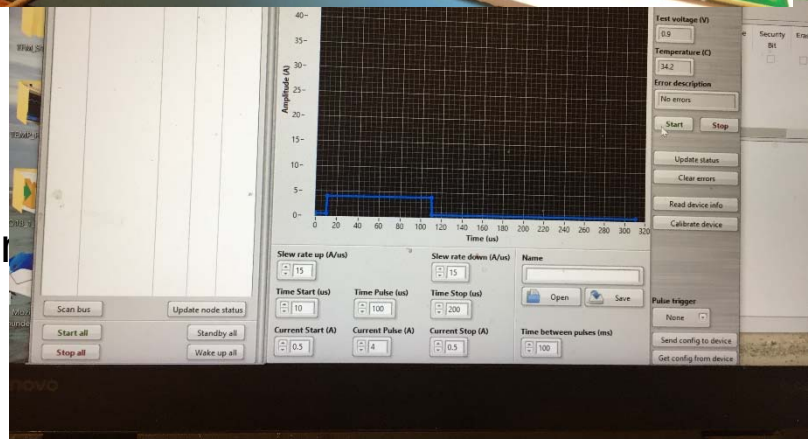
C_{BULK} = 900uF (Added 3x220uF)

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 4A - 15A/us Pulse
Deviation : 43mV Pk-Pk





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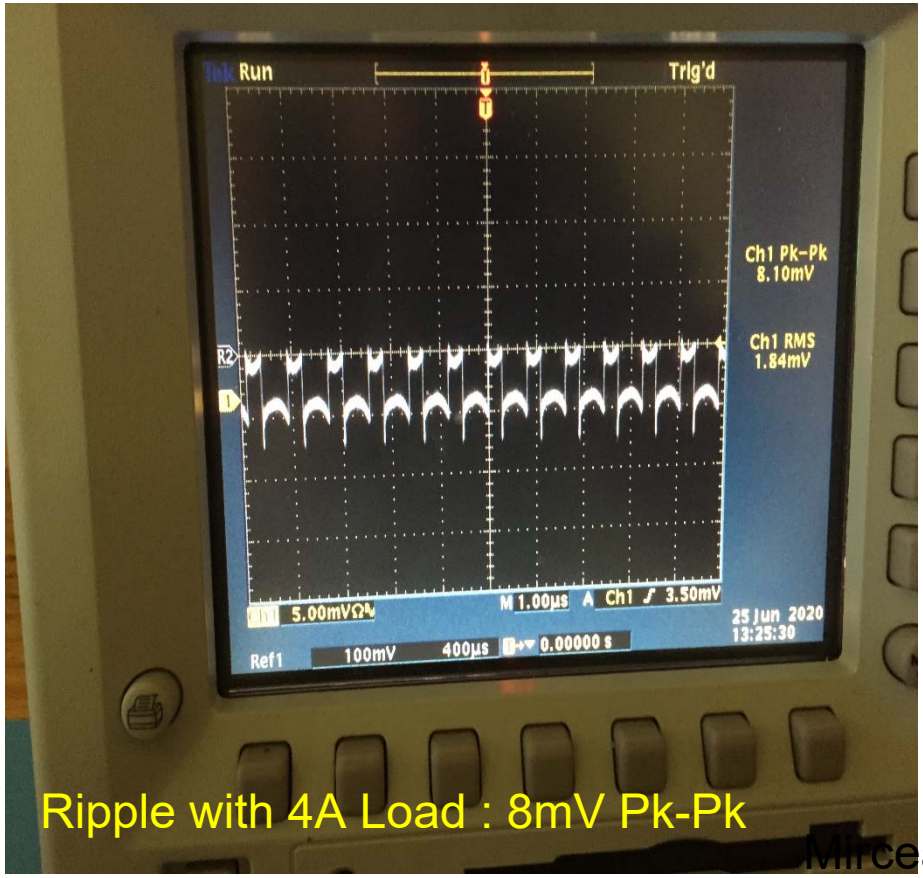
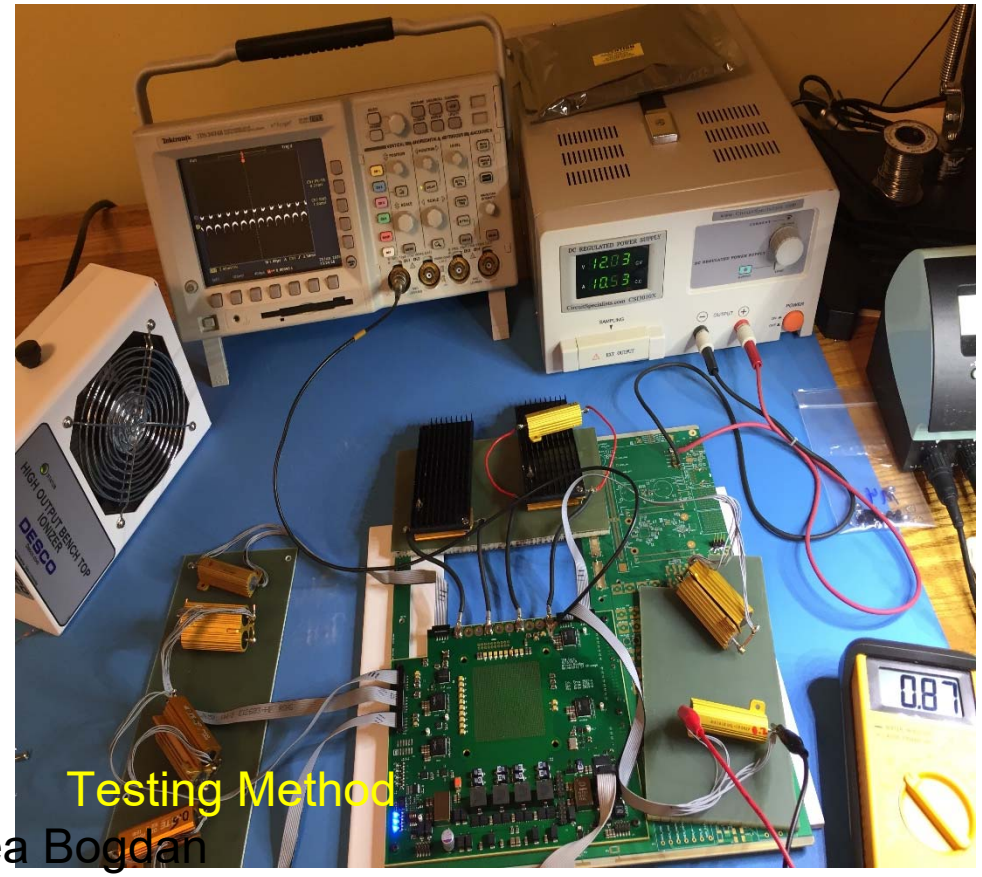
TFM – Power Rail Noise Testing – VCCRL 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 4A Load : 8mV Pk-Pk



Testing Method

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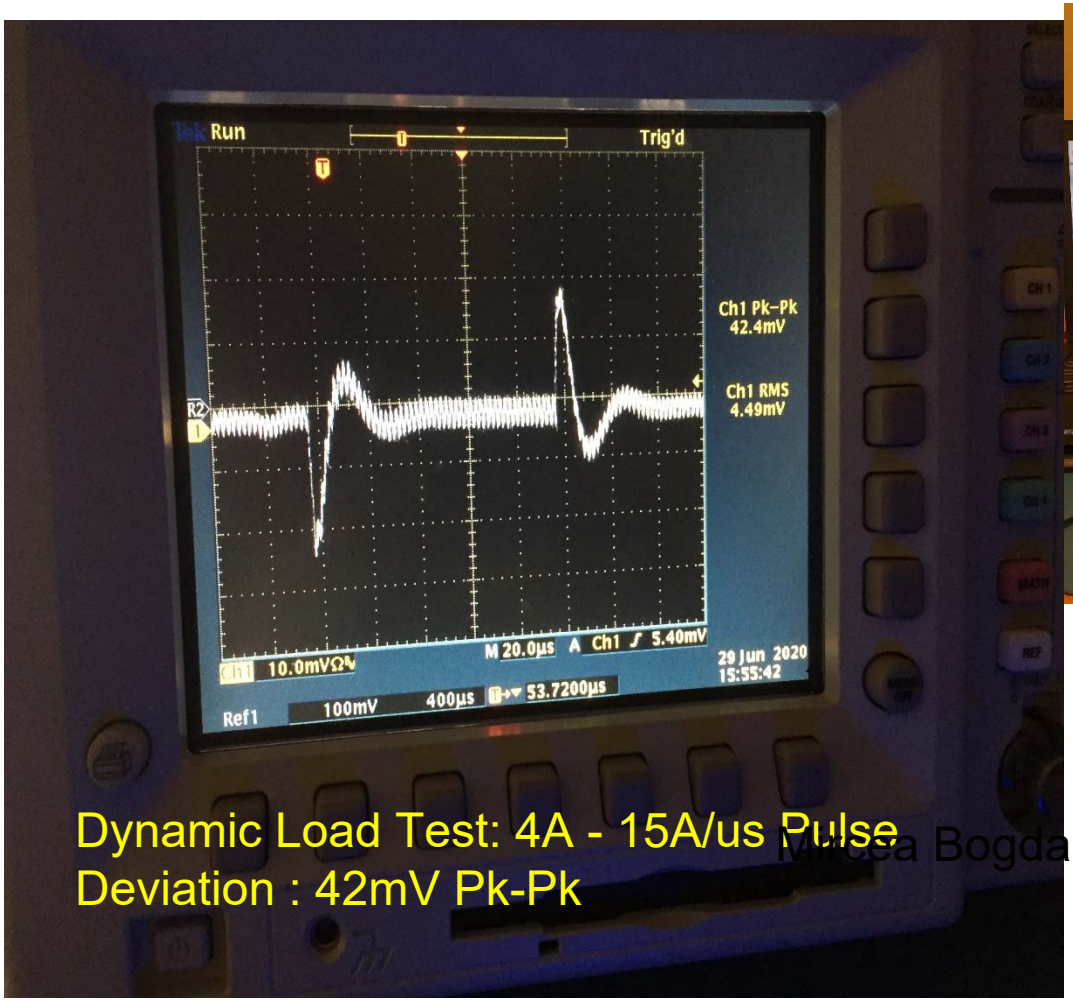
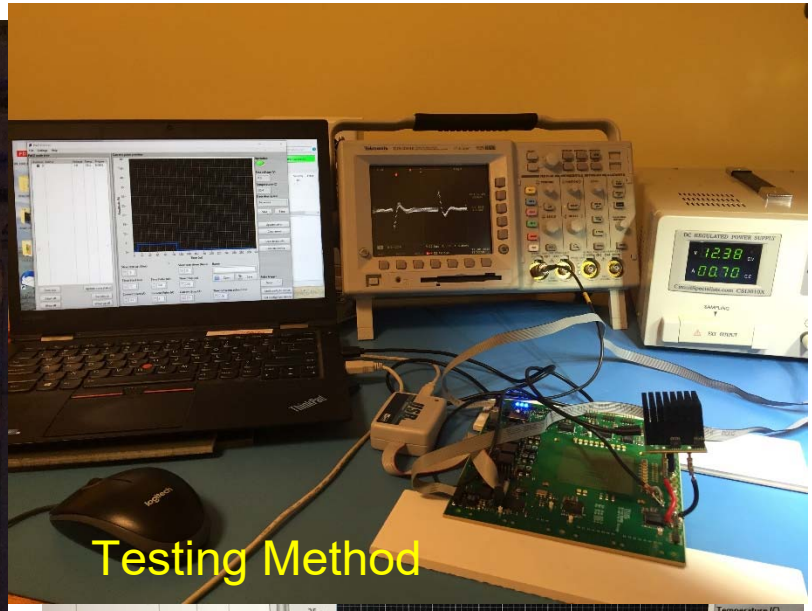
TFM – Power Rail Noise Testing – VCCRL 2

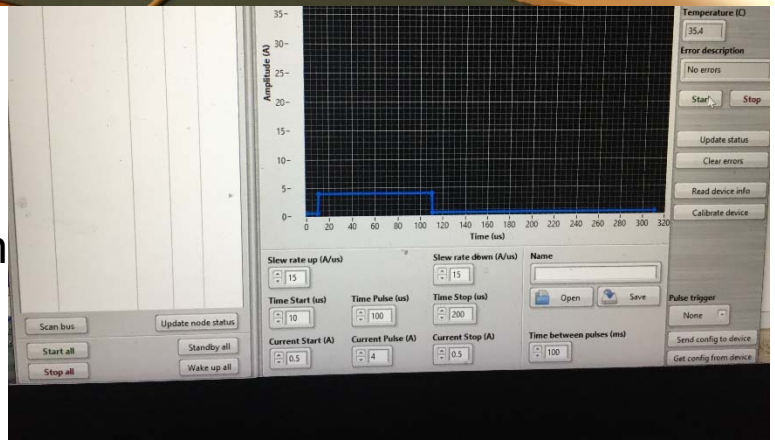
	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 4A - 15A/us Pulse
Deviation : 42mV Pk-Pk



Testing Method



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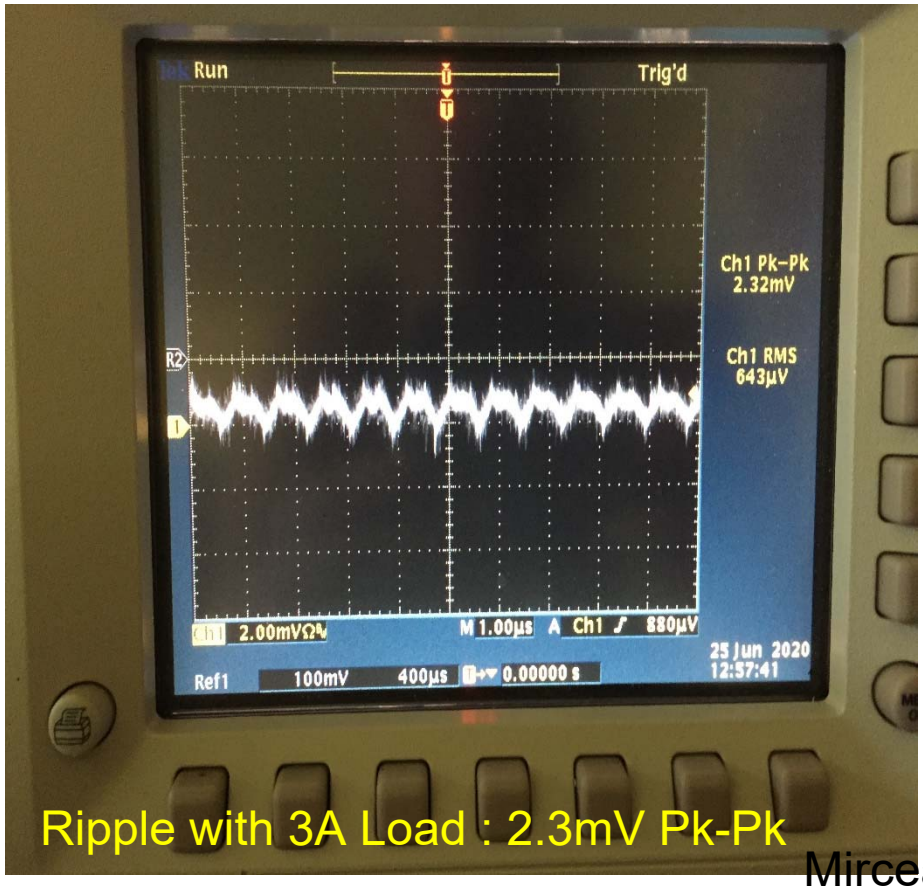
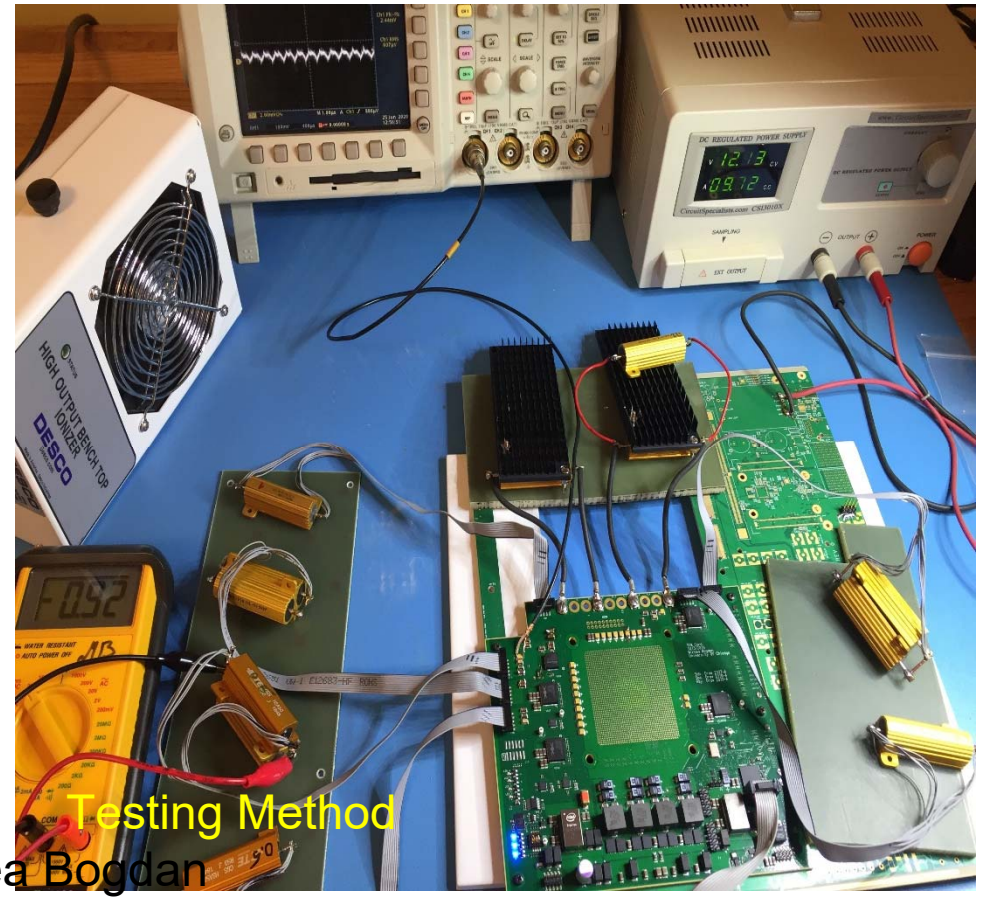
TFM – Power Rail Noise Testing – VCCT 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 3A Load : 2.3mV Pk-Pk



Testing Method

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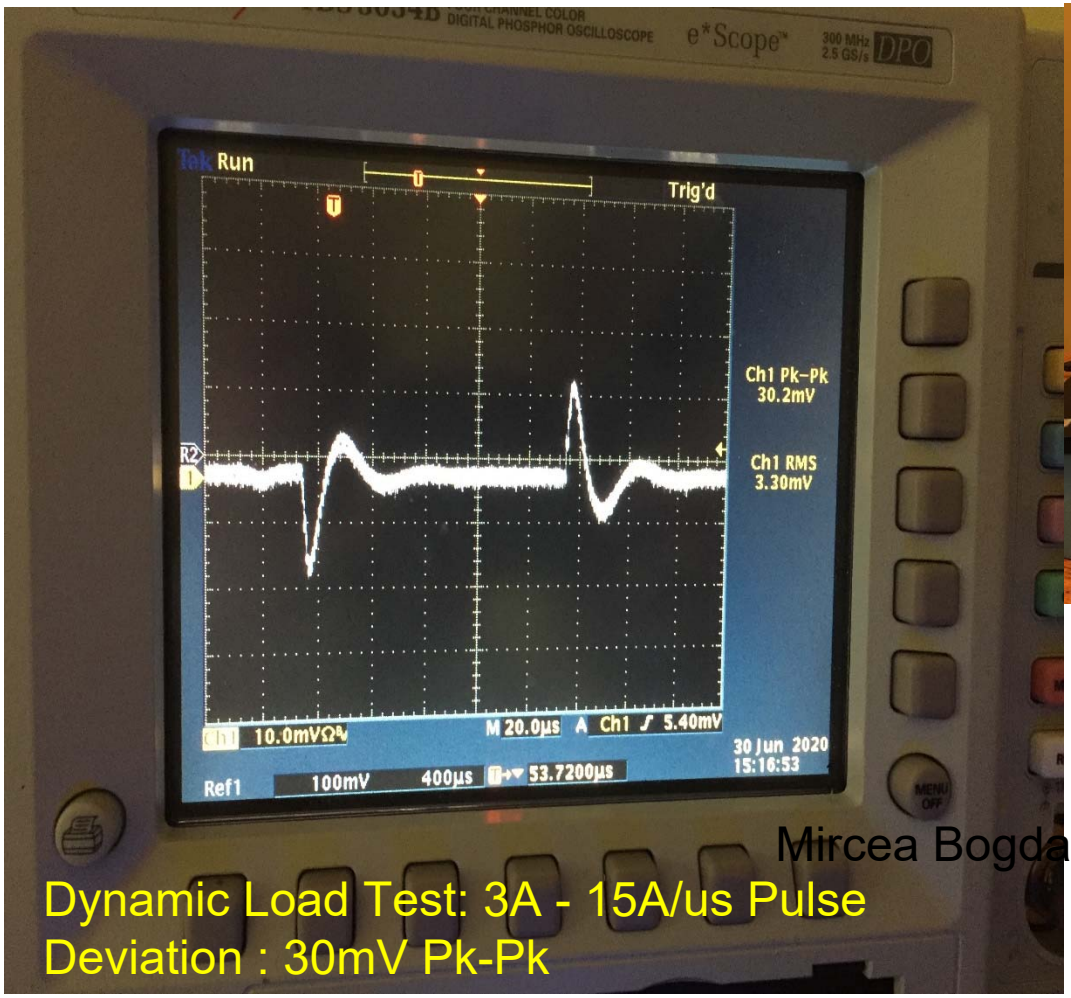
TFM – Power Rail Noise Testing – VCCT 2

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



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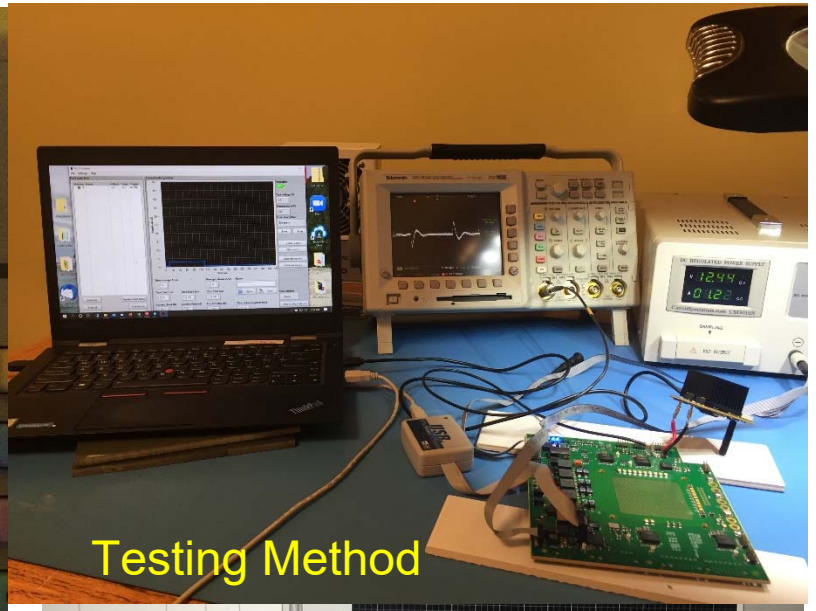
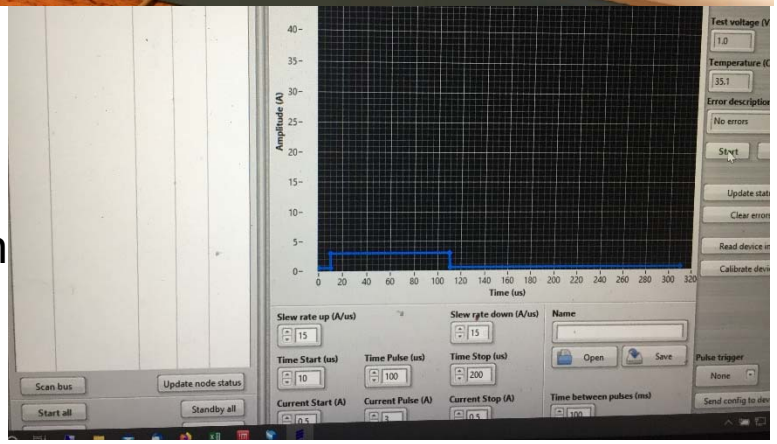
Dynamic Load Test: 3A - 15A/us Pulse
Deviation : 30mV Pk-Pk

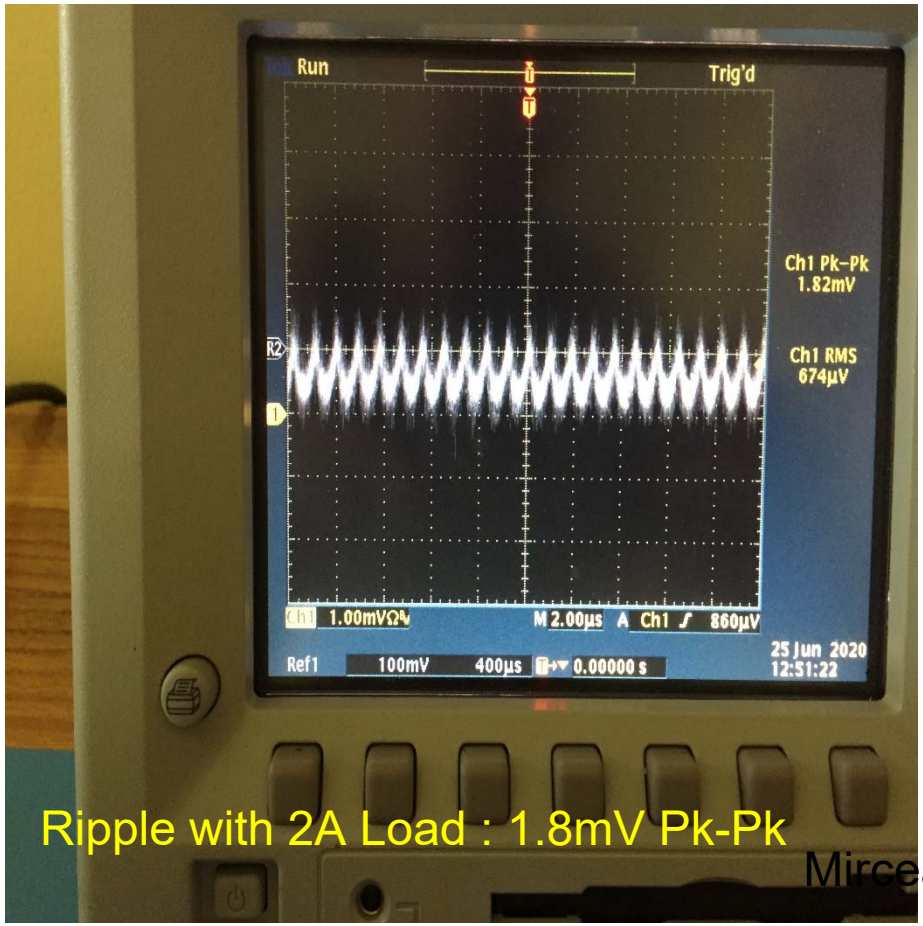


Testing Method



TFM – Power Rail Noise Testing – VCCM 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 2A Load : 1.8mV Pk-Pk

Testing Method

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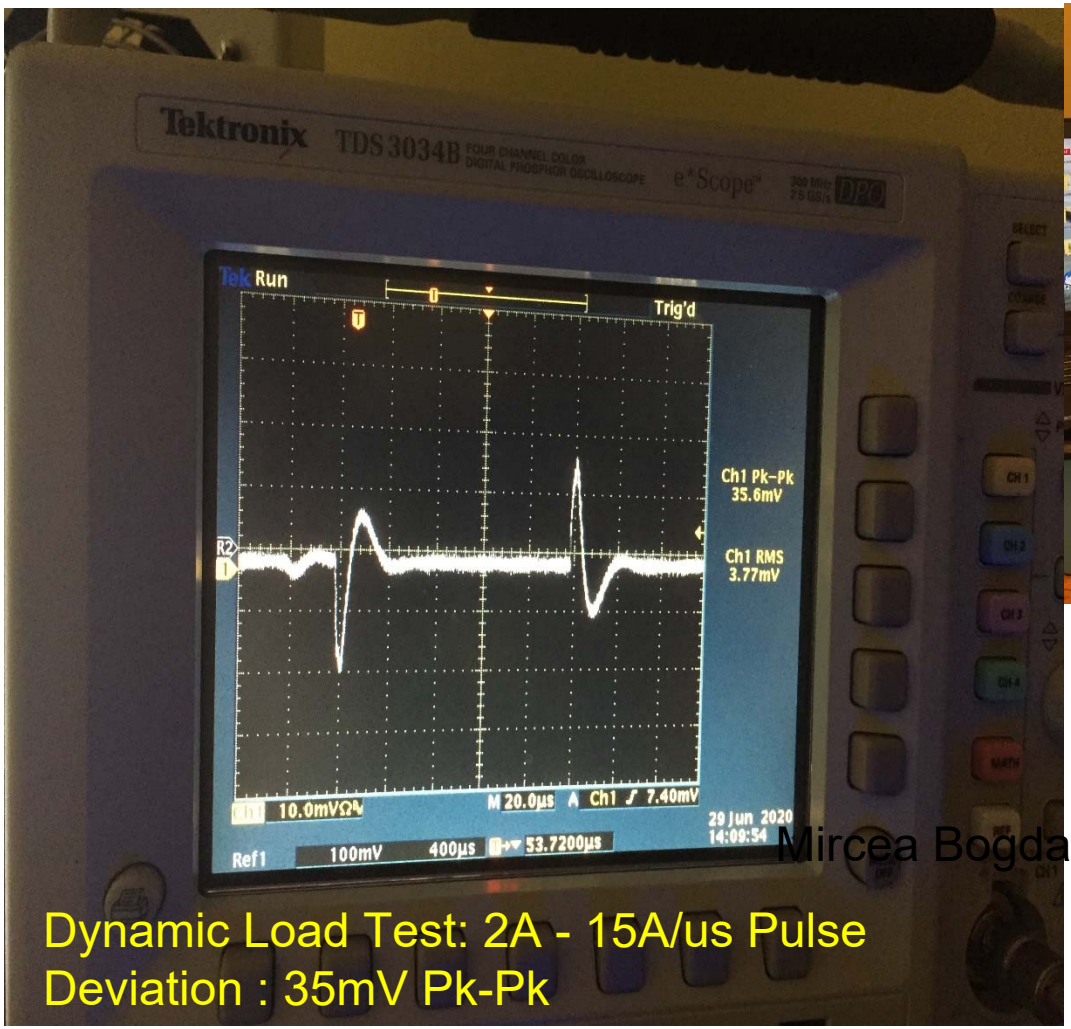
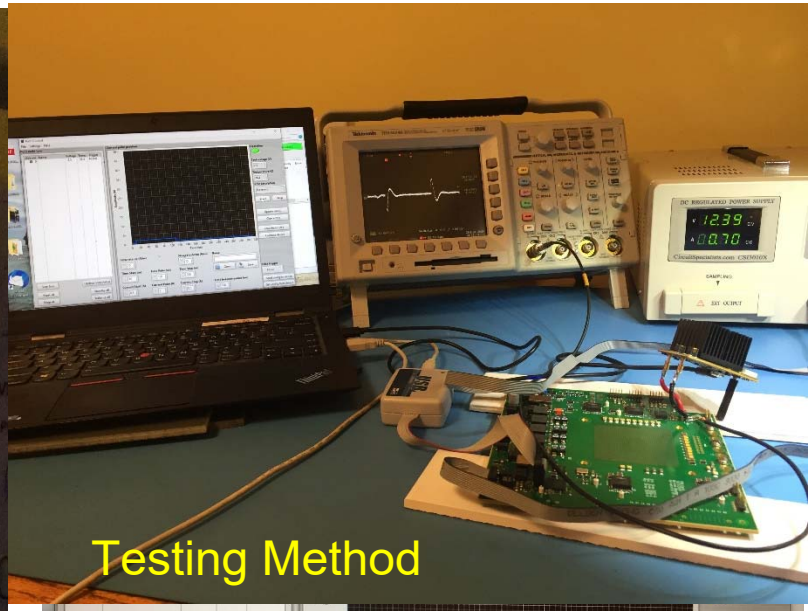
TFM – Power Rail Noise Testing – VCCM 2

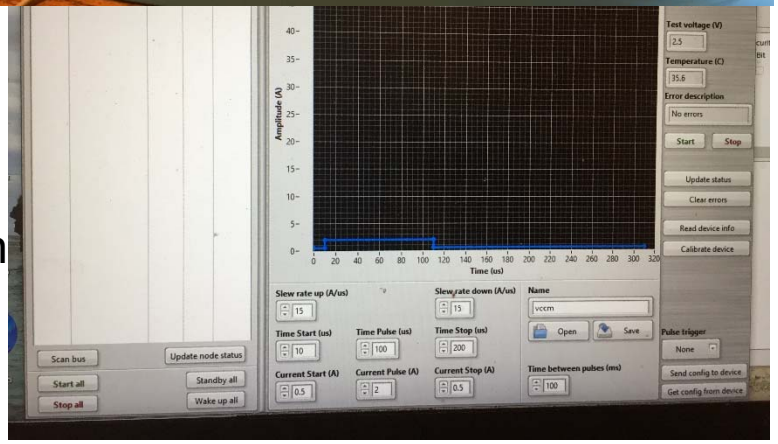
	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 2A - 15A/us Pulse
Deviation : 35mV Pk-Pk



Testing Method



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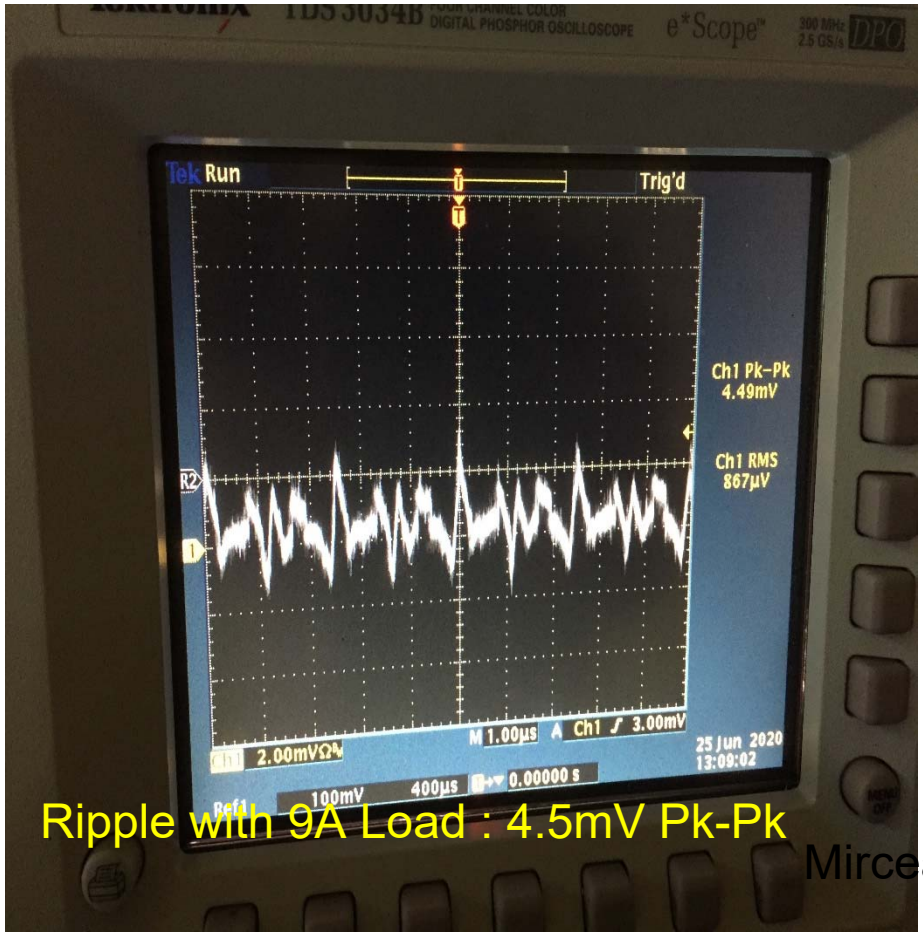
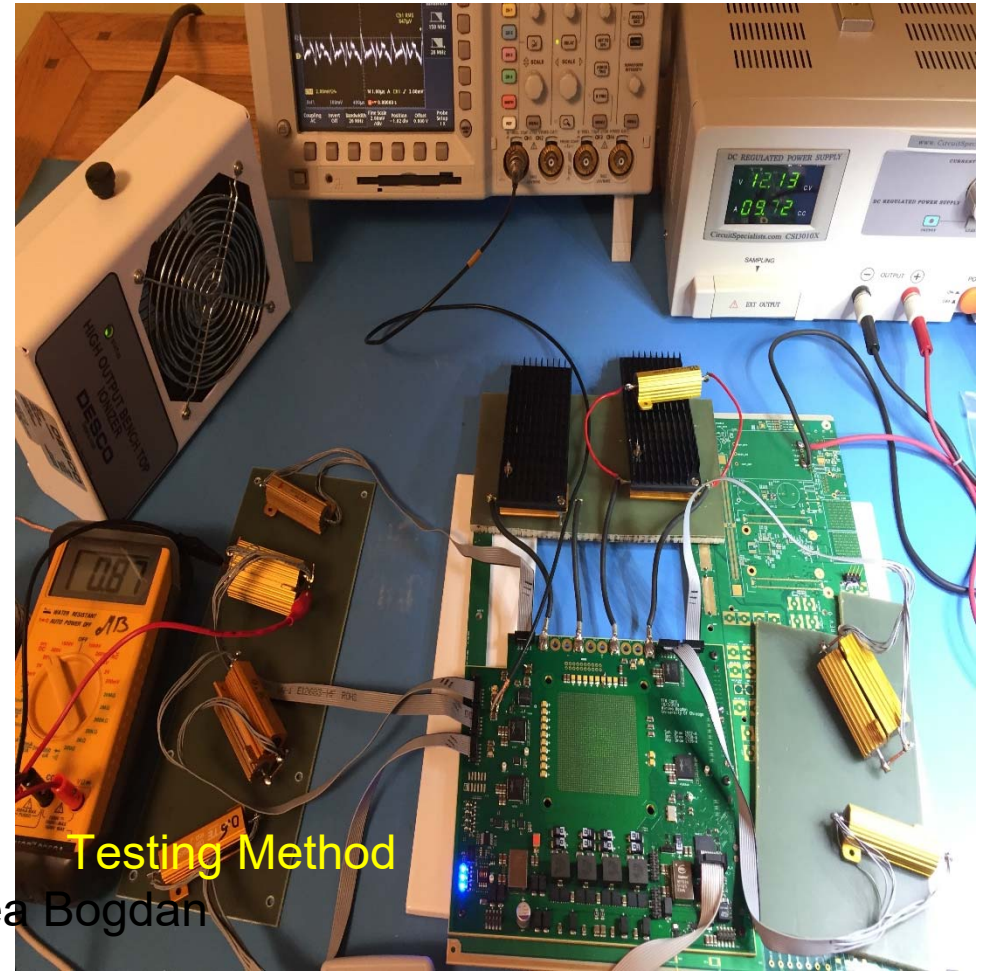
TFM – Power Rail Noise Testing – VCCIOUIB 1

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Ripple with 9A Load : 4.5mV Pk-Pk



Testing Method

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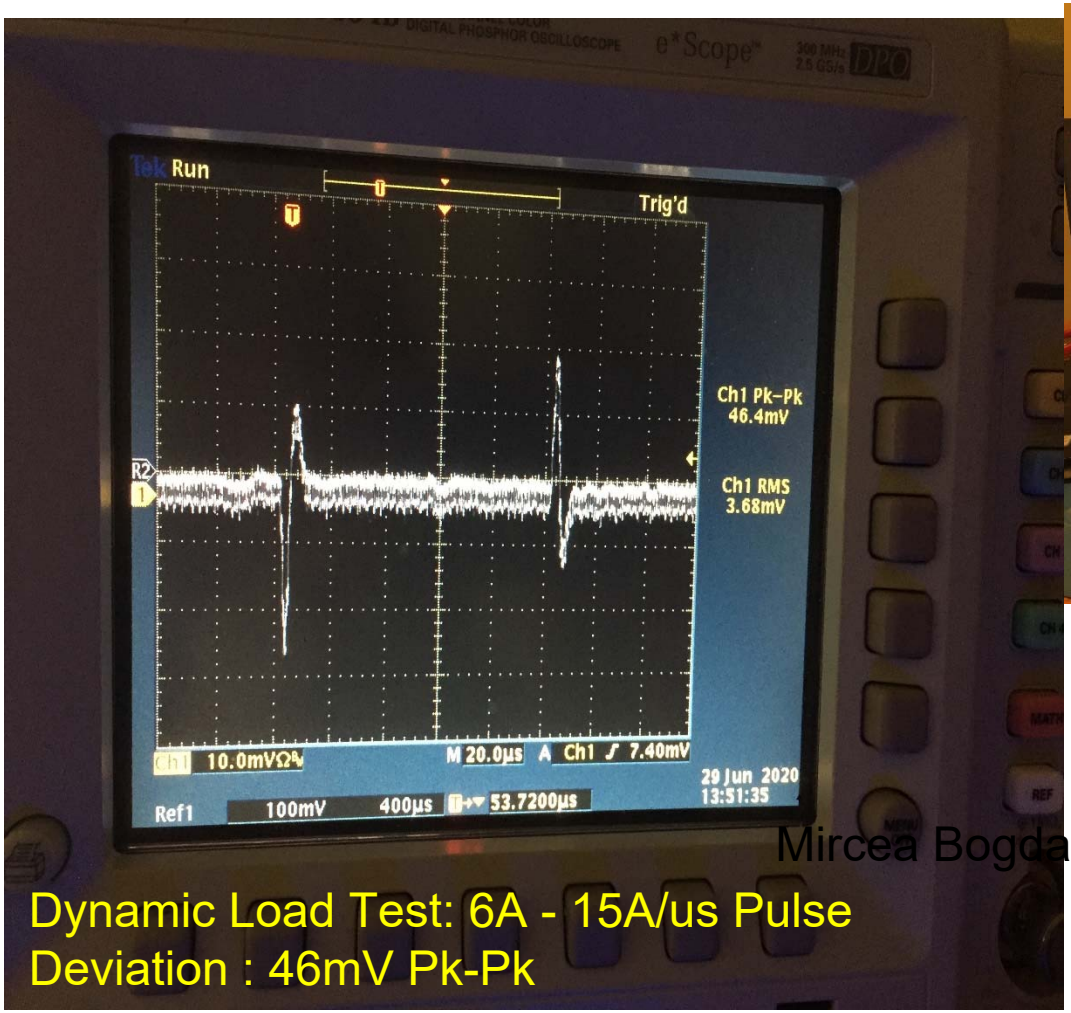
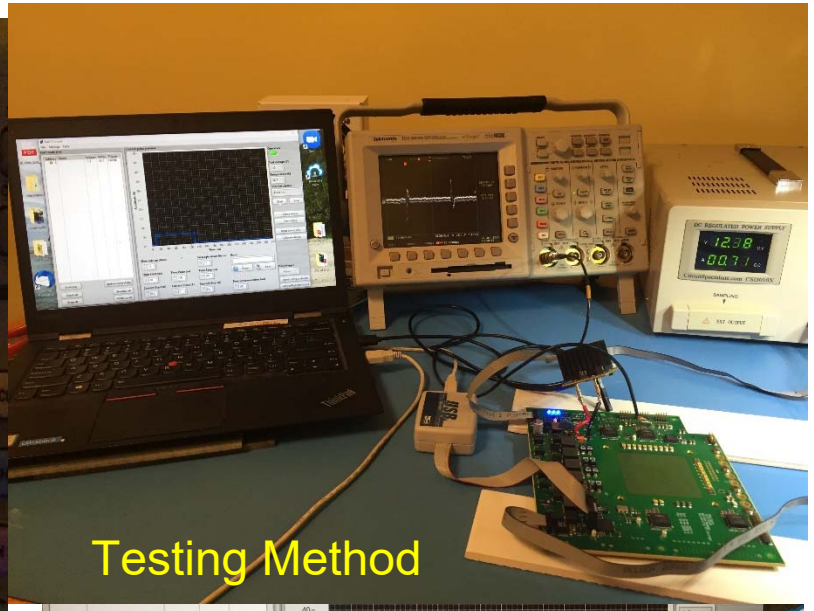
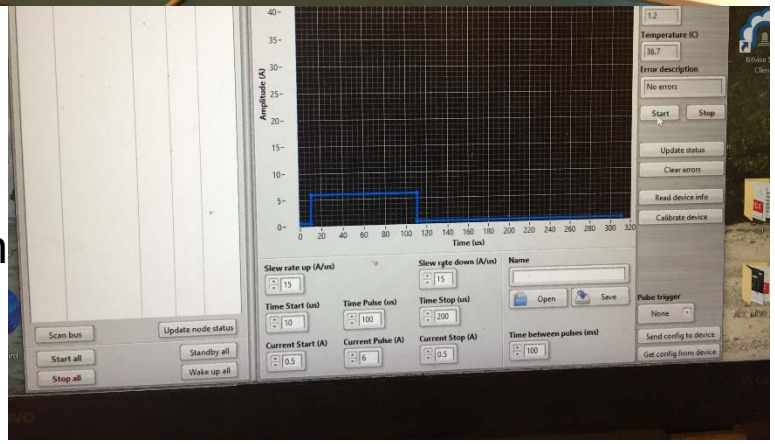
TFM – Power Rail Noise Testing – VCCIOUIB 2

	CORE	VCCH	VCCERAM	VCCRL	VCCT	VCCM	VCCIOUIB
Power Rail Voltage	0.86V	1.8V	0.9V	1.03V	1.03V	2.5V	1.2V
Power Rail Current Estimate	63A	7.45A	3.7A	2.3A	0.75A	2A	8A
Dynamic Current Change Requirement	18.9A	2.7A	1.9A	0.69A	0.45A	1.42A	5.68A
Noise Requirement	+/-40mV	+/-54mV	+/-45mV	+/-30mV	+/-20mV	+/-125mV	+/-60mV



Dynamic Load Test: 6A - 15A/us Pulse
Deviation : 46mV Pk-Pk





Mircea Bogdan

To Do on Current Modules w/o S10Mx FPGA:

- Test Power Sequencing:
  - Will have to adjust Firmware

To Do:

- Assembly of two more modules with S10MX
  - We have the PCBs and all the parts
  - PO has been issued
- Test of the two new modules
- Design/produce Loop-Back test card if needed

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