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Advanced Energy

ORV3 Rectifier Updates

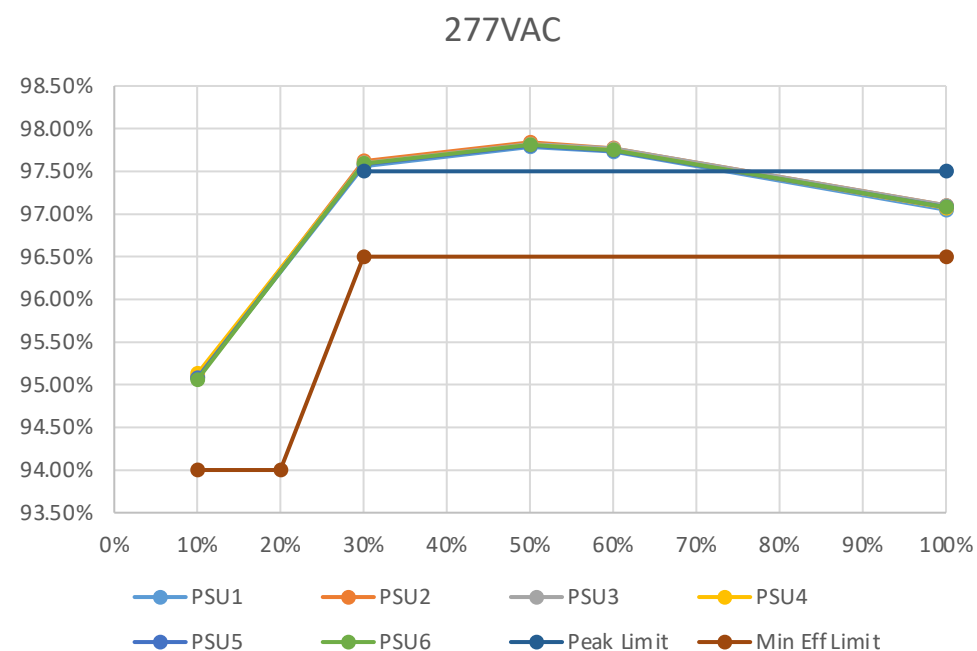
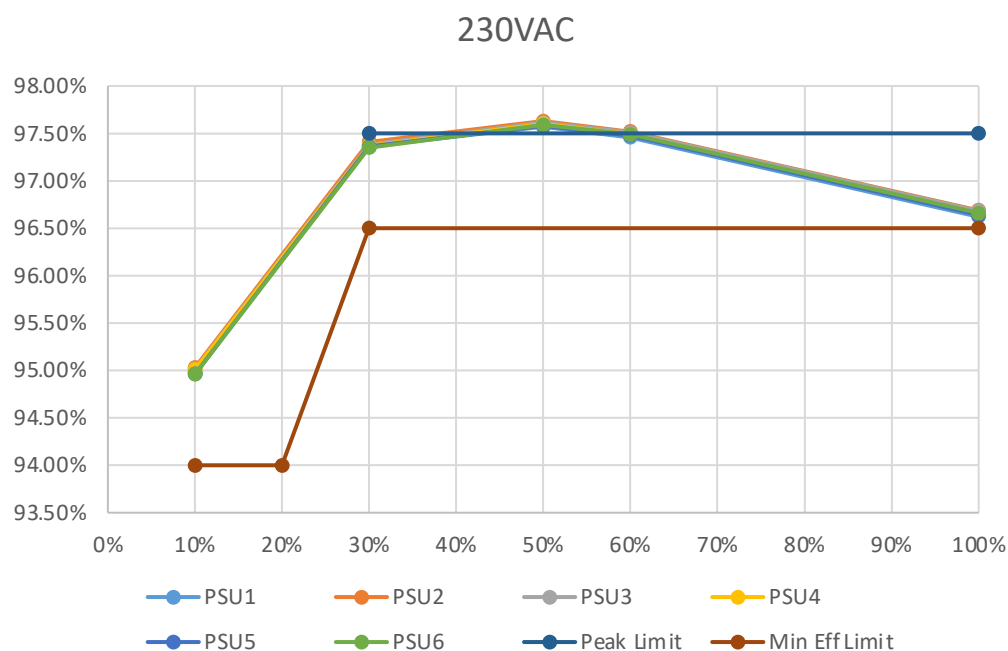
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Agenda

- Efficiency update for DVT units
- Rectifier to BBU transition update
- Automated Integration set up

ORV3 3KW efficiency (Pre production)



- *All 6 random selected units in DVT build meets peak and minimum efficiency across all line conditions
- *Data measurement co-relates with engineering and customer efficiency measure set-ups

ORV3 Rectifier to BBU Transitions Recap

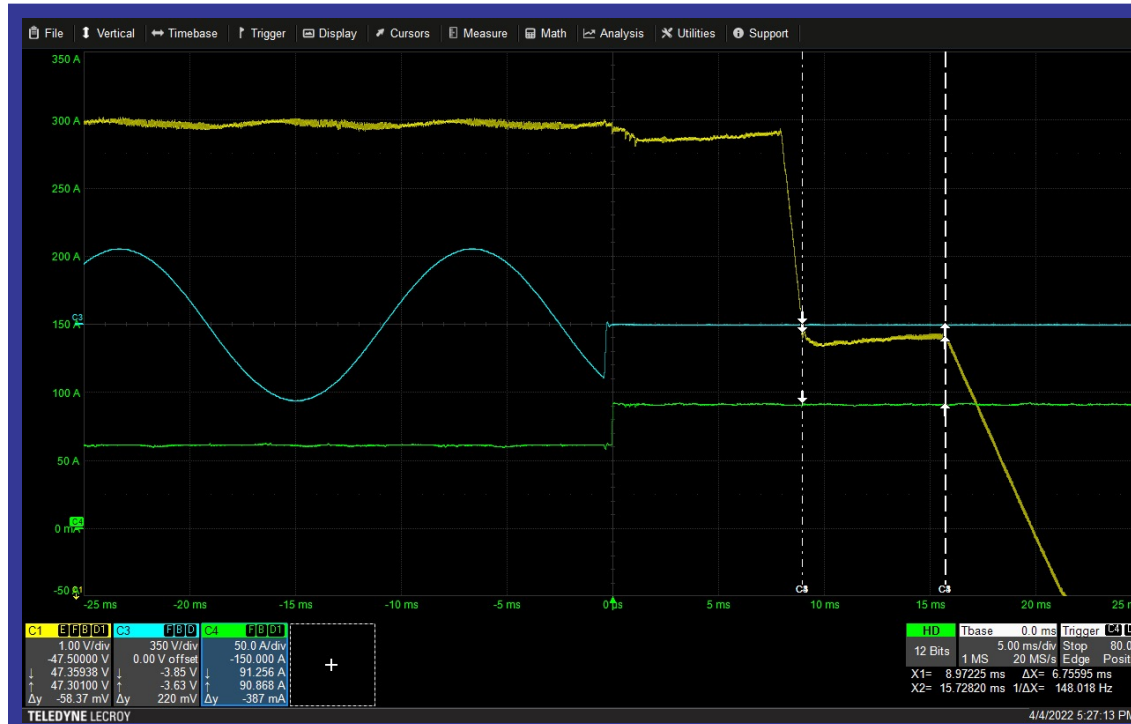
- For the load to transition or share from rectifier to BBU seamlessly, rectifier regulation would drop by 3V and maintain that level at minimum 4msec to trigger BBU to turn on and time to share.
- There are two main conditions for rectifier to adjust from 51V to 48V:
 - **Condition 1: During AC loss conditions**
 - Output will adjust if 66.6% of bulk energy is depleted
 - **Condition 2: Over power/current conditions:**
 - Average power more than 3.3kW for 10s
 - Average power more than 3.6kW for 100ms
 - Repetitive pulse power more than the pulse power envelope specified (up to 150% load)
 - Single pulse power more than holdup time at the overload condition (up to 150% load)

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ORV3 Rectifier to BBU Transitions Updates

- For the load to transition or share from rectifier to BBU seamlessly, rectifier regulation would drop by 3V and maintain that level at minimum 6msec to trigger BBU to turn on and time to share.
- There are two main conditions for rectifier to adjust from 51V to 48V:
 - Condition 1: During AC loss conditions
 - Output will adjust if 50% of bulk energy is depleted
 - Condition 2: Over power/current conditions:
 - Average power more than 3.3kW for 10s
 - Average power more than 3.6kW for 100ms
 - Repetitive pulse power more than the pulse power envelope specified (up to 150% load)
 - ~~Single pulse power more than holdup time at the overload condition (up to 150% load)~~

ORV3 Rectifier adjusts from 51V to 48V – AC Loss @150% load



To meet minimum 6msec, the bulk energy depleted trigger was set from 66.6% down to 50% (30J). This remaining energy can sustain output at 48V for at least 6msec with 150% load.
(note: specs is actually minimum 5.7msec for this condition)

CH1:Vout ; CH3:VAC; CH4:Iout
Remaining time @48V measured at 6.75msec

Why remove the single pulse power adjust?

- Single pulse power more than holdup time at the overload condition (up to 150% load)

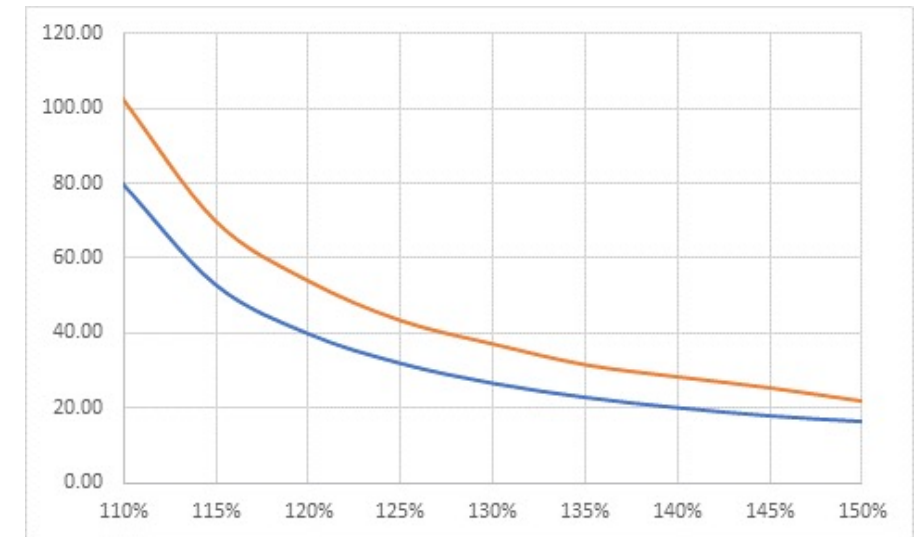
load power	holdup time (ms)
100%	20.00
110%	18.18
120%	16.67
130%	15.38
140%	14.29
150%	13.33

Previous specs allows output adjust by -3V if during pulse overload exceed the hold up time. i.e. as an example, if output loaded by 110%, after 18.18msec, output allowed to adjust.

- This overlaps with the repetitive pulse load condition
- By removing this adjust overload protection, it will allow rectifiers to be less susceptible to output adjusts during pulse overload

ORV3 Repetitive Peak Load before adjust

start load(A)	peak load (A)	DC-DC peak load	Specs time (ms) 24J	actual time (ms) to adjust
60	66	110%	80.00	103.22
60	69	115%	52.84	70.07
60	72	120%	39.76	54.00
60	75	125%	31.78	43.26
60	78	130%	26.41	36.89
60	81	135%	22.71	31.33
60	84	140%	19.97	28.12
60	87	145%	17.78	25.11
60	90	150%	16.28	21.59



- With update in over power condition to remove single pulse more than hold up, more peak load conditions can sustain output without adjusting
- If the peak load energy exceeds 24J (repetitive pulse power specs), it is only time output would adjust
- In the table above, actual test shows in AEI Rectifiers with peak load of 150% (step from 100%) can be sustained for >20msec before output adjusts

AEI ORV3 PSU-BBU Integration Set-up



- Automated test of integrated Power Shelf-BBU
- Test Set-up Ready for 2xPSU – 2xBBU integration with up to 54KW testing