

Unit 1 (Z15 420k) – Complete Bench Test & Frequency Sweep Report

Date: October 24–25, 2026 | **Unit:** Unit 1 (Lab Bench Node , PDU Outlet 3 @ 242 V L6-30R) | **Hardware:** C55 Control Board, 3 × 3-chip BM1746 Hashboards (J1 / J2 / J3) @ 780 mV | **System:** FO Build Ghost Shell v0.9.0 vs. OEM Factory OEM Stock (9.0.0.5)

1. Executive Summary: Optimal Operating Points vs. OEM Factory Factory Sticker & Empirical OEM Stock

Configuration / System Profile	PSU	Per-Chip Clocks (J1 ; J2 ; J3 MHz)	Active Chips	Settled Hashrate (5s / av)	Δ vs. Sticker (420k)	Δ vs. OEM Measured	Wall Power (Δ vs. 1,510 W Sticker)	PSU Load	Efficiency (J/KSol vs. 3.60 Sticker)	Chip Temps	Fans (RPM)	Rej / HW
0. OEM Factory Factory Sticker Spec (Advertised Z15)	APW7 1,800 W	Factory Rated (~800–815 MHz)	9 / 9 (3×3)	420.0 KSol/s (±5%)	Sticker (0.0%)	-4.5%	1,510.0 W (±10% 0.0 W)	83.9%	3.60 J/KSol (278.1 Sol/W 0.0%)	≤80 °C max	Auto	Spec
1. Empirical OEM Stock (9.0.0.5) (15.2h API + 8d ViaBTC)	APW7 1,800 W	815, 815, 815 ; 815, 815, 815 ; 815, 815, 815	000/000/000	440.0 KSol/s (441.0 av; 438.8 pool)	+4.8% (+20.0k)	Baseline (0.0%)	1,531.0 W (+21.0 W / +1.4%)	85.1%	3.48 J/KSol (287.4 Sol/W -3.3%)	64–67 °C	3,720–3,840	0.42% / 0
2. GS Uniform 815 MHz (Rung 3 APW7 & Rung 4 APW3++)	APW7 / APW3++	815, 815, 815 ; 815, 815, 815 ; 815, 815, 815	000/000/000	435.9 KSol/s (438.6 av APW7; 434.2 APW3++)	+3.8% to +4.4%	-0.5% to -0.9%	1,517.7 W (+7.7 W) / 1,511.6 W (+1.6 W)	84.3% / 94.5%	3.48 J/KSol (287.2 Sol/W -3.3%)	65/65/67 °C	3,840–3,960	0.00% / 0
3. GS Uniform 825 MHz (Best All-Chip Uniform Ceiling)	APW3++ / APW7	825, 825, 825 ; 825, 825, 825 ; 825, 825, 825	000/000/000	452.1 KSol/s (449.8 av APW3++; 442.9 av APW7)	+7.1% to +7.6% (+32.1k)	+2.0% to +2.8%	1,532.6 W (+22.6 W) / 1,543.7 W (+33.7 W)	95.8% / 85.8%	3.39 J/KSol (295.0 Sol/W -5.8%)	65/65/67 °C	3,840	0.00% / 0
4. GS Optimal Per-Board Hold (825 / 850 / 850 MHz) (79.8m)	APW7 1,800 W	825, 825, 825 ; 850, 850, 850 ; 850, 850, 850	000/000/000	444.3 KSol/s av (442.2 chain sum mean)	+5.8% (+24.3k)	+0.75% to +1.0%	1,570.4 W (+60.4 W / +4.0%)	87.2%	3.54 J/KSol (282.1 Sol/W -1.7%)	63/64/65 °C	3,720–3,840	0.55% / 0
5. GS Per-Chip Ceiling Profile (825 . 900 MHz) (J2 = 187.4k)	APW7 1,800 W	825, 880, 880 ; 895, 900, 900 ; 890, 850, 900	000/000/000	456.2 KSol/s av (J2 = 187.4 KSol/s)	+8.6% av (+36.2k)	+3.4% av	1,561.8 W (+51.8 W; 1,352–1,663 W)	86.8% (92.4% pk)	3.42 J/KSol (292.1 Sol/W -5.0%)	63/66/65 °C	3,960	0.00% / 0
6. GS 420k Sticker-Match Rung (793 MHz Uniform)	APW7 1,800 W	793, 793, 793 ; 793, 793, 793 ; 793, 793, 793	000/000/000	424.8 KSol/s (427.9 av)	+1.1% to +1.9% (+4.8k)	-3.5% (-58.6 W)	1,472.4 W (-37.6 W / -2.5% vs Sticker)	81.8%	3.44–3.47 J/KSol (-4.4% vs Sticker)	64/64/66 °C	3,602	0.00% / 0
7. GS Peak Efficiency Rung (681 MHz Uniform)	APW7 1,800 W	681, 681, 681 ; 681, 681, 681 ; 681, 681, 681	000/000/000	378.1 KSol/s (377.6 av)	-10.0% (-41.9k)	-14.1% (-301 W)	1,229.8 W (-280.2 W / -18.6% vs Sticker)	68.3%	3.25 J/KSol (307.5 Sol/W -9.7%)	56/56/57 °C	3,170	0.00% / 0

Per-Board & Per-Chip Silicon Ceilings (Identical on 1,800 W & 1,600 W PSUs)

- Board J1 (Chain 0):** Full-board `ooo` ceiling = **825 MHz** (141.3–158.6 KSol/s).
 - Chip `0:0` ceiling: **825 MHz** (drops to `xoo` at ≥850 MHz).
 - Chip `0:1` ceiling: **895 MHz** (holds `o` through 895 MHz).
 - Chip `0:2` ceiling: **880 MHz** (drops to `xox` at ≥885 MHz).
- Board J2 (Chain 1 — "Golden Board"):** Full-board `ooo` ceiling = **895–900 MHz**.
 - Chip `1:0` ceiling: **895 MHz**; Chips `1:1` & `1:2` ceiling: **900 MHz**.
 - Reaches **160.9–163.3 KSol/s** during uniform 890–895 MHz sweeps and **187.4 KSol/s** at 895, 900, 900.
- Board J3 (Chain 2):** Full-board `ooo` ceiling = **850 MHz** (141.7–151.9 KSol/s).
 - Chip `2:0`: **890 MHz**; Chip `2:1`: **850 MHz** (drops to `oxo` at ≥855 MHz); Chip `2:2`: **900 MHz**.

Key Engineering Conclusions from Unit 1 Testing

- Silicon Lottery, Not PSU Starvation:** Chip dropouts on `J1` (850 MHz) and `J3` (855 MHz) happened at the exact same frequencies on both the **APW7 1,800 W** and **APW3++ 1,600 W** PSUs when wall draw was only 1,445–1,533 W.
- Safe 900 MHz Auto-Tune Ceiling on Both PSUs:** Wall power scales linearly at **~2.08–2.27 W/MHz** across all 9 chips. Even a silicon-perfect 9-chip Z15 holding `ooo/ooo/ooo` at 900 MHz draws **~1,655–1,670 W** (92.8% of APW7 1,800 W; ~103% of APW3++ 1,600 W, matching OEM's 1,640 W pull).
- Keep Intra-Board Chip Splits Tight (≤10 MHz):** Wide clock splits on the same 3-chip serial domain (e.g., 825 vs. 880 MHz on J1, or 850 vs. 900 MHz on J3) cause domain work-pacing contention and power oscillation (1,352–1,663 W). Per-board uniform tuning (`825 / 850 . 885 / 850 MHz`) or uniform 825 MHz runs rock-steady with zero hardware errors.

2. Test 2: Unit 1 on APW3++ 1,600 W PSU — 17-Rung High-Range Sweep (800–900 MHz, Oct 25, 2026)

Rung	Target (MHz)	Wall Power (W)	Amps (A)	APW3++ 1600W %	APW7 1800W %	Settled 5s (KSol/s)	Avg (KSol/s)	Chain Rates J1 / J2 / J3 (KSol/s)	Eff. (J/KSol)	ΔW vs 815	ΔHash vs 815	Chip Temp (°C)	Fan (RPM)	ACS Status	Acc/Rej/HW
1	800	1475.8	6.12	92.2%	82.0%	413.83	419.01	134.9 / 139.9 / 139.0	3.57	-35.8	-4.68%	64/64/65	3590	ooo/ooo/ooo	113/0/0
2	805	1488.2	6.15	93.0%	82.7%	419.63	426.25	143.3 / 136.1 / 140.2	3.55	-23.4	-3.34%	63/64/65	3672	ooo/ooo/ooo	112/0/0
3	810	1498.8	6.22	93.7%	83.3%	435.79	435.67	145.8 / 146.8 / 143.2	3.44	-12.8	+0.38%	65/65/66	3685	ooo/ooo/ooo	66/0/0
4	815	1511.6	6.24	94.5%	84.0%	434.15	430.61	155.8 / 136.7 / 141.7	3.48	+0.0	+0.00%	65/65/66	3740	ooo/ooo/ooo	111/0/0
5	820	1524.2	6.32	95.3%	84.7%	429.62	431.48	144.1 / 144.9 / 140.6	3.55	+12.6	-1.04%	66/64/65	3770	ooo/ooo/ooo	125/0/0
6	825	1532.6	6.33	95.8%	85.1%	452.12	449.83	147.0 / 152.8 / 152.4	3.39	+21.0	+4.14%	65/65/67	3800	ooo/ooo/ooo	110/0/0
7	850	1445.8	5.98	90.4%	80.3%	384.62	386.94	100.8 / 142.2 / 141.7	3.76	-65.8	-11.41%	61/64/69	3878	xoo/ooo/ooo	134/0/0
8	855	1315.5	5.46	82.2%	73.1%	362.50	365.30	97.0 / 156.2 / 109.2	3.63	-196.1	-16.50%	62/64/66	3910	xoo/ooo/oxo	111/0/0
9	860	1324.8	5.51	82.8%	73.6%	354.75	358.31	100.2 / 145.9 / 108.7	3.73	-186.8	-18.29%	61/67/64	3832	xoo/ooo/oxo	93/0/0

Rung	Target (MHz)	Wall Power (W)	Amps (A)	APW3++ 1600W %	APW7 1800W %	Settled 5s (KSol/s)	Avg (KSol/s)	Chain Rates J1 / J2 / J3 (KSol/s)	Eff. (J/KSol)	ΔW vs 815	$\Delta Hash$ vs 815	Chip Temp (°C)	Fan (RPM)	ACS Status	Acc/Rej/HW
10	865	1336.5	5.55	83.5%	74.2%	333.94	344.77	84.7 / 150.7 / 98.6	4.00	-175.1	-23.08%	61/67/65	3970	xoo/ooo/oxo	69/0/0
11	870	1348.5	5.61	84.3%	74.9%	336.89	348.89	95.5 / 151.5 / 89.9	4.00	-163.1	-22.40%	63/66/65	4018	xoo/ooo/oxo	97/0/0
12	875	1359.6	5.67	85.0%	75.5%	349.78	357.41	104.0 / 139.5 / 106.3	3.89	-152.0	-19.43%	62/67/66	3998	xoo/ooo/oxo	111/0/0
13	880	1356.5	5.61	84.8%	75.4%	359.01	358.38	102.8 / 151.5 / 104.6	3.78	-155.1	-17.31%	61/68/66	4028	xoo/ooo/oxo	58/0/0
14	885	1244.5	5.17	77.8%	69.1%	312.26	325.94	63.6 / 140.9 / 107.8	3.99	-267.1	-28.07%	62/68/66	4148	xox/ooo/oxo	112/0/0
15	890	1181.8	4.91	73.9%	65.7%	286.76	308.38	48.8 / 160.9 / 77.0	4.12	-329.8	-33.95%	62/69/66	4152	xox/ooo/oxo	49/0/0
16	895	1093.9	4.57	68.4%	60.8%	240.45	254.81	39.2 / 144.3 / 57.0	4.55	-417.7	-44.62%	54/67/64	4190	xox/ooo/oxo	52/0/0
17	900	935.0	3.90	58.4%	51.9%	196.65	212.49	1.2 / 146.0 / 49.5	4.75	-576.6	-54.70%	35/68/67	4180	xxx/ooo/xxo	53/1/0

3. Test 1: Unit 1 on APW7 1,800 W PSU – Full 49-Rung Frequency Sweep (600–900 MHz, Sorted by Clock)

Rung #	Target (MHz)	Wall Power (W)	Amps (A)	APW7 1800W %	Settled 5s (KSol/s)	Avg (KSol/s)	Chain Rates J1 / J2 / J3 (KSol/s)	Eff. (J/KSol)	ΔW vs 815	ΔHash vs 815	Chip Temp (°C)	Fan (RPM)	ACS Status	Acc/Rej/HW
49	900	845.5	3.54	47.0%	167.00	187.74	5.2 / 112.2 / 49.5	5.06	-672.2	-61.68%	30/65/62	3598	xox/xoo/xxo	32/0/0
48	895	1077.3	4.47	59.9%	260.98	266.11	42.4 / 163.3 / 55.2	4.13	-440.4	-40.12%	54/66/62	3590	xox/ooo/xxo	122/0/0
47	890	1128.5	4.67	62.7%	277.80	287.38	52.5 / 153.9 / 71.4	4.06	-389.2	-36.26%	58/65/62	3670	xox/ooo/oxo	54/0/0
46	885	1206.6	4.99	67.0%	287.69	298.31	48.6 / 161.7 / 77.4	4.19	-311.1	-33.99%	57/65/63	3655	xox/ooo/oxo	46/0/0
45	880	1360.1	5.62	75.6%	353.22	349.61	97.7 / 156.9 / 98.6	3.85	-157.6	-18.96%	59/64/63	3615	xoo/ooo/oxo	120/0/0
44	875	1358.1	5.63	75.5%	353.00	356.70	105.5 / 157.1 / 90.4	3.85	-159.6	-19.01%	62/66/65	3675	xoo/ooo/oxo	63/0/0
43	870	1344.5	5.57	74.7%	376.32	378.89	103.5 / 158.9 / 113.9	3.57	-173.2	-13.66%	59/65/62	3602	xoo/ooo/oxo	135/1/0
42	865	1332.8	5.52	74.0%	359.28	367.61	98.2 / 156.2 / 104.8	3.71	-185.0	-17.57%	60/65/59	3680	xoo/ooo/oxo	63/0/0
41	860	1322.8	5.47	73.5%	351.31	352.68	94.8 / 155.3 / 101.2	3.77	-194.9	-19.40%	60/61/64	3640	xoo/ooo/oxo	66/0/0
40	855	1314.1	5.47	73.0%	359.94	356.51	102.0 / 147.9 / 110.0	3.65	-203.6	-17.42%	59/65/61	3622	xoo/ooo/oxo	115/0/0
39	850	1447.8	6.00	80.4%	410.89	410.26	99.5 / 159.6 / 151.9	3.52	-69.9	-5.73%	60/64/65	3550	xoo/ooo/ooo	136/0/0
1	825	1543.7	6.40	85.8%	431.70	442.91	141.3 / 155.3 / 135.2	3.58	+26.0	-0.95%	65/65/67	3840	ooo/ooo/ooo	27/0/0
2	820	1528.0	6.33	84.9%	437.87	433.06	146.9 / 148.6 / 142.4	3.49	+10.3	+0.46%	67/65/67	3595	ooo/ooo/ooo	80/0/0
3	815	1517.7	6.32	84.3%	435.85	438.55	144.6 / 152.7 / 138.6	3.48	+0.0	+0.00%	65/65/67	3628	ooo/ooo/ooo	77/0/0
4	810	1507.8	6.29	83.8%	420.34	424.23	135.9 / 146.2 / 138.2	3.59	-9.9	-3.56%	64/64/65	3668	ooo/ooo/ooo	137/0/0
5	805	1496.4	6.22	83.1%	411.43	416.27	138.3 / 144.3 / 128.8	3.64	-21.3	-5.60%	65/64/66	3572	ooo/ooo/ooo	151/0/0
6	800	1484.8	6.18	82.5%	413.18	412.05	137.2 / 143.8 / 132.1	3.59	-32.9	-5.20%	64/65/66	3615	ooo/ooo/ooo	113/0/0
7	793	1472.4	6.11	81.8%	424.76	427.93	140.3 / 142.8 / 141.7	3.47	-45.3	-2.54%	64/64/66	3602	ooo/ooo/ooo	64/0/0
8	787	1459.0	6.04	81.1%	418.70	414.91	142.6 / 141.4 / 134.7	3.48	-58.7	-3.93%	63/63/63	3598	ooo/ooo/ooo	70/0/0
9	781	1444.2	5.98	80.2%	429.07	425.21	136.2 / 143.6 / 149.2	3.37	-73.5	-1.56%	65/63/65	3565	ooo/ooo/ooo	97/0/0

Rung #	Target (MHz)	Wall Power (W)	Amps (A)	APW7 1800W %	Settled 5s (KSol/s)	Avg (KSol/s)	Chain Rates J1 / J2 / J3 (KSol/s)	Eff. (J/KSol)	ΔW vs 815	ΔHash vs 815	Chip Temp (°C)	Fan (RPM)	ACS Status	Acc/Rej/HW
10	775	1432.0	5.95	79.6%	418.48	416.13	131.8 / 149.1 / 137.6	3.42	-85.7	-3.99%	63/63/64	3555	ooo/ooo/ooo	113/0/0
11	768	1418.9	5.88	78.8%	416.24	412.12	139.8 / 141.5 / 135.0	3.41	-98.8	-4.50%	64/64/65	3530	ooo/ooo/ooo	92/0/0
12	762	1404.0	5.81	78.0%	408.10	409.08	134.7 / 125.7 / 147.8	3.44	-113.7	-6.37%	61/64/66	3528	ooo/ooo/ooo	121/0/0
13	756	1387.8	5.78	77.1%	394.82	394.20	124.6 / 137.0 / 133.2	3.51	-129.9	-9.41%	60/61/62	3405	ooo/ooo/ooo	97/0/0
14	750	1374.5	5.73	76.4%	403.93	396.71	136.9 / 139.0 / 127.9	3.40	-143.2	-7.32%	60/60/62	3332	ooo/ooo/ooo	129/0/0
15	743	1362.0	5.67	75.7%	381.07	384.44	134.1 / 119.3 / 127.6	3.57	-155.7	-12.57%	60/62/61	3308	ooo/ooo/ooo	61/0/0
16	737	1347.1	5.61	74.8%	398.00	405.62	141.1 / 133.4 / 123.5	3.38	-170.6	-8.68%	60/60/61	3310	ooo/ooo/ooo	86/0/0
17	731	1335.2	5.53	74.2%	371.19	377.64	121.0 / 124.6 / 125.7	3.60	-182.5	-14.84%	59/59/61	3258	ooo/ooo/ooo	153/0/0
18	725	1322.7	5.51	73.5%	371.84	376.64	124.3 / 125.5 / 122.0	3.56	-195.0	-14.69%	60/59/61	3270	ooo/ooo/ooo	118/0/0
19	718	1308.7	5.42	72.7%	389.78	388.62	127.0 / 133.6 / 129.1	3.36	-209.0	-10.57%	59/58/60	3277	ooo/ooo/ooo	127/0/0
20	712	1295.0	5.36	71.9%	383.04	382.15	133.2 / 125.2 / 124.7	3.38	-222.7	-12.12%	58/57/59	3255	ooo/ooo/ooo	66/1/0
21	706	1282.2	5.32	71.2%	371.68	369.23	132.3 / 128.7 / 110.7	3.45	-235.5	-14.72%	58/58/59	3238	ooo/ooo/ooo	106/0/0
22	700	1267.9	5.25	70.4%	377.19	374.70	125.3 / 125.1 / 126.8	3.36	-249.8	-13.46%	57/56/59	3225	ooo/ooo/ooo	62/0/0
23	693	1255.0	5.16	69.7%	363.24	364.29	131.2 / 119.8 / 112.3	3.46	-262.7	-16.66%	57/57/57	3163	ooo/ooo/ooo	71/0/0
24	687	1242.5	5.13	69.0%	350.76	351.18	112.0 / 122.0 / 116.8	3.54	-275.2	-19.52%	57/57/57	3202	ooo/ooo/ooo	127/1/0
25	681	1229.8	5.05	68.3%	378.12	377.62	128.2 / 125.1 / 124.8	3.25	-287.9	-13.25%	56/56/57	3170	ooo/ooo/ooo	105/0/0
26	675	1216.4	4.98	67.6%	358.79	360.17	130.8 / 115.4 / 112.5	3.39	-301.3	-17.68%	57/56/57	3098	ooo/ooo/ooo	60/0/0
27	668	1204.0	4.95	66.9%	357.54	364.62	119.9 / 116.5 / 121.1	3.37	-313.7	-17.97%	56/56/57	3120	ooo/ooo/ooo	66/0/0

Rung #	Target (MHz)	Wall Power (W)	Amps (A)	APW7 1800W %	Settled 5s (KSol/s)	Avg (KSol/s)	Chain Rates J1 / J2 / J3 (KSol/s)	Eff. (J/KSol)	ΔW vs 815	ΔHash vs 815	Chip Temp (°C)	Fan (RPM)	ACS Status	Acc/Rej/HW
28	662	1192.5	4.91	66.2%	335.20	337.73	114.6 / 112.0 / 108.7	3.56	-325.2	-23.09%	55/55/56	3102	ooo/ooo/ooo	93/0/0
29	656	1178.8	4.84	65.5%	345.14	349.74	108.7 / 121.5 / 115.0	3.42	-338.9	-20.81%	55/55/56	3080	ooo/ooo/ooo	93/0/0
30	650	1165.8	4.79	64.8%	349.07	346.33	119.7 / 112.9 / 116.5	3.34	-351.9	-19.91%	55/53/57	3020	ooo/ooo/ooo	57/0/0
31	643	1156.7	4.74	64.3%	335.80	335.62	112.6 / 106.4 / 116.8	3.44	-361.0	-22.96%	56/56/58	3080	ooo/ooo/ooo	58/0/0
32	637	1150.1	4.72	63.9%	336.62	345.56	108.6 / 112.3 / 115.8	3.42	-367.6	-22.77%	56/56/58	3198	ooo/ooo/ooo	162/0/0
33	631	1137.8	4.67	63.2%	343.72	339.94	114.5 / 121.3 / 108.0	3.31	-379.9	-21.14%	57/56/58	3135	ooo/ooo/ooo	53/0/0
34	625	1126.7	4.64	62.6%	329.90	336.36	103.6 / 115.6 / 110.8	3.42	-391.0	-24.31%	57/55/56	3190	ooo/ooo/ooo	93/0/0
35	618	1113.8	4.60	61.9%	331.10	333.00	106.3 / 114.2 / 110.6	3.36	-403.9	-24.03%	55/55/59	3158	ooo/ooo/ooo	51/0/0
36	612	1102.9	4.53	61.3%	318.76	322.45	110.3 / 107.6 / 100.8	3.46	-414.8	-26.86%	55/55/56	3175	ooo/ooo/ooo	87/0/0
37	606	1091.5	4.49	60.6%	317.56	323.88	104.1 / 108.6 / 104.9	3.44	-426.2	-27.14%	55/56/57	3135	ooo/ooo/ooo	83/0/0
38	600	1079.2	4.42	60.0%	312.80	312.52	100.4 / 112.8 / 99.5	3.45	-438.5	-28.23%	55/58/56	3182	ooo/ooo/ooo	129/1/0