Hardware V1 · Report rev. 1.0 · 27 November 2026

Power consumption test report

ST25R3916B Mini AAT NFC Reader Module with Dual Antennas

Bench data captured on **26 November 2026 (UTC+08:00)**. The measurements cover the reader module supply input, with the ESP32-S3 host powered separately. Each path had one MIFARE Classic S50 card in a fixed position. The reader drove the two paths in turn.

Reference drive · Mean current and power

Operating state	3.3 V avg. mA	3.3 V avg. mW	5 V avg. mA	5 V avg. mW
Standby, RF off	6.84	22.57	8.86	44.68
A/B diagnostic polling	41.54	130.72	54.88	269.24
A/B block reads	37.35	117.53	48.53	238.41
One A/B read cycle per second	14.98	47.92	19.45	96.38

Supply and drive comparison · Mean power (mW)

Operating state	3.3 V reference	3.3 V highest drive	5 V reference	5 V highest drive
Standby, RF off	22.57	23.06	44.68	44.85
A diagnostic polling	123.32	167.98	302.43	301.21
B diagnostic polling	137.12	165.30	235.74	229.59
A/B diagnostic polling	130.72	166.83	269.24	265.30
A block reads	112.04	149.52	271.79	274.52
B block reads	122.34	140.11	210.03	204.21
A/B block reads	117.53	145.42	238.41	236.97
One A/B read cycle per second	47.92	56.94	96.38	95.12
Return to standby	22.65	23.12	44.87	44.97

> **Sustained carrier at nominal 5 V**
> The highest measured sustained load was the A path at **89.22 mA / 440.57 mW**. The B path averaged **66.61 mA / 331.18 mW**. Each unmodulated RF hold lasted 12 s, with about 9 s used for the reported average.

Voltages above are nominal supply settings. The 3.3 V highest-drive run used a revised host power setup. The two 3.3 V columns therefore show the combined effect of the drive setting and test setup.

Setup and method

Module input and test load

- A P5S1 v2.2 meter measured voltage and current on the reader module input branch. The meter reported a 60 V / 330 mA range, 5.5 digits and 100 Hz acquisition. Independent calibration was unavailable.
- The ESP32-S3 ran the module's I^2C reference firmware and drew power from a separate supply branch. The bus ran at 100 kHz in the status configuration and switched to 400 kHz during block-read transactions.
- Each connected antenna held one MIFARE Classic S50 card at a fixed bench position. The two RF paths were exercised one at a time. The capture records do not specify antenna-to-card distance, antenna-to-port size assignment, cable length, ambient conditions or supply ramp.
- Both paths used reference drive setting 7 or highest drive setting 0 for each run. The 0 setting selects the lowest driver output resistance. The matching settings stayed fixed at A = 112 and B = 0 throughout. STMicroelectronics DS13541 Rev. 11, Table 78

Operating states and verification

- **Standby:** reader initialized with the RF field off. Standby was repeated at the end of every capture.
- **Diagnostic polling:** an amplitude and phase measurement followed by three ISO/IEC 14443 A/B polling trials per command. A successful result is an ISO/IEC 14443 A UID detection.
- **Block reads:** card discovery, authentication and a 16-byte read from Classic block 4. In continuous operation, requests ran as fast as the host completed them. In the one-second mode, A and B each ran once per cycle. Failed transactions and retry gaps remain in the traces and phase averages.
- **Sustained carrier:** a temporary diagnostic hold kept one antenna at a time emitting an unmodulated carrier for 12 s. The reported averages use the stable carrier intervals. The short diagnostic scan at the end of each hold remains in the waveform.

Analysis windows

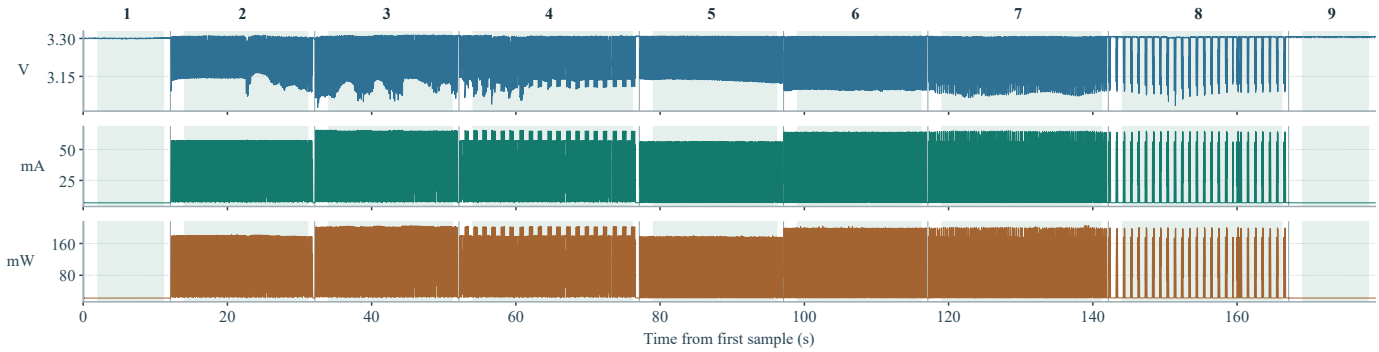
The nine normal phases had planned durations of 12, 20, 20, 25, 20, 20, 25, 25 and 12 s. Statistical windows normally exclude the first 2 s and last 1 s of a phase. The capture tool caps each trim at a fraction of the planned duration for short phases. Transaction counts cover the full phase. See the run figures for the shaded statistical windows.

Input power is computed from each synchronized voltage and current sample. Reported energy is the integral over the statistical window. Peak current and peak power are independent observations. The tables distinguish peaks in statistical windows from peaks across the entire capture.

26 November 2026 · Run 1 of 5

Nominal 3.3 V · Reference RF drive

11:32:06 to 11:35:05 (UTC+08:00) · 17,910 samples · 99.96 Hz · 3.027 to 3.315 V observed



Numbers above the trace match table rows. Shading identifies samples used for phase statistics.

Voltage and current (current in mA)

Phase	Samples	Mean V	Min. to max. V	Mean	Median	P95	P99	Max.	Successes
1 Standby, RF off	900	3.300	3.297 to 3.303	6.84	6.84	6.84	6.84	6.84	-
2 A diagnostic polling	1,700	3.199	3.071 to 3.313	38.97	46.76	57.30	57.39	57.60	A 93/93
3 B diagnostic polling	1,700	3.186	3.050 to 3.315	43.61	51.74	65.30	65.56	65.79	B 96/96
4 A/B diagnostic polling	2,200	3.186	3.040 to 3.314	41.54	50.46	64.90	65.40	65.62	A 56/57, B 57/57
5 A block reads	1,700	3.210	3.123 to 3.310	35.29	38.33	56.38	56.52	56.69	A 142/142
6 B block reads	1,699	3.191	3.091 to 3.310	38.88	41.32	63.96	64.23	64.35	B 149/151
7 A/B block reads	2,201	3.190	3.066 to 3.309	37.35	39.59	64.45	64.92	65.28	A 92/93, B 91/93
8 One A/B read cycle per second	2,200	3.274	3.034 to 3.309	14.98	6.87	56.30	64.33	64.94	A 25/25, B 25/25
9 Return to standby	900	3.306	3.304 to 3.308	6.85	6.85	6.85	6.86	6.86	-

Power and energy (power in mW)

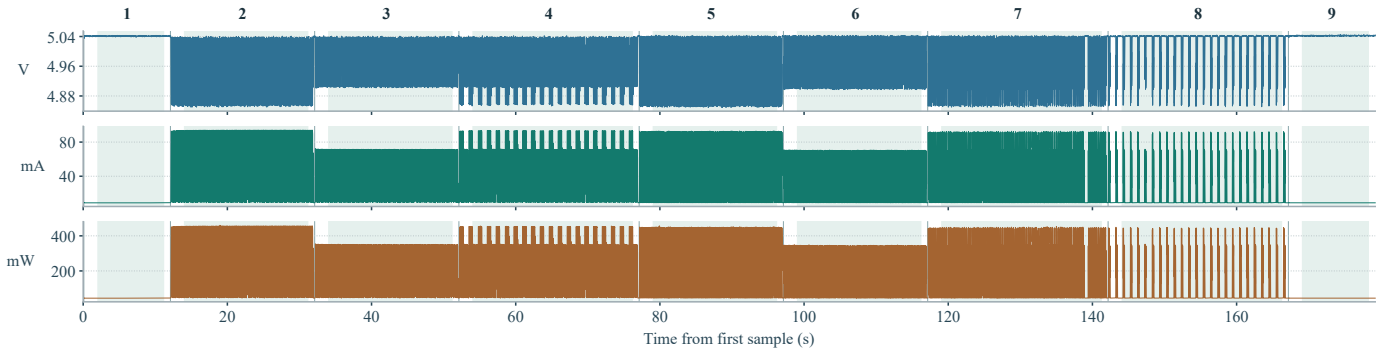
Phase	Mean	Median	P95	P99	Max.	Energy (mWh)
1 Standby, RF off	22.57	22.57	22.58	22.59	22.59	0.0564
2 A diagnostic polling	123.32	148.92	180.34	181.04	182.81	0.5825
3 B diagnostic polling	137.12	161.54	203.34	203.91	204.44	0.6472
4 A/B diagnostic polling	130.72	158.79	201.50	201.99	204.18	0.7989
5 A block reads	112.04	122.68	176.92	177.47	180.08	0.5288
6 B block reads	122.34	132.02	198.52	199.21	203.90	0.5776
7 A/B block reads	117.53	125.83	198.80	200.36	205.63	0.7187
8 One A/B read cycle per second	47.92	22.70	175.65	198.36	200.10	0.2928
9 Return to standby	22.65	22.65	22.66	22.67	22.68	0.0566

Whole-capture maxima at 100 Hz. Current: 65.794 mA (B diagnostic polling, 34.17 s, 3.079 V). Power: 205.627 mW (A/B block reads, 138.92 s, 3.167 V).

26 November 2026 · Run 2 of 5

Nominal 5 V · Reference RF drive

11:20:45 to 11:23:44 (UTC+08:00) · 17,910 samples · 99.92 Hz · 4.849 to 5.045 V observed



Numbers above the trace match table rows. Shading identifies samples used for phase statistics.

Voltage and current (current in mA)

Phase	Samples	Mean V	Min. to max. V	Mean	Median	P95	P99	Max.	Successes
1 Standby, RF off	901	5.041	5.038 to 5.043	8.86	8.86	8.87	8.87	8.87	-
2 A diagnostic polling	1,700	4.923	4.850 to 5.041	61.92	72.73	93.94	94.06	94.16	A 96/96
3 B diagnostic polling	1,700	4.955	4.902 to 5.041	47.83	57.04	71.43	71.60	71.77	B 86/96
4 A/B diagnostic polling	2,198	4.940	4.853 to 5.042	54.88	62.70	93.16	93.39	93.51	A 59/60, B 57/60
5 A block reads	1,701	4.935	4.849 to 5.044	55.52	56.63	92.22	92.66	92.99	A 147/153
6 B block reads	1,701	4.963	4.897 to 5.043	42.57	43.60	70.20	70.51	70.70	B 134/155
7 A/B block reads	2,199	4.951	4.850 to 5.043	48.53	50.59	91.58	92.37	92.72	A 93/94, B 74/94
8 One A/B read cycle per second	2,196	5.017	4.851 to 5.044	19.45	8.93	72.18	91.44	92.25	A 24/25, B 25/25
9 Return to standby	904	5.042	5.040 to 5.045	8.90	8.90	8.91	8.91	8.91	-

Power and energy (power in mW)

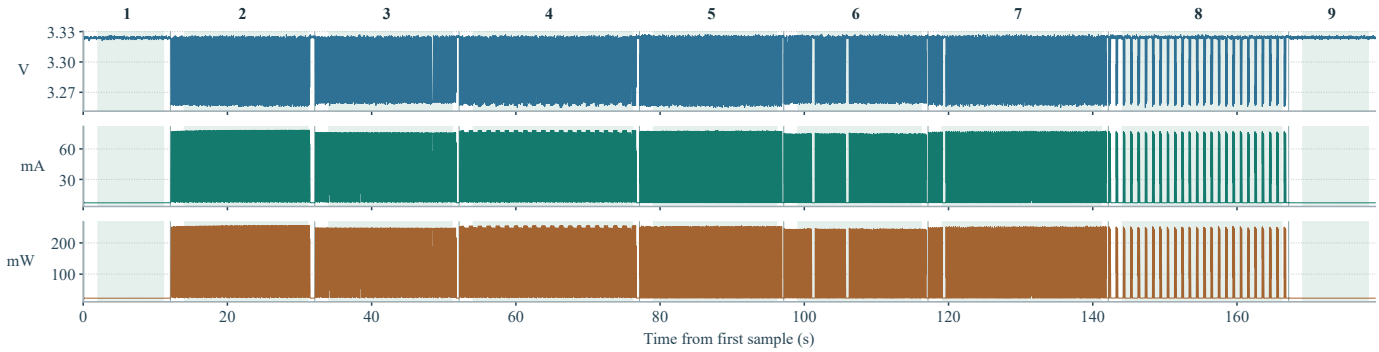
Phase	Mean	Median	P95	P99	Max.	Energy (mWh)
1 Standby, RF off	44.68	44.68	44.71	44.72	44.74	0.1117
2 A diagnostic polling	302.43	356.72	456.06	456.70	459.80	1.4272
3 B diagnostic polling	235.74	281.79	350.38	351.17	352.75	1.1135
4 A/B diagnostic polling	269.24	308.67	452.66	453.69	456.28	1.6444
5 A block reads	271.79	280.00	447.77	449.79	456.78	1.2835
6 B block reads	210.03	216.55	344.10	345.73	348.65	0.9919
7 A/B block reads	238.41	250.07	445.13	448.67	453.36	1.4576
8 One A/B read cycle per second	96.38	45.03	352.84	444.09	447.89	0.5902
9 Return to standby	44.87	44.86	44.91	44.92	44.93	0.1126

Whole-capture maxima at 100 Hz. Current: 94.155 mA (A diagnostic polling, 28.09 s, 4.854 V). Power: 459.797 mW (A diagnostic polling, 18.97 s, 4.927 V).

26 November 2026 · Run 3 of 5

Nominal 3.3 V · Highest RF drive setting

11:57:06 to 12:00:05 (UTC+08:00) · 17,910 samples · 99.96 Hz · 3.255 to 3.327 V observed



Numbers above the trace match table rows. Shading identifies samples used for phase statistics.

Voltage and current (current in mA)

Phase	Samples	Mean V	Min. to max. V	Mean	Median	P95	P99	Max.	Successes
1 Standby, RF off	900	3.324	3.321 to 3.326	6.94	6.94	6.94	6.94	6.94	-
2 A diagnostic polling	1,699	3.283	3.256 to 3.327	51.39	61.55	78.30	78.47	78.62	A 93/93
3 B diagnostic polling	1,702	3.284	3.257 to 3.327	50.54	62.80	75.95	76.17	76.31	B 90/93
4 A/B diagnostic polling	2,199	3.284	3.255 to 3.327	51.02	62.00	78.07	78.21	78.34	A 60/60, B 56/57
5 A block reads	1,701	3.288	3.255 to 3.327	45.68	49.54	77.23	77.71	77.99	A 148/149
6 B block reads	1,701	3.291	3.258 to 3.327	42.78	44.57	74.82	75.19	75.77	B 137/140
7 A/B block reads	2,199	3.289	3.255 to 3.327	44.41	46.89	76.84	77.36	77.76	A 91/91, B 84/90
8 One A/B read cycle per second	2,200	3.314	3.255 to 3.327	17.32	6.98	75.03	76.67	77.40	A 25/25, B 25/25
9 Return to standby	900	3.324	3.322 to 3.326	6.96	6.96	6.96	6.96	6.96	-

Power and energy (power in mW)

Phase	Mean	Median	P95	P99	Max.	Energy (mWh)
1 Standby, RF off	23.06	23.06	23.07	23.07	23.08	0.0576
2 A diagnostic polling	167.98	201.14	255.10	255.63	256.22	0.7936
3 B diagnostic polling	165.30	205.57	247.63	248.30	249.37	0.7812
4 A/B diagnostic polling	166.83	203.00	254.35	254.81	255.73	1.0192
5 A block reads	149.52	163.11	251.68	253.19	255.16	0.7060
6 B block reads	140.11	146.60	243.99	245.23	247.01	0.6617
7 A/B block reads	145.42	154.05	250.51	252.08	254.44	0.8885
8 One A/B read cycle per second	56.94	23.20	244.68	249.92	253.47	0.3480
9 Return to standby	23.12	23.12	23.15	23.15	23.16	0.0577

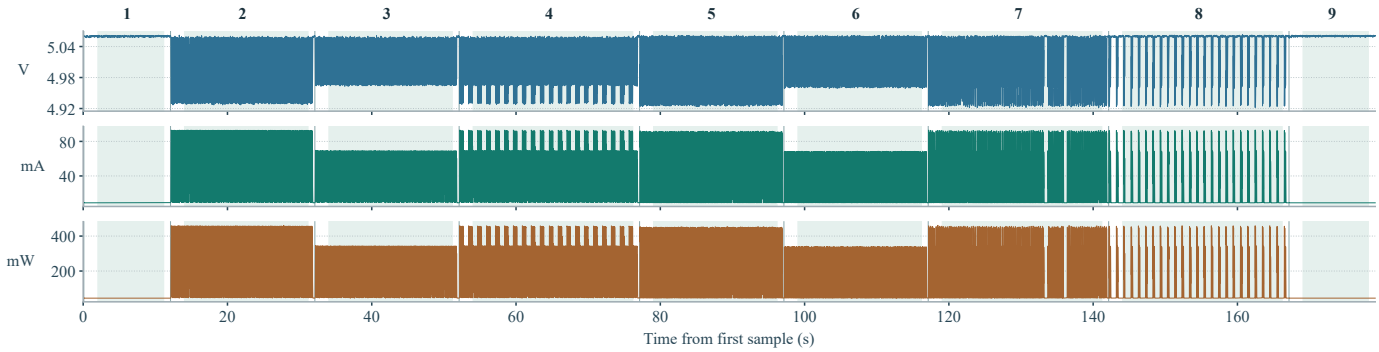
Whole-capture maxima at 100 Hz. Current: 78.620 mA (A diagnostic polling, 30.71 s, 3.259 V). Power: 256.223 mW (A diagnostic polling, 30.71 s, 3.259 V).

The ESP32-S3 used an independently supplied 5 V rail for this retest. The reader branch remained at nominal 3.3 V.

26 November 2026 · Run 4 of 5

Nominal 5 V · Highest RF drive setting

12:06:13 to 12:09:12 (UTC+08:00) · 17,900 samples · 99.94 Hz · 4.922 to 5.063 V observed



Numbers above the trace match table rows. Shading identifies samples used for phase statistics.

Voltage and current (current in mA)

Phase	Samples	Mean V	Min. to max. V	Mean	Median	P95	P99	Max.	Successes
1 Standby, RF off	901	5.060	5.057 to 5.062	8.86	8.86	8.87	8.87	8.87	-
2 A diagnostic polling	1,700	4.979	4.927 to 5.061	60.83	72.69	92.72	92.96	93.08	A 90/96
3 B diagnostic polling	1,699	5.001	4.963 to 5.061	46.08	54.55	69.09	69.23	69.36	B 86/96
4 A/B diagnostic polling	2,200	4.990	4.928 to 5.060	53.43	60.67	92.05	92.82	93.11	A 59/60, B 55/60
5 A block reads	1,700	4.984	4.924 to 5.062	55.38	58.88	91.02	91.57	92.01	A 149/152
6 B block reads	1,700	5.006	4.959 to 5.062	40.95	42.84	68.16	68.44	68.67	B 124/163
7 A/B block reads	2,199	4.996	4.922 to 5.062	47.69	49.53	91.29	92.43	92.75	A 93/93, B 76/92
8 One A/B read cycle per second	2,199	5.043	4.922 to 5.063	19.02	8.91	73.28	91.96	93.20	A 25/25, B 20/25
9 Return to standby	894	5.060	5.058 to 5.062	8.89	8.89	8.89	8.90	8.90	-

Power and energy (power in mW)

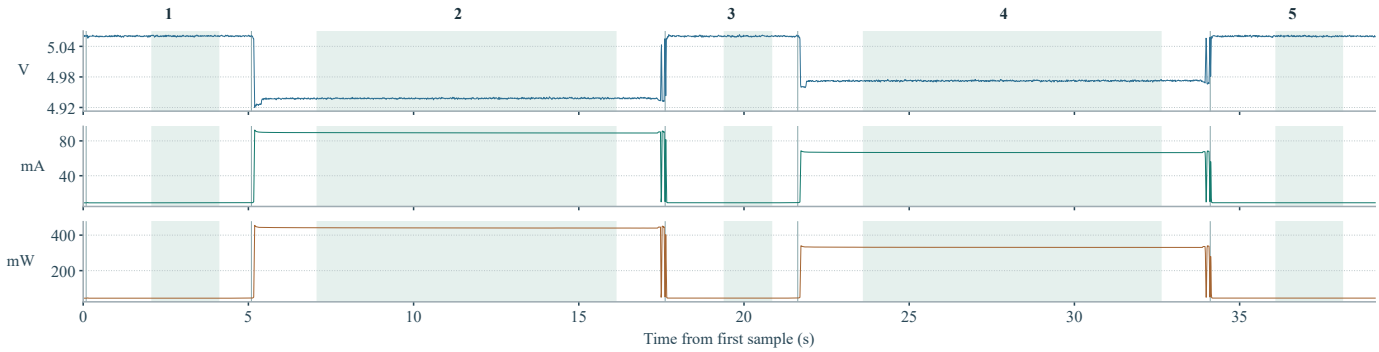
Phase	Mean	Median	P95	P99	Max.	Energy (mWh)
1 Standby, RF off	44.85	44.85	44.88	44.89	44.91	0.1121
2 A diagnostic polling	301.21	360.12	457.17	458.33	460.62	1.4218
3 B diagnostic polling	229.59	271.97	343.12	343.78	344.36	1.0840
4 A/B diagnostic polling	265.30	301.84	453.93	457.66	459.14	1.6209
5 A block reads	274.52	293.79	448.64	451.38	454.13	1.2967
6 B block reads	204.21	214.87	338.28	339.68	342.21	0.9637
7 A/B block reads	236.97	247.04	449.79	455.35	460.15	1.4481
8 One A/B read cycle per second	95.12	45.10	361.96	453.08	458.89	0.5812
9 Return to standby	44.97	44.97	45.01	45.02	45.03	0.1116

Whole-capture maxima at 100 Hz. Current: 93.205 mA (One A/B read cycle per second, 162.46 s, 4.922 V). Power: 461.360 mW (A/B block reads, 118.47 s, 4.976 V).

26 November 2026 · Run 5 of 5

Nominal 5 V · Sustained carrier

Two 12 s carrier holds, A then B · 3,910 samples · 99.96 Hz · 4.920 to 5.063 V observed



The two stable carrier windows lie inside phases 2 and 4. The short scan pulses following each carrier hold are visible outside the shaded windows.

Voltage and current (current in mA)

Phase	Samples	Mean V	Min. to max. V	Mean	Median	P95	P99	Max.
1 Standby, RF off	201	5.060	5.058 to 5.062	8.87	8.87	8.87	8.87	8.87
2 A continuous carrier	901	4.938	4.935 to 4.941	89.22	89.21	89.41	89.43	89.45
3 RF-off interval	141	5.060	5.058 to 5.063	8.95	8.95	8.96	8.96	8.96
4 B continuous carrier	898	4.972	4.970 to 4.975	66.61	66.61	66.70	66.72	66.74
5 Return to standby	199	5.060	5.058 to 5.062	8.95	8.95	8.96	8.96	8.96

Power and energy (power in mW)

Phase	Mean	Median	P95	P99	Max.	Energy (mWh)
1 Standby, RF off	44.87	44.87	44.89	44.90	44.92	0.0249
2 A continuous carrier	440.57	440.49	441.47	441.62	441.71	1.1028
3 RF-off interval	45.29	45.29	45.32	45.33	45.34	0.0176
4 B continuous carrier	331.18	331.19	331.67	331.80	331.89	0.8253
5 Return to standby	45.29	45.29	45.33	45.34	45.35	0.0249

Whole-capture maxima at 100 Hz. Current: 92.502 mA (A continuous carrier, 5.19 s, 4.920 V). Power: 455.110 mW (A continuous carrier, 5.19 s, 4.920 V).

Integrity and limits

Capture verification

Capture	Samples	Rate (Hz)	Missed, est.	Longest gap (ms)	Retries
3.3 V reference	17,910	99.96	5	20	1
5 V reference	17,910	99.92	12	20	1
3.3 V highest drive	17,910	99.96	6	20	3
5 V highest drive	17,900	99.94	9	30	2
5 V carrier	3,910	99.96	1	20	0

All five complete captures had zero CRC errors and zero reversed or duplicate timestamps. The meter binary and CSV were checked sample by sample. The firmware logs confirmed each workload and a return to RF-off standby after every run, including after both carrier holds.

Acquisition notes

- Incomplete attempts were excluded. The first 5 V reference run stopped on a missing serial response. At nominal 3.3 V, two attempts stopped on a meter stream or handshake issue. Two early highest-drive attempts stopped at 2.988 V and 2.996 V when the input fell below the 3.000 V capture stop threshold. The accepted nominal 3.3 V highest-drive retest followed the host power change.
- During the initial 5 V reference precheck, the example firmware performed one automatic write on a bench card before automatic testing was stopped. The five recorded acquisitions used diagnostic polling, read-only block transactions or carrier holds.

Coverage

Use these as measurements for the tested setup. The input spans in the run headers include voltage drop in the source, meter shunt, leads and connectors. The nominal 3.3 V captures include samples below 3.3 V. The results do not establish operation below the specified input range or a guaranteed supply-current limit.

The 100 Hz sampling interval is approximately 10 ms. Cold-start inrush, startup AAT current, deep sleep, tag-write current, and sustained carrier at nominal 3.3 V were not measured. The 12 s carrier test does not establish a long-duration thermal limit.

Raw capture data

Open this PDF's attachments panel in a desktop PDF reader to access the five unchanged CSV captures. Their phase labels are the original acquisition labels. The run tables use descriptive names for the same phases. The attached analysis-windows.json gives exact start and end times for each statistical window.

Attached capture	File	CSV checksum (SHA-256)
3.3 V reference	3v3_reference.csv	`0c18b0f6bf8369613badc5a3632d5eef5247a05d6b648a0bb766f3bca84eb9d8`
5 V reference	5v_reference.csv	`30b32bf90bea88784dd2a3383d1e16181ad695499aaef685b3e266e2dc5b9131`
3.3 V highest drive	3v3_highest.csv	`ad4145ed038077ff5920d10aa3442ea1f6e329f1c3d7474dfc195a28eca65128`
5 V highest drive	5v_highest.csv	`3a9f86edc360c5be6b4fb83ea9238a3a3f6bd06c5081cce21aa086acf631ddf0`
5 V carrier	5v_carrier.csv	`c1a548fe2cb063bd8825e87b5b5c308e774b94fdb011be5102265dfecd001e53`