

distributed hash research

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Same In Name Only: A Critical Flaw Discovered in Whatsminer PSUs

distributed hash research is dedicated to studying the mining ecosystem and producing content that empowers miners of all sizes and experience levels. For project consultation, hosting, or general inquiries, please email hosting@distributedha.sh

It is anecdotally expressed that MicroBT Whatsminer ASICs are more robust machines than their competitors under difficult mining conditions. Rough data suggests that Whatsminers will hash under more severe heat and cold when compared to their Antminer competitors. However, this rough comparison is incomplete as various Antminer models exceed Whatsminers in efficiency and have more resources for third party tuning via firmware.

While ASIC manufacturing technology appears to be reaching a near zenith in efficiency as ever desirable 3nm chips approach, we at distributed hash note that the manufacturing process itself is a liability in ASIC manufacturing.

In this report we discuss finding, troubleshooting, and validating a serious manufacturing quality differential in Whatsminer PSUs (Power Supply Units). We further discuss options for improved operations in extreme heat conditions. This differential is seen in large mining operations and not likely to be seen in home mining conditions with 1-2 miners (but may, in the worst conditions). We feel this is an important subject to bring to the table for discussion, as many mining hosts do not monitor individual machine metrics closely.

We at distributed hash monitor, by the minute, all temperatures, hash, fan speed and power draw not only by machine and customer, but by location in the mine. This enables us to identify the source of an issue that several mines noticed, but had not yet determined the cause.

We recommend you immediately identify if your machines are subject to this manufacturing issue, and have your PSUs warrantied and replaced if they are exhibiting any of the below described behaviors.

Notes on Miner Data:

The following data were collected in a dry, Western environment at an altitude over 4,000ft, but below the manufacturer recommended maximum operating altitude of 6,561ft (2000m) for most new generation miners. Data was collected via API query in a single air-cooled datacenter across multiple weeks. Temperature conditions varied between a high of 99F (37C) midday and 49F (9C) in the evenings. Precipitation was .43in over the period of data collection with humidity between 93% and 0% (average 27.4%).

Machine degradation and troubleshooting

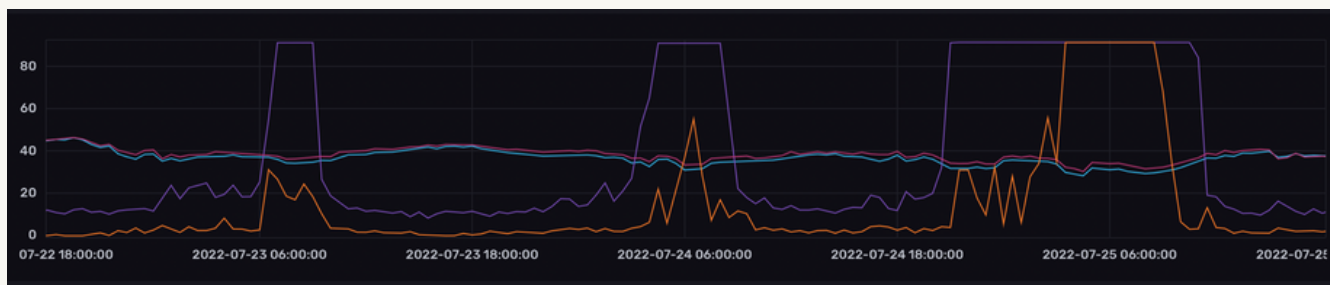
Most new operators monitor their machines via total hash produced at the pool.

This is a sensible but simplistic entry to mining. If you purchase ten 100T machines and run them in a facility, you expect to see 1000T (1 Petahash) online via your pool. However, ASIC miners consist of multiple components, namely, a chipset, control board, and PSU. Each of these components is subject to some degree of manufacturing tolerance and quality control and will influence the total hash output and performance of a given machine.

When trouble arises in the operation of an ASIC, the first metrics operators look to are temperature and hash produced. Note the two images below, the first is a visualization of 2 Whatsminer M3X machines operating flawlessly over 3 days (even at temps approaching 50C), while the second are 2 Whatsminer M3X machines severely underperforming at apparent temperature 'cutoffs' of 35C and 40C.



Upper orange lines show continuous hash at 88Th/s. Pink and Blue lines are the reported environmental temps of the two machines, cycling between 50C and 30C over 3 days.



Purple and orange lines show degraded, cycling hash from 0-88Th/s. Pink and Blue lines are the reported environmental temps of the two machines, cycling between 50C and 30C over 3 days. The purple machine can hash with temps below 40C, the orange only when temps are below 35C.

NOTE: Our research finds that the specific model of Whatsminer does not matter when assessing PSU failure, so that information has been omitted from this analysis. The PSU has been identified as the source of machine failure.

Finding the problem

Our initial assessment of failures to hash in ambient conditions over 35C and 40C appeared futile. There was no clear trend amongst miner model, chipset, or hash power. This proved frustrating as machine performance degraded over time, resulting in power cycling and hash cycling as demonstrated in the two images below.



Power consumption in kW for 3 machines over 3 days with degraded PSUs.



Hash rate in Th/s for the same 3 machines over 3 days with degraded PSUs.

The machines that initially demonstrated a failure to hash over 35C or 40C may have been within rough operating spec, meaning the machine is not at 'fault' for failure, but rather the operating facility and their ability to move enough cool air across the boards is causing overheating.

However, the above dataset demonstrates that there is machine degradation over time, resulting in this apparently random cycling up and down in both electrical draw and hashpower during all hours.

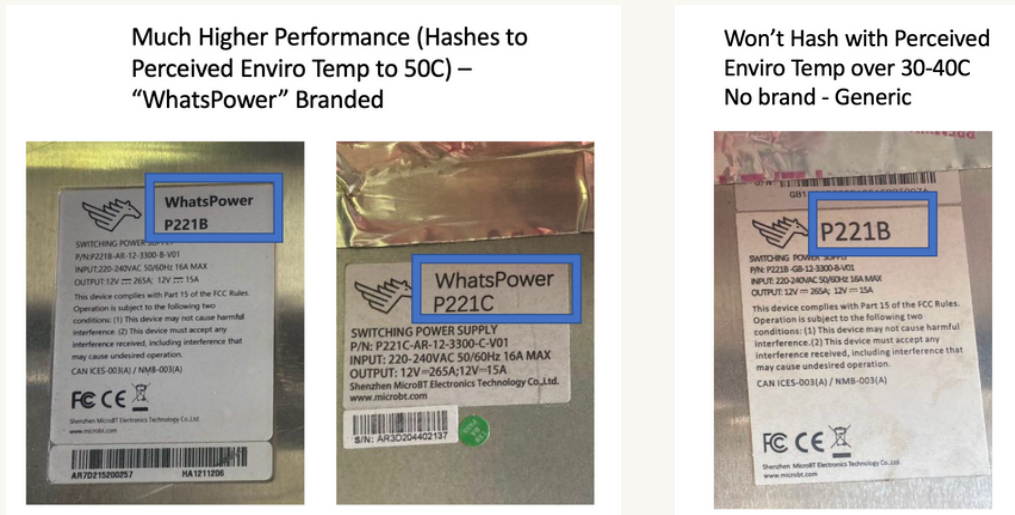
Importantly, an operator must now identify whether these machines demonstrate failures in chips, control boards, or PSUs.

As you can imagine, the seemingly random distribution of machine failures amongst various makes, models and stated hashpowers frustrated this search.

Mind your Power Supply Unit

After eliminating machine model, terahash ratings and locations within the facility as factors for failure, a physical examination of 225 functioning and failing machines revealed the small detail of PSUs labelled 'WhatsPower' versus, unlabeled (only branded with PSU specifications).

Images of WhatsPower and unlabeled PSUs follow.



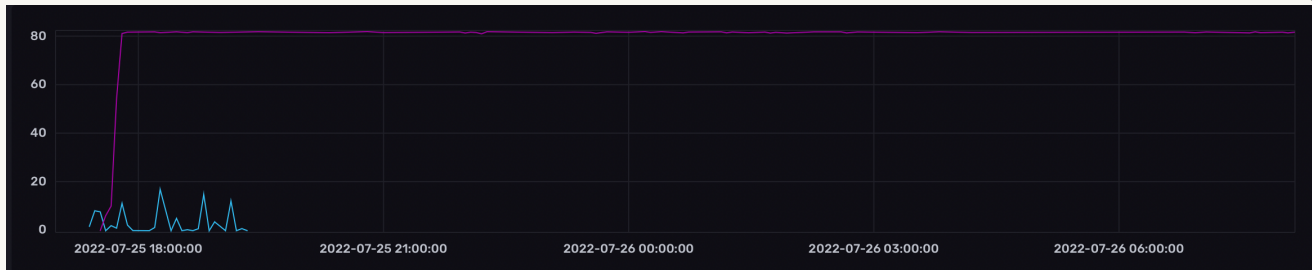
We have learned that there are up to 5 manufacturers of PSUs for WhatsMiner. It appears, comparing across all models of M3X, that WhatsPower-branded PSUs were initially the dominant (possibly only) PSU manufacturer. We hypothesize that with the bull market, demand increased so quickly WhatsMiner outsourced PSU production to additional manufacturers. It is clear even by cursory physical examination these alternate power supplies are designed and built quite differently from the WhatsPower brand, including materials.

Two question arose from this observation:

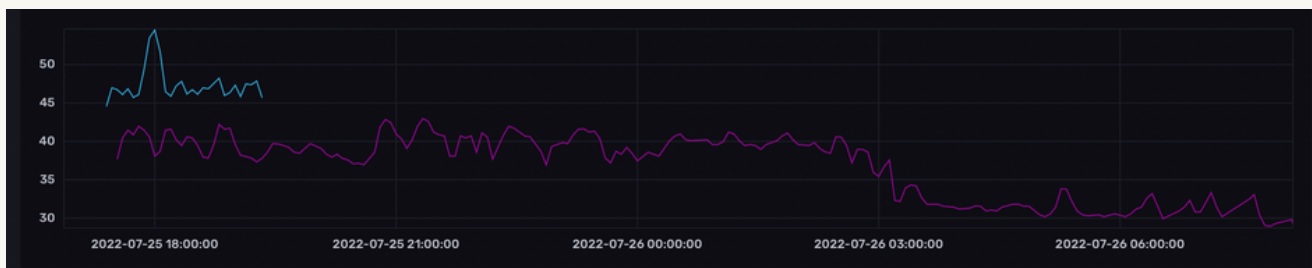
- 1) Could we exclude all other variables, and attribute the degraded performance solely to the PSU manufacturer?
- 2) Had the PSU degradation and cycling caused any damage to the other miner components?

We started with a machine that had gone beyond regular cycling to one that would attempt to hash, PSU temp would spike, and the machine would shut down. This is the ultimate and inevitable end we see with unbranded PSUs.

Dead to Alive - No Permanent Damage

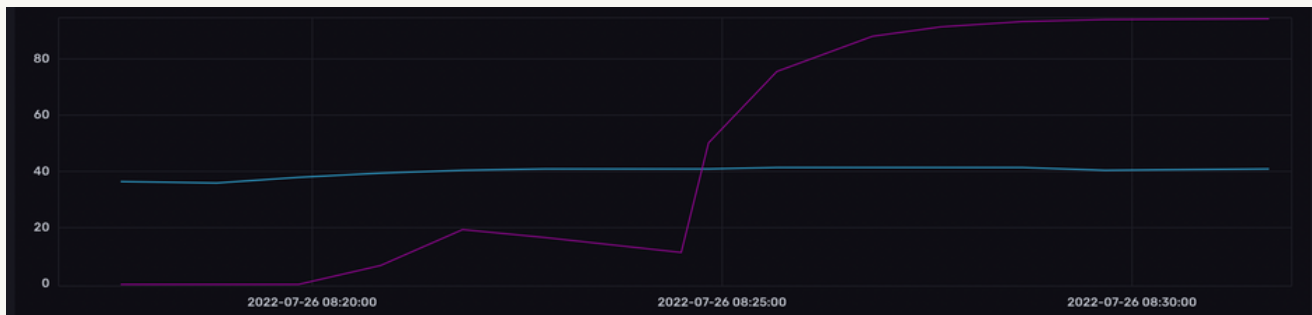


Above is 24-hour hash trace of a functioning 88Th machine in pink and another 88Th machine with a fully-degraded PSU in light blue. These two machines are side-by-side in the mine.



Above is the temperature trace of the same 2 machines. You see the temp of the normal machine stays relatively steady during start-up and falls overnight to the right. For the degraded PSU, note two things - the temperature on start-up of the degraded PSU is registering 7C hotter at start-up when the machine is within 1C of the other. Also, as soon as the machine starts to hash the temperature spikes to nearly 60C and causes the machine to shut down. This pattern repeats even on hard reset. The machine does not hash again.

We used this dead machine and replaced the PSU with a WhatsPower-branded PSU. To control for all other variables we returned the machine to exactly the same location in the mine.



Here is start-up with the new PSU. Blue line shows temperature holding steady and pink line shows start-up hash trace, coming quickly to full hash. This machine is running at full hash to this day, with no further issues or down time, even with outdoor temps over 40C.

Next Steps

We have been able to return M3Xs at all stages of degradation (losing hash over 35C, continuous cycling, and fully dead) to full performance by replacing the PSU with a WhatsPower-branded PSU.

Across all metrics, the machines perform like brand new and we see no lingering effects from the PSU degradation. This is not surprising, as nearly all the tech in the machine is solid state and you would not expect deterioration from cycling, but as you can imagine, this is a very serious concern for owners of many miners.

If you have an M3X in a hosted mine exhibiting any of the above stages of degradation, you should reach out and work with your provider to have those PSUs replaced under warranty, if they still are.

Even if your machines are out of warranty, around \$300 to replace the PSU to get 50% of your missing hash back seems well worth it to us. The amount of total hash you get back depends on the type of mine and location. Any mine in the southern US states can see temps above 35C pretty regularly for several months per year, leading to significant hash loss in advance of a PSUs total failure.

Either route, you want to be 100% certain you are replacing with a WhatsPower branded PSU. You can do this by specifying the power supply part number specifically. The WhatsPower brand are P/N P22XX-**AR**- versus the generic are P/N P22XX-**GB**-.

We have found in our mine, while waiting for new PSUs, we can adjust mining conditions to maximize hash on miners with PSUs in the early stages of degradation. By physically spreading the miners out (at least 6" apart) and maintaining positive pressure on the PSU intakes, we were able to gain more temperature stability in the short term. This level of tuning is beyond the capabilities of most large scale hosts, so we advise this only as a short term solution.

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Conclusions:

In summary, we observed apparently random machine downtime in our air cooled facility. Certain machines of various specifications would shut down at 40C, 35C, or continuously power cycle until total failure.

After assessing the failures at a datacenter level, we ruled out physical characteristics such as machine model, stated terahash, and location within the facility as potential causes. A visual comparison of functioning and failing machines revealed variations between on brand 'WhatsPower' PSUs and apparently outsourced un-labeled PSUs.

We validated our hypothesis of un-labeled PSUs as a source of failure by replacing a failing, un-labeled PSU with a 'WhatsPower' branded PSU and monitoring hash performance over time. Performance returned to stated specification immediately.

Our recommendation for all miners running Whatsminer M3X series machines is to immediately assess your brand of PSU. Should you have un-labeled PSUs within your farm, we recommend exploring warranty and replacement with your ASIC broker or the manufacturer directly.

Furthermore, we recommend for MicroBT to standardize third party component manufacturing as well as manage all quality controls more tightly at the factory door (i.e. establish quality control monitoring within your outsourced manufacturers themselves instead of on the assembly line.)

We have been loud supporters of MicroBT machine robustness and hope this issue is a minor one and not indicative of any trends in future production.

Knowledge is power.

-distributed hash team