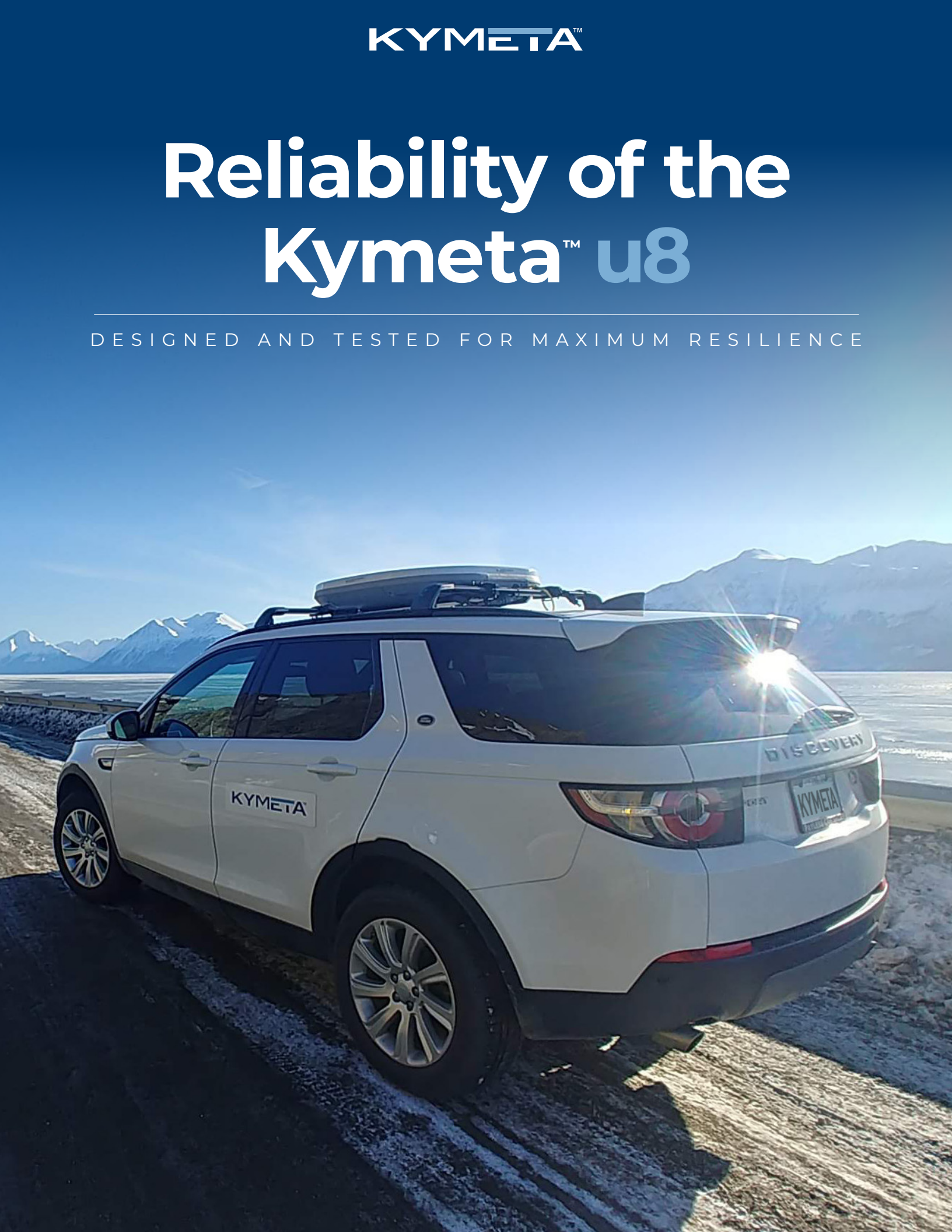
KYMETA™

Reliability of the Kymeta™ u8

DESIGNED AND TESTED FOR MAXIMUM RESILIENCE



WHAT IS RELIABILITY?

We encounter reliability metrics constantly in our day-to-day life. Lightbulbs, cars, and even food products have lifespans where we can expect them to work as intended. These metrics help us understand how long we can use a product before performing some maintenance or replace the product.

Failure Rate:
A reliability index (% yearly) that represents the rate at which a product fails.

Mean Time Between Failure (MTBF):
MTBF is a reliability index (hours) that indicates the average time between repairable failures in units. It can be derived once the reliability index is available, providing valuable insights into the product's overall reliability performance.

THE BATHTUB CURVE

Nearly all electronic components show a failure rate that looks like a bathtub. At the beginning of a product's life, failures result from bad components, assembly errors, and installation mistakes.

Failures of this type rapidly decrease over time, and the product achieves an equilibrium in its life cycle where the failure rate is low and constant. This is called the **useful life phase** or **service life,** and **this is the area where you can use MTBF to make predictions about the product's reliability.**

After the product's service life passes, the failure rate rises due to age and wear.

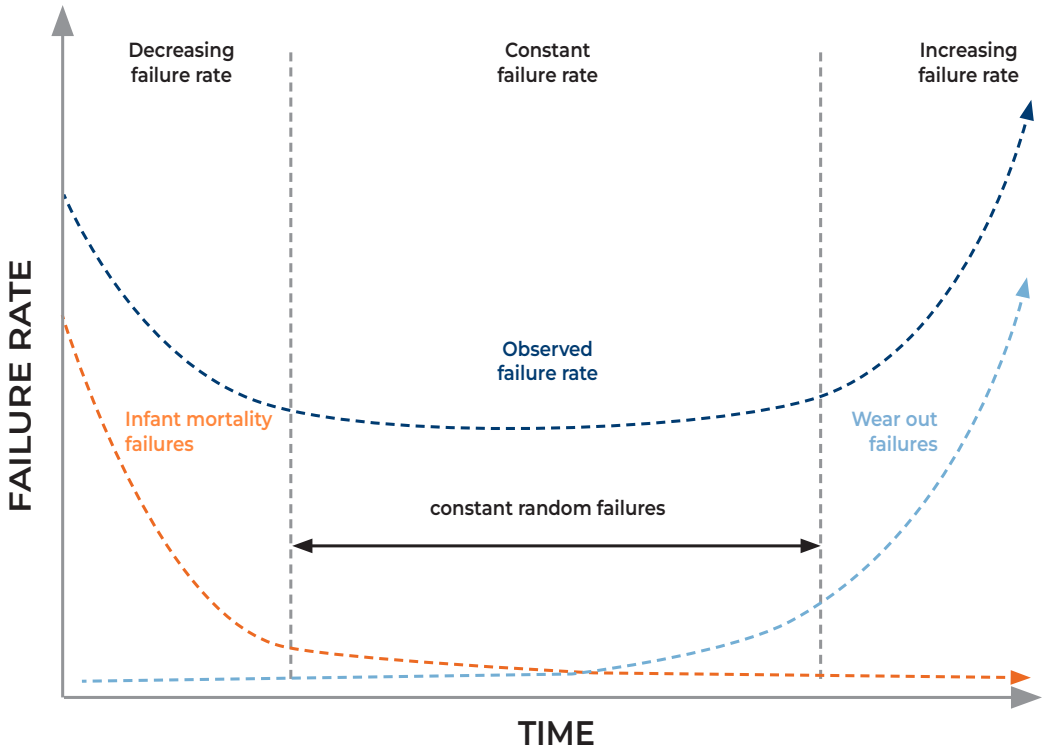
These failures are not counted in MTBF since they lie outside of the unit's defined field life.

MTBF is represented as a straight line in the graph because random failures happen at any time during a product's life. The failure rate affects the entire curve of observed failures, so the lower the failure rate, the more reliable the product is.

MTBF is the inverse of the failure rate. **The higher the MTBF, the lower the failure rate.**

Reliability can be difficult to quantify. How long will a product work before I need to fix it? How likely is a product to continue working year after year? What makes one product more reliable than another?

At a high level, you can use a couple indices to describe the reliability of a product: failure rate and mean time between failure (MTBF).



u8 GEO satellite terminals have a service life of 5 years and a calculated MTBF of **300,000** hours.

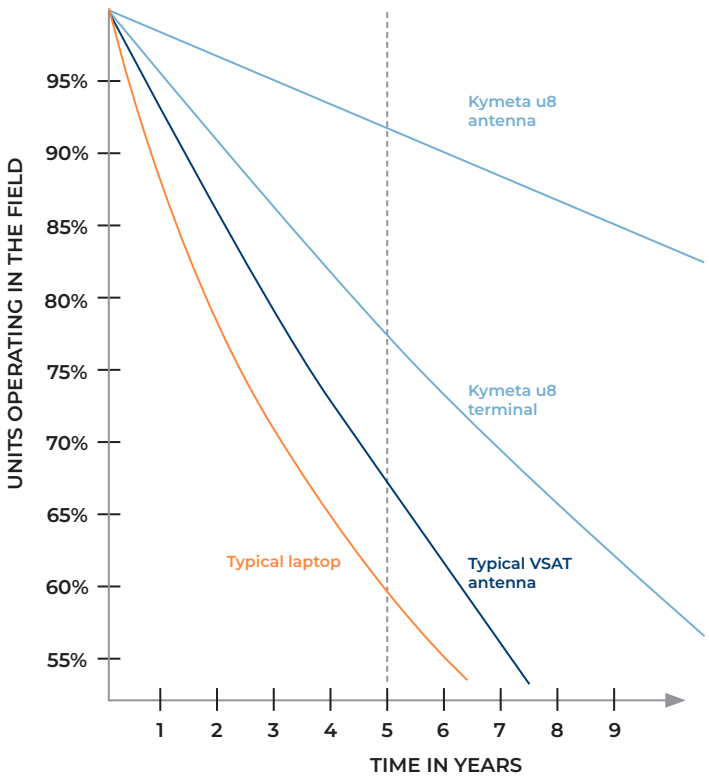
The u8 antenna MTBF is calculated at over **460,000** hours.

WHY KYMETA WINS

A major benefit of the Kymeta™ u8 antenna it is that it's electronically steered and has **no moving parts**. Mechanical components that move experience friction, which accelerates wear and eventual failure. Instead of using mechanical gimbals to steer, u8 antennas use metamaterial surface antenna technology to form holographic beams that can be steered via diffractive beamforming principles, which enables it to avoid wear induced by a mechanical system. Thus, the u8 antenna boasts an MTBF nearly 500% higher than a typical VSAT antenna.

The graph on the right compares the MTBF of the Kymeta u8 terminal (which includes the RF chain, modem, and power supply) and the u8 antenna to a typical laptop and VSAT antenna. Note that the data for the VSAT antenna **does not** include the antenna control unit, modem, BUC, power supply, and other essential components, meaning the **MTBF of VSATs is much lower** than presented.

The Kymeta u8 OneWeb satellite terminal is built on the reliability of the already established Kymeta antenna technology. The failure rate stated for the Kymeta u8 OneWeb terminal is theoretical. Ongoing monitoring and updates will ensure accurate information on the failure rate.



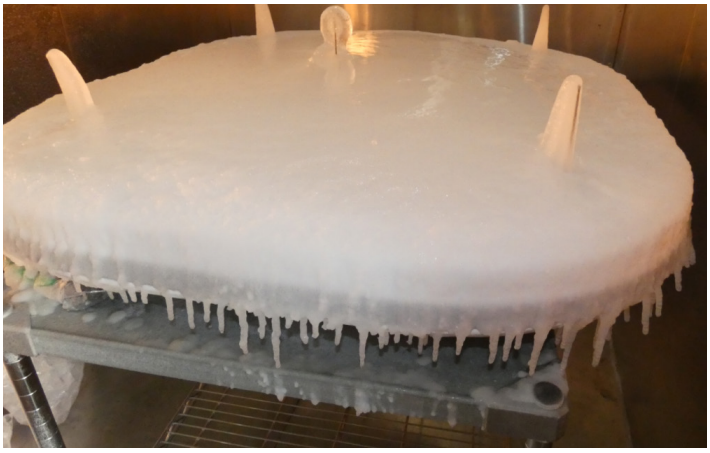
The u8 terminal is **inherently more reliable** than competitive products.

EQUIPMENT TYPE	MTBF (HRS.)	FAILURE RATE (%/ YEAR)
Laptop	85,000	10.0
Stabilized VSAT dish or VICTs antenna[1] [2]	100,000	8.8
Kymeta u8 LEO OneWeb satellite terminal[3]	215,000	4.1
Kymeta u8 GEO satellite terminal (with iDirect iQ 200 and 20 W BUC)	300,000	2.9
Kymeta u8 antenna (without RF chain & modem)[4]	460,000	1.9

1 SOURCE: https://www.thinkom.com/ifc-antennas-what-really-matters/

2 SOURCE: Sailor 800 & 900 VSAT technical manual, doc #98-133966-G2

3 Theoretical/conservative estimation. Kymeta has historically exceeded theoretical predictions.



CONCLUSION

Extensive lab testing to validate our designs and thousands of units of field experience has demonstrated that the Kymeta u8 is **extremely reliable under multiple use cases**. With a predicted average MTBF of **over 460,000 hours** for the u8 antenna, and 300,000 hours for u8 GEO satellite terminal. Further, Kymeta's years of **actual MTBF data shows that the u8 terminal is exceeding predictions**.

This unrivaled reliability makes the Kymeta u8 **the best SATCOM terminal for challenging mobile environments**.

TEST	SPECIFICS
Thermal cycling	42 cycles from -40 °C to 85 °C, non-operational at terminal level
	125 cycles from -35 °C to 85 °C, non-operational at PCB level
High temperature/ high humidity	>1000 hours 85 °C/95% RH on TFTs and FFC cables
Chemical compatibility ETS 300 019	External components tested for compatibility with a variety of common cleaners and chemicals
Temperature testing ETS 300 019/IEC 60068	+55 °C Operational 16-hour dwell
	–40 °C Operational 16-hour dwell
	–40 °C Non-operational 72-hour dwell
	+85 °C Non-operational 72-hour dwell
Water ingress IEC 60529	IP66
Condensation testing	Six cycles of IEC 60068 2-30 damp heat cyclic testing at terminal level
Salt fog ASTM B 117	1000 hours of salt fog testing at terminal level
Altitude IEC 60068-2-13	3,600 m operational, 12,800 m non-operational
Shock ETS 300 019, IEC 60068	120 at 10 g operational 18 at 31 g non-operational
Vibration ETS 300 019, MIL-STD-810G, SAE1455, IEC 60068, MIL-STD-167A	2 g sinusoidal, 1.45 g random
Sand/Dust ETS 300 019	Per test and analysis: unaffected by nominal sand and dust conditions
Ice Loading MIL-STD-810G	Loaded to 4" thickness, non-operational
Hail Impact	Tested to exceed 1.75" diameter hail stone, 20.7 joules of kinetic energy at terminal velocity 90% cumulative probability

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