Environmental/Vibration/MTBF data for Sophia Models UE-BUCx-1315 and UE-SSPAx-1318

Introduction:

The UE-BUCx-1315 and UE-SSPAx-1318 product series were developed specifically for the most difficult, high-vibration, vehicle-mounted applications. In its primary application of vehicle-mounted Satcom-on-the-move terminals, this product has been proven over four years in the most difficult of real-world environments, with over 50 units in long-term military service from desert combat environments to polar regions.

Also, units were qualified for use in a spaceborne, high-data-rate communications link.

MTBF:

The key for maintaining high MTBF in a Solid state power amplifier is junction temperature. Due to the large number of junctions and the high power dissipations in typical SSPAs, these components' lifetimes dominate the MTBF calculation. Furthermore, since the MTBF is an exponential function of junction temperature, the MTBF doubles for every 10C decline in junction temperature.

Due to the unmatched efficiency of the Sophia SSPA, it has inherent large advantages in MTBF over conventional SSPAs. Furthermore, since it was design from the start for a ultra-high-reliability application requirement, the heat conduction path from the junctions has been fully optimized to maintain lowest possible junction temperature. Basically, the entire half-space below the plane of the devices is filled with metal, leading in the shortest possible path directly into heat pipes incorporated into the baseplate.

The entire product and combining scheme was chosen for its optimal thermal properties, in marked contrast to waveguide-suspended or radial combining schemes, which, while suitable for RF, have very poor thermal paths with typically three to ten times higher thermal resistance from the devices to ambient than the thermally-optimized Sophia design.

Because MTBF is a calculated rather than measured parameter, comparison of SSPAs based only on published MTBF number can be unreliable, since manufacturers' published MTBF calculations are often erroneous or simply false. However, fundamentally the much higher efficiency and physical layout of the device cooling thermal path in Sophia products result in far superior MTBF.

Note that power dissipation varies somewhat at different levels of RF drive, per the chart below.

MTBF in hours for UE-BUC2-1315 and UE-SSPA2-1315

	RF output:		
Baseplate temp	none	P1dB	Psat
70	651,670	536,657	651,670
60	1,303,339	1,073,314	1,303,339
50	2,606,678	2,146,628	2,606,678
40	5,213,356	4,293,257	5,213,356

Vibration and Environmental Testing:

During qualification for spaceflight, units were subjected to extensive vibration and environmental testing. Please see testing report document in Appendix A (not included in this document some cases due to file size)

Complete document is available on the Sophia Website:

www.sophiawireless.com/pdfs/Ku_MTBF_Environmental.pdf