

PFR-181 Title: F3 EFI SPB IMONs Unstable

Assembly : EFI		SubAssembly : AXB			
Component : Sensor Grounding Door			Units Affected:	Units fixed:	
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Failure Occurred During (Check one $\sqrt{)}$					
\Box Functional test \Box Qualification test X S/C Integration \Box Launch operations \Box Other (Flight Assy)					
Environment when failure occurred:					
X Ambient	□ Vibration	I	□ Shock	□ Acoustic	
Thermal	Vacuum		□ Thermal-Vacuum	□ EMI/EMC	
Problem Description					

During an Instrument CPT on P3, it was found that the current consumption of both axes of SPBs was higher than expected, and growing at a rate of a few percent per minute. This symptom was similar to that observed on P1 (see PFR-096 for details) in association with increased leakage current without degradation in EFI function.

Analyses Performed to Determine Cause

A visual and mechanical inspection of the SPB spheres was performed, and established that each of the four was properly stowed and aligned with the SPB door mechanisms.

A boom unit LPT was performed on each of the four SPBs – all were in-spec and in-family except one (S/N 912, CH1, +X unit) that has a 4-mA current consumption on its positive supply, rather than the typical 2 to 3-mA consumption.

X- and Y-axis pairs of SPBs were turned on separately, with the other axis being replaced with a static load simulator (33-kohm||0.1 uF on each supply to ground) – it was found that the current consumption was still higher and trending upward on the axis with real SPB and preamp loads, while on the other, the current consumption was stable, and somewhat lower, indicating that the source of the anomalous current consumption lay in the SPB units temselves, rather than in the floating supplies in the LVPS. Short (10-min) duration bench tests of current consumption on all four SPBs were performed, and three of the four SPBs (preamps) showed elevated and unstable current consumption, relative to that observed during board-level acceptance tests (see Figure 1).



Figure 1: Short-Duration Test



All four SPBs were baked out in a vacuum at 65 C for 15 hours, and the short-duration current consumption test repeated to determine if the excess current consumption could be due to either board contamination or the uptake of moisture by the hygroscopic preamp PWB materal (Thermount). Two of the three units that were behaving anomalously were brought back into family by the bakeout, while the third (S/N 912 again) still showed anomalously high current consumption on its positive supply line (see Figure 2).



Figure 2: Post-Bakeout Test



Two long-duration (150-minute and 15-hour) current consumption tests were performed on S/N 912 to establish if the current consumed would stabilize (see Figures 3 and 4). While still noisy, the current consumed stayed within the 3.5 to 4.0 mA range throughout these tests, demonstrating that the unit, while consumping anomalously, would not exceed the \geq = 6-mA limit on the floating supply that would feed it in flight. In addition, the SHIELD (ground) connection of the SPB preamp was monitored during the overnight run in order. As is clear from the plot, the excess current consumption arises from leakage from the positive supply line to the shield, most likely through the same power supply bypass capacitors that were the culprits on P1 (see PFR-096 for details).



Figure 3: SPB-912, 150-Minute Run



Figure 4: SPB-912, Overnight Run, w/AGND Monitor



All four SPBs were integrated to the F5 Instrument suite, and run continuously for 3 days to establish if the units would continue to consume in a stable fashion over time; they did, and the four SPBs were then reintegrated to the F3 spacecraft, where their current consumption, while not as stable as on other suites, is still in spec.

Corrective Action/ Resolution

As was noted in the Resolution section of PFR-096, while significant in a fractional sense (20-30%), the excess current consumption only amounts to a few mA, and does not significantly impact the IDPU or SC power budgets, nor does it pose a significant risk to the LVPS, and so no invasive corrective action will be performed on the four preamps in question.

The current consumption of the four units are routinely tested and trended as part of the normal PT cycle for the probes during MINT activities, and so will continue to receive scrutiny throughout the remainder of the ground phase of the mission.

Acceptance:



MAM: Ron Jackson	_; MSE: Ellen Taylor
PM: Peter Harvey	: Cognizant Engineer

Date of Closure_____