

**SPAR - BRAMPTON (SSS)**

9445 AIRPORT RD

## Critical Items List

SRMS

BRAMPTON ONTARIO L6S4J3

CIL Ref#: **2605**

Revision: 0

FMEA Rev: 1

**System:** SRMS

**Subsystem:** ELECTRICAL SUB-SYSTEM

**Assembly Desc:** Servo Power Amplifier

**Part Number(s):** 51140F1177-3

51140F1177-5

**Item:**

**Function:** Analog Interface Assembly

Provides Tachometer excitation, SCU signal filtering, Phase Locked Loop and tachometer counter circuits to provide measured motor speed data to inner and outer rate loops. Provides analog to digital conversion of MDA buck output voltage, EPC +5V and reference voltages for BITE.

**Failure Mode:** Loss of Analog I/F U4 FPGA clocks.

H/W Func. Screen Failures

**Criticality:** 2 1R

**Mission Phase:** Orbit

**Cause(s):** Analog Interface Assembly

Loss of U4 clock signals.

**Failure effect on unit/end item:**

Clocks to redundant tach circuits and 50KHz clock to redundant MDA direct drive digital filters are lost. Corrupt redundant tach data will cause the TCO BITE to fail. Direct drive is lost in one or both directions.

**Worst Case:** Loss of mission. Loss of primary modes.

**Redundant Paths:** Backup Drive.

### Retention Rationale

**Design:**

Field Programmable Gate Arrays (FPGA's) and the Error Detection and Correction (EDAC) are semi-custom microcircuits in which the basic design functional elements are designed by the manufacturer. The interconnection of these elements is then customized by Spar to provide the functionality of the completed microcircuit. The design utilizes proven circuit techniques and is implemented using CMOS technology. This technology operates at low power and hence the device does not experience significant operating stresses. The technology is mature, and the basic device reliability is well documented. All stresses are additionally reduced by derating the appropriate parameters in accordance with SPAR-RMS-PA.003 and verified by design review.

This approach has a significant advantage in that it reduces the quantity of discrete parts required in the assembly and also the complexity of the PWB and results in significant weight and volume savings. This type of semi-custom part has been successfully used in other space applications.

The parts are qualified to the requirements of the applicable specification. They are 100% screened and burned in to the requirements of this Spar requirements document.

**Test:**

**QUALIFICATION TESTS** - The SPA is subjected to the following qualification testing:

**VIBRATION:** Each axis of the QM is subjected to Flight Acceptance Vibration Test (FAVT), Qualification Acceptance Vibration Test (QAVT), and Qualification Vibration Tests (QVT) in accordance with the SPA Vibration Test Procedure (826586). The level and duration for FAVT is as per Figure 6 and Table 2 of 826586; the level and duration for QAVT is as per Figure 7 and Table 2 of 826586; the level and duration for QVT is as per Figure 8 and Table of 826586. At the end of the three successive random vibration test in each axis, both directions (+/-) of each of the axis is subjected to a shock pulse test as per Figure 9 of 826586.

**THERMAL/VACUUM:** QM TVAC Test is in accordance with Figure 5 of the SPA TVAC Test Procedure (826588), with full Functional/Parametric Test performed at levels of +60 degrees C and -36 degrees C, and non-operating at -54 degrees C. The Qualification vacuum levels during TVAC is  $1 \times 10^{-6}$  torr or less. The total test duration is 7 1/2 cycles. The QM SPA is subjected to a minimum of 1000 hours of life testing and 1000 power On-Off cycles.

**EMC:** The QM is subjected to EMC Testing (tests CE01/CE03, CE07, CS01, CS02, CS06, RE02, RS02, and RS03) in accordance with the SPA EMC test Procedure (826477) based on MIL-STD-461A.

**UNIT FLIGHT ACCEPTANCE TESTS** - The FM SPA is subjected to the following acceptance testing:

**VIBRATION:** FM Acceptance Vibration Test (AVT) in accordance with the SPA Vibration Test Procedure (826586), with level and duration as per Figure 6 and Table 2 of 826586.

**THERMAL/VACUUM:** FM TVAC Test is in accordance with Figure 6 of the SPA TVAC Test Procedure (826588), with levels of +49 degrees C and -25 degrees C for a duration of 1 1/2 cycles. The vacuum levels during Acceptance TVAC Test is  $1 \times 10^{-5}$  torr or less.

**JOINT SRU TESTS** - The SPA is tested as part of the joints (ambient and vibration tests only). The ambient ATP for the Shoulder Joint, Elbow Joint, and Wrist Joint are as per ATP.2001, ATP.2003, and ATP.2005 respectively. The vibration test for the Shoulder Joint, and Elbow or Wrist Joint are as per ATP.2002, ATP.2004 and ATP.2006 respectively. Through wire function, continuity and electrical isolation tests are performed per TP.283.

**MECHANICAL ARM REASSEMBLY** - The SPA's/Joints undergo a mechanical arm integration stage where electrical checks are performed per TP.2007.

**MECHANICAL ARM TESTING** - The outgoing split-arm is configured on the Strongback and the Manipulator Arm Checkout is performed per ATP.1932.

**FLIGHT CHECKOUT:** PDRS OPS Checkout (all vehicles) JSC 16987.

**Inspection:**

Units are manufactured under documented quality controls. These controls are exercised throughout design procurement, planning, receiving, processing, fabrication, assembly, testing and shipping of the units. Mandatory inspection points are employed at various stages of fabrication, assembly, and test. Government source inspection is invoked at various control levels.

EEE parts inspection is performed as required by SPAR-RMS-PA.003. Each EEE part is qualified at the part level to the requirements of the applicable specification. All EEE parts are 100% screened and burned-in, as a minimum, as required by SPAR-RMS-PA.003, by the supplier. DPA is performed as required by PA.003 on a randomly selected 5% of parts, maximum 5 pieces, minimum 3 pieces for each lot number/date code of parts received. All cavity devices are subjected to 100% PIND. Wire is procured to specification MIL-W-22759 or MIL-W-81381 and inspected and tested to NASA JSCM8080 Standard Number 95A.

Receiving inspection verifies that all parts received are as identified in the procurement documents, that no physical damage has occurred to parts during shipment, that the receiving documents provide adequate traceability information and screening data clearly identifies acceptable parts.

Parts are inspected throughout manufacture and assembly as appropriate to the manufacturing stage completed. These inspections include:

Printed circuit board inspection for track separation, damage and adequacy of plated through holes, component mounting inspection for correct soldering, wire looping, strapping, etc. Operators and inspectors are trained and certified to NASA NHB 5300.4(3A-1) Standard. Conformal coating inspection for adequate processing is performed using ultraviolet light techniques. P.C. Board installation inspection includes checks for correct board installation, alignment of boards, proper connector contact mating, wire routing, strapping of wires etc. Post P.C.

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OMRSD Online None.  
Installation:

OMRSD Online Power-up arm. Select Direct Drive in both directions and verify that joint is attempting to drive. Verify no BITE errors.  
Turnaround:

Screen Failure: A: Pass  
B: Pass  
C: Pass

Crew Training: The crew will be trained to always observe whether the arm is responding properly to commands. If it isn't, apply brakes.

Crew Action: Select Backup for failed joint. Use Direct Drive for other joints.

Operational Effect: Prime modes of operation are not available. Autobrakes. Backup is available.

Mission None.  
Constraints:

**Approvals:**

Functional Group	Name	Position	Telephone	Date Signed	Status
Engineer	Hiltz, Michael	Systems Engineer	4634	15Oct97	Signed
Reliability	Molgaard, Lena	Reliability Engineer	4590	15Oct97	Signed
Program Management Office	Taplin, Ron	Technical Manager	4766	15Oct97	Signed
Subsystem Manager	Glenn, George	RMS Subsystem Manager	(281) 483-1516	24Mar98	Signed
Technical Manager	Peck, John	Technical Manager (JSC)	713-483-1264	31Mar98	Signed

*SAROTT - Mission Assigned COAN, DAVID*

*RMS SYSTEMS ENGINEER*

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