



**Aerospace
Systems Division**

Failure Mode, Effects and
Criticality Analysis of
ASE EMI Modifications

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This failure mode, effects and criticality analysis supplements the ALSEP FMECA, ATM 501B, by presenting a detail analysis of the EMI Modifications to the Active Seismic Experiment.

Criticality rankings were calculated on the basis of probability of failure, system effect and failure mode distribution. The probability criticality product (PCP) was calculated to indicate the order of criticality for each failure mode.

Each potential failure having a high ranking has been considered for corrective action within the Limitations of Schedule, Budget and Weight.

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1.1 INTRODUCTION

This analysis is detailed at the Active Seismic Experiment EMI Modification level as a supplement to the ALSEP Failure Mode, Effects and Criticality Analysis, ATM 501, which includes the ASE Failure Mode, Effects and Criticality Analysis at the experiment and subsystem level, each potential failure is considered in light of the probability of occurrence, failure mode distribution and its effect on experiment success.

1.2 PURPOSE

The purpose of a failure mode, effects and criticality analysis is to determine which failures are most critical to mission success and to aid in establishing design effort priorities.

1.3 ASE EMI MODIFICATIONS

The following EMI modifications were incorporated into the Active Seismic Experiment:

- (a) Receiver detector interface circuit modification to provide trigger with an input level of $-91 \text{ dbm} \pm 2 \text{ dbm}$.
- (b) Added 30 MHz ± 125 KHz with 3 db attenuator pad to 30 MHz events line.
- (c) Receiver discriminator circuit modified to limit bandwidth tracking.
- (d) Added Ferrite Filter to MPA and Thumper Lines.
- (e) Added 8 chokes to ASE A/D converter output.



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1.4 SINGLE THREAD FAILURES

Single thread failure in the EMI Modifications have been identified as follows:

- (a) MPA Line — Short to ground of 1 of 29 V operate line, 15 V power line or 5 V power line filters. (PCP-0.12814)
- (b) A/D Output — Short to ground of 1 of 8 A/D output chokes. (PCP-0.03290)

No design compensations to eliminate the above failure modes were incorporated because of the low probability criticality product and the schedule, budget and weight impact.

FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

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ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME		
		Perry Electronics		1301-S F	P. McGinnis		Active Seismic Experiment	EMI Modifications		
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY $\times 10^5$ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (α) \times (E) \times (Q) $\times 10^5$	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
Receiver sensitivity Limiting circuitry	Loss of series diode D6	Open	(0.300)	Degraded mortar impact data	0.010	4.900		0.01470	17	
		Short	(0.700)	Degraded mortar impact data	0.010	4.900		0.03430	15	
	Loss of parallel diode D7	Open	(0.300)	No effect	0.000	4.900		0.00000	21	
		Short	(0.700)	Loss of mortar impact data	0.046	4.900		0.15778	6	
	Loss of parallel capacitor C49	Open	(0.040)	Degraded mortar impact data	0.010	8.590		0.03436	14	
		Short	(0.960)	Loss of mortar impact data	0.046	8.590		0.35420	1	
Receiver Bandwidth Tracking Limiting Circuitry	Loss of diode D8	Open	(0.300)	Loss of one side of Bandwidth Limiting	0.010	4.900		0.01470	17	
		Short	(0.700)	Loss of mortar impact data	0.046	4.900		0.15778	6	
	Loss of resistor	Open	(0.090)	Loss of mortar impact data	0.046	9.500		0.03933	12	
		Short	(0.100)	Loss of one side of bandwidth limiting	0.010	9.500		0.00950	19	

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ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME	
		BxA		2330399-5Z	P. McGinnis		Active Seismic Experiment	EMI Modifications	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY $\times 10^5$ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT $(\alpha) \times (E) \times (Q) \times 10^5$	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
30 MHz events crystal filter	Loss of function	Open (0.333)	Loss of mortar impact data	0.046	20.000		0.30636	3	
		Short (0.167)	Loss of mortar impact data	0.046	20.000		0.15364	7	
		Drift (0.500)	Degraded mortar	0.023	20.000		0.30000	4	

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ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME		
		BxA		2334794N	P. McGinnis					
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY $\times 10^5$ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT $(\alpha) \times (E) \times (Q) \times 10^5$	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION	
Thumper line (3 ea.) Filters FL-LP Mortar package assembly line ferrite filters FL-FP	Loss of ferrite filter: 29 V operate line	Open (0.800)	Loss of thumper	0.046	4.400		0.16192	5		
		Short (to gnd)(0.200)	Loss of thumper	0.046	4.400		0.04048	11		
		Common return line	Open (0.800)	Loss of thumper	0.046	4.400		0.16192	5	
			Short (0.200)	Degraded data	0.010	4.400		0.00880	20	
		Thumper arm line	Short (to gnd) (0.800)	Degraded thumper data	0.023	4.400		0.08096	9	
			Open (0.200)	Degraded data	0.010	4.400		0.00880	20	
	Loss of MPA line filters: 29 V survival line	Open (0.900)	Degraded data	0.023	16.86		0.34900	2		
		Short (to gnd) (0.100)	Loss of MPA	0.046	16.86		0.07756	10		
		One of: 29 V operate line 15 V pwr line 5 V pwr line	Open (0.900)	Degraded data	0.023	16.86		0.34900	2	
			Short (to gnd) (0.100)	Loss of experiment	0.067	16.86		0.12814	8	
		Loss of one of remaining 17 MPA line filters:	Open/Short (0.900)	Degraded data	0.023	16.86		0.34900	2	
			Short (0.100)	Degraded data	0.023	16.86		0.03877	13	

FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE	ORIGINATOR	DATE INITIAL REVISION	SUBSYSTEM NAME	ASSEMBLY NAME	
		BxA		2334468J					
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMENT OF THE ASSUMED FAILURE	FAILURE MODE (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 ⁵ (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (α) × (E) × (Q) × 10 ⁵	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
A/D Converter Output chokes	Loss of one of 8 output chokes	Open (0.563)	Degraded data	0.023	1.000		0.01295	18	
		Short (to gnd) (0.433)	Loss of experiment	0.067	1.000		0.03290		