

Failure Mode, Effects and Criticality Analysis - Array D Redundant Command Receiver

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DATE	26	Feb.	1971	•

This Failure Mode, Effects, and Criticality Analysis was prepared by Motorola's Government Electronics Division as required under the Bendix/Motorola subcontract SC-0721 for the ALSEP program.

The ALSEP Redundant Command Receiver is a solid state receiver with active redundancy that may be used to receive either PM or PM-FM type signals. This receiver includes two identical electrically separate receivers, consisting of an rf converter, and IF and Audio Amp, and a power isolator. In addition, the redundant receiver has an rf power divider referred to an an rf coupler, and a selection circuit referred as an audio combiner.

The failure mode, effects, and criticality analysis shows, in a systematic way, the effect of part, pin, and receiver redundancy on system performance. Specifically these analyses have identified the only single point failure mechanism, have showed which piece part failure modes result in minor degradation at most and may be eliminated from the reliability calculation, and have verified that Receivers A and B are failure isolated.

This FMECA reflects the FACI configuration of the ALSEP Redundant Command Receiver. Based on this FMECA the reliability prediction is . 99795 in format 1 and . 99786 in format 2.

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Failure Mode, Effects, And Criticality Analysis For ALSEP Redundant Command Receiver BxA Part Number 2345147

"Preliminary - The Bendix Corporation Aerospace Systems Division Approval Pending"

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#### 1.0 INTRODUCTION

The failure mode, effects, and criticality analysis was performed on the ALSEP Redundant Command Receiver for Bendix Aerospace Systems. The method of analysis generally complied with the technique requirements as outlined in the Reliability Program Plan for the ALSEP Redundant Command Receiver (Motorola Document Number 3875/001, Rev. A, dated 30 April 1970).

This report is considered a final FMECA analysis, submitted to fulfill the requirements of the CDR. A revision of this report, if necessary, will be submitted 10 days prior to FACI.

#### 2.0 REQUIREMENTS

The failure mode, effects, and criticality analysis is required to show, in a systematic way, the effect of part, pin, and receiver redundancy on system performance. The procedures used and the results and conclusions are detailed within this report.

The FMECA accomplishes the following:

- 1. Identifies any single point failures.
- Shows which piece part failure modes result in minor degradation at most and may be eliminated from the reliability calculation.

3. Verifies that Receivers A and B are failure isolated.

The following ground rules were used in the performance of the FMECA:

- 1. Telemetry is considered non-mission essential, and failures resulting only in the loss of telemetry functions were not included in the reliability estimate.
- 2. For failure modes resulting in a low impedance path to ground from the +12 V supply, the following statements were assumed:
  - a. No receiver fusing is in the present configuration.
  - b. No secondary series regulator failures were postulated.
  - c. The +12 V supply can supply receiver B, as well as the failed receiver A, without mission degradation.
- 3. CSP A and B and Audio A and Audio B were not considered mission essential, except as used within the Redundant Command Receiver to provide a selected audio output.

#### 3.0 FUNCTIONAL DESCRIPTION

The ALSEP Redundant Command Receiver is a solid state receiver with active redundancy that may be used to receive either PM (Format 1) or PM-FM (Format 2) type signals.

The Redundant Command Receiver includes two identical electrically separate receivers, consisting of an RF converter, an IF and Audio Amp, and a power isolator. Each receiver (A and B) is a dual conversion superheterodyne receiver with a center frequency of 2119 MHz. In addition, the Redundant Command Receiver has an RF power divider referred to as an RF coupler and a selection circuit referred to as an audio combiner. The overall block diagram is shown in Figure 1.

The RF input power is provided to the receiver through a single RF connector interface and is divided by a power divider and applied to receivers A and B. The local oscillator injection for each converter is provided from a crystal oscillator at 110.9631 MHz. Selectivity is provided by a 3-pole preselector preceding the mixer, a 3-pole filter in the first IF, and a 5-pole filter following the second mixer. Integrated circuits are used in the receiver for most of the IF gain and the subcarrier and audio circuitry. After amplification and gain leveling, a limiter and a Travis discriminator circuit are used to demodulate the receiver signal. After the first discriminator, the signal is processed in accordance with

the format selected and then proceeds to the active filter output amplifier, which provides a narrow post detector bandwidth to reduce output audio noise.

A narrow band detector is used to recognize and indicate the presence of a 1 KHz synchronizing tone. The filter has a noise bandwidth of approximately 100 Hz. The output of the detection circuit is a bi-level signal, identified as a Command Signal Presence Indicator (CSP). The CSP is used within the audio combiner circuitry to implement the redundancy switch for switching from receiver A to receiver B.

The Redundant Command Receiver is designed to receive modulated signals in either of two types of modulation designated as Format 1 or Format 2. The format is selected by means of appropriate connections in the wiring harness external to the receiver.

The modulating signals are constructed as follows:

Digital data is bi-phase modulated onto a 2 KHz subcarrier and a 1 KHz synchronizing tone is added. This combination then constitutes the composite audio signal and is used in either format. In Format 1, the composite audio signal is phase modulated directly onto the S-band carrier at 3 radians peak. In Format 2, the composite audio signal is frequency modulated onto a 70 KHz subcarrier at 5 KHz peak deviation.

Module of the receiver, the signal processing is dependent upon the format. In Format 1 operation, an integrator having a corner frequency of approximately 80 Hz is used to restore the original composite audio form. This is necessary because the received PM signal is demodulated by a FM discriminator. The output amplifier is combined with an active filter to provide a narrow post-detection bandwidth to reduce the output audio noise.

In Format 2 operation, the first discriminator output is the 70 KHz subcarrier with its frequency modulation. This signal is further processed through an Integrator (corner frequency of 30 KHz), a limiter, and a pulse counting discriminator. The composite audio signal from the discriminator goes to the active filter output amplifier.

major design characteristic. Figure 2 shows the reliability model for the Redundant Command Receiver. Both receivers A and B are operating during the mission. When the CSP from receiver A indicates the presence of a command signal from the output of receiver A, receiver A is selected by the audio combiner. When CSP does not appear, either due to failure of A or due to no command signal, then receiver B will be selected.

All single point failure modes have been eliminated through the use of part redundancy, except the RF input receptacle which is a contractually specified interface. All functions, except telemetry, have redundant pin connections within the multipin connector.

### 4.0 ANALYSIS DETAILS

An FMECA was performed on a subassembly and a system level. The worksheets are contained in Appendix B.

4.1 SUBASSEMBLY LEVEL: On each subassembly, all piecepart components were itemized in accordance with the following schematic numbers and revisions, and the assembly parts list dated 20 Nov. 1970. Schematics are not included in the report and are assumed submitted as project documentation under separate cover.

Schematic Name	Schematic No.	Revision
IF and Audio	63-P11349B	<b>D</b>
RF Converter	63-P11377B	В
Audio Combiner & Power Isolator	63-P11380\$	В
Overall Schematic	63-P11356B	С

The major failure modes for each component piecepart were listed along with the probability of that piece part failing in each mode (designated as ≪). The values of ≪ were

obtained from Table VI of Motorola's R&C Special Memorandum Number 265, included as Appendix A.

The effect of each piecepart failure mode on the sub-assembly was determined and itemized. An effect number (E) was assigned from 0 to 1.0, with 0 representing the smallest (least critical) effect, and 1.0 representing the largest (most critical) effects.

The failure probability (Q) is the failure rate of each piecepart at  $45^{\circ}$ C and at the stresses tabulated on the Part Application Analysis.

The criticality product was then derived as the product of  $\propto$  x E x Q. The criticality products were then ranked, starting with 1 assigned to the largest product. Criticality products of less than 10.0 were not ranked.

Table 1 lists the five most critical failure modes for each subassembly and the respective criticality products.

4.2 SYSTEM LEVEL: At the system level, the subassembly failure modes were grouped according to the criticality of those failure modes.

The  $\propto$  for a system failure mode was obtained by dividing by the sum of the module  $\propto$ 's by the total subassembly  $\propto$  sum.

The effect on the Command Receiver System was considered by listing conditions where switch-over to receiver B was accomplished and where redundancy was lost.

The following general assumptions were used in assigning system effect numbers (E).

- 1. Telemetry not considered mission essential and assigned a .2.
- 2. Loss of RFI filtering between modules was assigned a .5.
- 3. Loss of case ground in the multipin connector was assigned a .2.
- 4. The pins are redundant in the multipin connector. In addition, further redundancy is possible due to redundant receivers. If both redundant pins fail and the command receiver still operates, a system effect number of .3 is assigned to each pin failure. If both redundant pins fail and the command receiver fails, a system effect number of .5 is assigned to each pin failure.

The ten most critical failure modes for the command receiver are ranked in Table 2, from the subassembly criticality products shown in Table 1.

4.3 RELIABILITY: The failure rates (%/1000 hours) are itemized in the Reliability Model Code column of the system FMECA sheets for those failure modes considered mission essential. These failure rates also comprise the reliability model in Figure 2.

#### 5.0 CONCLUSIONS

In the system critical ranking, there are three part types that appear in the first ten:

- 1. Sensistors (06-P14404A)
- 2. Toroidal inductors (24-P11420B)
- 3. Toroidal inductors (24-P11417B)

The sensistors were assigned a failure rate of .015 %/1000 hours, in accordance with SM-188. In addition, since a catastrophic failure is critical to the Command Receiver, the criticality is high. However, the use of sensistors is imperative in the design and no feasible design alternative exists. The toroidal inductors (both 24-P11420B and 24-P11417B) are not actually component pieceparts until after potting of the Command Receiver. These toroidal inductors are manufactured as assemblies and, therefore, cannot be screened as pieceparts. However, these toroidal inductors were assigned a failure rate from SM-188 as unscreened coils. Since they are single layer windings, relatively few turns, visually examined, and are

screened by virtue of module tests, the assigned failure rate is considerably pessimistic. No feasible design alternative seems acceptable.

Figure 1

ALSEP Redundant Command Receiver

Functional Block Diagram

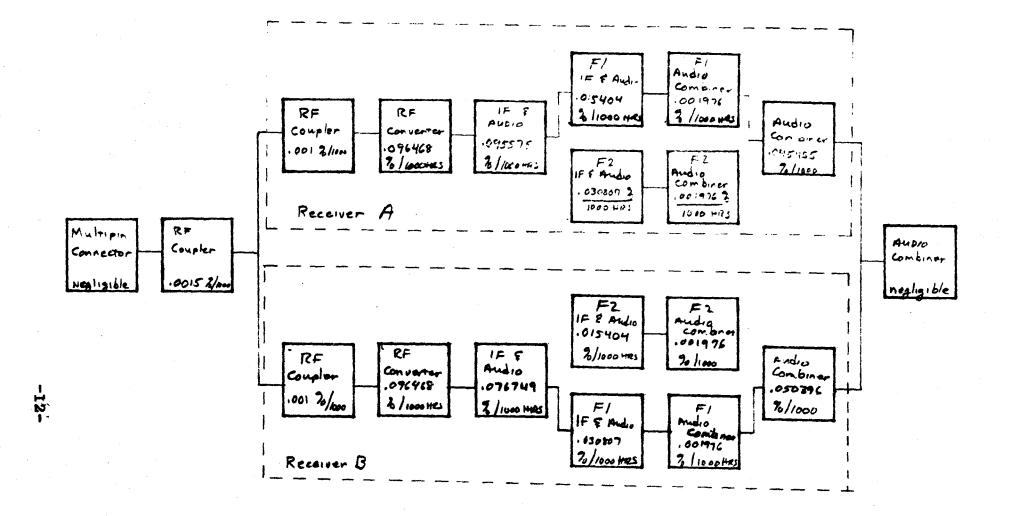


Figure 2

ALSEP Redundant Command Receiver

Reliability Block Diagram

Table 1
Subassembly FMECA Ranking

Subassembly Name	Part	Failure <u>Mode</u>	F.R. (%/1000)	System Effect Number	Criticality Ranking	Criticality Product
IF & Audio	<b>T1</b>	Open	.005	1.0	1	452
	T2	Open	.005	1.0	2	452
•	T5	Open	.005	1.0	3	452
	Т6	Open	.005	1.0	4	452
	FL1	Short	.0036	1.0	5	255.5
RF Converter	R30	Open	.015	1.0	1	750
	T2	Open	.0056	1.0	<b>2</b>	452
	тз	Open	.0056	1.0	3	452
	T4	Open	.0056	1.0	4	452
	R30	Drift	.015	.5	5	325
Power Iso.	FL8	Short	.0036	1.0	ı	255.5
Audio Comb	FL9	Short	.0036	1.0	2	255.5
	FL10	Short	.0036	1.0 (F1)	3	255.5
	FL11	Short	.0036	1.0 (F1)	4	255.5
	FL1	Short	.0036	1.0	5	252

Table 2

n		System Leve	el FMECA Ranking		
Subassembly	Part	Failure Mode	F.R. (%/1000)	System Effect Number	Criticality Ranking
RF Converter	R30	Open	.015	1.0	1
IF & Audio	<b>T1</b>	Open	.00565	1.0	2
	<b>T2</b>	Open	.00565	1.0	3
	<b>T</b> 5	Open	.00565	1.0	4
	Т6	Open	.00565	1.0	5
RF Converter	T2	Open	.00565	1.0	6
	<b>T3</b>	Open	.00565	1.0	7
	T4	Open	.00565	1.0	8
IF & Audio	T3	Open	.00565	.8	9
Power Isolator Audio Combiner	FL8	Short	.0036	1.0	10

# APPENDIX A SM-265

APPENDIX A IS ON FILE WITH ORIGINAL MOTOROLA DOCUMENT 3875/035

APPENDIX B
FMECA Data Sheets

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AILURE MODE, EFFECTS, AND C	RITICALITY A	NALYSIS WORKSHEET											
SSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHA	SE(S)	A	SSY DWG OR SK REFEREN	CE ORIG	NATOR	DATE 7/31/70	Supeyer	PAGE 1	OF 51	PAGE
	GOAL		· ·	· · · · · · · · · · · · · · · · · · ·		63-P11349B	J. J. J.	THA TOK	INITIAL REVISION 20 Nov 70	SUBSYST	EM NAME	ASSEMBLY N	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE	: (α	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATO ELIMINATE THE	LION	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
C1 (Solid Tant)			Open	. 15	. 05	Possible ripple No effect	. 9	•			4. 4100	<del>-  </del>	
			Short		. 85	No signal	. 0 1. 0	. 00098			83.3	37	
C4 (Ceramic)		•	Open	2.5	. 05	Fl* Degraded	. 5	.001095			2. 7375		
				. 25	. 20	perf Fl No effect	. 0				0.00		
	ļ		Open	. 25	. 01	F2** Degraded perf	. 5				2.7375		
	ļ		Short		. 24	F2 No effect F1 No effect	.0				0.00		1
					. 75	F2 No signal	1.0		. [		0.00 82.125	38	
C5 (Ceramic)			Open		. 23	Fl No effect	. 0	. 001050			0.00		
			Short		. 23 . 75	F2 No signal F1 No effect	1.0 .0				26. 25 0. 00	113	
a( 1a					. 75	F2 No signal	1.0				78. 75	42	
C6 (Ceramic)			Open		. 25 . 25	F1 No effect F2 Degraded sig	.0	.001050			0.00 7.875		
			Short		.75 .75	F1 No effect F2 No signal	.0 1.0				0.00		
C7 (Ceramic)			Open		. 25	F1 No effect	. 0	001050		-	78.75	43	-
					. 25	F2 Degraded perf	.7	.001050			0.00 18.375	135	
			Short		.75 .75	F1 No effect F2 No signal	. 0				0.00		
					. 13	r 2 No signal	1.0			. '	78.75	44	
		•											
										1	•	. [	
70-7A *F1 = Format		<u> </u>	1			i		ì	1	1		-1	

\*\*F2 = Format 2

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FAILURE MODE, EFFECTS, AND C	RITICA: ITY A	NAI YSIS WORKSHEET									NO.		REV. NO A
			MISSION PHA		1						PAGE 2	OF	51 PA
	RELIABILITY	SOFFEIER NAME	MISSION PHA	SE(S)	AS	SY DWG OR SK REFEREN 63-P11349B	CE ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYSTE	M NAME	ASSEMBL IF	Y NAME Audio
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY * 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	RA FO AS	MODEL COD
C8 (Ceramic)			Open	. 25	. 25	F1 No effect F2 Possible oscillation	.0	. 001365			0.00 5.46		
			Short		. 20 . 75 . 75	F2 No effect F1 No effect F2 No signal	.0 .0 1.0				0.00 0.00 02.375		.6
C9 (Ceramic)			Open		. 25 . 25	F1 No effect F2 Wrong	.0	. 001050			0.00 10.5	1	
			Short		.75 .75	passband F1 No effect F2 No signal	.0 1.0				0. 00 78. 75		15
C10 (Ceramic)			Open		. 25	F1 No effect F2 Degraded output	. 0 . 5	.001050			0.00 13.125	1	50
. •			Short			F1 No effect F2 No output	.0 1.0				0.00 78.75	4	16
Cll (Ceramic)			Open		. 25 . 25	F1 No effect F2 Degraded output	.0	.0010505			0.00 7.875		
			Short		.75 .75	F1 No effect F2 No signal	.0 1.0	15			0.00 78.75		7
C12 (Ceramic)			Open		. 25 . 25	F1 No effect F2 Degraded output	.0	.001050			0.00 7.875		
			Short		.75 .75	F1 No effect F2 No signal	. 0 1. 0			}	<b>0.00</b> 7 <b>8.7</b> 5		:8
C13 (Mica)			Open	. 80		Possible osc Increased band width-mope noise	. 8 . 9	. 000080			0.64 5.64		
			Short Drift		.15	No signal No effect	1.0				1. 20 0. 00		

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ASSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHA	E E /6\	Lie	SY DWG OR SK REFEREN					PAGE 3	OF	51	PAGES
	GOAL	SUPPLIER NAME	MISSION FITA			63-P11349B	ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYST	EM NAME	ASSEME	LY NA	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE	· (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSA TO ELIMINATE THE FAILURE MODE	TION	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	1 5	RANK FOR NSSY	RELIABILITY MODEL CODE IDENTIFICATION
Cl4 (Ceramic)			Open		. 25	Fl No effect	. 0				0.00	-+		
	1				. 25	F2 No signal	1.0	.001050	1		26. 25	1	114	!
	Į.		Short		.75	Fl No effect	.0				0.00		***	
	ļ				.75	F2 No signal	1.0	·		1	78.75	ı	49	
C15 (Ceramic)			Open		. 25	Fl Distorted output	. 6	. 001110			16.65		138	
			1		. 25	F2 No effect	. 0		1	- 1	0.00	l		
	ł		Short		.75	Fl No signal	1.0	l	1	1	83.25	- 1	36	
					.75	F2 No effect	. 0			ŀ	0.00	1	36	
Cl6 (Ceramic)	1							ł				1		
CIO (Ceramic)	i		Open	•	. 25	F1 No effect	.0	.001050		i	0.00			
	į		1		. 25	F2 Distorted output	. 5		1	- 1	13.125	- 1	161	i
	Ì		Short		.75	F1 No effect	. 0			- 1				
	j		15		.75	F2 No signal	1.0	1		- 1	0.00 78.75	- 1		
	1		1				2,,		•		10.15	- 1	50	
C17 (Ceramic)	1		Open		. 25	Fl No effect	. 0	.001050		Į.	0.00	1		
	1				. 25	F2 Distorted	. 5			- 1	13.125	. !	162	
			l			output		1	1	l				
	1		Short		.75	Fl No effect	. 0				0.00	- 1		
	1				.75	F2 No signal	1.0	1		- 1	78.75	- 1	51	
C18 (Ceramic)			Open		. 25	Fl No effect	. 0	.001185		- 1	0.00			
	ļ		1 -		. 05	F2 Poss osscil-	1.0	1		- 1	5. 925	- 1		
•	1			. 25		lation					0,723	- 1		
	1 .		l		. 20	F2 No effect	.0	<b>.</b>	· ·	1	0.00	1		
	1		Short		.75	Fl No effect	.0			ı	0.00	1		
	1		1		.75	F2 No signal	1.0	l	Ì	1	88.875	1	29	
C19 (Ceramic)			Open		. 25	Fl No effect	.0	.001335	<b>!</b>	i.				
	1		l ope		. 25	F2 No signal	1.0	.001335	].		0.00	]		
			Short		. 75	Fl No effect	.0	1	1	1	33.375 0.00	- 1	99	
					.75	F2 No signal	1.0			1	100.125	1	21	
G200 (24) - 1						-				- 1		-		
C200 (Mica)	1		Open		. 80	Increased noise	.7	.000080		}	4. 48	1		
			6.			Degraded signal						- 1		
	1		Short Drift		.15	No Signal	1.0			J	1.20	1		
	1		Drift		. 05	No effect	.0	ł	1	1.	0.00	1		,

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Page 24 of 81 NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 4 OF 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 20 Nov 70 63-P11349B IF & Audio FAILURE PROBABILITY x 10<sup>5</sup> (Q) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT SYSTEM EFFECT NUMBER (E) STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY  $(\alpha)$ (α) x (E) x (Q) x 10<sup>5</sup> C201 (Mica) Open .80 No signal 1.0 .000080 6.40 Short Widen bandwidth .15 . 5 0.60 increase noise Drift . 05 No effect . 0 0.00 C22 (Ceramic) Open Fl No effect . 25 . 0 .001095 0.00 . 25 F2 Little effect . 1 2.7375 Short .75 Fl No effect .0 0.00 .75 F2 No signal 1.0 82.125 39 C23 (Ceramic) Open . 25 F1 No effect . 0 .001050 0.00 F2 Poorer inte-. 25 . 5 13.125 163 gration i.e. distortion Short . 75 Fl No effect . 0 0.00 . 50 F2 No output 1.0 52.50 .75 83 . 25 F2 Distorted . 5 13.125 164 output C24 (Ceramic) Open . 25 Fl No effect . 0 .001050 0.00 . 25 F2 Poor Inte-. 5 13.125 165 gration i.e. distortion Short .75 Fl No effect . 0 0.00 .50 F2 No output 1.0 52.50 .75 84 . 25 F2 Distorted . 5 13.125 166 C25 (Ceramic) Open . 25 Fl Distorted . 5 .001125 14.0625 155 sig . 25 F2 No effect . 0 0.00 Short .75 Fl No signal 1.0 84.375 36 .75 F2 No effect . 0 0.00 C26 (Ceramic) Open . 05 Fl Oscillation . 7 .001365 4.7775 . 25 .20 Fl No effect . 0 0.00 . 25 F2 No effect . 0 0.00 Fl No signal Short .75 1.0 102.375 18 .75 F2 No effect . 0 0.00 970-7A

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SSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	TAG	SY DWG OR SK REFERENC					PAGE 5		o≠ 51	PAGE
	GOAL				63-P11349B	ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYST	EM NAME		MBLY NA	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	I ON	PROBABILIT CRITICALITY PRODUCT (a) x (E) x (Q)	y × 10 <sup>5</sup>	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
C27 (Ceramic)		,,	Open	. 25	Fl No signal	1.0							
	1		1	. 25	F2 No effect	.0	.001185		1	29.625 0.00	1	106	
	l		Short	.75	F1 Distorted	. 8	1		1	71.10	}	7.0	
	1				output			•	.	71.10	1	70	
	1			.75	F2 Distorted	. 6				53.325	i	82	
	1	•	į		output		j	1	j	33.323	)	٥٤	
C28 (Ceramic)							ļ		1				
Ozo (Ceramic)	1		Open	. 25	F1 No effect	. 0	.001095		- 1	0.00	ı	111	
	1		Short	. 25	F2 No signal	. 0			1	27.375	1	_	
	1		Short	.75	F1 Distorted	• 6	1		1	49.275	1	87	
	1			. 75	output F2 Distorted	•			1		1		
				. 15	output	. 8	Ì		i	65.700	I	76	
C202 (Mica)	•		Open	.80	Increased noise,	. 5	.000080		- 1		ı		
	1		- F		decreased part	. 5	.000080	)	1	3.20	1	. 1	
	İ		Short	. 15	No signal	1.0	1		1				
	1		Drift	. 05	No effect	. 0		I	- 1	1.20	ł		
	1					. •			- 1	0.00	1		-
C203 (Mica)	1		Open	.80	No signal	1.0	.000080		- 1	6.40	í		
	j .		Short	. 15	Decreased parts	. 5			- 1	0.60	j		
			Drift	. 05	No effect	. 0			- 1	0.00	l		
C31 (Ceramic)	1				ł			1	- 1	0.00	1	l	-
Col (Ceramic)	1 .		Open	. 25	Decreased perf	. 6	.001050		- 1	15.75	- 1	141	
			Short	.75	No signal	1.0	[		- 1	78.75	1	52	
C32 (Ceramic)					[_ [		1		)		ŀ		İ
out ( out and )	1		Open	. 25	Decreased perf	0.5	.001050		1	13.125	1	167	
			Short	.75	No signal	1.0			ĺ	7 <b>8.7</b> 5	1	53	
C204 (Mica)	j		Open	. 80	T	-			1		J		
	l .		Open	. 00	Increased noise decreased perf	. 5	.000080		1	3.20	- 1		
	1		Short	.15	No signal	1.0					- 1		
			Drift	. 05	No effect	.0	ł		1	1.20	Į		
	1			. 05	1.0 011001	• 0	1		ĺ	0.00	- 1		
C205 (Mica)	1	4	Open	.80	No signal	1.0	.000080		- 1	6.40	1		
	1		Short	.15	Decreased perf	. 5	1 000000	1	1	0.60			
	1		Drift	. 05	No effect	. 0			ì	0.00	ı		
	)						}	j	1	J. 00			
	ı								1				
	1		1		. 1		ł	1	ł		1		
	I		1				1	1	1				

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REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 6 OF 51 ASSY FAILURE DESCRIPTION PAGES RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 63-P11349B IF & Audio 20 Nov 70 PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE PROBABILITY SYSTEM FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE EFFECT NUMBER (E) RELIABILITY MODEL CODE IDENTIFICATION EFFECT ON ASSEMBLY CRITICALITY PRODUCT RANK FOR (a) ASSY  $(\alpha) \times (E) \times (Q) \times 10^5$ C206 (Mica) Open .80 Decreased perf . 5 3.20 Short .15 No signal 1.0 .000080 1.20 Drift . 05 No effect . 0 0.00 C36 (Mica) Open .80 Decreased perf . 5 .000080 3.20 Short . 15 No signal 1.0 1.20 Drift . 05 No effect .0 0.00 C37 (Ceramic) Open .20 No effect . 0 .001365 0.00 . 03 Possible oscil-0.8 5.46 lation Short .75 No signal 1.0 102.375 18 C207 (Mica) Open .80 No signal 1.0 .000080 6.40 Short .15 Decreased perf 0.5 0.60 Drift . 05 No effect . 0 0.00 C208 (Mica) Open .80 Decreased perf 0.5 .000080 3.20 Short . 15 No signal 1.0 1.20 Drift . 05 No effect . 0 0.00 C209 (Mica) Open .80 No signal 1.0 .000080 6.40 Short .15 Decreased perf . 5 0.60 Drift .05 No effect 0.0 0.00 C41 (Ceramic) Open .20 No effect . 0 0.00 . 05 Poss oscillation . 7 .001050 3.675 Short .75 No signal 1.0 78.75 54 C42 (Ceramic) Open . 25 No signal 1.0 .001050 26. 25 116 Short . Ђ No signal 1.0 78.75 55 C43 (Ceramic) Open . 25 Probable .90 .001050 23.625 126 oscillation Short .75 Degraded perf . 95 74.8125 67 (AGC disabled) 970-7A 1

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REV. NO A FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET 7 PAGE 51 OF PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 20 Nov 70 63-P11349B IF & Audio SYSTEM EFFECT NUMBER (E) PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE PROBABILITY FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RELIABILITY MODEL CODE IDENTIFICATION RANK EFFECT ON ASSEMBLY PRODUCT FOR ASSY (a) (a) x (E) x (Q) x 105 C44 (Ceramic Open . 25 Probable oscill .90 .001050 23.625 127 Short .75 Degraded perf .95 74.8125 68 (AGC disabled) C45 (Ceramic) Open . 25 No signal 1.0 .001050 26.25 116 Short . 75 No signal 1.0 78.75 561 C46 (Ceramic) Open . 01 Possible osc . 8 .001065 0.852 No effect . 24 . 0 0.00 Short .75 No signal 1.0 79.875 40 C47 (Ceramic) Open . 25 0.8 Possible osc or .001050 21.00 129 deg perf Short .75 No signal 1.0 78.75 57 C48 (Ceramic) Open Probable osc or . 3 .001050 23.625 128 deg perf Short .75 Degraded perf .95 74.8125 69 (AGC disabled) C49 (Ceramic) Open . 25 Degraded perf 0.6 .001275 19.125 133 Short .75 No signal 1.0 95.625 22 C50 (Ceramic) Open . 20 No effect . 0 .001365 . 25 0.00 Possible oscl . 05 1.0 6.825 Short . 75 No signal 1.0 102.375 19 C51 (Ceramic) Open . 25 Deg perf . 2 .001050 5.25 Short .75 Deg perf . 2 15.75 142 C52 (Ceramic) Open . 25 Deg perf 1.0 .001905 47.625 89 responds to noise Short .75 Deg perf . 2 28.575 108

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Page 28 of 81 REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 8 OF 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL 63-P11349B IF & Audio REVISION 20 Nov 70 PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION PROBABILITY SYSTEM FAILURE PROBABILITY x 10<sup>5</sup> (Q) STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE EFFECT NUMBER (E) RELIABILITY MODEL CODE IDENTIFICATION EFFECT ON ASSEMBLY CRITICALITY PRODUCT RANK FOR ASSY (a) (α) x (E) x (Q) x 10<sup>5</sup> CE3 (Ceramic) Open . 05 Oscillate 1.0 . 25 9.525 . 20 Deg perf . 5 .001905 19.05 134 Short .75 Deg perf . 5 90.4375 73 C54 (Ceramic) Open . 25 Decrease band-. 3 .001125 8.4375 width Short . 75 No signal 1.0 84.375 30 C55 (Not used) C56 (Ceramic) Open . 05 Possible oscil-1.0 .001050 5.25 . 25 lation . 20 No effect . 0 0.00 Short .75 No signal 1.0 78.75 58 C57 (Ceramic) Open . 05 Possible oscil-1.0 .001050 5.25 . 25 lation . 20 No effect 1.0 78.75 59 C58 (Ceramic) Open . 25 No signal 1.0 .001050 26.25 117 Short .75 No signal 1.0 78.75 60 C53 (Ceramic) Open . 25 AC on DC 1.0 .001365 34.125 98 signal line Short .75 No signal 1.0 102.375 21 C60 (Ceramic) Open . 05 Possible oscilla . 8 .001050 4.20 . 25 . 20 No effect . 0 0.00 Short .75 No signal 1.0 78.75 61 C61 (Ceramic) Open . 25 Degraded gain . 7 .001050 18.375 136 Short .75 No signal 1.0 78.75 62 C62 (Ceramic) Open . 05 Possible 1.0 .001050 5.25 . 25 oscillation . 20 No effect . 0 0.00 Short . 75 No signal 1.0 78.75 63

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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET 9 51 PAGE OF PAGES DATE 7/31/70 SUBSYSTEM NAME ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR ASSEMBLY NAME INITIAL REVISION 63-P11349B IF & Audio 20 Nov 70 PROBABILITY SYSTEM EFFECT NUMBER (E) FAILURE PROBABILITY × 10<sup>5</sup> (Q) RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE EFFECT ON ASSEMBLY  $(\alpha) \times (E) \times (Q) \times 10^5$ (a) . 80 . 8 .000080 C63 (Mica) Open Less gain 5.13 distorted output .15 . 8 Short Less gain 0.96 distorted output No effect Drift . 05 .0 0.00 .000080 C64 (Mica) Open .80 Less gain . 8 5.12 distorted output 0.96 Short . 15 Less gain . 8 distorted output Drift . 05 No effect . 0 0.00 . 25 1.0 .001065 26.625 Open No signal 112 C65 (Ceramic) Short .75 No signal 1.0 79.875 41 . 8 .000600 C66 (Air variable) Short . 87 Less gain 41.76 91 distorted output Mildly distorted . 3 2.34 Open . 13 output . 25 . 8 .001050 21.00 130 C67 (Ceramic) Open Less gain distorted output Short .75 . 8 63.00 77 . 25 Less gain . 8 .001050 21.00 131 C68 (Ceramic) Open distorted output 78 . 75 . 8 63.00 Short Less gain distorted output .000060 C69 (Glass) .80 Less gain . 8 3.84 Open distorted output . 8 0.24 . 05 Less gain Short distorted output No effect .0 0.00 Drift . 15

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NO. REV. NO A

FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 9A OF 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 63-P11349B IF & Audio 20 Nov 70 PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION SYSTEM EFFECT NUMBER (E) FAILURE PROBABILITY × 10<sup>5</sup> (Q) STATEMENT OF THE ASSUMED FAILURE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY
FOR MODEL CODE
ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) x (E) x (Q) x 10<sup>5</sup>  $(\alpha)$ C70 (Air variable) Short . 87 Less gain .000600 41.76 91 distorted output Open .13 Mildly distorted . 3 2.34 output C71 (Glass) Open .80 Less gain . 8 .000060 3.84 distorted output Short . 05 Less gain . 8 0.24 distorted output Drift .15 No effect . 0 0.00

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

ASSY FAILURE DESCRIPTION

RELIABILITY GOAL

RELIABILITY GOAL

RELIABILITY GOAL

MISSION PHASE(S)

ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME

ASSEMBLY NAME

ASSEMBLY NAME

ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	AS	SY DWG OR SK REFEREN 63-P11349B	CE ORIG	INATOR	DATE 7/31/70 INITIAL REVISION	SUBSYSTEM NAME	1	LY NAME & Audio
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	IT OF THE ASSUMED FAILURE	FAILU	RE (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	20 Nov 70  DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	PROBABILIT CRITICALIT PRODUCT (a) x (E) x (Q)	Y P	ANK RELIABILITY OR MODEL CODE SSY IDENTIFICATIO
C72 (Ceramic)			Open	. 25	Extreme noise	1.0	. 001050	<u> </u>			
•	İ		Short		No signal	1.0	1001050		26. 25 78. 75		118 64
C73 (Ceramic)			Open	. 25	Detuned discriminator	1.0	.001050		26. 25		119
			Short	. 75	No output	1.0			78.75		65
C74 (Not used)											
C75 (Ceramic)			Open	. 25 . 25	Fl No effect F2 No signal	.0	. 001050		0. 00 26. 25		120
			Short	.75 .75	F1 No effect F2 Widen	. 0			0. 00		.20
077 (0					bandwidth	.4			31.50		100
C77 (Ceramic)			Open	. 25	Fl Narrow bwdtl decrease gain	. 5	.001050		13.125		168
			Short		F2 No effect F1 Distort sig	. 0 . 9			0.00 70.875		71
				.75	badly F2 No effect	. 0			0.00		
C78 (Ceramic)			Open	. 25	Fl Narrow bdwtl	. 5	.001050		13.125		169
			Short	.75	gain F2 No effect	. 0			0.00		
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AILURE MODE, EFFECTS, AND C	RITICALITY A	NAI YSIS WODYSMEET								NO.	REV	A A
SY FAILURE DESCRIPTION			MISSION PHASE(S	146	CV DING OF CO.					PAGE 11	<b>OF</b> 5	l PAG
	RELIABILITY GOAL		MISSION PHASE(S	" [^`	SY DWG OR SK REFEREN	CE ORIGI	NATOR	DATE 7/31/70	SUBSYSTE	M NAME	ASSEMBLY N	AME
	T	<u> </u>	<u> </u>		63-P11349B	<u>_</u>		REVISION 20 Nov 70			IF & A	udio
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	NT OF THE ASSUMED FAILUR	E F	AILURE MODE (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (2) x (E) x (Q) x	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATI
C79 (Ceramic)			Open Short	. 25	Noisy signal No signal	1.0 1.0	.001125			28. 25 84. 375	109 31	
C80 (Ceramic)			Open Short	. 25 . 75	Noisy signal No signal	.6 1.0	.001050			15.75 78.75	143 66	
C81 (Ceramic)			Open	. 25	Low gain, low signal	1.0	.001215			30. 375	105	
G02 (G			Short	. 75	No signal	1.0				91.125	23	
C82 (Ceramic)			Open Short	. 25 . 75	Decreased bdwtl No signal	.3 1.0	.001125			8. 4375 84. 375	32	
C83 (Ceramic)			Open	. 25	Fl Decreased bdwth	. 3	.001125			8. 4375		
			Short	. 25 . 75	F2 No effect F1 No signal	.0 1.0				0.00 84.375	33	
C84 (Ceramic)			Open	. 75	F2 No effect F1 No effect	.0	. 001125			0.00		
					F2 Decreased bandwidth	. 3	. 001123			0.00 8.4375		
			Short	.75 .75	F1 No effect F2 No signal	.0 1.0				0.00 84.375	34	
				. *								
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70.74	1							}	1		1	1

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LURE MODE, EFFECTS, AND C										PAGE 12	OF s	51 PAGE
Y FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHAS	E(S)	SSY DWG OR SK REFEREN	CE ORIG	NATOR	DATE 7/31/70	SUBSYST		ASSEMBLY N	
	1				63-P11349B			INITIAL REVISION 20 Nov 70			IF & A	
ART, COMPONENT, UNIT, CIRCUI EM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
CR1		·.	Open	. 42	F1 No signal	1.0						<del> </del>
	1	` <del>*</del>	1	. 42		.0	.000320		i	13.44 0.00	158	<b>'</b> ]
	1		Short	. 39	Fl No effect	.0			- 1	0.00	ļ	
	1		1	. 39	F2 Fickts on	1.0			- 1	12. 48		
	(		Drift	. 19	F1 No effect	.0		1	- 1	0.00	172	·1
	İ			. 19	F2 No effect	.0				0.00		
CR2			Open	. 42	Fl No effect	.0	. 000336					
			1 -	. 42		1.0	.000330	}	- 1	0.00		.1
			Short	. 39	F1 No effect	.0			l	14.112	154	r d
	1		ı	. 39	F2 No effect	.0			- 1	0.00	1	1
	1		Drift	. 19	F1 No effect	.0		1		0.00 0.00	- 1	i
	1			. 19	F2 No effect	.0			1	0.00		1
CR3			Open	. 42	No signal	1.0	.000320				- 1	
	1		Short	. 39	Noisy signal	1.0	.000320		- 1	13.44	159	
			Drift	. 19	No effect	.0				12.48 0.00	173	1
CR4			Open	. 42	Dist signal	.4	. 000129			0.1/04		
			Short	. 39	Dist signal	.5	. 000129	1		2. 1672	l	i
	ĺ		Drift	. 19	No effect	.0				2. 5155 0. 00		
CR5	1		Open	. 42	Dist signal	.5	.000129			·		ļ
<del>-</del>			Short	. 39	Dist signal	.4	. 000129			2.7090	1	
			Drift	. 19	No effect	.0				2.0124 0.00	- 1	
CR6			Open	. 42	Dist signal	.4	.000129					
	1		Short	. 39	Dist signal	.5	. 000129	1	1	2. 1672		1
			Drift	. 19	No effect	.0				2. 5155 0. 00		Ĭ
CR7			Open	. 42	Dist signal	. 5	.000129					
	j		Short	. 39	Dist signal	.4	.000129	•	1	2.7090		j
			Drift	. 19	No effect	.0		1		2. 0124	1	1
					THE CAROLE					0.00		ŀ
		•										1
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FAILURE MODE, EFFECTS, AND C	DITICAL ITY A	NAI Veie WARVEILET								NO. REY. NO		
SSY FAILURE DESCRIPTION			MISSION PHASE(S)					_ ·		PAGE .	OF	PAC
	RELIABILITY GOAL	SOFT CIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE		CE ORIG	INATOR	DATE	SUBSYST	EM NAME	ASSEMBLY I	IAME
	_							INITIAL REVISION			IF & A	ıdio
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	IT OF THE ASSUMED FAILURE	FAILURE MODE	· (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	TI ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	RANK FOR ASSY	RELIABILITY MODEL CODI IDENTIFICATI
FL1			Short (to gnd) Open (to cap)	, 7 . 3	No Signal No Filtering	. 0	. 003650			255.50	7	
FL2			Short (to gnd)	. 7	Fl No Signal	1.0	. 003650			54.75 255.50	79 8	
			Open (to cap)	.7 .3 .3	F2 No Effect F1 No Effect F2 No Filtering	.0 .0 .5				0.00		
FL3			Short (to gnd)	. 7	No Telemetry	. 2	.003500			54.75 49.00	80 89	
FL4			Open (to cap) Short (to gnd)	. 3	No Filtering No Signal	.5 1.0	. 003600			52.50	85	
FL5			Open (to cap)	. 3	No Filtering	.5	.003600	, , , , , , , , , , , , , , , , , , ,		252.00 54.00	9 81	
r L5			Short (to gnd) Open (to cap)	. 7	No Signal No Filtering	1.0 .5	. 003500			245.00 52.50	10 86	
<b>J1</b>			Short (to gnd) Open (to sig)	. 1	No Signal No Signal	1.0 1.0	. 001000			10.00 90.00	176 24	
										,0.00	24	
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10.00			_1			,			1			1

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ASSY FAILURE DESCRIPTION			e			v-				PAGE	OF	PAG	
SST PAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE	5) AS:	SY DWG OR SK REFEREN	CE ORIG	INATOR	DATE	SUBSYST	M NAME A	SSEMBLY N		
					63-P11349B	ļ		INITIAL REVISION			IF & A	ıdio	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	F	AILURE MODE (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ОИ	PROBABILITY CRITICALITY PRODUCT (Q) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATI	
L1 (Not Used)													
L20 (Toroid)			Short Open Drift	. 07 . 86 . 07	No Signal Deg Perf No Effect	1.0 .7 .0	.002060			19.420 124.012	149 11		
L21 (Toroid)			Short Open Drift	. 07 . 86 . 07	No Signal Deg Perf No Effect	1.0	. 002060			0.00 14.420 124.012	150 12		
L22 (Toroid)			Short Open Drift	. 07 . 86 . 07	No Signal Deg Perf No Effect	.0 1.0 .7	.002060			0.000 14.420 124.012	151 13		
L23 (Toroid)			Short Open Drift	. 07 . 86 . 07	No Signal Deg Perf No Effect	.0 1.0 .7 .0	. 002060			0.00 14.420 124.012	152 14		
L6 (Toroid)			Short	. 07 . 07	Fl No Effect F2 No Signal	.0 1.0	. 004120			0.00 0.00 14.420	153		
			Open Drift	. 86 . 86 . 07 . 07	F1 No Effect F2 Deg Perf F1 No Effect	.0 .7 .0				0.00 124.012 0.00	15		
				.07	F2 No Effect	.0				0.00			
		• •		•									
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AILURE MODE, ÆFFECTS, AND C	DITECAL STV A	MAI VEIE WARVEUPP-									NO.		V. NO
SSY FAILURE DESCRIPTION	RELIABILITY				T						PAGE	OF	PAG
SOT THEORE SCALERY THON	GOAL	SUFFER NAME	MISSION PHASE	E( <b>5</b> )	J	SY DWG OR SK REFEREN	CE OR	GINATOR	DATE INITIAL	SUBSYS	TEM NAME	ASSEMBLY !	NAME
					63-P11349B				REVISION			IF & Audio	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BODX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE	<b>(α</b> )	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	ION	PROBABILITY CRITICALITY PRODUCT (\alpha\) x (E) x (Q) x	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICAT
Q1, 2N304			Short		. 45	F1&F2 Ckts					· · · · · · · · · · · · · · · · · · ·		
	1		Open		. 33	Both On No Signal	1.0 1.0	.000840	·	- 1	37.80	95	l
			Drift		. 22	No Effect	0.0	1			27.74 0.00	110	
Q2, 2N27::IA			Short		. 45	No Signal	1.0	.000780		- 1		1	
	1		Open		. 33	No Signal	1.0	.000780		- 1	35.10	96	
			Drift		. 22	No Effect	0.0	ĺ		İ	27.74 0.00	1 25	
Q3, 2N304			Short		. 45	No Signal	1.0	.000460			20.70	1,,,	1
	1		Open		. 33	No Signal	1.0	1		- 1	20.70 15.18	132 146	
	1		Drift		. 22	No Effect	0.0	1			0.00	140	
Q4, 2N 9 3:			Short		. 45	No Signal	1.0	. 000880			39.60	93	1
•	Ì		Open		. 33	No Signal	1.0		l	- 1	29.04	107	
			Drift		. 22	No Effect	0.0				0.00		ł
R1, Comp.			Open		.65	F1, No Effect	0.0	.000010			0.00	-	1
	1		7-16		. 65	F2, No Signal	1.0	1		1	0.65	1	
			Drift		. 35	F1, No Effect F2, No Effect	0.0	1		1	0.0	1	1
					. 33	r 2, No Ellect	0.0				0.0		
R2, Comp			Open		{.30	F1, No Effect	0.0	.000010			0.0		
	1	•		.65	(.35	F1, No Signal	1.0			1	. 35	- 1	1
			Drift		. 65 . 35	F2, No Effect F1, No Effect	0.0	1	Ĭ	- 1	0.00	1	
					. 35	F2, No Effect	0.0	1		. ]	0.00 0.00	1	1
R3, Comp											0.00		
ito, comp	1		Open		.65	F1, No Effect	0.0	.000010		- 1	0.00	1	1
			Drift		. 65 . 35	F2, No Signal F1, No Effect	1.0 0.0	İ		- 1	0.65	1	
					. 35	F2, No Effect	0.0				0. 00 0. 00		İ
			·										}
			1					1				. ]	
					- ]	-				1	•		1
<b>V</b>			1							1			
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SSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S	) A:	SSY DWG OR SK REFERENC	E OPIG	INATOR	DATE	C117 C110	PAGE 16		PAGE
	GUAL			1	63-P11349B-X3 APL-7/13/70	OKIO	, na rok	INITIAL REVISION	SUBSYST	EM NAME	ASSEMBLY I	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FA	AILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	IF and RANK	RELIABILITY MODEL CODE IDENTIFICATIO
R4, Comp.			Open	.65	Wrong Band- width	0.5	. 000010			0.375		
			Drift	. 35	Distorted Signal No Effect	0.0				0.00		
R5, Comp.			Open	.65	Fl, No Effect	0.0	.000010			0.00		
			Drift	. 65	F2, Osc/No Sig F1, No Effect	1.0			- [	0.65 0.00		
R6, Comp.				. 35	F2, No Effect	0.0				0.00		
ko, comp.			Open	.65	F1, No Effect F2, No Signal	1.0	.000010			0.00 0.65		
			Drift	. 35 . 35	F1, No Effect F2, No Effect	0. 0 0. 0				0.00 0.00		
R7, Comp.			Open	.65	F1, No Effect	0.0	. 000010		1	0.00		
			Drift	. 65 . 35 . 35	F2, No Signal F1, No Effect	1.0				0.65 0.00		
R8, Comp.			Open	. 65	F2, No Effect	0.0				0.00		
•			Drift	.65	F1, No Signal F2, No Effect F1, No Effect	1.0 0.0 0.0	. 000010			0.00 0.00		
			3111	. 35	F2, No Effect	0.0	, , , , , , , , , , , , , , , , , , ,			0.00 0.00		
R9, Comp.			Open	65 (.60	Dist. Output No Output	0.5 1.0	.000010			0.60		
•			Drift	. 35	No Effect	0.0				0.00		
R10, Comp.			Open Drift	.65 .35	No Signal No Effect	1.0 0.0	. 000010			0.65 0.00		
R11, Comp.			Open	. 65	No Effect	0.0	.000010			0.00		
•			Drift	. 35	No Effect	0.0				0.00	-	
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ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	TA	SSY DWG OR SK REFEREN	e lonie	INATOR	2.47		PAGE 17	OF	51	CAUE
	GOAL	·			63-P11349B-X3 APL-7/13/70	JE ORIG	TNA FOR	DATE INITIAL REVISION	SUBSYSTI	EM NAME	IF an		
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAIL: MOD	JRE E (α	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	I ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	FO	NK RE	ELIABILITY ODEL CODE SENTIFICATION
R12, Comp.	l		Open	. 65	F1, No Effect	0.0	.000010			0.00	_	十	
	Į.		ļ <sup>-</sup>	.65	F2, No Signal	1.0			- 1	0.65	l	ł	
	I		Drift	. 35	F1, No Effect	0.0			ł	0.00		- 1	
	1			. 35	F2, No Effect	0.0			İ	0.00			
R13, Comp.	•		Open	. 65	El No Eff	0.0			İ		- 1		
tito, somp.	1		Open	.65	F1, No Effect	0.0	.000010		į	0.00		- 1	
	ł		Drift		F2, No Signal	1.0		}	1	0.65		- 1	
	1		l Drut	. 35	F1, No Effect	0.0	1	1	1	0.00	ı	1	
				. 35	F2, No Effect	0.0	I		1	0.00	1	ł	
R14, Not Used			1								ı		
R15, Comp.	1		Open	. 65	F1, No Effect	0.0	.000010	1	- 1	0.00		- 1	
			1 -	. 65	F2, No Signal	1.0			1	0.65		1	
			Drift	. 35	F1, No Effect	0.0	İ		ı	0.00	- 1	ł	
				. 35	F2, No Effect	0.0				0.00	I		
R16, Comp.			Open	.65	Fl, No Effect	0.0	.000010		1			1	
	1		open.	.65	F2, No Signal	1.0	.000010			0.00	- 1	- 1	
	Ì		Drift	. 35	F1, No Effect	0.0	Ī	I	- 1	0.65		- 1	
			1 5111	. 35	F2, No Effect	0.0	]		1	0.00 0.00		1	
			.							0.00			
R17, Comp.	i		Open	.65	Fl, No Signal	1.0	.000010		- 1	0.65	- 1	- 1	
	1		1	.65	F2, No Effect	0.0			1	0.00	1	- 1	
	1		Drift	. 35	F1, No Effect	0.0		1		0.00			
			1	. 35	F2, No Effect	0.0			- 1	0.00			
R18, Film			Short	. 11	F1, Clipping	0.6	.000083		1	0.55	-		
•	1			.11	F2, No Effect	0.0	. 500003		- 1	0.55 0.00	ł		
	1		Open	. 78	F1, No Signal	1.0	ļ	1	1		- 1		
	1		1	. 78	F2, No Effect	0.0	}		. }	6.48	- 1		
	1		Drift	.11	F1, No Effect	0.0	1		}	0.00	ı		
	1			.11	F2, No Effect	0.0	j		- 1	0.00	ı		
		•	ļ	• • •	2 2, 140 Direct	J. U	<b>\</b>		1	0.00		ļ	
					]				1			ł	
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SSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S	) ^	SSY DWG OR SK REFERENC	E ORIG	INATOR .	DATE	SUBSYST	PAGE 18	OF 5	, AGE
	T				63-P11349B-X3 APL-7/13/70			INITIAL REVISION			IF and A	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FA	ALURE MODE (a	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSA TO ELIMINATE THE FAILURE MODE	TI ON	PROBABILITY CRITICALITY PRODUCT (\alpha\) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R19, Comp.			Open	.65	Fl, No Signal	1.0	.000010			0.65		<del> </del>
	Ī			. 65	F2, No Effect	0.0		1			1	1
	ł		Drift	. 35	F1, No Effect	0.0	1		- 1	0.00		
	1.			. 35	F2, No Effect	0.0	1		ı	0.00		
	1		1		1 - 7	0.0	1	1	i	0.00	i	[
R20, Comp.	1		Open	. 65	F1, No Signal	1.0	.000010	1	i		1	1
	1		1	.65	F2, No Effect	0.0	.000010	1	l	0.65		1 .
			Drift	. 35	Fl. No Effect	0.0	l	1	1	0.00	1	}
			]	. 35	F2, No Effect	0.0		]	}	0.00		}
			1	. 33	12, No Effect	0.0			- 1	0.00		1
R21, Comp.	1		Open	. 65	F1, No Signal	1.0	. 000010					į.
			1	.65	F2, No Effect	0.0	. 000010	ł	1	0.65		1
	1		Drift	. 35	F1, No Effect	0.0	l			0.00		1
	l			. 35	F2, No Effect	0.0	ł	1	ı	0.00	i	I
	1		1		1 2, 110 231260	0.0			- 1	0.00	ł	1
R2Z, Comp.			Open	. 65	Fl, Dist. Signal	0.7	. 000010	1	1			I
				.65	F2, No Effect	0.0	. 000010	1	1	0.455		
	i		Drift	. 35	F1, No Effect	0.0		İ		0.00	ļ	į.
	1			. 35	F2, No Effect	0.0		1	- (	0.00	- (	f
				. 33	re, No Ellect	0.0			ı	0.00	1	
R23, Comp.	1		Open	. 65	F1, Dist. Signal	0.7	. 000010				ı	
				.65	F2, No Effect	0.0	.000010	1	- 1	0.455		
			Drift	. 35	1 1	0.0	1	į.	ļ	0.00	1	1
			1 2	. 35	F2, No Effect	0.0	l	1	Į.	0.00		
	1			. 33	12, No Effect	0.0				0.00	į	1
R24, Not Used												
R25, Film	1		Short	. 11	F1, Wrong Gain	0.5	000000	1	- 1		-	ł
	1			• • • •	F2, Wrong BW	v. 5	.000083	1		0.4565		1
	1		1	.11		0.9		1	1			1
	1	*	Open	.78		1.0		1	. [	0.8217	1	1
	1			. 78		0.0	]		i	6.474	j	1
			Drift	.11	1 '	0.0				0.00		1
	1			. 11	1 .	0.0		1.	[	0.00	- 1	1
	I		1		1, 110	·. ·			1	0.00		j
•	1							1	1			
	1				1		1	l	- I		1	1
	1				1			1	1			1
	1		1		1				- 1			
			1		1		1	.1			- 1	1

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ASSY FAILURE DESCRIPTION	DEL LABIL ITY	NALYSIS WORKSHEET	MISSION PHASE(S)							PAGE 19	OF 5	1 PAGES
TALLONG DESCRIPTION	RELIABILITY GOAL	SUFF CIER NAME	MISSION PHASE(S)		63-P11349B-X3 APL-7/13/70	E ORIG	INATOR	DATE INITIAL REVISI <b>O</b> N	SUBSYS	THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN TRANSPORT NAMED IN THE PERSON NAMED IN TRANSPORT NAMED IN THE PERSON NAMED I	SEMBLY N	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILUR MODE	Ε (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENS. TO ELIMINATE TH FAILURE MODE	ATI ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R26, Film			Short	. 11	Clipped Signal	1.0	. 000083				_	<b></b>
			Open	. 78	No Signal	1.0	.000003		1	0.913	l	1
	1		Drift	.11	No Effect	0.0				6.474		i
	ł		ł				1	ì	- 1	0.00		1
R27, Comp.	1		Open	.65	No Signal	1.0	.000010		1	0.65		1
			Drift	. 35	No Effect	0.0				0.00	1	
R28, Film			63					1				
	1		Short	. 11	Dist. Signal	0.5	.000083	1	1	0.4565	ı	
	1		Open Drift	.78 .11	No Signal No Effect	1.0			1	6.474		ł
	1		D. II.	. 11	No riiect	0.0			- 1	0.00	1	
R29, Comp.	i	1 1	Open	. 65	No Signal	1.0	.000010	i i	•	n /=	1	Į
	1		Drift	. 35	No Effect	0.0		l	- 1	0.65 0.00	1	Ì
R30, Film									- 1	0.00		
R30, FIIM	j		Short	. 11	Low Signal	1.0	.000083			0.913	1 .	l
	1		Open	. 78	Clipped Signal	0.6		ŀ	- 1	3.8844	1	l
	1		Drift	. 11	No Effect	0.0	1	ł	- 1	0.00	1	1
R31, Comp.	1	· ·	Open	. 65	Fl, No Signal	1.0	.000010		- 1			
	1		o po	. 65	F2, No Effect	0.0	.000010	İ	- 1	0.65	1	l
	1		Drift	. 35	Fl. No Effect	0.0	1		1	0.00	i i	1
	}		1	. 35	F2, No Effect	0.0		1		0.00 0.00		1
R32, Comp.			<u> </u>					ļ		0.00	ı	
R32, Comp.	1		Open	. 65	No Signal	1.0	.000010			0.65		
	İ		Drift	. 35	No Effect	0.0			- 1	0.00	1	1
R33, Comp.	ł		Open	.65	No Signal	1.0	000010	ł	1		ł	l
			Drift	. 35	No Effect	0.0	.000010			0.65	1	İ
	1					0.0	ľ		1	0.00	ĺ	İ
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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 20 OF 51 ASSY FAILURE DESCRIPTION PAGES RELIABILITY GOAL SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME 63-P11349B-X3 INITIAL REVISION IF and Audio APL-7/13/70 SYSTEM EFFECT NUMBER (E) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK FOR ASSY RELIABILITY MODEL CODE IDENTIFICATION EFFECT ON ASSEMBLY (a)  $(\alpha) \times (E) \times (Q) \times 10^5$ R34, Comp. Open .65 No Signal 1.0 . 000010 0.65 Drift . 35 No Effect 0.0 0.00 R35, Comp. Open .65 Dist. Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R36, Comp. Open No Signal .65 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R37, Comp. Open .65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R38, Comp. Open .65 Dist. Signal 0.8 .000010 0.52 Drift . 35 No Effect 0.0 0.00 R39, Comp. Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R40, Film Short . 11 No Signal 1.0 .000083 0.913 Open . 78 No Signal 1.0 6.474 .11 Drift No Effect 0.0 0.00 R41, Film Short .11 No Signal 1.0 .000083 0.913 Open . 78 No Signal 1.0 6.474 Drift No Effect ς.10 0.0 0.00 .01 Wrong Gain 0.5 0.0415 R42, Comp. Open ç. 30 No Effect 0.0 000010 0.00 (.35 Wrong Signal Respond to 1.0 0.35

Noise

Small Effect

0.1

. 35

Drift

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Page 41 of 81 NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 21 **OF** 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY GOAL SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGI NATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 63-P11349B-X3 IF and Audio APL-7/13/70 PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION SYSTEM EFFECT NUMBER (E) PROBABILITY STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY
FOR MODEL CODE
ASSY IDENTIFICATION CRITICALITY PRODUCT EFFECT ON ASSEMBLY (a) (a) x (E) x (Q) x 105 R43, Not Used R44, Film Short . 11 Low Signal 1.0 000083 0.913 Open 5.40 No Effect 0.0 . 78 0.00 . 38 Incr LF Gain/ 1.0 3.154 may resp to noise Drift .11 No Effect 0.0 0.00 R45, Film Short . 11 Low Signal 1.0 000083 .78 ( • 18 0.913 Open No Effect 0.0 0.00 .60 Incr Gain/Osc/ may resp to 1.0 4.98 noise Drift .11 No Effect 0.0 0.00 R46, Comp. Open . 65 No Signal 1.0 000010 0.65 Drift . 35 No Effect 0.0 0.00 R47, Film Short . 11 No Signal 1.0 000083 0.913 Open . 78 No Signal 1.0 6.474 Drift . 11 No Effect 0.0 0.00 R48, Film Short .11 No Signal 1.0 000083 0.913 Open . 78 No Signal 1.0 6.474 Drift .11 No Effect 0.0 0.00 R49, Film Short .11 No Signal 1.0 000083 0.913 Open .78 No Signal 1.0 6.474 Drift . 11 No Effect 0.0 0.00

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REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE OF PAGES ASSY FAILURE DESCRIPTION RELIABILITY GOAL SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 63-P11349B-X3 APL-7/13/70 IF and Audio PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RELIABILITY MODEL CODE IDENTIFICATION EFFECT NUMBER (E) RANK EFFECT ON ASSEMBLY FOR ASSY (a) (a) x (E) x (Q) x 105 R50, Film Short . 11 No Signal 1.0 .000083 0.913 Open .78 No Signal 1.0 6.474 Drift .11 No Effect 0.0 0.00 R51, Film Short . 11 Noisy Output 1.0 .000083 0.913 Probable Open . 78 No Signal 1.0 6.474 Drift .11 No Effect 0.0 0.00 R52, Film Short .11 No Signal 1.0 . 000083 0.913 Open . 78 Noisy Signal 1.0 6.474 Drift . 11 No Effect 0.0 0.00 R53, Comp. Open . 65 No Sig to TLM 0.2 .000010 0.13 Drift . 35 No Effect 0.0 0.00 R54, Comp. Open No Signal .65 .000010 1.0 0.65 Drift . 35 No Effect 0.0 0.00 R55, Film Short .11 F1, No Effect 0.0 .000083 0.00 F2, Noisy Sig. . 11 0.5 . 4565 . 78 F1, No Effect 0.0 0.00 Open . 78 F2, No Signal 1.0 6.474 . 11 F1, No Effect 0.0 0.00 Drift .11 F2, No Effect 0.0 R56, Film Short . 11 F1, No Effect 0.0 . 000083 0.00 .11 F2, Noisy Sig. 0.5 .4565 Open . 78 Fl, No Effect 0.0 0.00 . 78 F2, No Signal 1.0 6.474 Drift .11 F1, No Effect 0.0 0.00 .11 F2, No Effect 0.0

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SSY FAILURE DESCRIPTION	DELIABILITY	SUPPLIER NAME	MICCION DIVICE							PAGE 23	OF	51 PAGES
OUT THE DESCRIPTION	RELIABILITY	SOFT CLER NAME	MISSION PHASE(S)		63-P11349B-X3	CE ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYST	EM NAME A	SSEMBLY N IF and	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAI	ILURE ODE (a)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ION	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R57, Comp.			Open Drift	.65 .35	No Signal No Effect	1.0	.000010			0.65 0.00		
R58, Film			Open Drift	.78	Low Signal/ Distortion	0.5	. 000083			3. 237		
			Drift Short	.11	No Effect Low Signal/ Distortion	0.0 .5				0.00 .4565		
R59, Film			Open	. 78	Low Signal/ Distortion	0.5	.000083			3. 237		
			Drift Short	.11	No Effect Low Signal/ Distortion	0.0				0.00 .4565		
R60, Film			Short Open	.11 .78 { .18 .60	Low Dignal No Effect Incr Gain/Osc/ may resp to	0.5 0.0	. 000083			0.4565 0.00 4.98		
			Drift	.11	noise No Effect	0.0				0.00		
R61, Comp.			Open Drift	65	No Effect No Effect	0. 0 0. 0	.000010			0.00 0.00		
R62, Comp.			Open Drift	.65 .65 .35	F1, No Effect F2, No Signal F1, No Effect	0.0 1.0 0.0	.000010			0.00 0.65		
D/3 - DI				. 35	F2, No Effect					0.00		
R63, Film			Short Open	.11 .11 .78	F1, No Effect F2, Wrong BW F1, No Effect	0.0	. 000083			0.00 0.4565		
·.			Drift	.78 .11	F2, No Signal F1, No Effect	0. 0 1. 0 0. 0				0.00 6.474 0.00		
				. 11	F2, No Effect	0.0				0.00		
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FAILURE MODE, EFFECTS, AND C									•	PAGE	OF	PAGE
ASST PAILURE DESCRIPTION	GOAL	SUPPLIER NAME	MISSION PHASE(5)	- 1	SSY DWG OR SK REFEREN	CE ORIG	INATOR	DATE 7/3/70	SUBSYST	EM NAME	ASSEMB LY	
		L		<u></u>	3-P11349			INITIAL REVISION 20 Nov 70			IF and	Audio
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (\alpha\) x (E) x (Q) x 1	05 RAN FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R65, Comp			Open Drift	.65 .35	No Effect	1.0 0.0	.000010			0.65 0.00		
R66, Comp			Open Drift	. 65 . 35		1.0	.000010			0.65 0.00		
R67, Comp			Open Drift	.65 .35	No Signal No Effect	1.0 0.0	.000010			0.65 0.00		
R68, Comp			Open Drift	. 65 . 35	Low Signal No Effect	0.9 0.0	.000010			0.585 0.00		
R69, Comp			Open Drift	.65 .65		0.7 0.0 0.0	.000010			0.455 0.00 0.00		
				. 35		0.0				0.00		

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SY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S)	TA:	SY DWG OR SK REFEREN	T LODIO		2 /21 /82	·	PAGE	OF	PAGE
	GOAL				63-P113 B	LE ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYST	EM NAME	RF Cor	AME overter
PART, COMPONENT, UNIT, CIRCUIT TEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURI MODE	Ε (α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATO ELIMINATE THE	אס ויז	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
C20, Cap, Var. Air			Short Open	.87	No Signal No Signal	1.0	.000600			52.20 7.80	55	
C21, Fxd. Mica			Short Open Drift		No Effect	1.0 0.5 0.0	.000080			1.20 3.20 0.00		
C22, Fxd. Cer.			Short Open	. 25		1.0 2.5				78.75 13.125	40 88	
C23, Fxd. Glass			Short Open Drift	.05	No Signal	0.5 1.0 0.0	.000060			0.15 4.80 0.00		
C24, Var. Air			Short Open			1.0	.000600			52.20 7.80	56	
C23, Fxd. Cer.			Short Open			1.0	.001050			78.75 26.25	41 66	
C26, Fxd. Cer.						1.0 0.5	.001050			78.75 13.125	42 89	
C28, Fxd. Glass						1.0 1.0 0.0	.000060			0.30 4.80 0.00		
C30, Fxd. Cer.			Short Open	.70 .08 .22	No Effect	1.0 1.0 0.0	.001050			78.75 3.15 0.00	43	
C31, Fxd. Cer.			Short Open		No Signal Low Signal	1.0 0.5	001050			78.75 13.125	44 90	

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ATT_COMPONENT_UNIT_CIRCUIT  THAT SET OR BOX DESCRIPTION  THAT COMPONENT_UNIT_CIRCUIT  THAT COMPONENT_UN				MISSION PHASE(S)	AS	SY DWG OR SK REFEREN	CE ORIGI	NATOR	DATE	SURSVET			
C42, Ceramic Short .75 Open .25 No. Signal 1.0 .00105 75.75 13.125				T	- 1				INITIAL REVISION 11-20-70		A A		
Short .75 Open .28 No Signal 1.0 .00105 .75.75 13.125	PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	1 1	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	ION	PROBABILITY CRITICALITY PRODUCT (\alpha\) x (E) x (Q) x 10 <sup>5</sup>	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
	C42, Ceramic							. 00105			75.75	1	
								,					
	70-7A `												

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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME 63-P11377B-X3 INITIAL APL-13 July 1970 REVISION FAILURE PROBABILITY × 10<sup>5</sup> (Q) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RELIABILITY MODEL CODE IDENTIFICATION EFFECT ON ASSEMBLY FOR ASSY (a) (a) x (E) x (Q) x 10<sup>5</sup> R14, Res, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R15, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R16, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R17, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R18, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R19, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R20, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R21, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R22, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R23, Fxd Comp Open .65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 R24, Fxd Comp Open .65 Low Signal 0.5 .000010 0.325 Drift . 35 No Effect 0.0 0.00 R25, Fxd Comp Open . 65 No Signal 1.0 .000010 0.65 Drift . 35 No Effect 0.0 0.00 970-7A '

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SSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S)	I AS	SY DWG OR SK REFEREN	E LOBIO	INATOR	DATE 7/31/70		PAGE	OF	PAGES
	GOAL				3-P11377B	ORIG	INATOR	INITIAL REVISION 20 Nov 70	SUBSYST		RF Con	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	<b>(α</b> )	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
R26, Res, Fxd Comp			Open Drift	.65 .35	No Signal No Effect	1.0 0.0	.000010			0.65 0.00	_	
R27, Not Used												
R28, Fxd Comp			Open Drift	. 65 . 35	No Signal No Signal	1.0	.000010			0.65 0.00		
R29, Fxd Comp			Open Drift	. 05	No Signal No Effect	1.0	.000010			0.65 0.00		
R30, Thermistor			Open Drift	.50 .50	No Signal Low Signal	1.0 0.5	.015000			750.00 325.00	1 5	
R31, Res, Fxd Comp			Open Drift	.65 .35	,	0.5 0.0	.000010			0.325 0.00		
R32, Fxd Comp			Open Drift	. 65 . 35	No Signal No Effect	1.0	.000010			0.65 0.00		
R33, Fxd, Comp			Open Drift	.65 .35	Low Signal No Effect	.5 0.0	. 00001			3.25 0.0		
R40, Fxd, Comp			Open Drift	. 65 . 35	No Signal No Effect	1.0	.000010			0.65 0.00		
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SY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASI	F(S)	ASSY DWG OR SK REFEREN			·		PAGE	OF	PAGE
	GOAL		1		63-P11377B	CE ORIG	INATOR	DATE 7/31/70 INITIAL REVISION 20 Nov 70	SUBSYSTE	EM NAME	RF Co	nverter
PART, COMPONENT, UNIT, CIRCUIT TEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE		FAILURE MODE (d	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	I ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
L1, Coil, RF, Phenolic	:		Open	1.0	No Signal	1.0	.002060			206.00	15	
L2, RF, Iron	]		Short	. 07	No Signal	1 0	002025				-	1
	1		Open	.86		1.0	002825		- 1	19.775	71	1
	1		Drift	. 07	No Effect		1		1	242.94	8	}
			1	.01	No Ellect	0.0				0.00	1	ľ
L3, RF, Phen.			Open	1.0	No Signal	1.0	.002060			206.00	16	
L4, RF, Phen.			Open	1.0	No Signal	1.0	.002060			206.00	17	
L5, RF, Iron	1		Short	. 07	No Signal	1.0	.002825		- 1	10 775		1
	1		Open	.86	No Signal	1.0	1			19.775 242.95	72	1
	1		Drift	. 07	No Effect	0.0	l		j	0.00	9	I
14 DE D	1				i		1		1	0.00	- 1	Į.
L6, RF, Phen.			Open	1.0	No Signal	1.0	.002060			206.00	18	1
L7, RF, Iron			Short	. 07	No Cianal						1	1
	1		Open	. 86	No Signal No Signal	1.0	.002825	1	ı	19.775	73	1
	1		Drift	.07	No Effect	1.0			- 1	242.95	10	j
L8, Not Used				, , ,	NO EMICEL	0.0				0.00		
L9, Coil, RF, Iron	1		Short	. 07	No Signal	1.0	.002825					1
	İ		Open	. 86	No Signal	1.0	1002023	į.	1	19.775	74	1
	1		Drift	. 07	No Effect	0.0				242.95	11	1
I 10 DE Torre			1			-			- 1	0.00	1	1
Llo, RF, Iron	1		Short	. 07	No Signal	1.0	.002825			19.775	1	1
	1		Open	. 86	No Signal	1.0			ļ	242.95	75 12	1
			Drift	. 07	No Effect	0.0				0.00	12	l
Lll, RF, Phen.			Open	1.0	No Signal	1.0	.002060			206.00	19	
L12, RF, Iron	I		Short	. 07	No Circui			1				1
		· ·	Open	.86	No Signal No Signal	1.0	.002825			19.775	76	l .
			Drift	. 07	No Effect	1.0			1	242.95	13	1
	1			• 01	No Effect	0.0				0.00		
Ll3, RF, Phen.			Open	1.0	No Signal	1.0	.002060			206.00	20	
L14, RF, Phen.			Open	1.0	No Signal	1.0	.002060		I	206.00	21	

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NO. REV. NO Α FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE OF PAGES RELIABILITY SUPPLIER NAME ASSY FAILURE DESCRIPTION MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME 63-F11377B INITIAL REVISION RF Converter 20 Nov 70 SYSTEM EFFECT NUMBER (E) FAILURE PROBABILITY × 10<sup>5</sup> (Q) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) (a) x (E) x (Q) x 105 L15, Coil, RF, Iron Short .07 Low Signal 0.3 .002060 4.326 50 Open .86 Low Signal 0.3 59.74 Drift . 07 No Effect 0.0 0.00 L16, RF, Phen. Open 1.0 No Signal 1.0 .002060 206.00 22 L17, RF, Phen. Open 1.0 No Signal 1.0 .002060 206.00 23 L18, RF, Iron Short . 07 No Signal 1.0 .002825 19.775 77 Open .86 No Signal 1.0 242.95 14 Drift .07 No Effect 0.0 0.00 L19, RF, Air Open 1.0 No Signal 1.0 .002825 282.50 6 L20, Not Used 970-7A '

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SY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S	6	SY DWG OR SK REFERENC 3-P11377B-X3 APL-13 July 1970	E ORIG	INATOR	DATE INITIAL REVISION	SUBSYST		ASSEMBLY N	AME
PART, COMPONENT, UNIT, CIRCUIT TEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	F	AILURE MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSA TO ELIMINATE THE FAILURE MODE	TI ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
T1, Not Used											+	
T2, Transformer, RF, Fxd			Short Open Drift	.15 .80 .05	No Signal No Signal No Effect	1.0 1.0 0.0	.005650			84.75 452.00 0.00	26 2	
T3, RF, Fxd			Short Open Drift	.15 .80 .05	No Signal No Signal No Effect	1.0 1.0 0.0	.005650			84.75 452.00 0.00	26	
T4, RF, Fxd			Short Open Drift	.15 .80 .05	No Signal No Signal No Effect	1.0 1.0 0.0	.005650			84.75 452.00 0.00	26 4	
			1		1			1	ł		1	1

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SSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE	(S)	ASS	Y DWG OR SK REFERENC	E ORIGI	NATOR	DATE 7/31/70	SUBSYST	PAGE	OF	PAG
	T		_ <del></del>		L,	63-P11377B			INITIAL REVISION 20 Nov 70	30831318		Convert	
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	IT OF THE ASSUMED FAILURE	. !	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	'I ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10 <sup>2</sup>	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
CR1, Diode, Step, Rec			Short Open Drift	.11 .15	5	No Signal No Signal No Effect	1.0 1.0 0.0	.000052			0.572 0.78 0.00		
CR2, Diode, Mixer			Short Open Drift	.11 .15	5	No Signal No Signal No Effect	1.0 1.0 0.0	.000044			2.684 3.660 0.00		
CR3, Diode, Mixer			Short Open Drift	.11 .15 .74	5	No Signal No Effect	1.0 1.0 0.0	.000244			2.684 3.660 0.00		
CR4, Diode,			Short Open Drift	• 09	9		0.5 1.0 0.0	.000320			6.24 13.44 0.00	82	
Ql, Transistor			Short Open Drift			No Signal No Signal No Effect	1.0 1.0 0.0	.000994			44.73 32.802 0.00	57 60	
Q2, Transistor			Short Open Drift			No Signal No Signal No Effect	1.0	.000522			23.49 17.226 0.00	69 78	
Q3, Transistor			Short Open Drift			No Signal No Signal No Effect	1.0 1.0 0.0	. 000507			22.815 16.731 0.00	70 79	
Q4, Transistor			Short Open Drift			No Signal No Signal No Effect	1.0 1.0 0.0	.001210			54.45 39.93 0.00	52 58	

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REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE OF PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME 63-P11377B-X3 INITIAL REVISION RF Converter APL-13 July 1970 SYSTEM EFFECT NUMBER (E) PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY \* 10<sup>5</sup> (Q) PROBABILITY FAILURE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY
FOR MODEL CODE
ASSY IDENTIFICATION EFFECT ON ASSEMBLY PRODUCT  $(\alpha)$ (a) x (E) x (Q) x 105 Q5, Transistor Short . 45 No Signal 1.0 .000368 16.56 82 Open . 33 No Signal 1.0 12.144 98 Drift . 22 No Effect 0.0 0.00 Q6, Transistor Short . 45 No Signal 1.0 .000368 16.56 83 Open . 33 No Signal 1.0 12.144 99 Drift . 22 No Effect 0.0 0.00 Ul, Not Used U2, Integrated Circuit Short . 25 No Signal 1.0 .000387 9.675 100 Open .30 No Signal 1.0 11.61 Drift . 45 No Effect 0.0 0.00 U3, Integrated Circuit Short . 25 No Signal 1.0 .000387 9.675 101 Open .30 No Signal 1.0 11.61 Drift . 45 No Effect 0.0 0.00 Yl, Crystal, Quartz Short .11 No Signal 1.0 .000500 5.50 61 Open . 67 No Signal 1.0 33.50 Drift . 22 No Effect 0.0 0.00 FLI, Filter, RFI Short .70 No Signal 1.0 .003700 259.00 7 Open .30 Low S/N 0.5 55.00 53 Jl, Conn., RF Open 1.0 No Signal 1.0 .001000 100.00 24 J2, Conn., RF Open 1.0 No Signal 1.0 .001000 100.00 25

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			MISSION PHASE(	\$)	6	sy Dwg OR SK REFERENC 3-P11356B-X3 APL-13 July 1970	CE ORIG	SINATOR	DATE INITIAL REVISION	SUBSYSTE	1	OF ASSEMBLY A Audio Co Power Is	mbiner
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	F	AILURE MODE	(a)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ОИ	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	RANK FOR	T T
Cl, Cap, Fxd, Solid Tant.			Short Open	. 1		No A Supply Volt. A Rcvr. Ripple	1.0	.000980			83.30 1.47	16	
C2, Cap, Fxd, Solid Tant			Short Open	. 8		No B Supply Volt. B Rcvr. Ripple	1.0	.000980			83.30 1.47	17	
C3, Cap, Fxd, Ceramic			Short	.7	'5	Loss of DC Isol. at Aud. A Output	0.1	.001050			7.875	39	
C4, Cap, Fxd, Ceramic			Open Short	. 2		No Audio A  Loss of DC	0.5		·		13.125		
			Open	. 2		Isol. at selected Output No Part Redund	0.1 0.5	.001050			7.875 13.125	40	
C5, Cap, Fxd, Ceramic			Short Open	.7		Loss of DC Isol. No Part Redund	0.1 0.5	.001050			7.875 13.125	41	
C6, Cap, Fxd, Ceramic			Short	.7	5	Loss of DC	0.1	.001050			7.875	43	
C7, Cap, Fxd, Wet Slug			Open Short	.1		No Audio B No A Supply	0.5				13.125	42	
	·		Open	.9	0	Volt. A Revr. Ripple	1.0	.010500			10.50 9.45	49	
C8, Cap, Fxd, Wet Slug			Short Open	.1		No B Supply Volt.	1.0	.010500			10.50	50	
	·		J open	• 7	•	B Revr. Ripple	0.1				9.45		
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SSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MACCIONI DALCETTIC							PAGE 42	<b>OF</b> 5	) i PAG
	GOAL	3077 EIER NAME	MISSION PHASE(S)	1	SY DWG OR SK REFEREN 63-P11356B-X3 APL - 13 July 197	1	NATOR	DATE INITIAL REVISION	SUBSYST	1.	ASSEMBLY N Audio Co Power Is	MAME Ombiner
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	ION	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR	RELIABILITY MODEL CODE IDENTIFICAT
R1, Res, FxD, Comp.			Open Drift	.65	No A Supply Volt No Effect	1.0	.000010			0.65		
R2, Res, FxD, Comp.			Open Drift	.65	A Revr. Ripple No Effect	0.1 0.0	.000010			0.65		
R3, Res, FxD, Comp.			Open Drift	.65 .35	BRevr. Ripple No Effect	0.1	. 000010			0.00 0.65 0.00		
R4, Res, FxD, Comp.			Open Drift	. 65 . 35	No B Supply Volt No Effect	1.0 0.0	.000010			0.65		
R5, Res, FxD, Comp.			Open	.65	A Revr. Only At Selected Out- put	0.5	.000010			0.325		
R6, Res, FxD, Comp.			Drift	.35	No Effect					0.00		
. , , ,			Open Drift	. 65	Simult. Aud. Output No Effect	0.2	.000010			0.13		
R7, Res, FxD, Comp.			Open Drift	.65	No B Supply Reg. No Effect	0.2 0.0	.000010			0.00		
R8, Res, FxD, Comp.			Open Drift	. 65	No A Supply Reg. No Effects	0.2	.000010			0.00		
R9, Res, FxD, Comp.			Open Drift	. 65	No 1 KHZ BTLM No Effect	0.2 0.0	. 000010			0.00		
R10, Res, FxD, Comp.			Open Drift	.65	No 11 Volt BTLM No Effect	0.2 0.0	.000010			0.00		
R11, Res, FxD, Comp.			Open Drift	.65	No N Volt B T LM No Effect	0.2	.000010			0.00		
R12, Res, FxD, Comp.			Open Drift	. 65 . 35	No Temp TLM No Effect	0.2 0.0	. 000010			0.00 0.13 0.00		

Page 65A of 81 NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 42A **OF** 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 63-P11356B-X3 Audio Combiner APL - 13 July 1970 Power Isolator SYSTEM EFFECT NUMBER (E) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY x 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a)  $(\alpha)$  x (E) x (Q) x  $10^5$ R13, Thermistor Open . 50 No Temp TLM 0.2 150.00 Drift .015000 10 .50 No Effect 0.0 0.00

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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 43 OF 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME 63-P11356 B-X3 INITIAL REVISION Audio Combiner APL-13 July 1970 Power Isolator SYSTEM EFFECT NUMBER (E) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY
FOR MODEL CODE
ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) (α) x (E) x (Q) x 10<sup>5</sup> R14, Res, FxD, Comp .65 No Part Redun-Open 0.5 0.325 dancv Drift . 35 No Effects .000010 R15, Q6 0.0 0.00 R15, Res, FxD, Comp Open .65 No Part Redun-0.5 .000010 R14, Q8 0.325 dancy Drift . 35 No Effect 0.0 0.00 R16, Res, FxD, Comp Open .65 A Revr. At Sel-0.5 0.325 ected Output Drift . 35 No Effect 0.0 .000010 0.00 R17, Res, FxD, Comp Open .65 No 1 KHz A TLN 0.2 0.13 Drift . 35 No Effect 0.0 .000010 0.00 R18, Res, FxD, Comp Open .65 No 1 KHz A TLM 0.2 0.13 Drift . 35 No Effect 0.0 .000010 0.00 R19, Res, FxD, Comp Open .65 No 1 KHzBTLM 0.2 0.13 Drift . 35 No Effect 0.0 .000010 0.00 R20, Res, FxD, Comp SEE RF COUPLER R21, Res, FxD, Comp .65 No Part Redndcy Open 0.5 0.325 Drift . 35 No Effect 0.0 .000010 R24 0.00 R22, Res, FxD, Comp Open .65 No livolt A TLM 0.2 0.13 Drift . 35 No Effect 0.0 .000010 0.00 R23, Res, FxD, Comp Open .65 No livolt A TLM 0.2 0.13 Drift . 35 No Effect 0.0 .000010 0.00 R24, Res, FxD, Comp .65 No Part Redndcy Open 0.5 0.325 Drift . 35 No Effect 0.0 .000010 R21 0.00 R25, Res, FxD, Comp Open .65 No A Supply Volt. 1.0 0.65 Drift . 35 No Effect 0.0 .000010 0.00 R26, Res, FxD, Comp Open .65 No A Supply Volt 1.0 0.65 Drift . 35 No Effect 0.0 .000010 0.00 970-7A Project: ALSEP

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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 44 **OF** 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE 63-P11356 B-X3 ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION Audio Combiner APL-13 July 1970 Power Isolator PROBABILITY CRITICALITY PRODUCT SYSTEM EFFECT NUMBER (E) PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY  $(\alpha)$ (a) x (E) x (Q) x 105 R27, Res, FxD, Comp Open .65 No B Supply Volt 1.0 0.65 Drift . 35 No Effect 0.0 .000010 0.00 R28, Res, FxD, Comp .65 No B Supply Volt Open 1.0 0.65 Drift . 35 No Effect 0.0 .000010 0.00

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NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 45 OF 51 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME 63-P11356B-X3 INITIAL REVISION Audio Combiner APL-13 July 1970 Power Isolator SYSTEM EFFECT NUMBER (E) PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION FAILURE PROBABILITY x 10<sup>5</sup> (Q) STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) (a) x (E) x (Q) x 10<sup>5</sup> Ll, Coil, RF, Phenolic Open 1.0 No A Supply Volt 1.0 .002060 206.00 8 L2, Coil, RF, Phenolic Open 1.0 No B Supply Volt 1.0 .002060 206.00 9 970-7A

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ASSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S)	TAS	CV DWC OD CV DECEMBER					PAGE 46	OF	51 PAGE
	RELIABILITY SUPPLIER NAME GOAL		MISSION PHASE(S)	ASSY DWG OR SK REFERENCE 63-P11356B-X3 APL-13 July 1970		CE ORIG	INATOR	DATE INITIAL	SUBSYST	EM NAME	ASSEMB L	Y NAME
								REVISION	l .		Audi	Audio Combiner
					T		<del></del>		<u> </u>		Powe	r Isolator
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 1	FO	NK RELIABILITY R MODEL CODE BY IDENTIFICATE
Ql, Transistor	1											
21, 11000001			Short	. 45	No A Supply Reg	0.3			- 1	12.015	4	,
	1		Open	. 33	No A Supply Volt	1.0	.000890			29.37	3	
	1		Drift	. 22	No Effect	0.0		<b>.</b>		0.00	ر ا	
Q2, Transistor			g		l.,			İ	- 1	3.00	į	1
	1		Short	. 45	No B Supply Reg	0.3				12.015	4.	
	1		Open	. 33	No B Supply Volt	1.0	.000890		- 1	29.37	3	
	ſ		Drift	. 22	No Effect	0.0				0.00	3,	·
Q3, Transistor	1									0.00		ı
	ł		Short	. 45	Simult.Avd.Outp	t 0.2				8.55	- 1	1
	1		Open	. 33	A Revr. only	0.5	.000950	İ		15.675		,
	i		Drift	. 22	No Effect	0.0			1	0.00	3	·
Q4, Transistor	1				1				1	0.00	- 1	l l
21, ITAMBIBIOI	1		Short	. 45	No B Supply Volt	1.0		1	- 1	E1 20		į.
	ł		Open	. 33	No B Supply Reg.	0.3	.001140		- 1	51.30	26	I
	1		Drift	. 22	No Effect	0.0			1	11.286	45	' <b>i</b> .
Q5, Transistor	l		Ĭ		1			1		0.00	- 1	1
25, ITAMBISTOR	1		Short	. 45	No A Supply Volt	1.0				F1 00	l	. 1
	1		Open	. 33	No A Supply Reg.	0.3	.001140			51.30	21	
	I		Drift	. 22	No Effect	0.0				11.286	46	·
Q6, Transistor			ł		1				1	0.00		
Qo, fransistor			Short	. 45	No Effect	0.0		1				İ
	ļ		Open	. 33	No Part Redndcy		.000566	Q8	- 1	0.00		i i
	i		Drift		No Effect			120	- 1	9.339	- 1	
Q7, Transistor	l									0.00		
21, 1ransistor			Short	. 45	Simult. Avd.Outp	at 0.2				5 004	- 1	ı
	İ		Open	. 33	A Revr. Only	0.5	.000566			5.094	- 1	
	l		Drift	. 22	No Effect	0.0		İ	- 1	9.339	ı	ı
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			1 4 6	N DWG G.				PAGE 47	-, 51	OF 51 PAGE	
GOAL	SUPPLIER NAME	MISSION PHASE(S)		63-P11356B-X3 APL-13 July 1970	ORIG	NATOR	DATE S INITIAL REVISION	UBSYSTEM NAME	ASSEMBLY N Audio C Power I	AME ombiner	
STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE		EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION	
		Short Open	. 45 . 33	No Effect No Part Redun-	0. 0 0. 5	. 000566	Q6	0. 00 9. 339			
		Drift	. 22	No Effect	0.0		İ	0. 00			
		Short	. 45	No A Supply Volt	1.0	. 000597		26. 865	33		
İ		Open	. 33	No A Supply	0.3			5, 9103			
		Drift	. 22	No Effect	0.0			0.00			
		Short	. 45	No B Supply Volt	1.0	. 000597		26. 865	34		
		Open	. 33	No B Supply Reg.	0.0			0. 00			
		Short Open Drift	. 39 . 42 . 19	No Protection Fl Only No Effedt	0. 1 0. 5 0. 0	.000314		1. 2246 6. 594 0. 00			
		Short Open Drift	. 39 . 42 . 19	No Protection Fl Only No Effect	0.1 0.5 0.0	. 000314		1. 2246 6. 594			
		Short	. 39	Simult. Aut.	0. 2			3. 4788			
		Open Drift	. <b>42</b> . 19	A Rcvr. Only No Effect	0.5 0.0	. 000446		9. 366 0. 00			
			i								
	STATEMEN	STATEMENT OF THE ASSUMED FAILURE	Short Open Drift Short Open Drift Short Open Drift Short Open Drift Short Open Drift Short Open Drift Short Open Drift Short Open Drift Short	STATEMENT OF THE ASSUMED FAILURE   MODE   (a)	STATEMENT OF THE ASSUMED FAILURE   FAILURE   MODE	STATEMENT OF THE ASSUMED FAILURE   FAILURE   MODE   EFFECT ON ASSEMBLY   SYSTEM EFFECT ON ASSEMBLY   SYSTEM EFFECT ON ASSEMBLY   EFFECT ON EXAMINED   EFFE	STATEMENT OF THE ASSUMED FAILURE   FAILURE   MODE   (c)   EFFECT ON ASSEMBLY   SYSTEM   FRICURE PROBABILITY   10 <sup>3</sup> (Q)	STATEMENT OF THE ASSUMED FAILURE	STATEMENT OF THE ASSUMED FAILURE   FAILURE   MODE   EFFECT ON ASSEMBLY   EFFECT ON ASSEMBLY   STATEM PROBABILITY   TO CALIMINATE THE PROBABILITY   FAILURE MODE   C(a)   EFFECT ON ASSEMBLY   STATEM PROBABILITY   FROUDCT (a) x (E) x (0) x	STATEMENT OF THE ASSUMED FAILURE   FAILURE   HODE   Columbia   FAILURE   FAILURE   EFFECT ON ASSEMBLY   STATEMENT OF THE ASSUMED FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE MODE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE   FAILURE MODE   FAILURE MO	

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INITIAL REVISION Audio Combiner APL-13 July 1970 Power Isolator PROBABILITY CRITICALITY PRODUCT SYSTEM EFFECT NUMBER (E) FAILURE PROBABILITY × 10<sup>5</sup> (Q) PART, COMPONENT, UNIT, CIRCUIT STATEMENT OF THE ASSUMED FAILURE FAILURE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY FOR ASSY (a)  $(\alpha) \times (E) \times (Q) \times 10^5$ FLI, Filter, RF Short . 7d No A Rcvr. 1. 0 252, 00 5 Open . 30 No Filtering 0.5 .003600 54.00 22 FL2, Filter, RF Short . 70 No A Rcvr. 1. 0 245.00 Open .30 No Filtering 0.5 .003500 52.50 24 FL3, Filter, RF Short . 70 No B Rcvr. 1. 0 252, 00 6 Open . 30 No Filtering 0.5 .003600 54.00 23 FL4, Filter, RF Short . 70 No Filtering 0, 5 122, 50 11 Open . 30 No Filtering 0.5 .003500 52, 50 25 FL5, Filter, RF Short . 70 No 1 KHz B 0.2 49.00 28 TLM Open . 30 No 1 KHz B 0, 2 .003500 21, 00 35 TLM FL6, Filter, RF Short . 70 No Sig. A TLM 0.2 49.00 29 Open . 30 No Sig. A TLM 0. 2 .003500 21.00 36 FL7, Filter, RF Short .70 No Sig. B TLM 0. 2 49.00 30 Open No Sig. B TLM 0. 2 .003500 21.00 37 FL8, Filter, RF Short . 70 No A Supply 1, 0 255.50 1 Volt Open . 30 A Rcvr. 0.1 .003650 10, 95 47 Ripple FL9, Filter, RF Short . 70 No B Supply 1.0 255.50 2

Volt

B Rcvr.

A F2 No Effect

A Fl No Signal

A F2 No Filter

A Fl No Filter-

Ripple

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ing

0.1

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003650

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ASSY DWG OR SK REFERENCE 63-P11356B-X3

ORIGINATOR

DATE

970-7A '

FL10, Filter, RF

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

RELIABILITY SUPPLIER NAME

MISSION PHASE(S)

Open

Short

Open

ASSY FAILURE DESCRIPTION

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54.75

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REV. NO

OF

ASSEMBLY NAME

51

PAGES

NO.

SUBSYSTEM NAME

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

AILURE MODE, EFFECTS, AND CR			<del></del>							PAGE 48 A		51	PAGES
SSY FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S)	AS	SY DWG OR SK REFERENC 63-P11356B-X3	E ORIGI	INATOR	DATE	SUBSYS		ASSEMB L		
i	GUAL		1			1		INITIAL REVISION	l			Combin	
1				-	APL -13 July 1970	1			l		Power	Isolate	or
	T	<del></del>							T	PPORARU ITY			
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILUR	E FAILURE MODE			SYSTEM	FAILURE	DESIGN COMPENSAT	ION	PROBABILITY CRITICALITY PRODUCT	RA	NK REL	LIABILITY
ITEM, SET OR BOX DESCRIPTION	1		MODE		EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	- 1	PRODUCT	5 7	SY IDEN	LIABILITY DEL CODE NTIFICATION
				(a)		(6)				(a) x (E) x (Q) x	10"	L_	
PIN PILE DP	1										- 1	- 1	
FLII, Filter, RF	ì		Short	. 70			l		ı	0.00	ı	1	
	1		_	. 70					1	255.50	1	4	
	l		Open	. 30	B F2 No Filter	- 0.5	.003650	l	l l	54.75	2	0	
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	1		i	. 30	B Fl No Filter	0.5			- 1	54.75	2	1	
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Y FAILURE DESCRIPTION	RELIABILITY	SUPPLIER NAME	MISSION PHASE(S)	TA C	SY DWG OR SK REFEREN	T				PAGE 49	0F	50 PAG
	GOAL	SUPPLIER NAME	mission i Habe(s)		63-P11356B-X3 APL-13 July 1970		INATOR	DATE INITIAL REVISION	SUBSYSTE	A NAME	ASSEMBLY Audio Power	NAME Combiner Isolator
ART, COMPONENT, UNIT, CIRCUIT FEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(α)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	ON (	PROBABILITY CRITICALITY PRODUCT Q) x (E) x (Q) x	RAN FOR	RELIABILITY MODEL CODE IDENTIFICATI
l - Plug, RF			Open	1. 0	No Output, Receiver "A"	1. 0	. 00100			100.00	12	
l - P <sub>2</sub> , Plug, RF			Open	1. 0	No Output, Receiver, "A"	1. 0	.00100			100. 00	13	
2 - P <sub>1</sub> , Plug, RF			Open	1. 0	No Output, Receiver "B"	1. 0	. 00100			100.00	14	
2 - P <sub>2</sub> , Plug, RF			Open	1. 0	No Output, Receiver "B"	1. 0	. 00100			100.00	15	

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 50 PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE 7/31/70 SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION 20 Nov. 70 63-P11356B RF Coupler SYSTEM EFFECT NUMBER (E) PROBABILITY CRITICALITY PRODUCT FAILURE PROBABILITY × 10<sup>5</sup> (Q) PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) (α) x (E) x (Q) x 10<sup>5</sup> J102, Conn., RF Open No Signal A, 1. 0 .001500 150.00 Pl, "A", Conn., RF Open (1.0) No Signal A 1.0 .001000 100.00 Pl, "B", Conn., RF Open (1.0)No Signal B 1.0 .001000 100.00 R1, Res., Fixed Comp. Open Low Signal A, 0.5 .000010 0.325 Drift Low Signal A, 0.5 0.175 970-7A

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ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	146	SV DWG GD AV GDG				PAGE 40	OF 51	l PAGE
	GOAL		mission France(s)		SY DWG OR SK REFEREN 63-P11377B	CE ORIG	NATOR	DATE 7/31/70 INITIAL REVISION 20 Nov. 70	SUBSYSTEM NAME	RF Co	AME
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE	(a)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (\alpha) \times (E) \times (Q) \times 1	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
Q5, Transistor			Short Open Drift	. 45 . 33 . 22	No Signal	1. 0 1. 0 0. 0	.000368		16. 56 12. 144 0. 00	80 94	
Q6, Transistor			Short Open Drift	. 45 . 33 . 22	No Signal	1. 0 1. 0 0. 0	.000368		16. 56 12. 144 0. 00	81 95	
U1, Not Used					!						1
U2, Not Used				:							1
U3, Integrated Circuit			Short Open Drift	. 25 . 30 . 45	No Signal	1. 0 1. 0 0. 0	. 000387		9. 675 11. 61	96	
Yl, Crystal, Augrtz			Short Open Drift	. 11 . 67 . 22		1. <b>0</b> 1. 0 0. 0	. 000500		0. 00 5. 50 33. 50 0. 00	59	
FLI, Filter, RFI			Short Open	. 70	No Signal Low S/N	1. 0 0. 5	.003700		259. 00 55. 00	7 51	
Jl, Conn., RF			Open	1. 0	No Signal	1. 0	. 001000		100.00	24	
J2, Conn., RF			Open	1. 0	No Signal	1. 0	. 001000		100.00	25	
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SSY FAILURE DESCRIPTION RELIAN	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENCE		SINATOR	DATE	SUBSYSTE	PAGE 1	OF ASSEMBLY N	7 PAGE
	<u> </u>						INITIAL REVISION			ALSEP	Redundant nd Receiver
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE (a	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATI TO ELIMINATE THE FAILURE MODE	ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
IF & Audio (Receiver ''A'' Common Parts	7)		DEGRADATION A (. 30 (Oscillation, No signal increased Bandwidth degraded performance Distorted Signal, Distorted Output, Extreme noise, detune discriminator, noisy signal, bad signal, F1 & F2 modes clipped signal)	l, "A" Output	1. 0	. 154011	Switch to Receiv	ver	4620. 00	2	0.046203
			DEGRADATION B (. 00) (Degraded performance F1 & F2 modes, wrong Pass band, degraded output, increased nois oscillation, degraded gain, noisy signal, no filtering, clipping, wrong gain, low signal	eReceiver	0. 6	. 154011			831. 66	8	0. 0. 3861
			DEGRADATION C (.0) (Degraded signal, wrong bandwidth, mildly distorted signal	Receiver "A" Output	0. 2	. 154011			30.80	23	
			No Telemetry (0. (No signal level Telem	l Slightly degraded ) Receiver "A" out No effect on Reliability	0. 2	. 154011			30. 80	24	
			No Effect (. 10	0							

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REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE ASSY FAILURE DESCRIPTION OF PAGES RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION ALSEP Redundant Command Receiver PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION PROBABILITY STATEMENT OF THE ASSUMED FAILURE SYSTEM FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE MODE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE EFFECT NUMBER (E) RANK RELIABILITY FOR MODEL CODE ASSY IDENTIFICATION EFFECT ON ASSEMBLY PRODUCT (a) ( $\alpha$ ) x (E) x (Q) x  $10^5$ IF & Audio (Receiver "A") DEGRADATION A No Receiver 1.0 . 154011 Switch to Receiver 1078.08 Fl 0.010781 (. 07 "A" Output "C". (No signal, distorted output, noisy signal) DEGRADATION B Degraded Re-0.6 . 154011 184, 81 15 0.003080 ceiver "A" (Degraded perfor-Output mance, distorted output, oscillation. wrong sandwidth. clipping, wrong gain) No Effect (.03)IF & Audio (Receiver "A") DEGRADATION A No Receiver 1. 0 . 154011 Switch to Receiver FZ 2310.17 3 0.023102 (. 15) "A" Output "B". (No signal. oscillation) DEGRADATION B Degraded 0.6 . 154011 277. 22 12 0.004620 (.03)Receiver "A" (Degraded perfor-Output mance, wrong passband, degraded output, distortion, wron bandwidth, no filtering, noisy signal) No Effect (.04)IF & Audio (Receiver "B") The failure mode, effects, and criticality analysis for the IF & Audio Receiver B" is identical to the IF & Audio Receiver "B" except (1) a further effect on the assembly is a loss of edundancy and (2) there is no design compensation for no Receiver "B" output. 970-7A

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET

ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFEREN	E OBIG	INATOR	DATE S	PAGE 3	OF '	
	T				UKIG	THAT OR	INITIAL REVISION	A	LSEP comman	AME Redundant nd Receiver
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURI	MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY x 10 <sup>5</sup> (Q)	DESIGN COMPENSATIO TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (\alpha\) x (E) x (Q) x 10 <sup>5</sup>	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
IF & Audio (Receiver "A" only)			DEGRADATION A  (No signal, oscillation, degraded performance, AC on line, noisy signal, signal, wrong signal increased gain)	11) ceiver "A" and Audio "A" f- Telemetry. DC low	1. 0	. 154011	Switch to Receiv	er 1694.12	5	0.01694
			DEGRADATION B  (. (Degraded performance, noisy sign no filtering, wrong gain, low signal)	al, effect on	0.1	. 154011		15, 401	26	
			(Decreased perfor mance, small effect	Slightly degrad ol) ed Audio "A" - Telemetry ct) no effect on reliability	- 0.0	. 1540ī i		0. 00	30	
IF & Audio (Receiver "B" only)			DEGRADATION A (. (No signal, oscilla tion, degraded per formance, AC on I line, noisy signal, low signal, wrong signal, increased	- reliability OC	0. 2	. 154011		338. 82	11	
70-7A <b>`</b>			DEGRADATION B (. (Degraded performance, noisy signs no filtering wrong, gain, low signal)	Degraded Audi 01) "B" Telemetry No effect on al, reliability	0.1	. 154011		15. 401	27	

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Page 77A of 81 NO. REV. NO FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET PAGE 3A PAGES ASSY FAILURE DESCRIPTION RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION ALSEFRedundant Command Receiver PROBABILITY CRITICALITY PRODUCT PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION STATEMENT OF THE ASSUMED FAILURE FAILURE PROBABILITY × 10<sup>5</sup> (Q) DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE FAILURE MODE RANK RELIABILITY
FOR MODEL CODE
ASSY IDENTIFICATION EFFECT ON ASSEMBLY (a) x (E) x (Q) x 105 DEGRADATION C Slightly degrad . 154011 0.0 0.00 31 ed Audio "B" (Degraded perfor-Telemetry mance, small effect) No effect on reliability No Effect (. 02

970-7A '

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A I M-984

RELIABILITY GOAL	SUPPLIER NAME MI	ISSION PHASE(S)	SY DWG OR SK REFEREN	CE ORIGI	NATOR	DATE SUB:	SYSTEM NAME ASS	<b>OF</b> 7	PAGE
<u></u>	<u> </u>		<del></del>		Natur	INITIAL REVISION	AI	SEP R	ME edundant Receiver
STATEMENT	T OF THE ASSUMED FAILURE	FAILURE MODE (a)	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10 <sup>5</sup>	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
		Degradation A (.75) (No Signal)	No Receiver	1.0	. 112445	Switch to Receiver	8433.375	1	0.084333
		Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal) No Effect (.16)	Degraded Re- ceiver "A" Output	0.5	. 112445		506.003	10	0.010120
Analysis is identi except ( is a loss	s for the RF Converter cical to the RF Converter (1) a further effect on s of redundancy and (2)	r Receiver "A" the Assembly there is no							
	This Fa Analysi is ident except ( is a los	is identical to the RF Converts except (1) a further effect on is a loss of redundancy and (2)	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter Receiver "B" is identical to the RF Converter Receiver "A" except (1) a further effect on the Assembly is a loss of redundancy and (2) there is no	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter Receiver "B" is identical to the RF Converter Receiver "A" except (1) a further effect on the Assembly is a loss of redundancy and (2) there is no	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter is identical to the RF Converter except (1) a further effect on is a loss of redundancy and (2) there is no	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter Receiver "B" is identical to the RF Converter Receiver "B" except (1) a further effect on the Assembly is a loss of redundancy and (2) there is no	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter is identical to the RF Converter except (1) a further effect on its a loss of redundancy and (2) there is no   Degradation A (.75) (No Receiver "A" Output  Degraded Receiver "A" Output  Degraded Receiver "A" Output  This Failure Mode, Effects, and Criticality Receiver "B" is identical to the RF Converter Receiver "A" the Assembly is a loss of redundancy and (2) there is no	Degradation A (.75) (No Signal)  Degradation B (.09) (Low Signal, Low S/N) Ratio, Distorted Signal)  No Effect (.16)  This Failure Mode, Effects, Analysis for the RF Converter is identical to the RF Converter except (1) a further effect on is a loss of redundancy and (2) there is no

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AILURE MODE, EFFECTS, AND CI								PAGE 5	OF	7 PAGE
ASSY FAILURE DESCRIPTION	RELIABILITY GOAL	SUPPLIER NAME	MISSION PHASE(S)	ASSY DWG OR SK REFERENC	CE ORIG	INATOR	DATE SI INITIAL REVISION	UBSYSTEM NAME	ASSEMBLY N ALSEP E	1 70 %
PART, COMPONENT, UNIT, CIRCUIT ITEM, SET OR BOX DESCRIPTION	STATEMEN	T OF THE ASSUMED FAILURE	FAILURE MODE (	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
Audio Combiner & Power Isolator (Receiver ''A'')			Degradation A (. 25) (No "A" Supply Voltage, No Output)	"A" Output	1.0	. 098816	Switch to Receive	r 2470.40	4	0.024704
		Degradation B (.21) (No Audio "A", "A" Receiver Ripple, Loss of DC Isolation at Audio "A" Output, No "A" Supply Regulation, No Filtering, No Forma	Receiver "A" Output	0.5	. 098816		1037. 57	7	0.020751	
			No Telemetry (. 14) (No 1 kHz "A" TLM, No "A" Supply TLM, No Signal "A" TLM)	ceiver "A"	0.2	. 098816		276. 69	13	
			No F2 (.02)	No Receiver "A" Output	1. 0	. 098816	Switch to Receive	r 197.63	16	0.001976
			No F1 (.02)	No Receiver "A" Output	1.0	. 098816	Switch to Receive	r 197.63	17	0.001976
Audio Combiner & Power Isolator (Receiver "B")	Analys Receiv Pwr Is on the	sol. Receiver "A" exc Assembly is a loss of	No Effect (. 16) and Criticality biner/PWR Isol. the Audio Combiner/ ept (1) a further effect redundancy and (2) the no Receiver "B" outp	re						

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RELIABILITY	SUPPLIER NAME	MISSION BUASE(S)	FEW DWG OF THE THE					PAGE 6	OF 7	PAGE
GOAL	SOLVE STATE	A SOLON PRASE(S)	ASSY DWG OR SK REFERENC	ORIG	INATOR	DATE INITIAL REVISION	SUBSYST	·	ALSEP	AME Redundant nd Receiver
STATEMEN	T OF THE ASSUMED FAILURE	MODE	EFFECT ON ASSEMBLY	SYSTEM EFFECT NUMBER (E)	FAILURE PROBABILITY × 10 <sup>5</sup> (Q)	DESIGN COMPENSAT TO ELIMINATE THE FAILURE MODE	i ON	PROBABILITY CRITICALITY PRODUCT (a) x (E) x (Q) x 10	RANK FOR ASSY	RELIABILITY MODEL CODE IDENTIFICATION
		Loss of DC Isolation at Selected Output, Loss of Filtering)	Slight Degrada- tion Receiver "A" & "B" Output No Effect on Reliability	0.1	. 098816		3	38. 9344	20	
		No Telemetry (.01) (No Temperature TLM) No Effect (.005)	Slightly Degraded Receiver "A" Output No Effect on Reliability	0.2	. 098816		3	19.77		
				0.5	. 098816		24	17.04	14	0.004941
	STATEMEN		Degradation C (.09) (No Part Redundancy Loss of DC Isolation at Selected Output, Loss of Filtering)  No Effect (.04) No Telemetry (.01) (No Temperature TLM) No Effect (.005)  Degradation A (.05) (Loss of Receiver "B" Select Audio Output, Simultaneou Select Audio Output)	Degradation C (.09) (No Part Redundancy, Loss of DC Isolation at Selected Output, Loss of Filtering) No Effect (.04) No Telemetry (.01) (No Temperature TLM) No Effect (.005) No Effect (.005) Degradation A (.05) (Loss of Receiver "B" Select Audio Output, Simultaneous Select Audio Output)	STATEMENT OF THE ASSUMED FAILURE    Degradation C (.09) (No Part Redundancy, Loss of DC Isolation at Selected Output, Loss of Filtering)   Output No Effect on Reliability	STATEMENT OF THE ASSUMED FAILURE    Degradation C (.09) (No Part Redundancy, Loss of DC Isolation at Selected Output, Loss of Filtering)   No Effect (.04)   No Telemetry (.01) (No Temperature TLM)   No Effect (.005)   No Effect on Reliability     Degradation A (.05) (Loss of Receiver "B" Select Audio Output, Simultaneous Select Audio Output)     Degraded	STATEMENT OF THE ASSUMED FAILURE  FAILURE MODE  (c)  Degradation C (. 09) (No Part Redundancy, Loss of DC Isolation at Selected Output, Loss of Filtering) No Effect (. 04) No Telemetry (. 01) (No Temperature TLM) No Effect (. 005)  Degradation A (. 05) (Loss of Receiver "B" Select Audio Output) Stimultaneous Select Audio Output) STATEMENT OF THE ASSUMED FAILURE PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PROPABILITY PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY PAILURE PROPABILITY PROPABILITY OUTput No Effect on Reliability No Effect	STATEMENT OF THE ASSUMED FAILURE    STATEMENT OF THE ASSUMED FAILURE   FAILU	STATEMENT OF THE ASSUMED FAILURE    STATEMENT OF THE ASSUMED FAILURE   FAILURE   MODE   (a)	ASSY DWG OR SK REFERENCE ORIGINATOR ORIGINATOR SUBSYSTEM NAME ALSEEP CO-minal Revision  STATEMENT OF THE ASSUMED FAILURE  FAILURE MODE  (a)  Degradation C (.09) (No Part Redundancy, Loss of DC Isolation at Selected Output, Loss of Filtering) No Effect (.04) No Telemetry (.01) (No Temperature TI.M) No Effect (.005)  Degradation A (.05) (Loss of Receiver "B" Output Simultaneous Select Audio Output) Slightly Degraded Receiver "B" Output Output Simultaneous Select Audio Output) Select Audio Output) STATEMENT OF THE ASSUMED FAILURE  PROBABILITY PROBABILITY CRITICALLY PROBA

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FAILURE MODE, EFFECTS, AND CRITICALITY ANALYSIS WORKSHEET 7 PAGE OF ASSY FAILURE DESCRIPTION PAGES RELIABILITY SUPPLIER NAME MISSION PHASE(S) ASSY DWG OR SK REFERENCE ORIGINATOR DATE SUBSYSTEM NAME ASSEMBLY NAME INITIAL REVISION ALSEP Redundant Command Receiver SYSTEM EFFECT NUMBER (E) PART, COMPONENT, UNIT, CIRCUIT STATEMENT OF THE ASSUMED FAILURE PROBABILITY FAILURE PROBABILITY × 10<sup>5</sup> (Q) FAILURE DESIGN COMPENSATION TO ELIMINATE THE FAILURE MODE RANK FOR ASSY RELIABILITY MODEL CODE IDENTIFICATION EFFECT ON ASSEMBLY CRITICALITY  $(\alpha)$ (a) x (E) x (Q) x 105 RF Coupler No Signal A, B (.430) No Output 1.0 .00351 None 150.00 19 0015 RCVR A and B No Signal A (. 284) No Output 0.5 Switch to 50.00 21 0010 RCVR A Receiver B No Signal B (. 284) No Output 0.5 50.00 22 0010 RCVR B Low Signal (.002) Slight Degra-0.1 . 07 29 A and B dation no Effect on Reliability Multi-Pin Connector Loss of Pin (.63) Loss of Pro-0.3 .0408 771.120 9 Redundancy tection Negligible Effect on Reliability Loss of Case (.02) Slight Degra-0.1 8.200 28 Ground dation no Effect on Reliability Loss of TLM (.24) Loss of a 0.2 95.840 18 and Test Point Specification no Effect on Reliability Unused Pins (.11) No Effect 0.0

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