

***PARTS HISTORY LOG*****Radiation Testing**

PROGRAMME:- XMM

PART TYPE:- 2N2905A

RADIATION REPORT:- RD 222

IGG TASK NUMBER:- 1500

SUMMARY OF TEST RESULTS

This component showed a substantial drift in both h_{FE1} and h_{FE2} but no failures in these or any other parameters were recorded. All other parameters showed no significant drift over the 100kRad(Si) total dose. There was minimal difference in the results of the biased and unbiased tests.



Radiation Report Number:- RD 222

Project:- XMM

Part Type:- 2N2905A

Date Code:- 9701

Manufacturer:- STM

IGG Task No:- 1500

Project Approval of Lot Traveller:-

Signed.....*[Signature]*.....

Date. 22-4-97.

Position. COMPONENT ENGINEER

Serial Number Range:-

- 010 Control
- 011 through 015 (inclusive-biased)
- 016 through 020 (inclusive-unbiased)

I certify that the subject component has been tested in accordance with the following radiation specifications:-

Test Method - ESA/SCC22900

ISSUE- 4 DATE- Jan '95

Irradiation Test Plan- XM-PL-IGG-0037

ISSUE- 2 DATE- Nov '96

Closed/Approved NCR No:- N

Approved Waiver No:- WAR N/A

Signed.....*[Signature]*.....

Date. 18/4/97.

Upscreening Engineer

Signed.....*[Signature]*.....

Date. 18/4/97.

Upscreening Manager



Page 3 of 7

RADIATION REPORT NUMBER:- RD 222

DATE:- 17.4.97

PROJECT:- XMM

RIR IN:- 77212

PART NUMBER:- 2N2905A

MANUFACTURER:- STM

PROCUREMENT LEVEL:- ESA/SCC5202/002-02B

DATE CODE:- 9701

TEST METHOD:- ESA/SCC22900 ISSUE- 4 DATE- Jan '95

TEST PLAN:- XM-PL-IGG-0037 ISSUE- 2 DATE- Nov '96

START QUANTITY:- 11

No.	Test (Sample Size)	XM-PL-IGG-0037 Test Method and Conditions	Date in	Qty in	Date out	Qty out	SIGNED Op/QA	
1	Serialisation and Selection of Control Sample (100%)	Control Sample= SN 10	31/3/97	11	31/3/97	10 + CONTROL SAMPLE	 IGG 16 CT	
2	Initial Electrical Measurements (100% read and record)	Table A Testing at IGG	31/3/97	10	31/3/97	10	 IGG 16 CT	
3	Initial Electrical Measurements (100% read and record)	Table A Testing at ERA UB=Unbiased B=Biased	UB	2/4/97	5	2/4/97	5	
			B	2/4/97	5	2/4/97	5	IGG 16 CT
4	Set-up and apply Bias per Figure 1	Verify Bias Circuit and conditions (in-situ) for the 5 biased test samples	UB	2/4/97	5	2/4/97	5	
			B	2/4/97	5	2/4/97	5	IGG 16 CT
5	Irradiation 1 (10 samples)	Dose=10kRADSi Rate= 10RADSi per second Time= 1000sec	UB	2/4/97	5	2/4/97	5	
			B	2/4/97	5	2/4/97	5	IGG 16 CT
6	Interim 1 Electrical Measurements (100% read and record)	Table A. Bias to be maintained until testing is performed. Tdwel=10mins maximum	UB	2/4/97	5	2/4/97	5	
			B	2/4/97	5	2/4/97	5	IGG 16 CT



Report No: RD 222		Part Type: 2N2905A			Date: 17.4.97			
No.	Test (Sample Size)	XM-PL-IGG-0037 Test Method and Conditions	Date in	Qty in	Date out	Qty out	SIGNED Op/QA	
7	Irradiation 2 (10 samples)	As Test 5	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
8	Interim 2 Electrical Measurements (100% read and record)	As Test 6	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
9	Irradiation 3 (10 samples)	As Test 5	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
10	Interim 3 Electrical Measurements (100% read and record)	As Test 6	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 18 CT
11	Irradiation 4 (10 samples)	Dose=20kRADSi Rate= 10RADSi per second Time=2000secs	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
12	Interim 4 Electrical Measurements (100% read and record)	As Test 6	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
13	Irradiation 5 (10 samples)	Dose=25kRADSi Rate= 10RADSi per second Time=2500secs	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 16 CT
14	Interim 5 Electrical Measurements (100% read and record)	As Test 6	UB	2/4/97	5	2/4/97	5	<i>P.A.R.</i>
			B	2/4/97	5	2/4/97	5	IGG 18 CT



Report No: RD 222		Part Type: 2N2905A			Date: 17.4.97			
No.	Test (Sample Size)	XM-PL-IGG-0037 Test Method and Conditions	Date in	Qty in	Date out	Qty out	SIGNED Op/QA	
15	Irradiation 6 (10 samples)	As Test 13	UB	2/4/97	5	2/4/97	5	P.R.
			B	2/4/97	5	2/4/97	5	IGG 16 CT
16	Final Electrical Measurements (100% read and record)	As Test 6 At ERA	UB	2/4/97	5	2/4/97	5	P.R.
			B	2/4/97	5	2/4/97	5	IGG 16 CT
17	Annealing Test (10 samples)	UB or B-24hr min at +25°C (record exact time)	UB	2/4/97	5	3/4/97	5	P.R.
			B	2/4/97	5	3/4/97	5	IGG 16 CT
18	Post Annealing Electrical Measurements (100% read and record)	Table A	UB	3/4/97	5	3/4/97	5	P.R.
			B	3/4/97	5	3/4/97	5	IGG 16 CT
19	Accelerated Aging under bias (10 samples)	168 hours at +100±5°C unbiased or biased	UB	4/4/97	5	11/4/97	5	P.R.
			B	4/4/97	5	11/4/97	5	IGG 16 CT
20	Post Aging Electrical Measurements (100% read and record)	Table A	UB	11/4/97	5	11/4/97	5	P.R.
			B	11/4/97	5	11/4/97	5	IGG 16 CT
21	Test Report Collation				18/4/97		IGG 2 CT	
22	Test Report Approval				18/4/97		IGG 2 CT	
23	NOTES:-							



FAILURE LIST AND APPLICABLE NCR

Test No.	Serial Number(s)	Failed Parameter and Failure Mode	Applicable NCR



RADIATION TEST SUMMARY

PART TYPE : 2N2905A

DESCRIPTION : LOW POWER PNP TRANSISTOR

REPORT NO. : RD 222

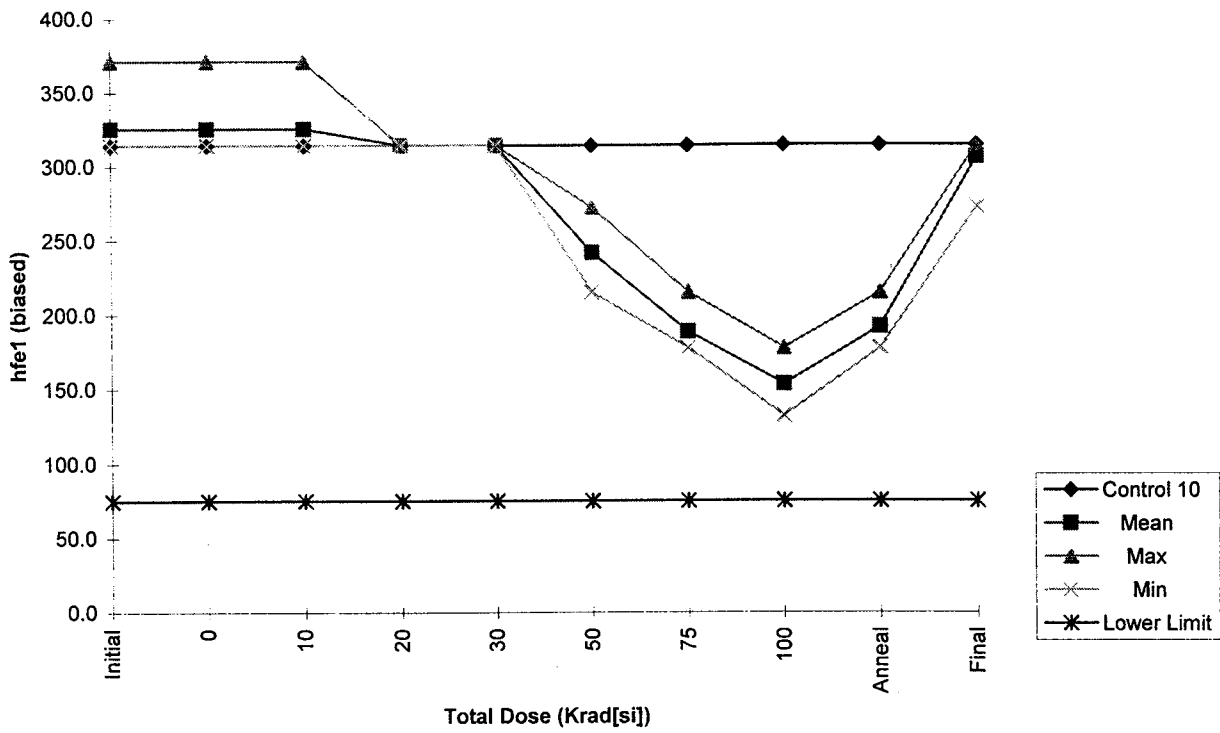
PARAMETERS PLOTTED :

hfe1
hfe2

NOTE : The results for the remaining parameters showed no significant change and hence plots were not considered necessary.



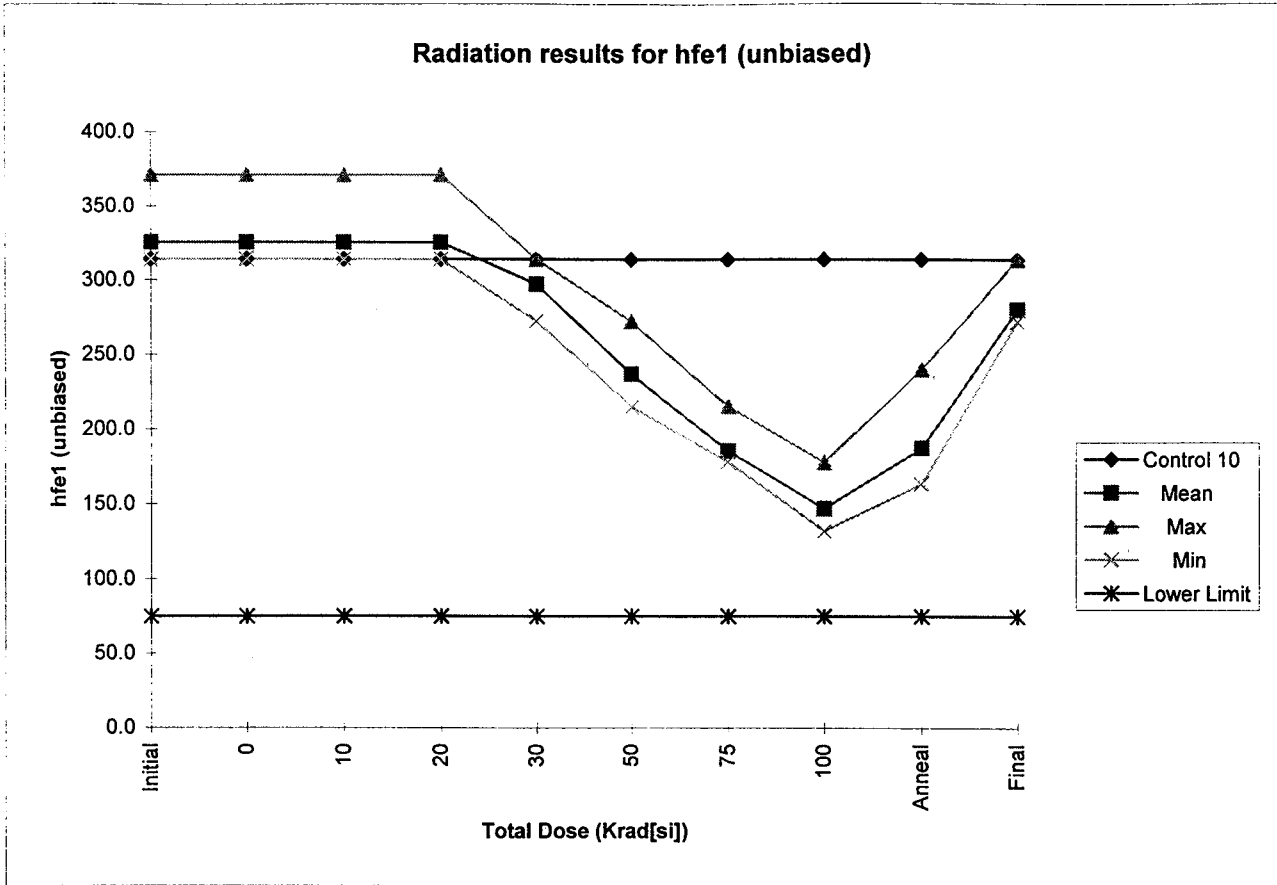
Radiation Results for hfe1 (biased)



Dose (kRad)	Control 10	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
Initial	314.1	325.48	371.00	314.10	75	-	25.45
0	314.1	325.48	371.00	314.10	75	-	25.45
10	314.1	325.48	371.00	314.10	75	-	25.45
20	314.1	314.10	314.10	314.10	75	-	0.00
30	314.1	314.10	314.10	314.10	75	-	0.00
50	314.1	241.72	272.30	215.10	75	-	20.30
75	314.1	188.64	215.10	177.80	75	-	16.50
100	314.1	153.18	177.80	132.00	75	-	18.13
Anneal	314.1	192.02	215.10	177.80	75	-	15.42
Final	314.1	305.74	314.10	272.30	75	-	18.69

Lot size for statistics : 5 devices

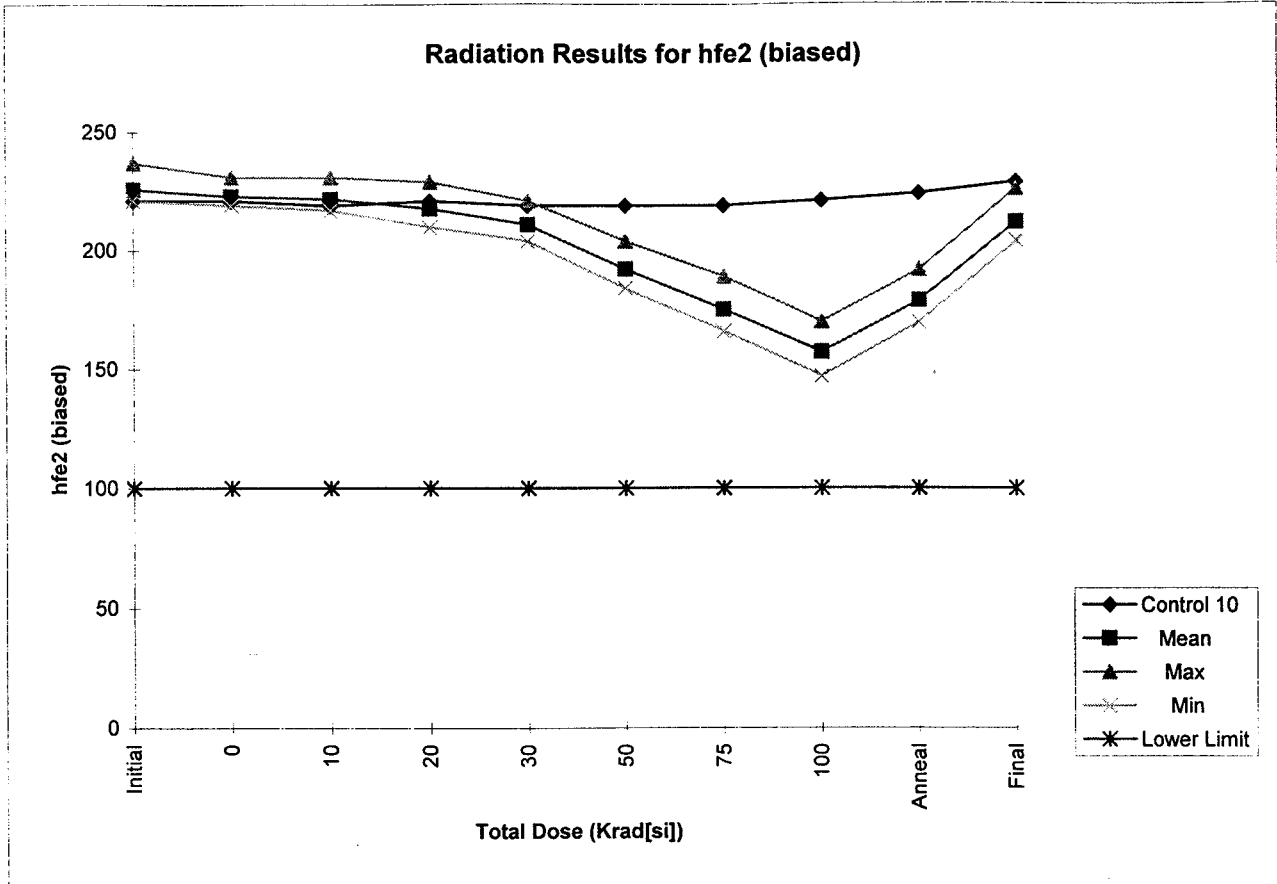
RD 222 Date code 9701



Dose (kRad)	Control 10	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
Initial	314.1	325.48	371.00	314.10	75	-	25.45
0	314.1	325.48	371.00	314.10	75	-	25.45
10	314.1	325.48	371.00	314.10	75	-	25.45
20	314.1	325.48	371.00	314.10	75	-	25.45
30	314.1	297.38	314.10	272.30	75	-	22.89
50	314.1	236.66	272.30	215.10	75	-	23.60
75	314.1	185.26	215.10	177.80	75	-	16.68
100	314.1	146.86	177.80	132.00	75	-	19.07
Anneal	314.1	187.48	240.40	163.60	75	-	30.22
Final	314.1	280.66	314.10	272.30	75	-	18.69

Lot size for statistics : 5 devices

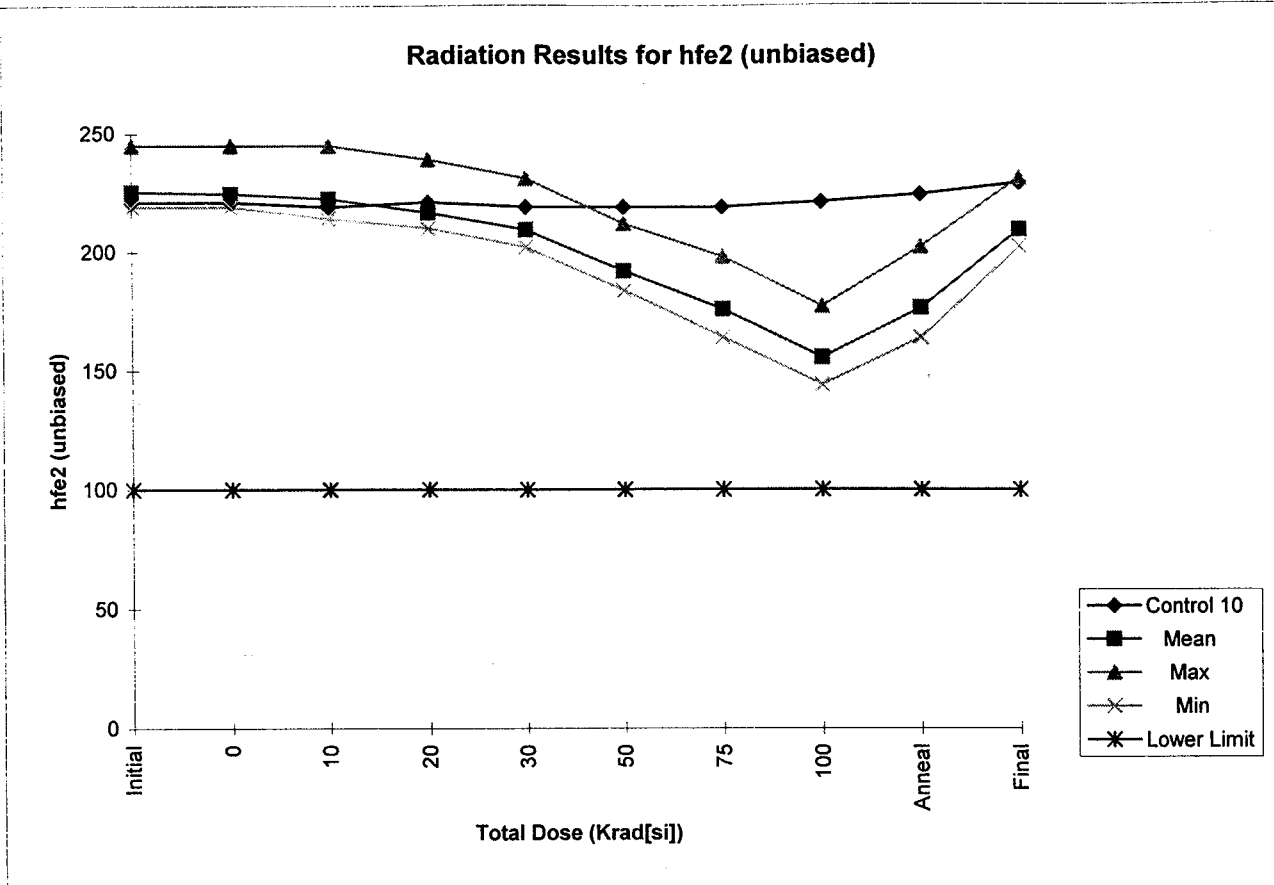
RD 222 Date code 9701



Dose (kRad)	Control 10	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
Initial	221	225.8	237.0	221.0	100	-	6.61
0	221	222.8	231.0	219.0	100	-	5.02
10	219	221.8	231.0	217.0	100	-	5.40
20	221	217.8	229.0	210.0	100	-	7.12
30	219	211.0	221.0	204.0	100	-	6.16
50	219	192.2	204.0	184.0	100	-	7.36
75	219	175.0	189.0	166.0	100	-	8.80
100	221	157.2	170.0	147.0	100	-	8.73
Anneal	224	179.0	192.0	170.0	100	-	8.03
Final	229	212.0	226.0	204.0	100	-	8.25

Lot size for statistics : 5 devices

RD 222 Date code 9701



Dose (kRad)	Control 10	Mean	Max	Min	Lower Limit	Upper Limit	Std.Dev.
Initial	221	225.4	245.0	219.0	100	-	10.99
0	221	224.6	245.0	219.0	100	-	11.44
10	219	222.4	245.0	214.0	100	-	12.76
20	221	216.6	239.0	210.0	100	-	12.64
30	219	209.4	231.0	202.0	100	-	12.24
50	219	192.0	212.0	184.0	100	-	11.47
75	219	175.8	198.0	164.0	100	-	13.08
100	221	155.4	177.0	144.0	100	-	12.82
Anneal	224	176.4	202.0	164.0	100	-	14.84
Final	229	209.4	231.0	202.0	100	-	12.24

Lot size for statistics : 5 devices

RD 222 Date code 9701



XMM
RD 222
RIR 77212

IRRADIATION TEST PLAN NO.

XM-PL-IGG-0037

Issue No. 2
Date: November 1996
Page: 1/4

Component No.
520200202B

Component Designation:
Transistor, Low Power,
PNP, Type 2N2905A

Irradiation Spec No. N/A

Iss. Rev.

Specification

Detail ESA/SCC 5202/002 Iss.5C

Acceptance

Evaluation _____
Element _____
Diffusion _____
Lot X

Electrical Meas.

In-situ _____
Remote X

Project/Programme

XMM

Manufacturer: SGS Thomson
Address: Avenue De Suisse
BP 4199
35041 Rennes-Cedex
FRANCE

Test Facility: ERA
Address: Leatherhead
Surrey
ENGLAND

Originator: IGG CT
Name: S. Thacker

Radiation Source:

COBALT 60

Sample Size: 10

Control Devices: 1

Exposure:

Single _____
Multiple X

Annealing Test:

YES X NO _____

Radiation Level:

10kRAD(Si), 50kRAD(Si)
20kRAD(Si), 75kRAD(Si)
30kRAD(Si), 100kRAD(Si)

Single Exposure:
Dose [kRAD(Si)]
Dose Rate [RAD(Si)/s]
Exposure Time

Not Applicable

Multiple Exposure:

Irradiation Steps	1	2	3	4	5	6
Dose [kRAD(Si)]	10	10	10	20	25	25
Maximum Dose Rate [RAD(Si)/s]	10	10	10	10	10	10
Minimum Exposure Time[s]	1000	1000	1000	2000	2500	2500

Bias Requirements: During and after Exposure (for remote electrical measurements): YES (for 5 biased test units)

Bias Conditions:

Test Circuits: The Electrical Bias circuit for the 5 biased test units is given in Figure 1 herein. The 5 unbiased test units shall have all leadouts open circuit.

Shielding:

Shielding is required to minimize dose enhancement effects caused by low energy, scattered radiation. The test specimens shall be enclosed in a Pb/Al container of Pb 1.5mm minimum, surrounding an inner shield of Al 0.7 to 1.0mm.

Irradiation Test Sequence

Test Step	Description	Requirements
1	Irradiation Test Samples	Quantity 11 devices shall be selected from the lot delivered to IGG.
2	Serialisation	Serialisation - (if the devices are not serialised). Test units shall be serialised 1 to 5 (unbiased test units), 6 to 10 (biased test units) and the control unit shall be 11.
3	Initial Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG. (See Remarks 1 and 2).
4	Initial Electrical Measurements (at ERA)	Per Table A herein - (Read and Record) - on all 11 parts at ERA. (See Remarks 1 and 2).

S.T.
6-11-96



XMM

IRRADIATION TEST PLAN NO.

XM-PL-IGG-0037

Issue No. 2

Date: November 1996

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1

2

Irradiation Test Sequence (Cont.)

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Test Step	Description	Requirements
5	Set-up Test	Verify Bias Circuit and Voltages (In-situ) for 5 biased test units. (See Remark 3).
6	Irradiation Exposure	Verify radiation dose rate and position in the chamber to achieve required dose for all 10 test units. Verify and witness duration of exposure to achieve required dose. (See Remark 4).
7	Intermediate Electrical Measurement (at ERA)	Bias to be maintained until test is performed for 5 biased test units. Test per Table A herein - (Read and Record) - on all 11 parts. Test to be performed immediately upon removal from chamber (less than 10 mins interval). Upon completion of test 5 biased test units shall be replaced in bias circuit and all 10 test units returned to chamber. Maximum interval between two consecutive exposures to be 30 mins. (See Remark 2).
8 to 22	Repeat Set-up/Exposure/Test sequence upto a Final Total Dose of 100kRAD(Si)	Repeat Steps 5, 6, 7 for a total of 6 cycles as per multiple exposure in Box No. 19. (See Remark 5).
23	Annealing	Bias shall be maintained during Annealing for 5 biased test units. Annealing shall be at room temperature for 24 hours. (See Remark 3).
24	Post Annealing Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG. (See Remark 2).
25	Accelerated Aging (under Bias)	Bias shall be maintained during Aging for 5 biased test units. Aging shall be at $T_{amb} = +100 \pm 5^{\circ}C$ for 168 hours for all 10 test units. (See Remark 3).
26	Final Electrical Measurements (at IGG)	Per Table A herein - (Read and Record) - on all 11 parts at IGG (See Remark 2).
27	Total Dose Irradiation Test Report	ESA/SCC No. 22900.

Remarks

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- The initial electrical measurements performed at IGG (Test Step 3) shall be performed within 24 hours of the initial electrical measurements at ERA (Test Step 4).
- All electrical testing shall be performed on the same set of equipment in order to achieve correlation of results both at IGG and ERA.
- The control unit and the 5 unbiased test units shall not be biased during testing.
- The dose rates and exposure times given above, may be adjusted during irradiation testing to achieve convenient test points but shall not exceed the limits specified in Box No. 19. The dose rates and exposure times used during the testing shall be recorded for each test step.
- The set up/exposure/test sequence shall be stopped for any device that exhibits repeated functional failure.