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Radiation Test Report for ADG704 (commercial devices)

Project STEREO

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CHANGE RECORD

Issue: 1 Revision: 0

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Table Of Contents

Test Report Number	
Project	STEREO
SCC Component no.	
Component Designation	Dual, Single Supply, Precision Operational Amplifier (MAX478)
Irradiation Spec. no.	
Family	Integrated Circuits
Group	Silicon Monolithic
Package	Plastic DIP/SO
Component Specification	
Test House Name	ESA / ESTEC
Irradiation Test Plan Number	
Manufacturer name	
Application type of Acceptance	
Serial Number of samples	Five (5) samples serialised as Ref, 1, 2, 3 and 4
Manufacturing Date Code	
Irradiation Measurement Interval: Biased Unbiased: Circuit Reference: Supply Voltage: Temp ^{o}C: Duration:	 Yes No +8V Room temperature 20 ± 3
Electrical Measurement Parameters	
Facility Source: Energy: Dose Rate: Absorbed Material: Thickness: Temperature ^{o}C:	 60Co 4.6 rad/min N/A N/A 20 ± 3
Dosimetry / Calibration method.	A calibrated NE2571, 0.66cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter.
Anneal Test Biased Unbiased Bias Circuit Reference Supply Voltage Duration	 Yes No +8V 24 hours room temperature and 336 hours at +80 ^{o}C

1 INTRODUCTION

The following document contains the TID Radiation Test Report for ADG704 CMOS analog multiplexer for the STEREO project.

2 APPLICABLE DOCUMENTS

AD1- ESA/SCC 22900 “Total Dose Steady-State Irradiation Test Method”

3 TEST DESCRIPTION

Five (5) ADG704, Flight Lot, AD devices were selected for TID irradiation testing at the ESTEC ^{60}Co facility. Irradiations were performed at a dose rate of 4.6 rad(Si)/min. Post irradiation annealing measurements were also performed on the devices.

Of the selected devices, one was assigned as a reference device while, four were serialised for radiation exposure. All devices were of the Small Outline (SO) type and for ease of measurements were soldered on special adapter boards. These boards were mounted on the irradiation test-boards during exposure. After each exposure-step the adapter boards were removed and mounted on the SZ-test system for parametric measurements. The irradiation test-board can accommodate and bias four adapter boards (four devices). Each op-amp was operated in a high gain configuration for real-time measurement of the output-offset voltage. The biasing scheme of the operational amplifiers is illustrated in figure 1. The operating conditions during irradiation were provided by the STEREO project. The device operating conditions, temperature conditions and applied dose rates are listed in table1.

Figure 1 Schematic diagram of irradiation biasing scheme.

Parameter	Ref. Dev.	Dev1	Dev2	Dev3	Dev4
Bias During Irradiation	NA	+8V	+8V	+8V	+8V
Dose Rate	NA	4.6rad(Si)/min	4.6rad(Si)/min	4.6rad(Si)/min	4.6rad(Si)/min
Irradiation Temperature	20 ± 3 ^{o}C	20 ± 3 ^{o}C	20 ± 3 ^{o}C	20 ± 3 ^{o}C	20 ± 3 ^{o}C

Table 1 Irradiation Test Conditions

3.1 Measurement set-up

Two sets of measurements were performed one set of continuous measurements (in 10 min intervals) during the irradiation runs and one set of parametric measurement at regular intervals between irradiation steps. Continuous measurements were performed employing a HP-VEE system consisting of:

- HP 6626A System DC Power Supply
- HP 34970A Data Acquisition / Switch Unit

Measurement number	Devices 1,2,3 and 4
1	
2	

Table 2 Continuous measurements for each device during irradiation.

Parametric measurements were performed employing a SZ parametric tests system:

- SZ M3000 Test Station Sm02B
- M3000 TA10 Test Adapter
- Software UTS-Version 2.3.3

Table 3 list all parametric measurements performed and their limit values.

Test Parameter	Limit
Supply Current	Upper 1uA
Ron	Upper 5 ohms
Leakage Current	Upper 0.1nA
AO Leakage	Lower –100nA
AO Leakage	Upper 100nA
S Leakage	Lower –0.1nA
S Leakage	Upper 0.1nA
EN Leakage	Lower –100nA
EN Leakage	Upper 100nA

Table 3 Parameters measured by the SZ parametric Test System

The time between irradiation stop, performing parametric measurements and starting irradiation for all irradiation steps were less than 60min. 4 irradiation steps were performed and parametric measurements performed after each step (parametric also performed for the reference device except after 2.2 and 8.4 krad(Si)). Pre-irradiation measurements were performed on all devices. Table 4 illustrates the irradiation and measurement history.

Irradiation steps	Ref. Dev.	Dev1	Dev2	Dev3	Dev4
Pre-rad. Par. measurements	Yes	Yes	Yes	Yes	Yes
2.0 krad(water)					
par. measurements	Yes	Yes	Yes	Yes	Yes
7.1 krad(water)					
par. measurements	Yes	Yes	Yes	Yes	Yes
8.9 krad(water)					
par. measurements	Yes	Yes	Yes	Yes	Yes
13.5 krad(water)					
Par. Measurements	Yes	Yes	Yes	Yes	Yes
20.5 krad(water)					
Par Measurements	Yes	Yes	Yes	Yes	Yes

Table 4 Irradiation and measurement history

3.2 Thermal conditions

All irradiations and measurements were performed at room temperature (20 ± 3 ^{o}C).

3.3 Dosimetry

A calibrated NE2571, 0.66cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter was used to measure the Total Ionising Dose.

3.4 Test Results

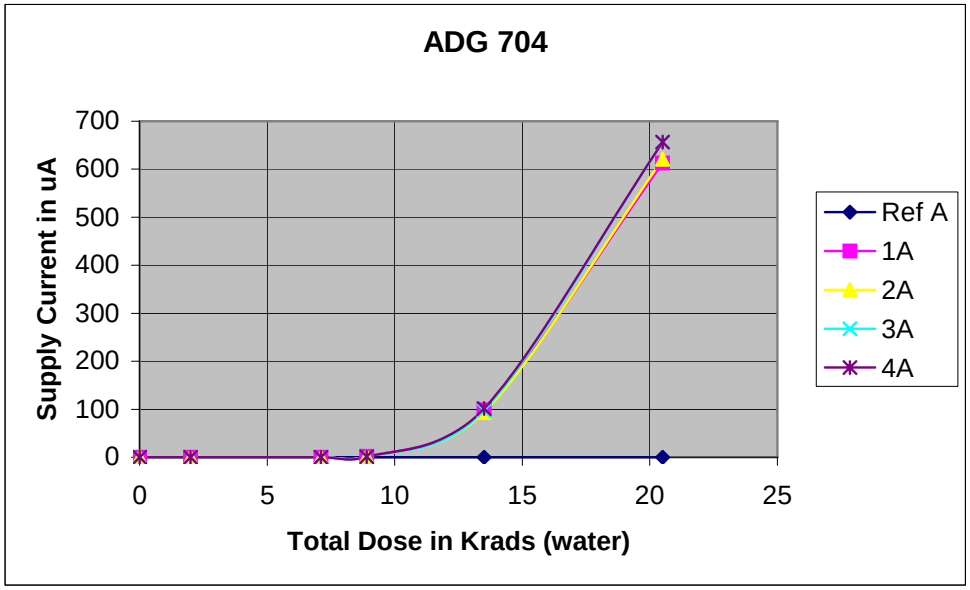

Figure 2 Supply Current as a function of Dose, gamma 5.2 rad(water)/min

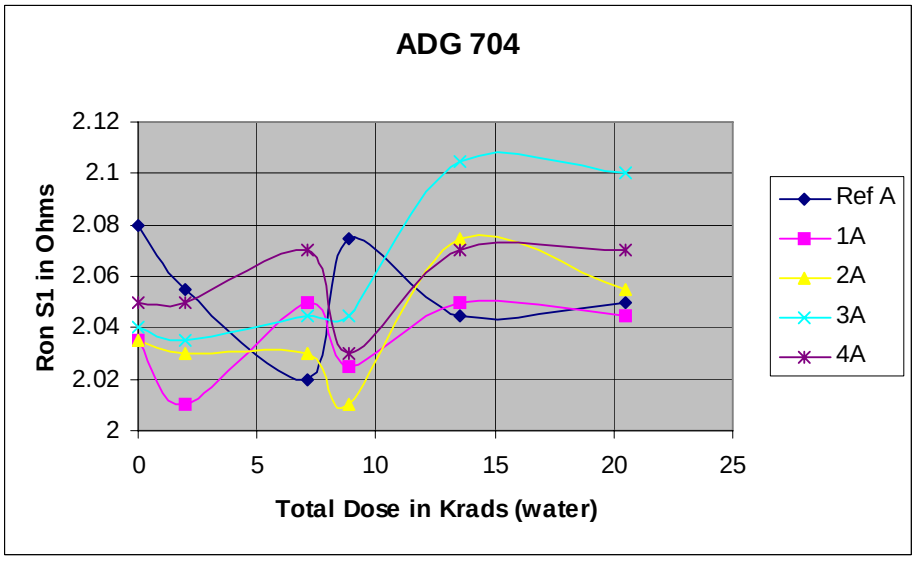

Figure 3 On Resistance S1 as a function of dose, gamma 5.2 rad(water)/min

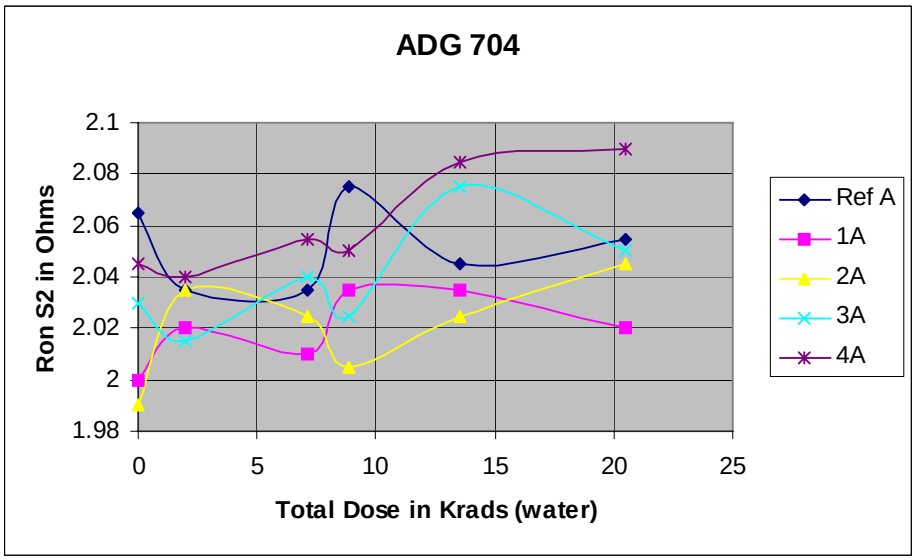

Figure 4 On Resistance S2 as a function of dose, gamma 5.2 rad(water)/min

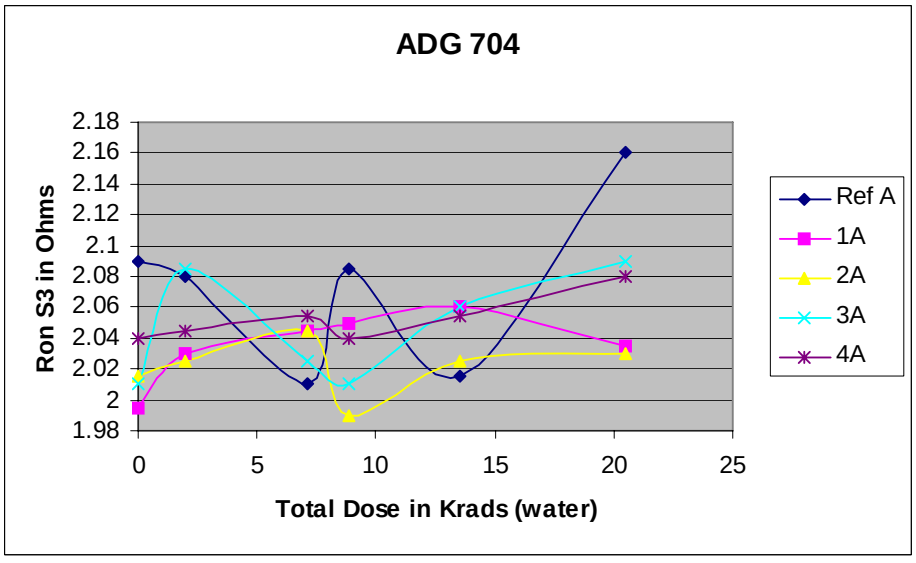

Figure 5 On Resistance S3 as a function of dose, gamma 5.2 rad(water)/min

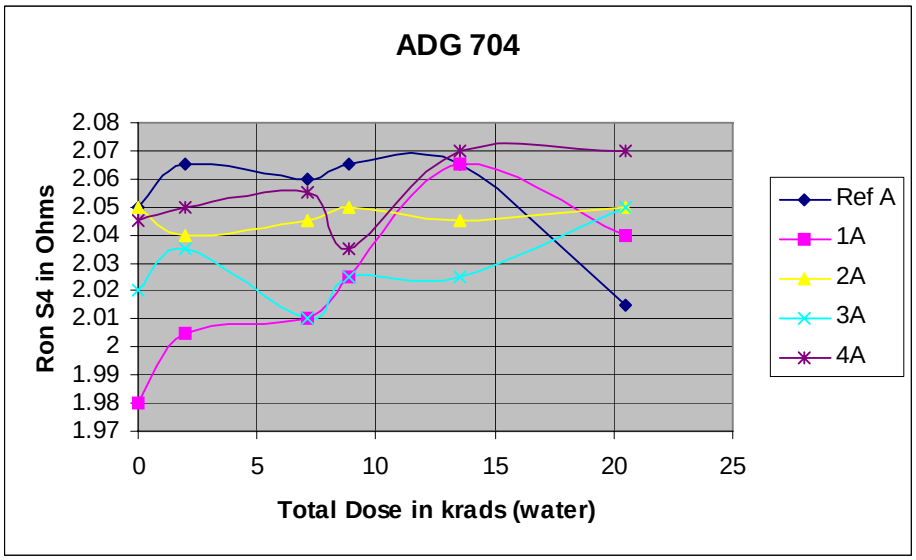

Figure 6 On Resistance S4 as a function of dose, gamma 5.2 rad(water)/min

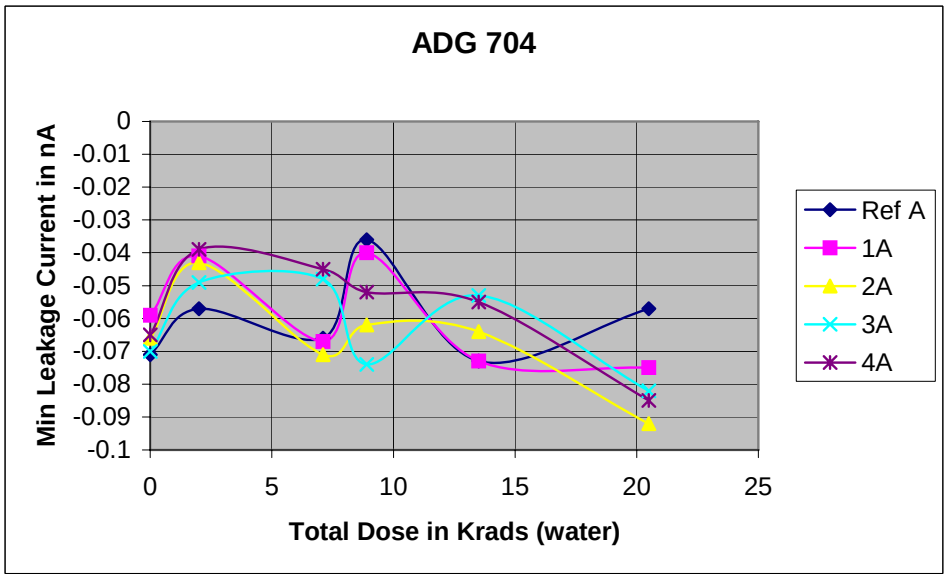

Figure 7 Minimum Leakage Current as a function of dose, gamma 5.2 rad(water)/min

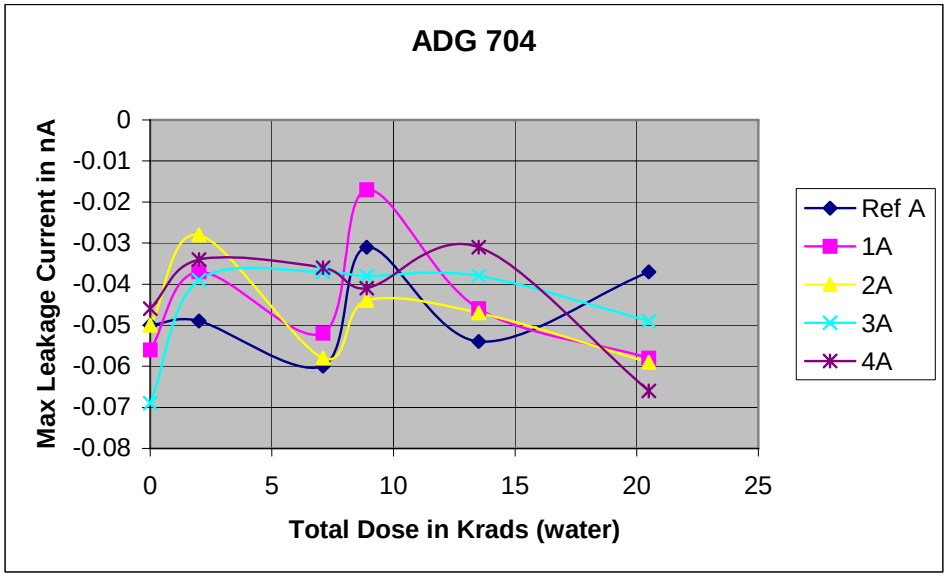

Figure 8 Maximum Leakage Current as a function of dose, gamma 5.2 rad(water)/min

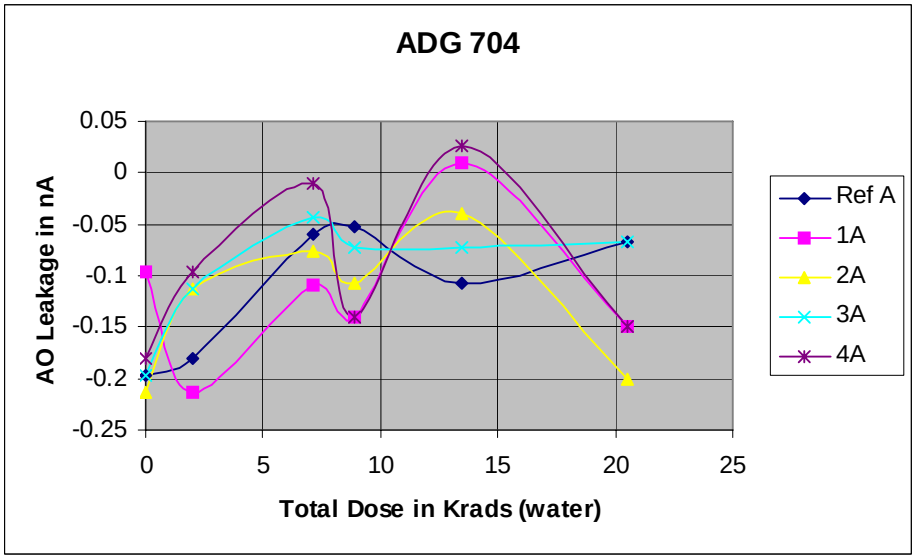

Figure 9 AO Leakage Current as a function of dose, gamma 5.2 rad(water)/min

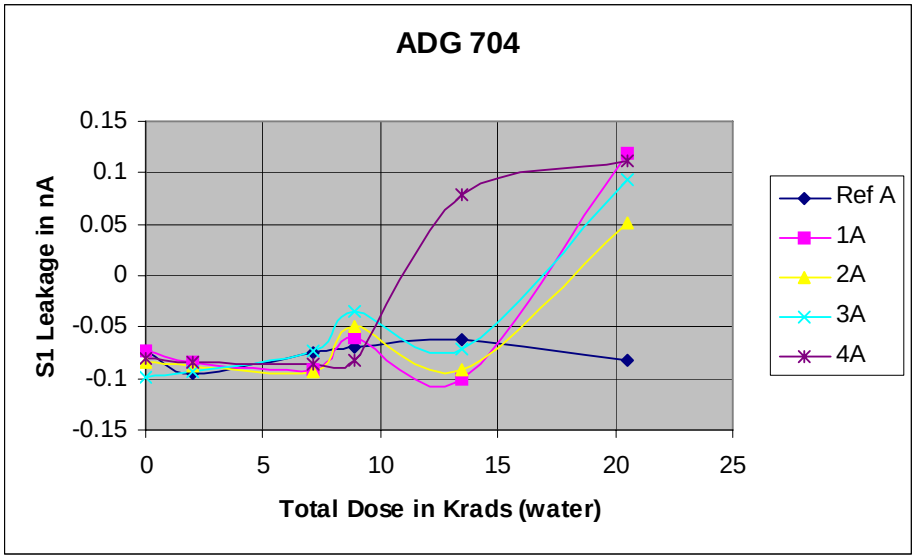

Figure 10 S1 Leakage Current as a function of dose, gamma 5.2 rad(water)/min

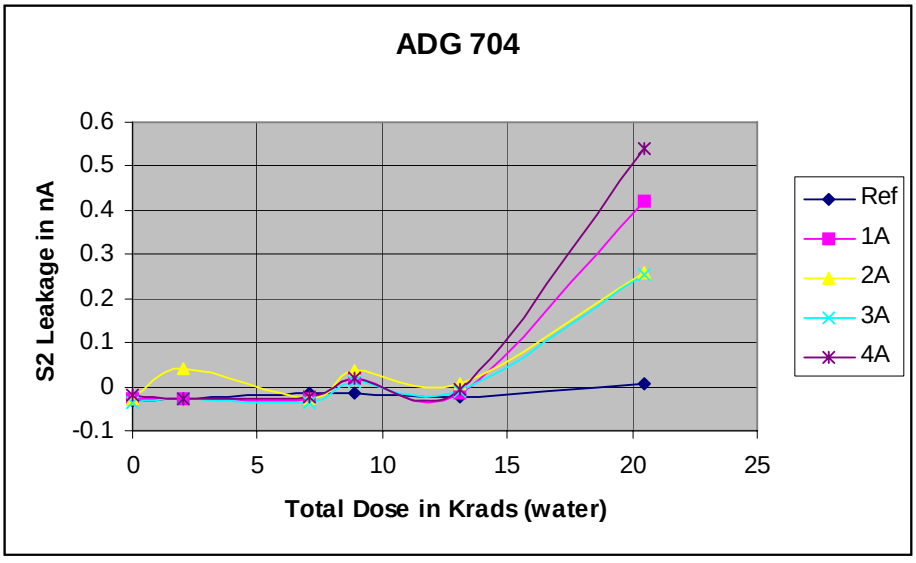

Figure 11 S2 Leakage Current as a function of dose, gamma 5.2 rad(water)/min

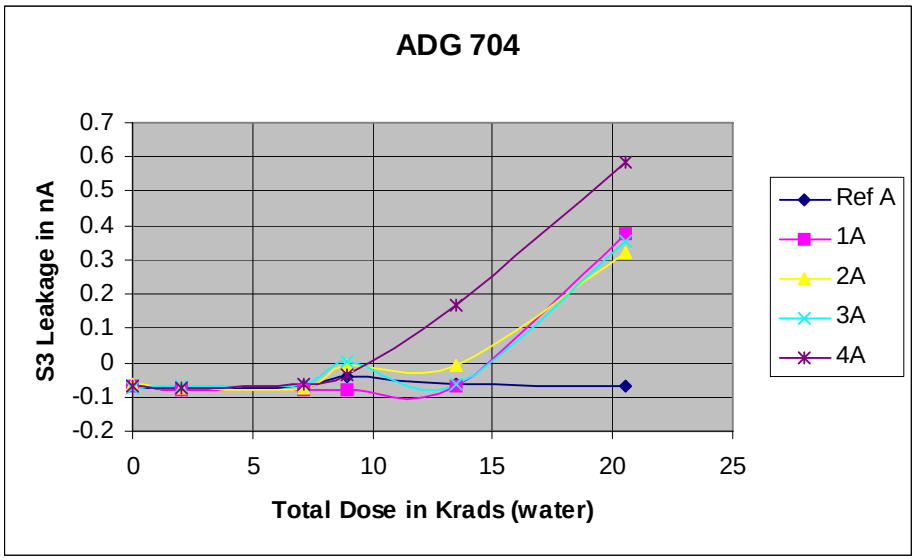

Figure 12 S3 Leakage Current as a function of dose, gamma 5.2 rad(water)/min

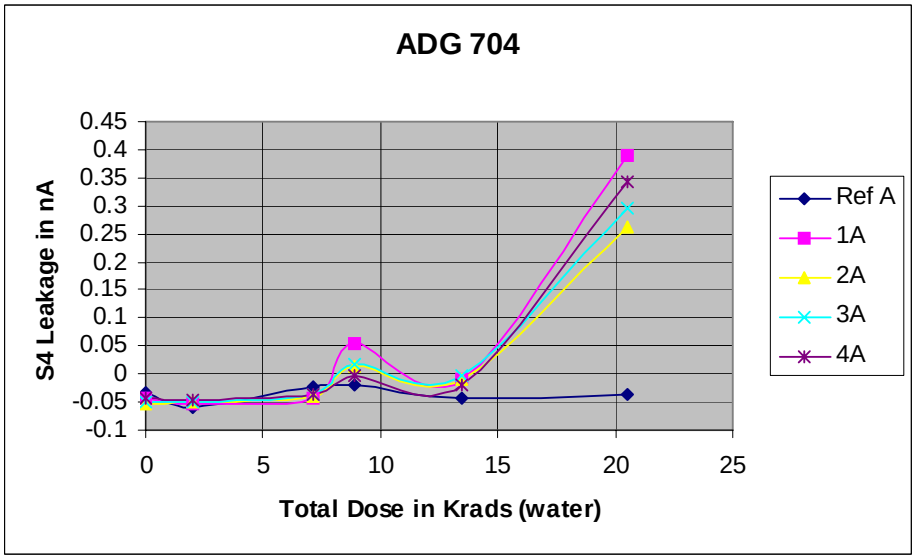

Figure 13 S4 Leakage Current as a function of dose, gamma 5.2 rad(water)/min

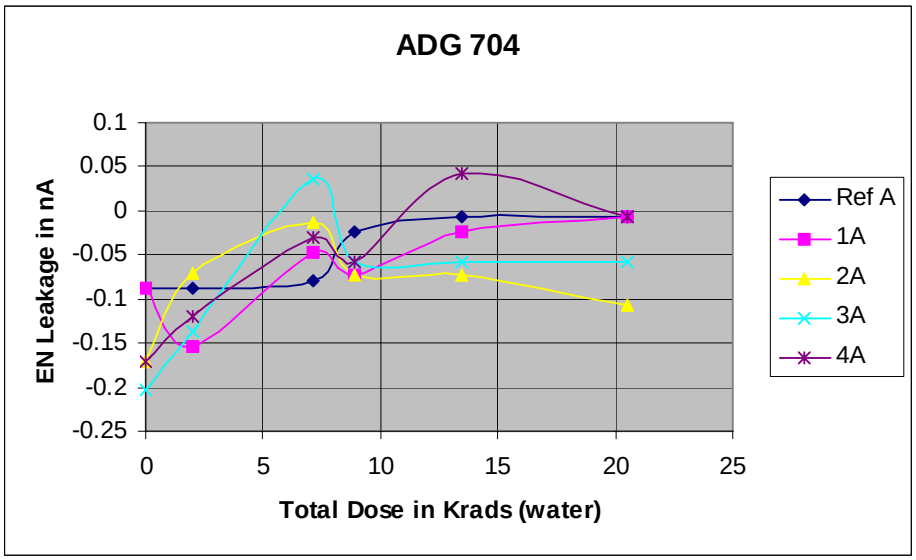

Figure 14 EN Leakage Current as a function of dose, gamma 5.2 rad(water)/min