esa DOCUMENT

document title/ titre du document

RADIATION TEST REPORT

UC1845

prepared by/*préparé par* Ali Mohammadzadeh / Bob Nickson

reference/*réference*
issue/*édition* 1
revision/*révision* 0
date of issue/*date d'édition* 28 February 2007
status/*état* Draft
Document type/*type de document* Radiation Test Report
Distribution/*distribution*

European Space Agency
Agence spatiale européenne

ESTEC
Keplerlaan 1 - 2201 AZ Noordwijk - The Netherlands
Tel. (31) 71 5656565 - Fax (31) 71 5656040

APPROVAL

author *auteur*		date *date*

approved by *approuvé by*	date *date*

CHANGE LOG

reason for change */raison du changement*	issue/*issue*	revision/*revision*	date/*date*

CHANGE RECORD

Issue: 1 Revision: 1

reason for change/*raison du changement*	page(s)/*page(s)*	paragraph(s)/*paragraph(s)*

Table Of Contents

Test Report Number	ESA_QCA0707T_I
Project	
SCC Component no.	
Component Designation	Pulse Width Modulator
Irradiation Spec. no.	
Family	Linear
Group	Silicon
Package	DIL
Component Specification	
Test House Name	ESA / ESTEC
Irradiation Test Plan Number	
Manufacturer name	Texas
Application type of Acceptance	
Serial Number of samples	Four (4) samples serialised as 1, 2, 3 & 4(Ref)
Manufacturing Date Code	0413
Irradiation Measurement Interval: Biased Unbiased: Circuit Reference: Supply Voltage: Temp ^{o}C: Duration:	 Yes (2 parts –1 & 2) Yes (1 part – 3) Room temperature 20 ± 3

Electrical Measurement Parameters	Vstart, Vmin, Istart, Iop, Vzener, Vref, Line reg, Load reg,OUTsc, Accuarcy, Vpin4, Vin,Ibias2, Iout, Isource, Vouthigh, Voutlow, Isense, Ibias3, Outlow20, Outlow200, Outhigh20,Outhigh200
Facility Source: Energy: Dose Rate: Absorbed Material: Thickness: Temperature ^{o}C:	 60Co 0.5 rad(Si)/min N/A N/A 20 ± 3
Dosimetry / Calibration method.	A calibrated NE2571, 0.6cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter.
Anneal Test Biased Unbiased Bias Circuit Reference Supply Voltage Duration	Yes 168h at 80^{o}C No Yes

1 INTRODUCTION

The following document contains the TID Radiation Test Report for UC1845 pulse width modulator for the project.

2 APPLICABLE DOCUMENTS

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

3 TEST DESCRIPTION

Four (4) UC1845, devices were selected for TID irradiation testing at the ESTEC ^{60}Co facility. Irradiations were performed at a dose rate of 0.5rad(Si)/min. Post irradiation annealing measurements were also performed on the devices.

Of the selected devices, one was assigned as a reference device (4) while, three were serialised for radiation exposure (1 & 2 biased and 3 unbiased). After each exposure-step the components were removed and tested on the SZ-test system for parametric measurements. Each irradiation test-board accommodated the biased and unbiased UC1845 devices. The biasing scheme of the modulators is illustrated in

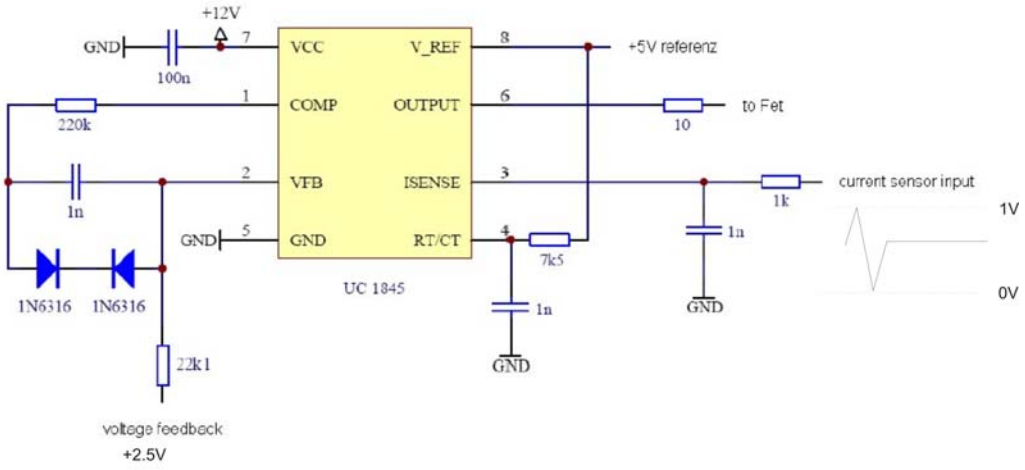

Figure 1: UC1845 irradiation biasing conditions

, Figure 2 illustrates the device package. The operating conditions during irradiation were provided by the project. The device operating conditions, temperature conditions and applied dose rates are listed in Table 1.

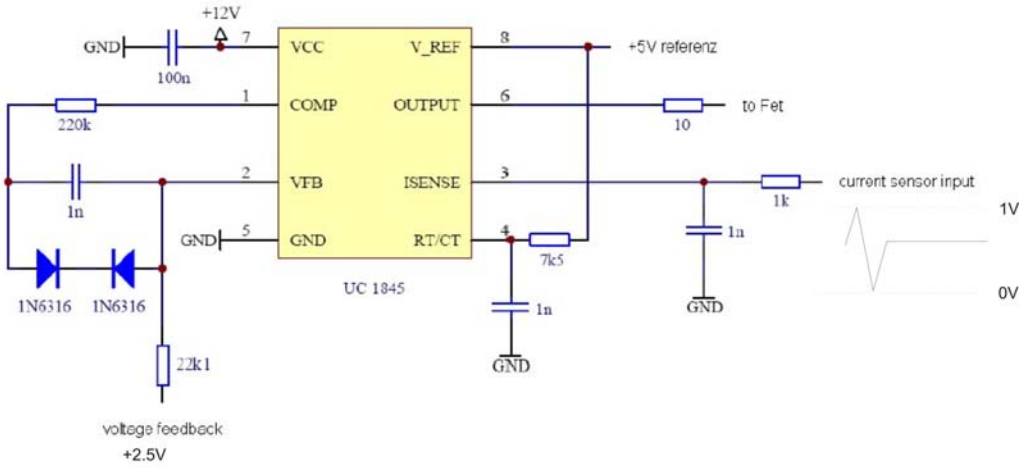

Figure 1: UC1845 irradiation biasing conditions

Figure 2 UC1842 package

Table 1: irradiation Test Conditions

Parameter	Ref	Dev1	Dev2	Dev3
Bias During Irradiation	NA	+12V	+12V	0V

Dose Rate	NA	0.5rad(Si)/min	0.5rad(Si)/min	0.5rad(Si)/min
Irradiation Temperature	NA	20 ± 3 °C	20 ± 3 °C	20 ± 3 °C

3.1 Measurement set-up

No in-situ measurements were performed during irradiation. Parametric measurements were performed with regular intervals as listed in Table 3. Parametric measurements were performed employing a SZ parametric tests system:

- SZ M3000 Test Station Sm02B
- M3000 TA11 Test Adapter
- Software UTS-Version 2.5.1

Table 2 lists all parametric measurements performed and their limit values.

Table 2: parameters measured by the SZ parametric Test System

Parameter	Unit	LL	UL
Start threshold	V	15	17
Min.operating volt.	V	9	11
Start up current	mA	0	1
Oper.supply current	mA	0	17
Vcc Zener voltage	V	30	45
Ref.output voltage	V	4.95	5.05
Line regulation	mV	0	20
Load regulation	mV	0	25
Output short circuit	mA	-180	-30
Initial accuracy	kHz	47	57
Amplitude Vpin 4	V	0.6	2.6
Input voltage	V	2.45	2.55
Inp.bias curr.(Pin2)	uA	-1	1
Output sink current	mA	2	40
Outp. source current	mA	-4	-0.5
Vout high (Pin 1)	V	5	15

Vout low (Pin 1)	V	0	1.1
Max.cur.sense signal	V	0.9	1.1
Inp.bias curr.(Pin3)	uA	-10	10
Outp.low (Is=20mA)	V	0	0.4
Outp.low (Is=200mA)	V	0	2.2
Outp.high (Is=20mA)	V	13	15
Outp.high(Is=200mA)	V	12	15

The time between irradiation stop, performing parametric measurements and starting irradiation for all irradiation steps were less than 45min. 9 irradiation steps were performed and parametric measurements taken after each step (parametric also performed for the reference device). Pre-irradiation measurements were performed on all devices. Table 3 illustrates the irradiation and measurement history.

Table 3: irradiation and measurement history

Irradiation steps	Ref	Dev 1	Dev 2	Dev 3
Pre-rad. Par. measurements	Yes	Yes	Yes	Yes
3.0 krad(Si)				
Par. measurements	Yes	Yes	Yes	Yes
5.8krad(Si)				
par. measurements	Yes	Yes	Yes	Yes
8.9krad(Si)				
par. measurements	Yes	Yes	Yes	Yes
13.3krads(Si)				
par. measurements	Yes	Yes	Yes	Yes
19.1krad(Si)				
Par. Measurements	Yes	Yes	Yes	Yes
26.7krad(Si)				
Par Measurements	Yes	Yes	Yes	Yes
34.3krad(Si)				
par. measurements	Yes	Yes	Yes	Yes
44.5krad(Si)				
par. measurements	Yes	Yes	Yes	Yes
53.4krad(Si)				
par. measurements	Yes	Yes	Yes	Yes

3.2 Thermal conditions

All irradiations and measurements were performed at room temperature (20 ± 3 °C).

3.3 Dosimetry

A calibrated NE2571, 0.6cc air ionisation chamber read by a calibrated Farmer 2670 dosimeter was used to measure the Total Ionising Dose.

3.4 Test Results

- The irradiation test results for UC1845 are presented in **Error! Reference source not found.** to **Error! Reference source not found.**25

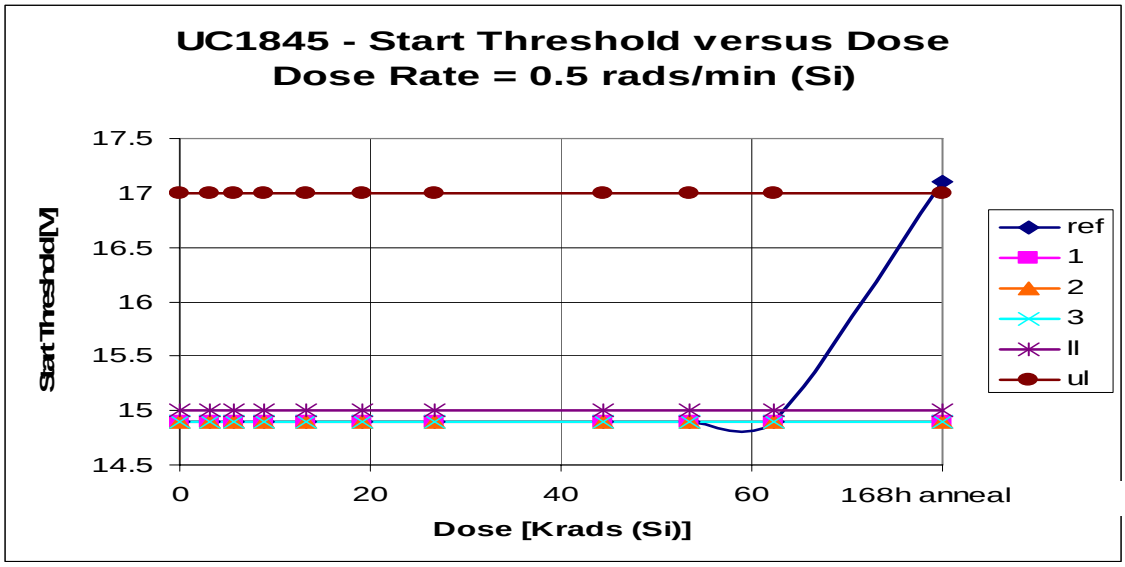

Fig 3.Start Threshold versus Dose [Dose Rate=0.5 rads/min(Si)]

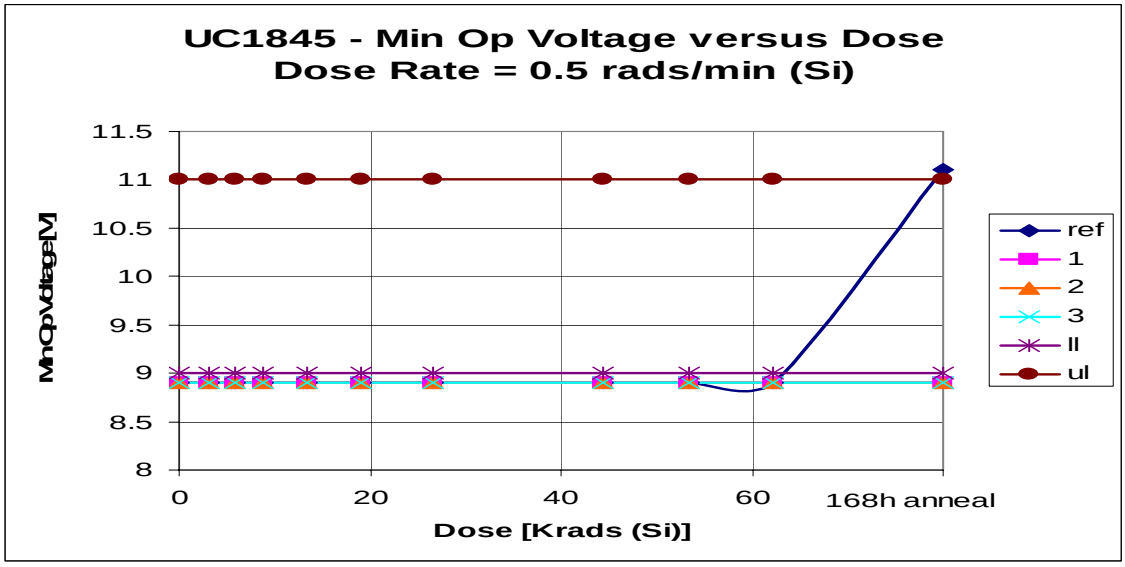

Fig 4. Vop. Min versus Dose [Dose Rate=0.5 rads/min(Si)]

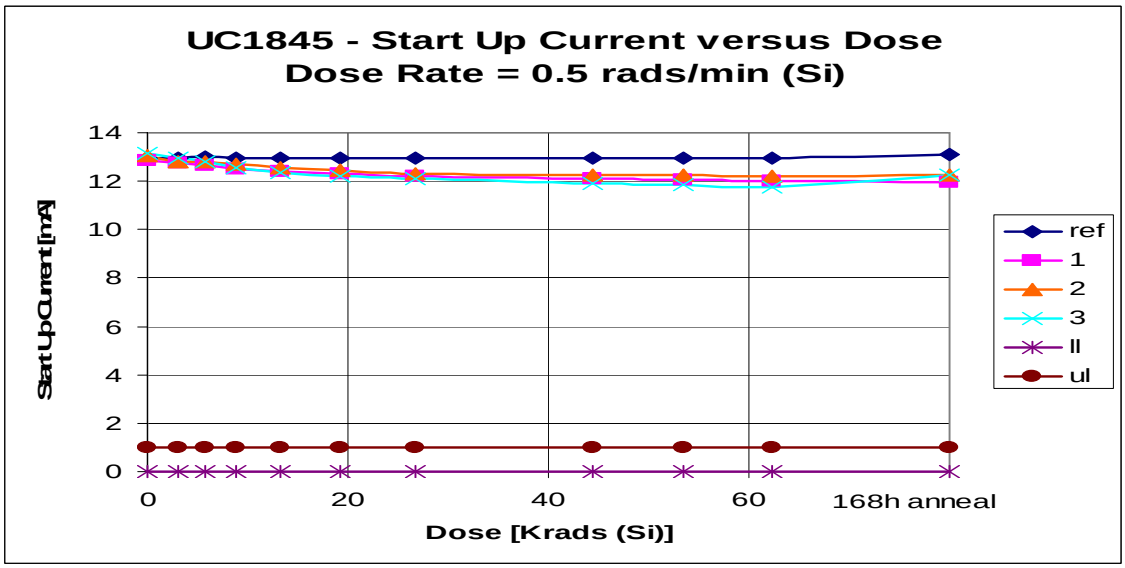

Fig 5.Start-Up Current versus Dose [Dose Rate=0.5 rads/min(Si)]

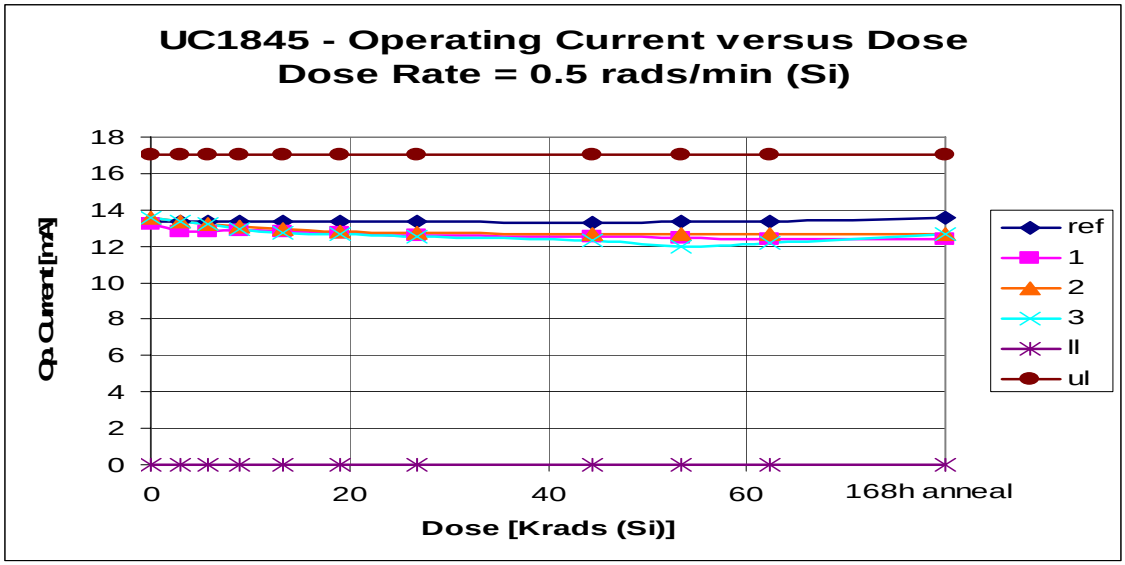

Fig 6. Operating Current versus Dose [Dose Rate=0.5 rads/min(Si)]

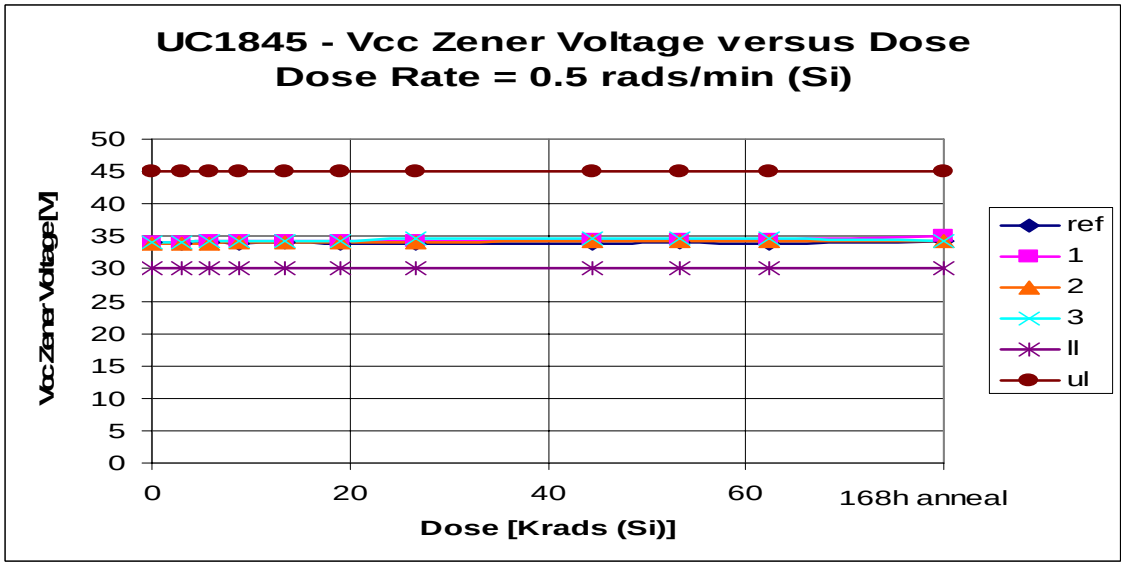

Fig 7. Zener Voltage versus Dose [Dose Rate=0.5 rads/min(Si)]

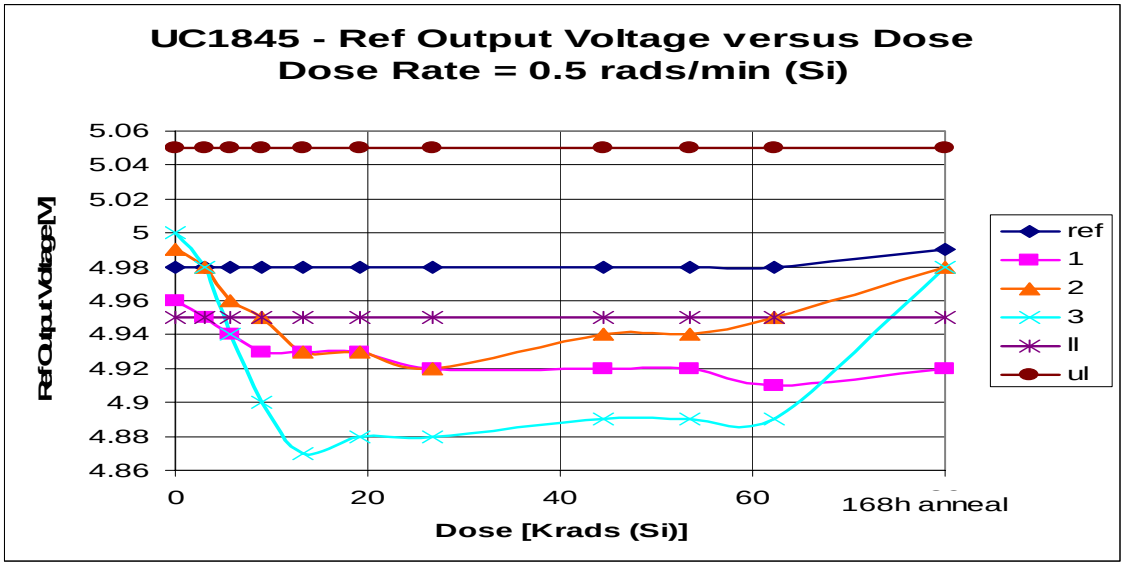

Fig 8. Reference Output Voltage versus Dose [Dose Rate=0.5 rads/min(Si)]

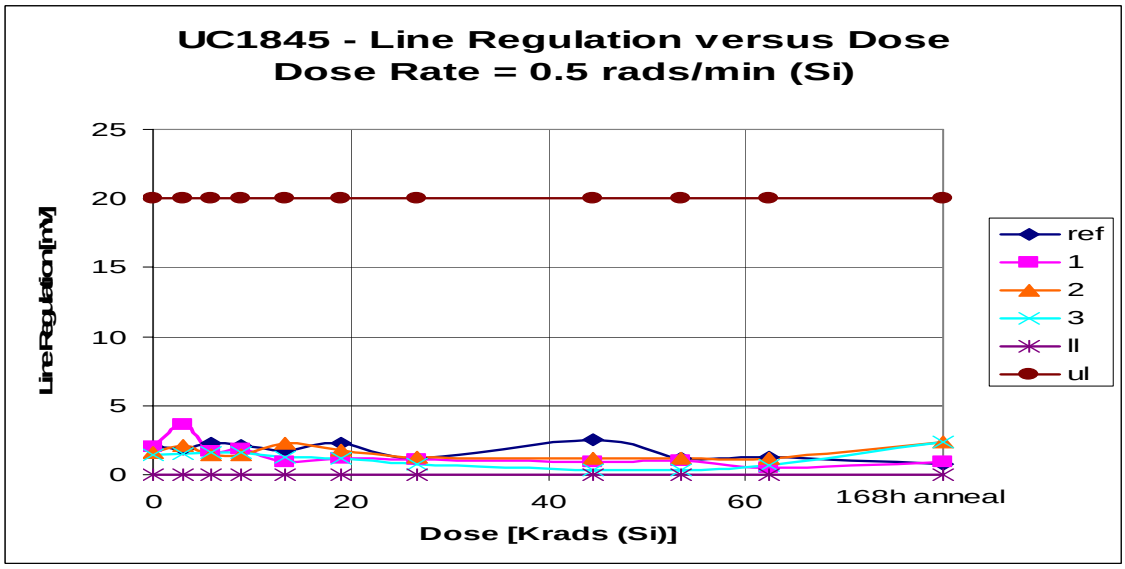

Fig 9. Line Regulation versus Dose [Dose Rate=0.5 rads/min(Si)]

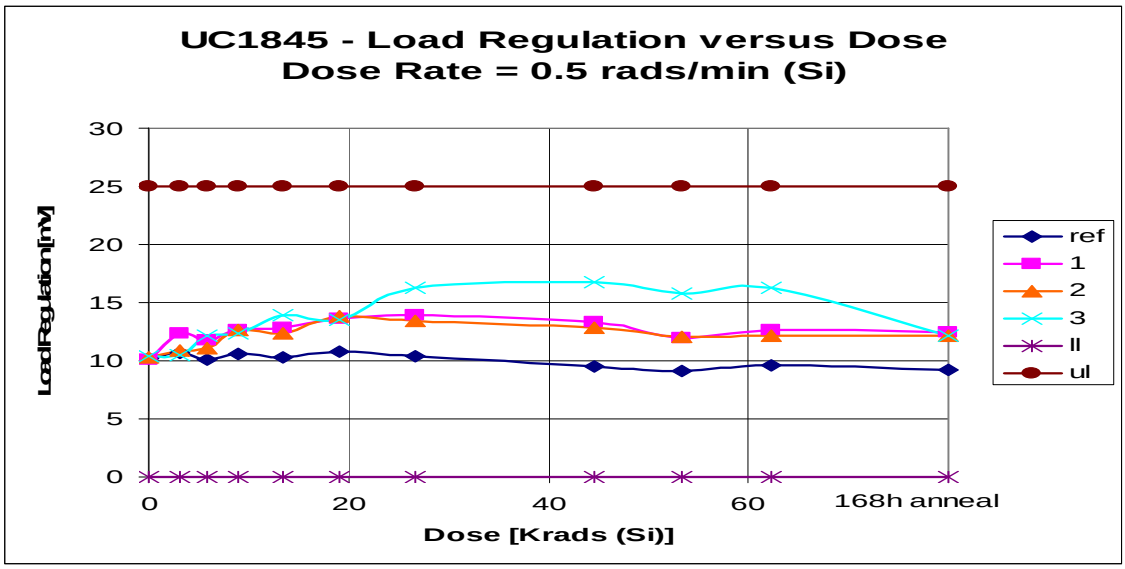

Fig10. Load Regulation versus Dose [Dose Rate=0.5 rads/min(Si)]

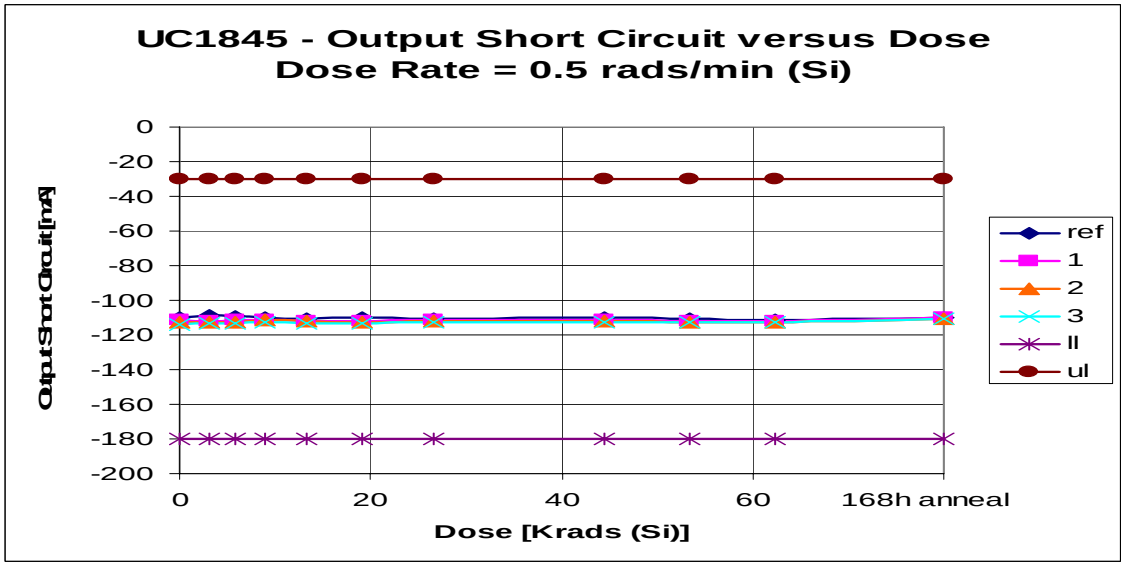

Fig 11. Output Short Circuit versus Dose [Dose Rate=0.5 rads/min(Si)]

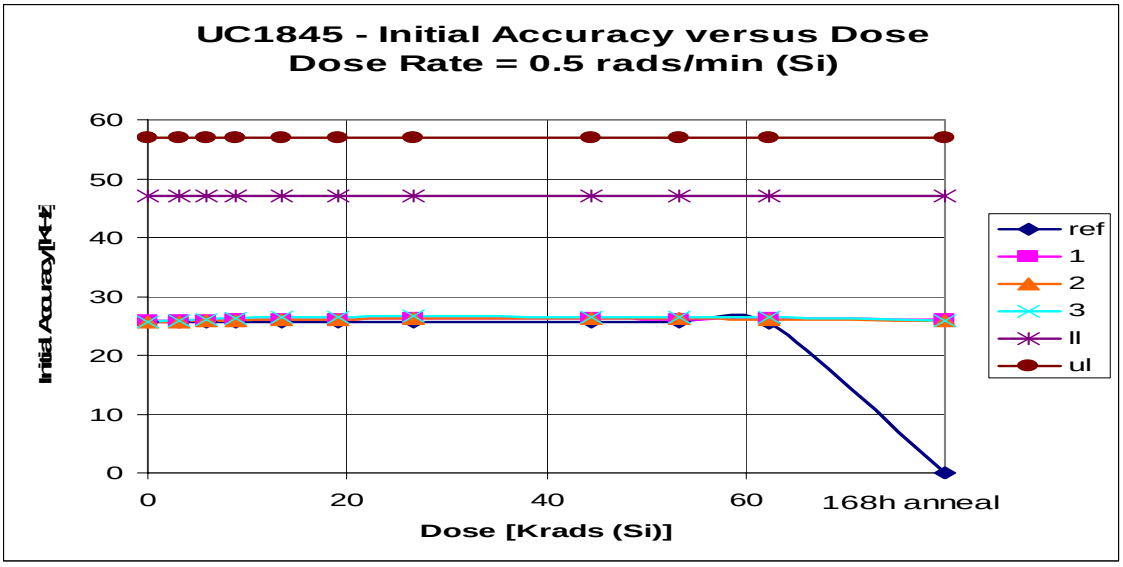

Fig 12. Initial Accuracy versus Dose [Dose Rate=0.5 rads/min(Si)]

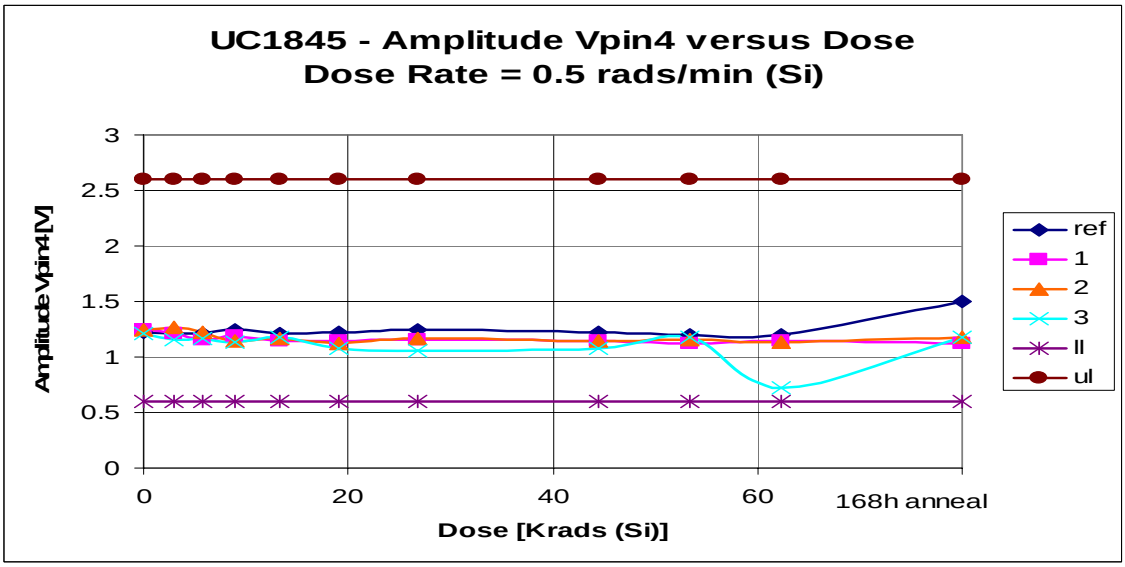

Fig 13. Amplitude Pin4 versus Dose [Dose Rate=0.5 rads/min(Si)]

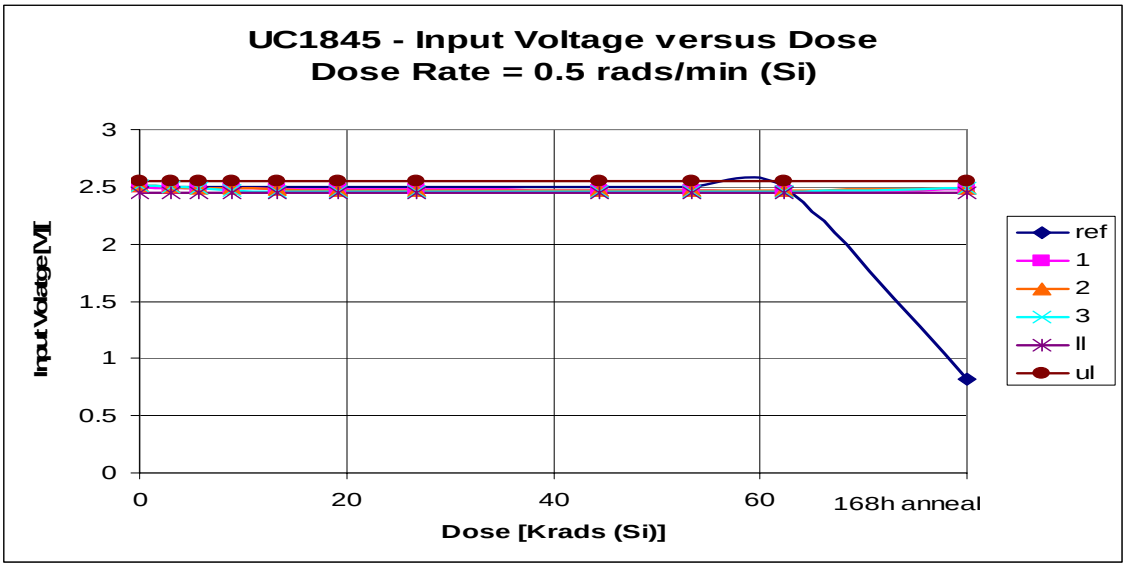

Fig 14. Input Voltage versus Dose [Dose Rate=0.5 rads/min(Si)]

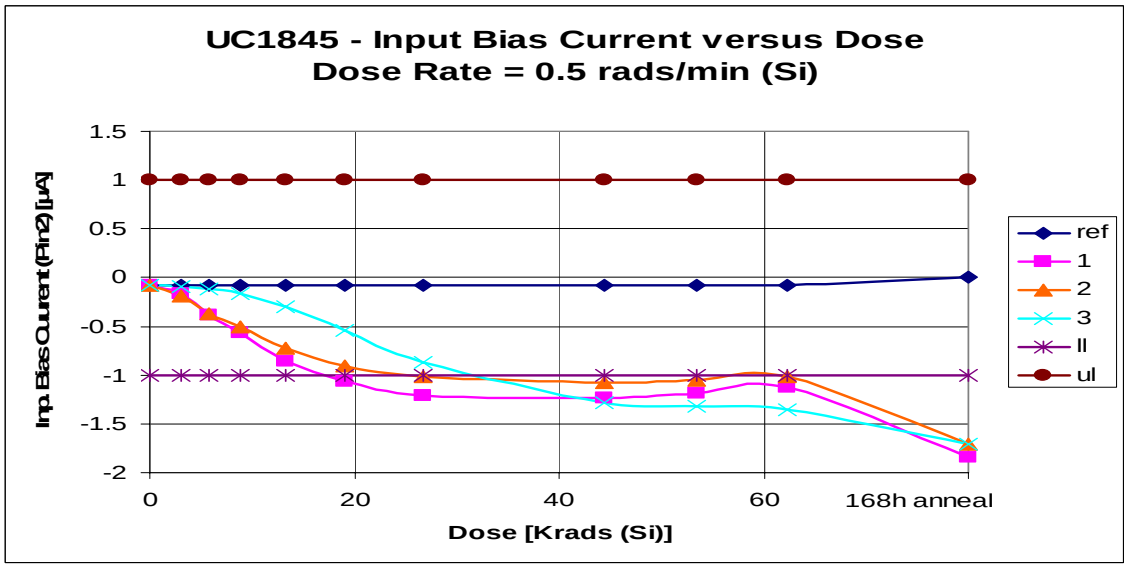

Fig 15. Input Bias Current versus Dose [Dose Rate=0.5 rads/min(Si)]

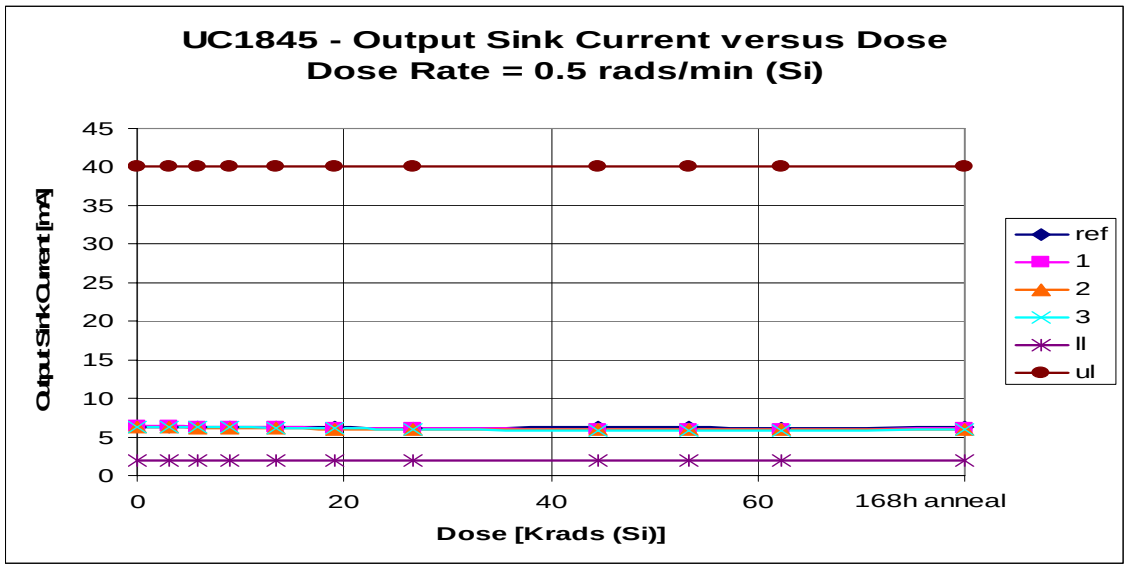

Fig 16. Output Sink Current versus Dose [Dose Rate=0.5 rads/min(Si)]

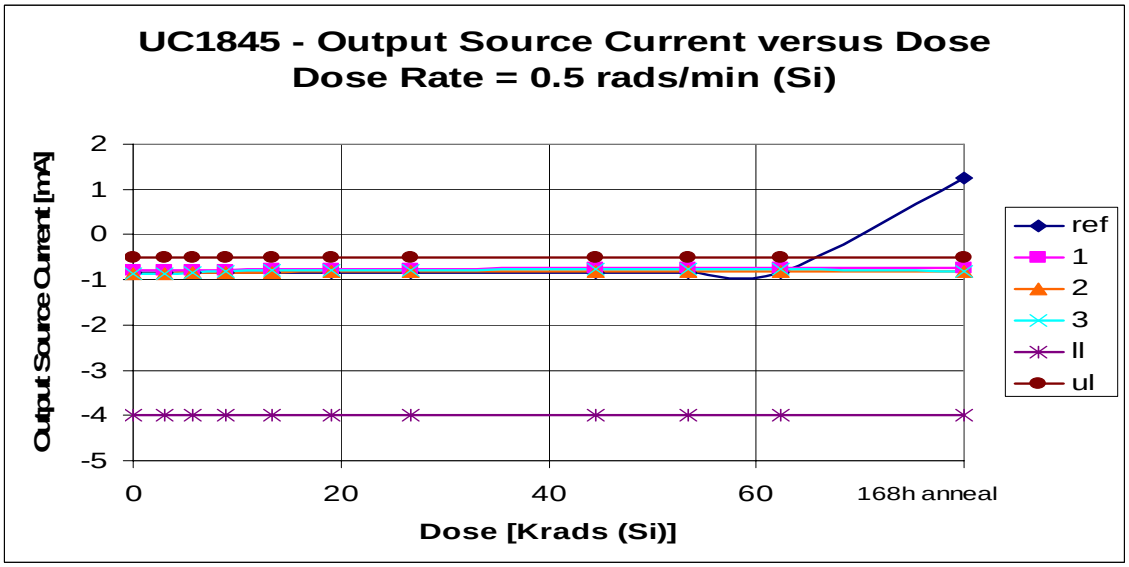

Fig 17. Output Source Current versus Dose [Dose Rate=0.5 rads/min(Si)]

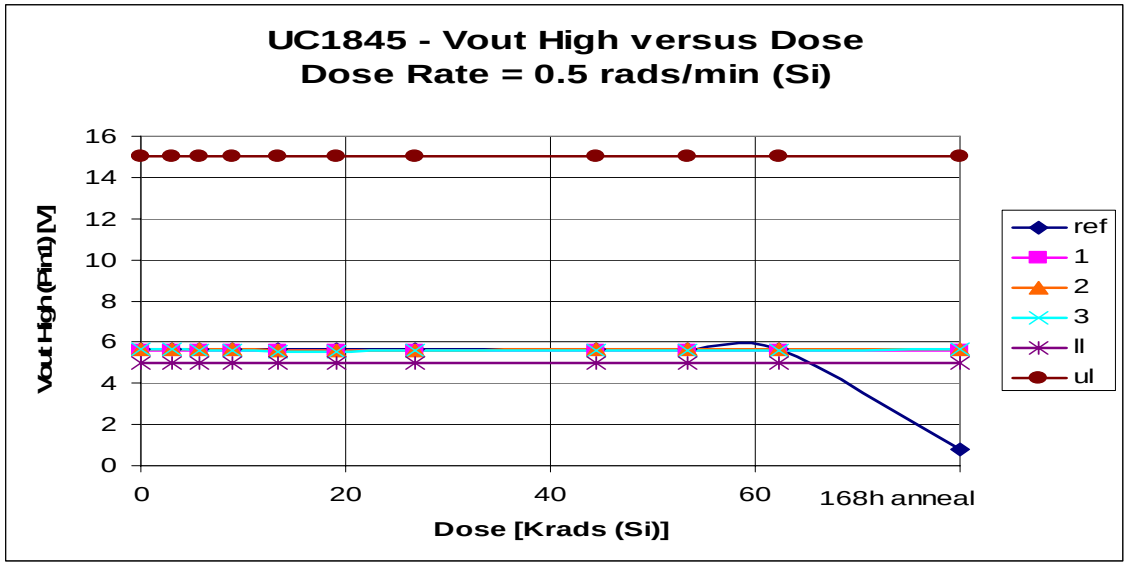

Fig 18. Vout High (Pin1) versus Dose [Dose Rate=0.5 rads/min(Si)]

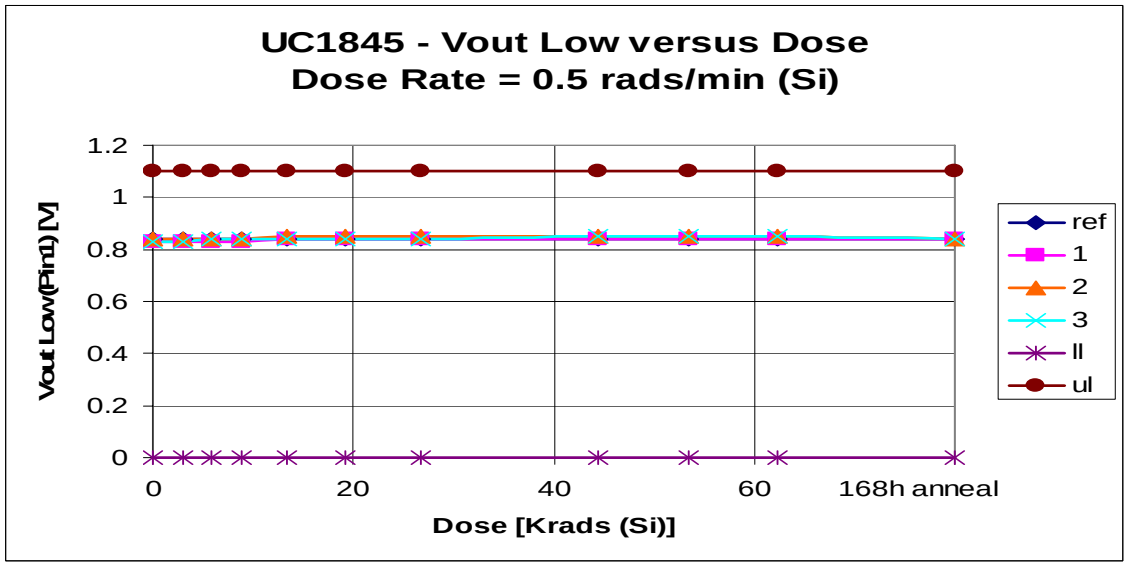

Fig 19 Vout Low (Pin1) versus Dose [Dose Rate=0.5 rads/min(Si)]

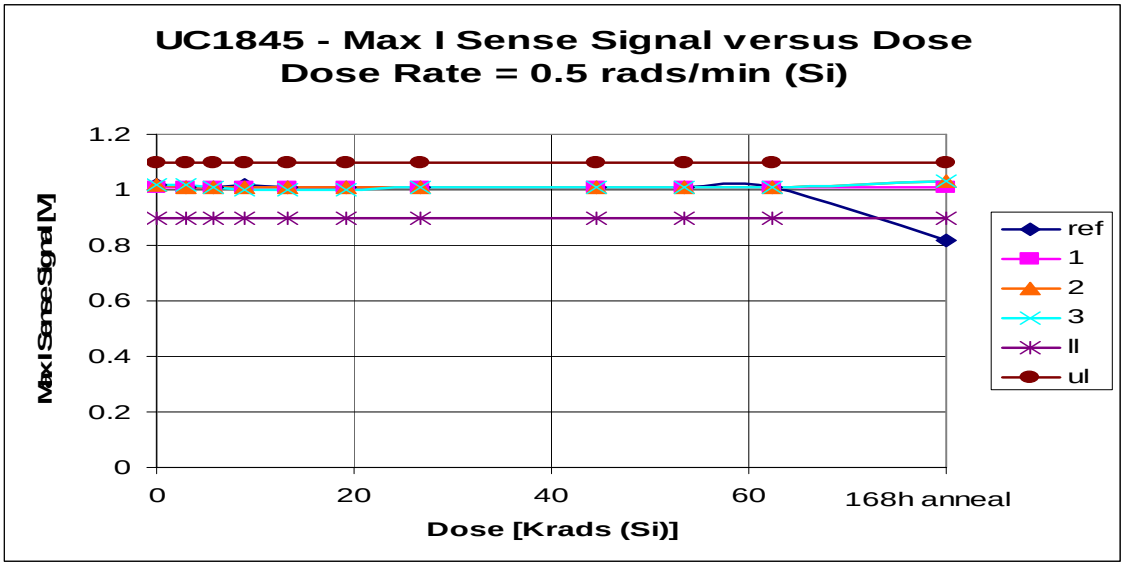

Fig 20. Max Current (Sense) versus Dose [Dose Rate=0.5 rads/min(Si)]

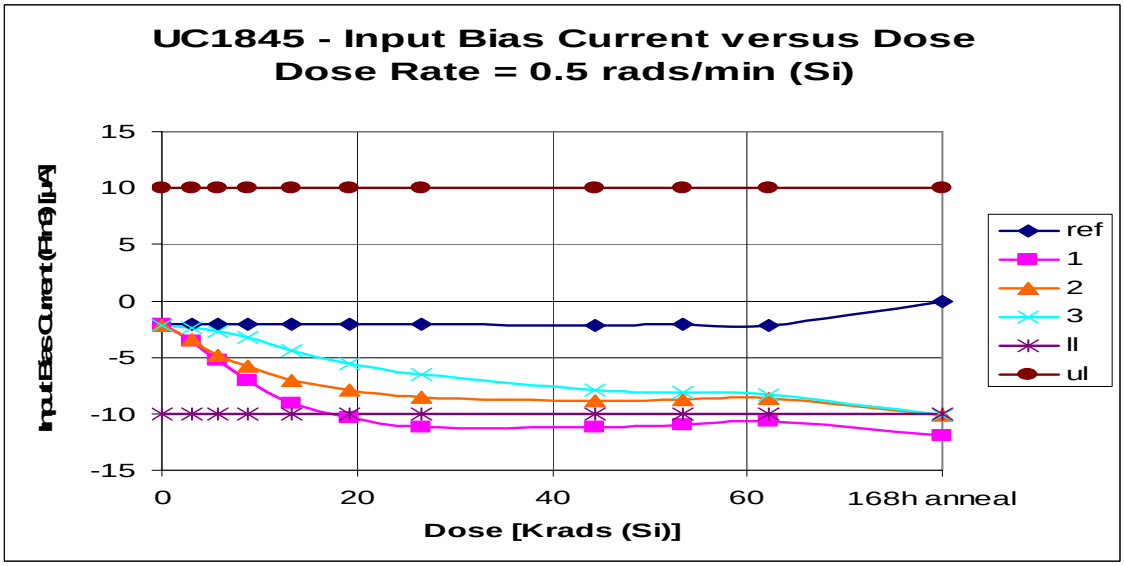

Fig 21. Input Bias Current (Pin3) versus Dose [Dose Rate=0.5 rads/min(Si)]

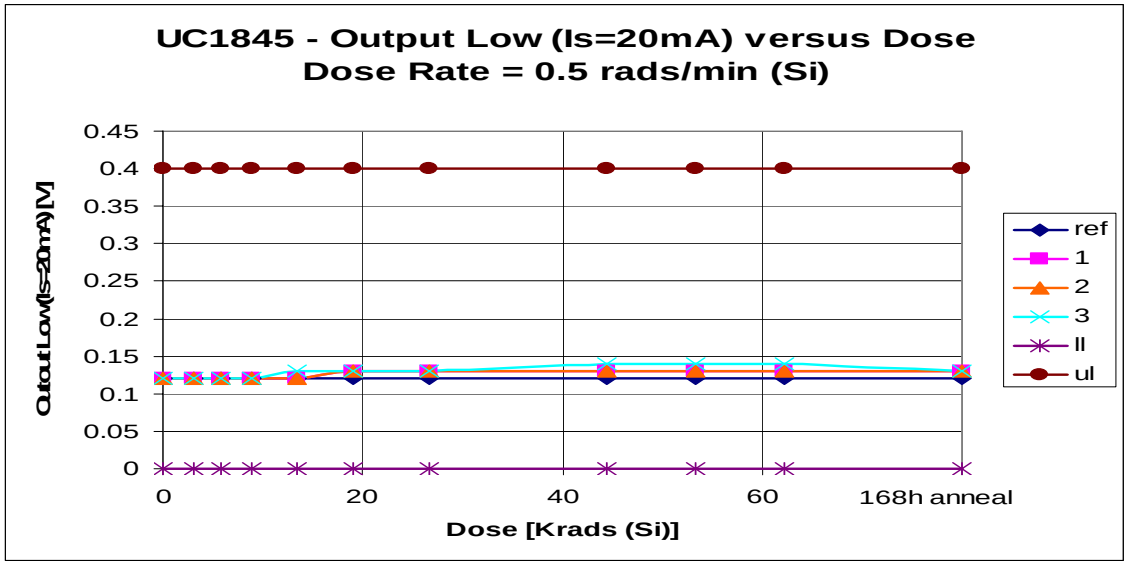

Fig 22.Output Low (20mA) versus Dose [Dose Rate=0.5 rads/min(Si)]

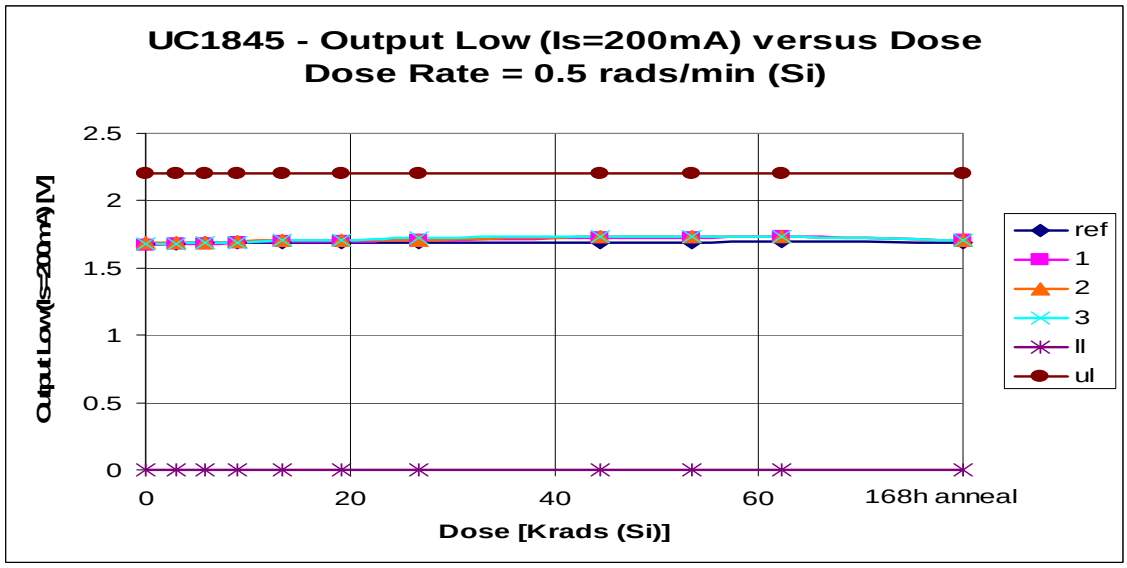

Fig 23.Output Low (200mA) versus Dose [Dose Rate=0.5 rads/min(Si)]

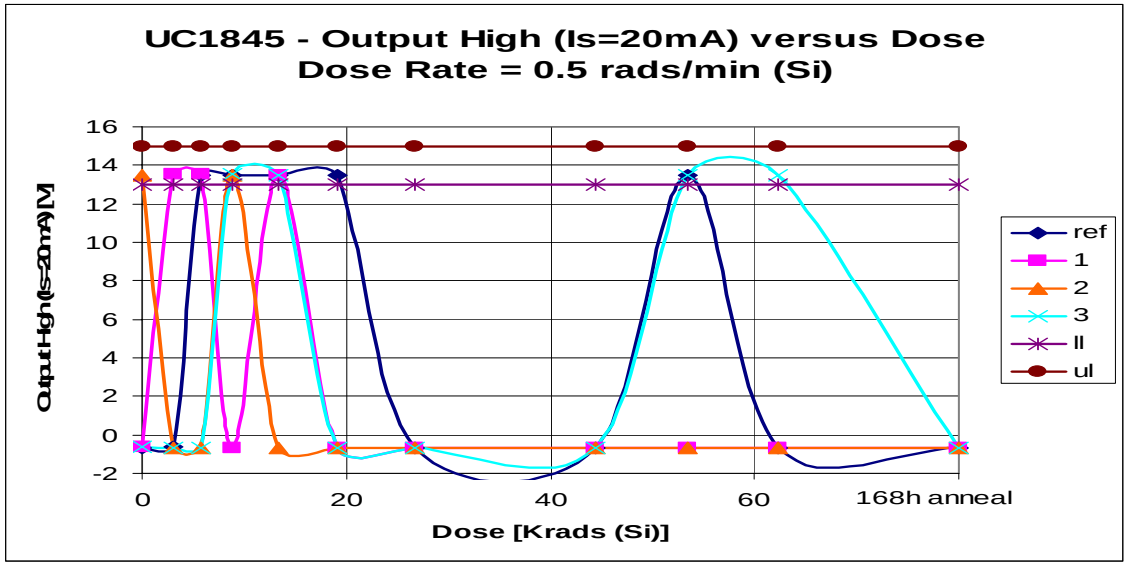

Fig 24.Output High (20mA) versus Dose [Dose Rate=0.5 rads/min(Si)]

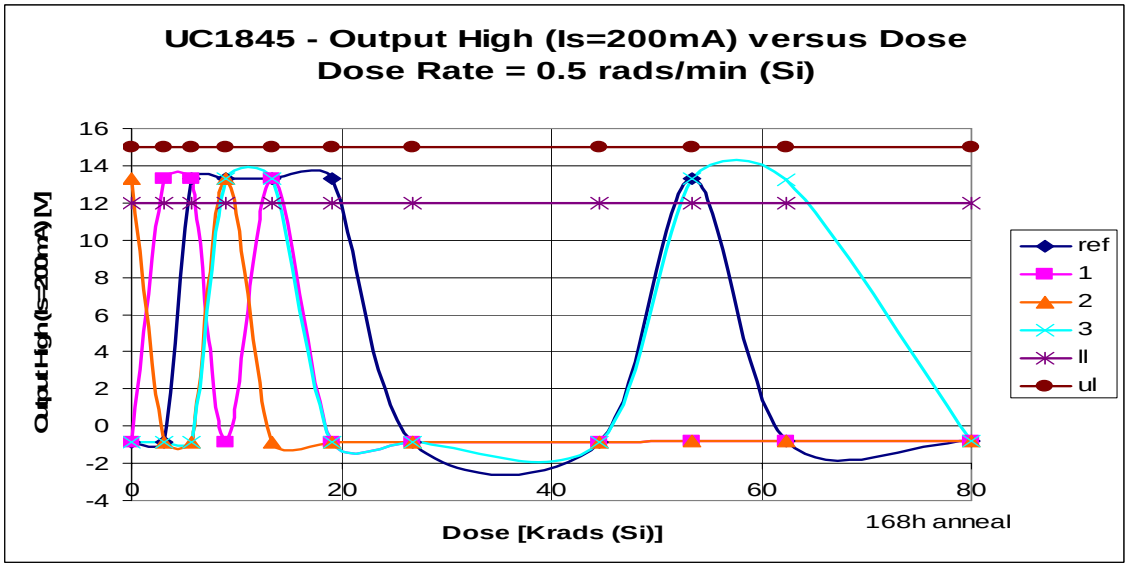

Fig 25.Output High (200mA) versus Dose [Dose Rate=0.5 rads/min(Si)]

4 CONCLUSION

Irradiation tests of the UC1845 devices were performed to investigate the component's suitability for flight.

Note that it was not possible, at the time, to re-program the SZ tester for the UC1845 parameter test conditions so the UC1842 test program was used and this may account for some of the unusual behaviour experienced.

The Reference device shows anomalous behaviour after the anneal period, even though the reference device did not undergo annealing. This behaviour occurred for Vstart, V op. min., Initial accuracy, V in, Output source current, Vout high (pin1) and max sense current.

For parameter Ref. Out device 1 was outside limits by 5.8Krads and all devices outside limits by 13.3Krads.

For the Input Bias current parameter device 1 was outside limits at 19Krads and all devices by 44Krads.

For parameter Input Bias (pin3), again device 1 went outside limits at 19Krads.

The High (20mA) and High (200mA) parameters show a strange switching behaviour between readings which maybe due to the state the device was stopped in (as a pulse was applied during radiation) prior to the SZ measurement. This effect was not seen for the UC1842 devices that were not pulsed during radiation exposure.