

Co-60 Low Dose Rate Testing of the LM 137 Voltage Regulator

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Semelab LM 137 Voltage Regulator

- Concern over ELRS effect (NASA)

- Tested in 1999 at 600 rads(Si)/min

no significant changes noted at 30Krad (Si)

(University of Birmingham School of Physics & Space Research)

Semelab LM 137 Voltage Regulator

- Astrium GmbH supplied 11 devices (+ 1 reference)
- Level of interest for MetOp Project : 12 Krads.
- Biasing boards for radiation and reference supplied (diodes on board also irradiated)
- 3 Dose Rates selected :
 - 1.8 rads/min (Si) – device s/n : 84,85 & 86
 - 3.6 rads/min (Si) – device s/n : 76,77,78,79 & 80
 - 36 rads/min (Si) – device s/n : 87, 88 & 89
 - Reference device s/n : 75

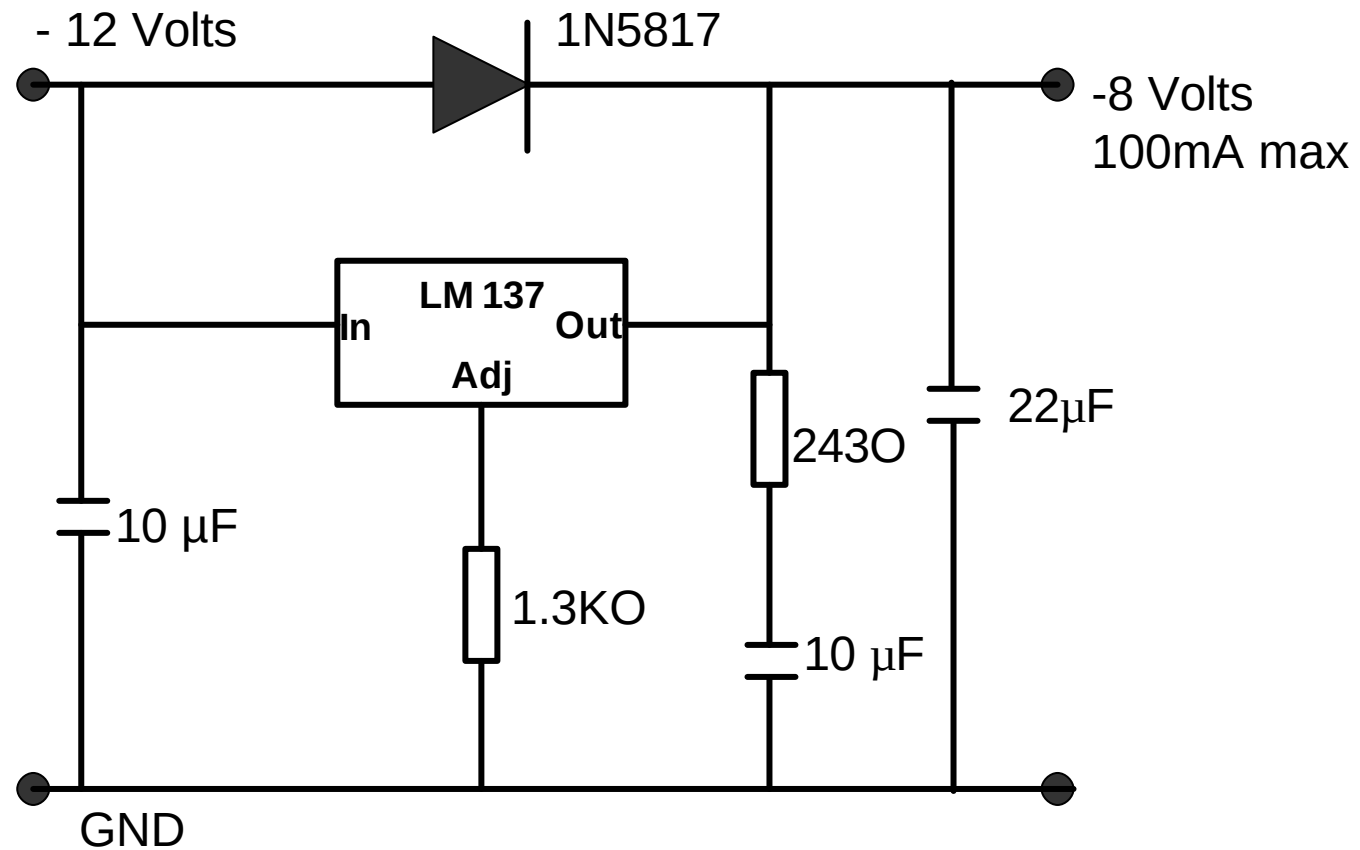
-Measurements during irradiation :

- Supply Voltage
- Supply Current
- Output voltages (set for –8 volts)
- Temperature in irradiation room
- Total Dose in rads (water)

Automatic logging system takes a data record every 10 minutes.

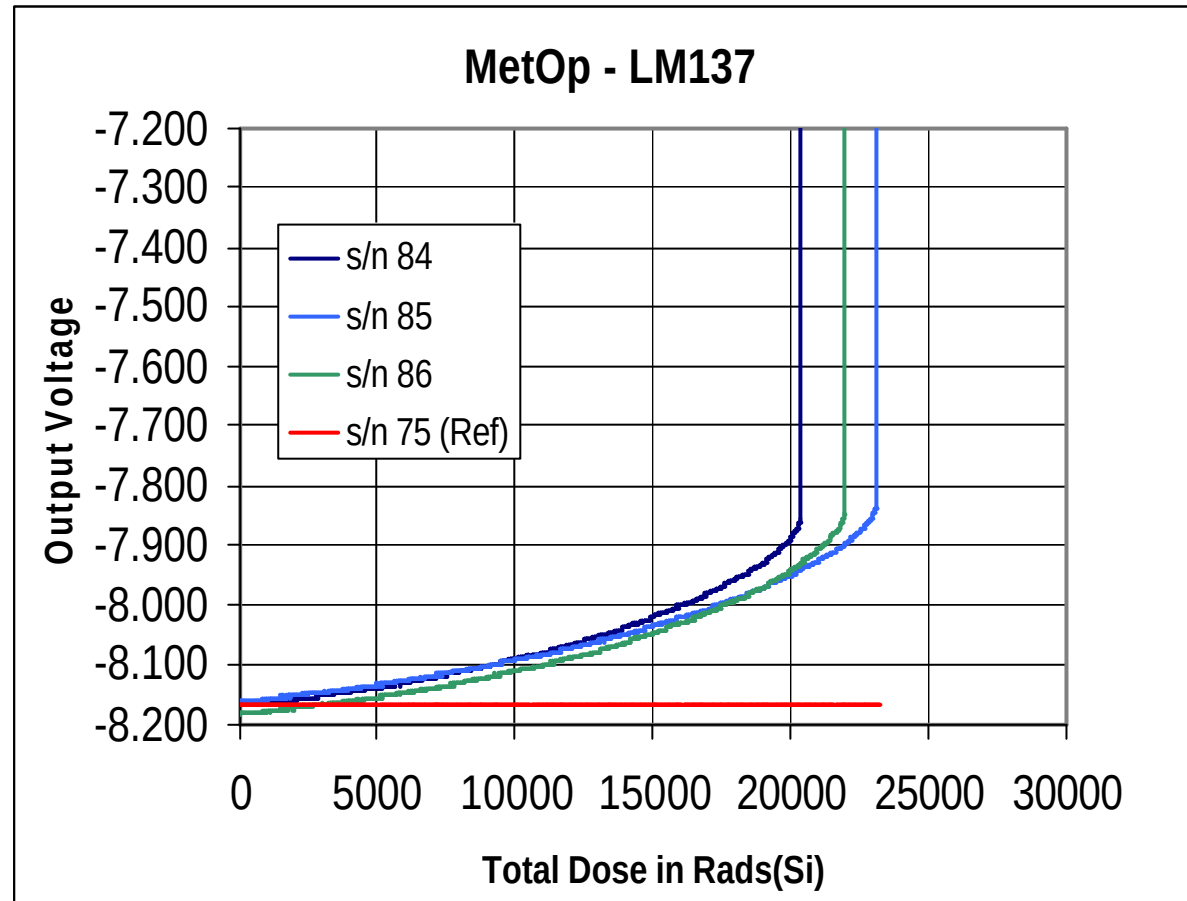
Record file is in ascii and the file is read into and formatted in an Excel sheet using a macro

Semelab LM 137 Voltage Regulator



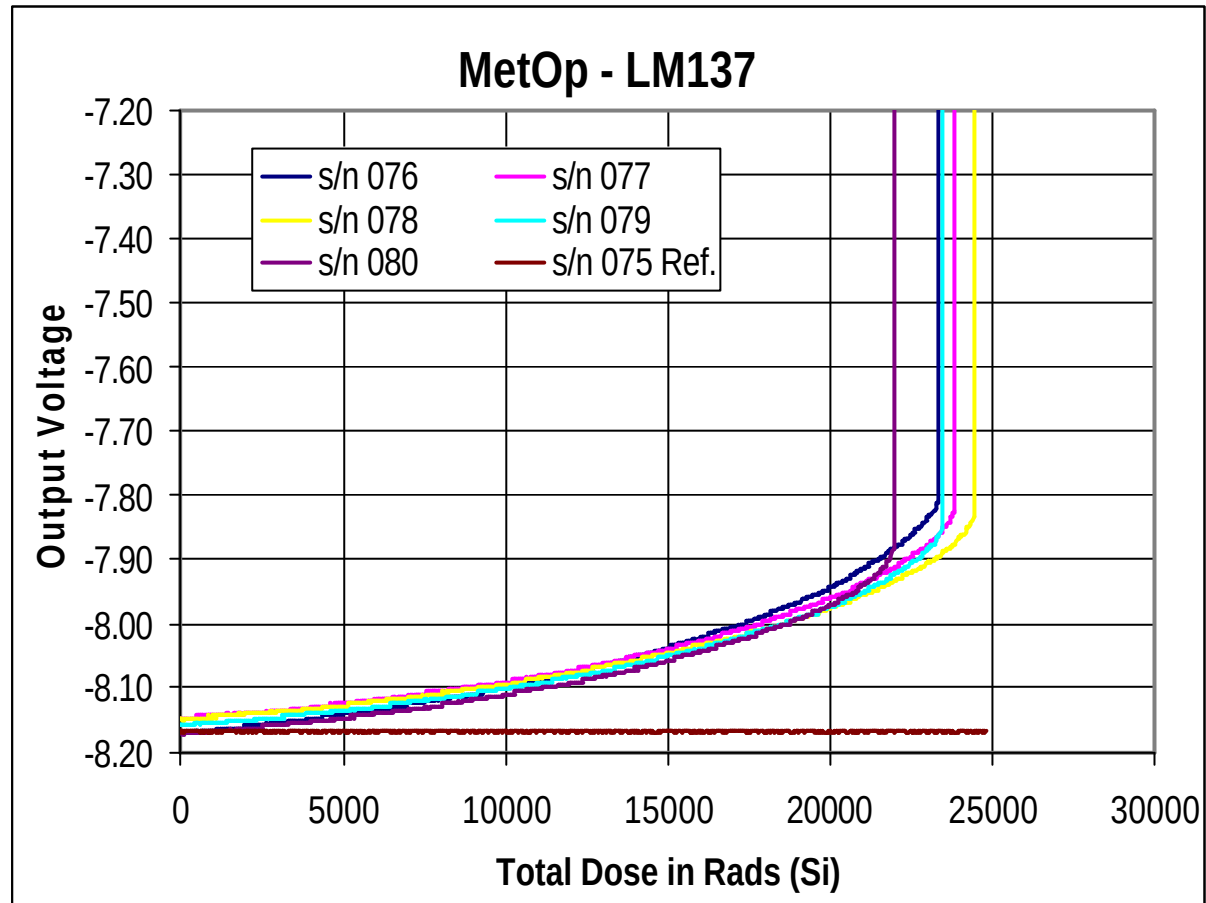
Semelab LM 137 Voltage Regulator

Dose Rate : 1.8 rads/min (Si)



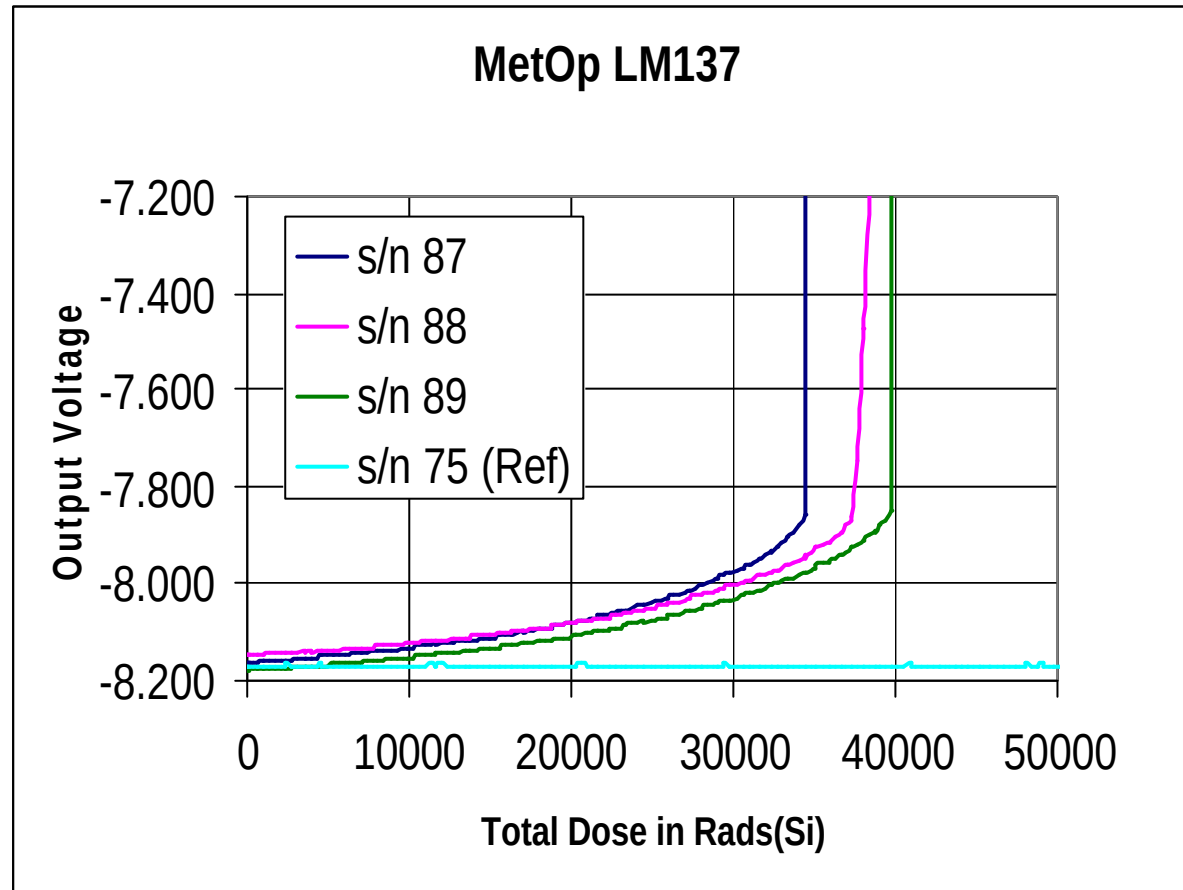
Semelab LM 137 Voltage Regulator

Dose Rate : 3.6 rads/min (Si)



Semelab LM 137 Voltage Regulator

Dose Rate : 36 rads/min (Si)



Semelab LM 137 Voltage Regulator

- device failure at :
 - 22 Krads with 1.8 rads/min dose rate
 - 23.5 Krads with 3.6 rads/min dose rate
 - 37 Krads with 36 rads/min dose rate
- all devices show same symptoms : slow output degradation followed by a threshold effect at about -7.9 volts where the outputs turn off
- Biased anneal at 20°C for 24 hours
 - no sign of recovery
- Unbiased anneal at 70°C for 168 hours
 - no sign of recovery

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Conclusion

Devices pass the 12Krad MetOp level of interest
Devices suffer from ELDRS

What is the high level dose rate threshold for ELDRS ??
What is the low level dose rate threshold for ELDRS ??

High Dose rate testing can camouflage ELDRS.

Need to test potential ELDRS candidates at low dose rates