ESA-QCA0009T-C

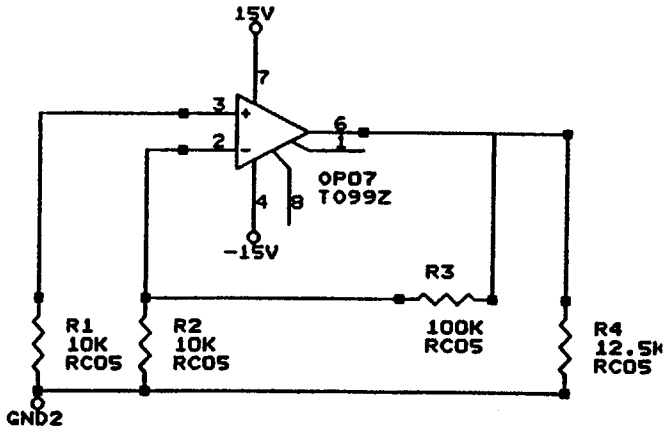
Tecnologica	TOTAL DOSE RADIATION TEST REPORT No. TL-SIL-RR-079	Issue: 1 Rev.: Date: 19/04/94 Date: Page: 1/11

SCC Component No.: M38510/13501SGA	Component Designation: OP07AJ	Irradiation Spec. No.: TL-SIL-0009
Gen. Spec.: MIL-M-38510 J Det. Spec.: M-M-38510/135 B Amend.:	Evaluation: _ Acceptance Difussion: _ Acceptance Lot: X	Project/Programme: SILEX
Family: 08 / Group: 09	Functional Assignment: OPERATIONAL AMPLIFIER	Package: TO-99
Manuf.Name: AD Address: USA	Irradiation Facility: CIEMAT Address: MADRID (SPAIN)	Test House: CIEMAT Address: MADRID (SPAIN)
Radiation Test Plan No.: TL-SIL-RP-079 Iss.2	Sample Size: 5 Irradiation Devices: 4 Control Devices: 1	Date Code: 9248 Mask No.: -
Radiation Source: Cobalt-60	Energy: 1,3 MeV Dose Rate: 20 kRad/h	Date of Test: 09.03.94

Electrical Measurements. Parameters Tested:
Input Offset Voltage (V_{OS}); Input Bias Current (I_{B+}, I_{B-}); Output Short Circuit Current (Isc(+), Isc(-)); Open Loop Voltage Gain (A_{VO}); Common Mode Rejection Ratio (CMRR)

Irradiation Conditions: Biased: Y Unbiased: N Test Circuit: Figure 1	Irradiation Measurements Interval: Unbiased: Y Test Circuit: N/A	Annealing Tests: YES Biased: Y Duration: 24/168h Unbiased: N Temp.°C: 25 Test Circuit: Figure 1

Figure 1:



Irradiat. Respons.: O. RAMOS Date: 19/04/94 Signature:	Electr. Test Resp.: I VAQUERO Date: 19/04/94 Signature:	Approved by QA: M GASSET Date: 19/4/94 Signature:

CONCLUSION

Total dose steady-state irradiation test has been carried out on 4 OPERATIONAL AMPLIFIER OP07AJ from ANALOG DEVICES, date code 9248. The irradiated parts were labelled as lollows: R2= S/N 13, R3= S/N 15, R4= S/N 16, R5= 17 and R1= S/N 12 CONTROL.

The results indicate that:

-Input Offset Voltage oversteps specification limit between 15 and 30 KRad, but there are not available results due to a problem tester.

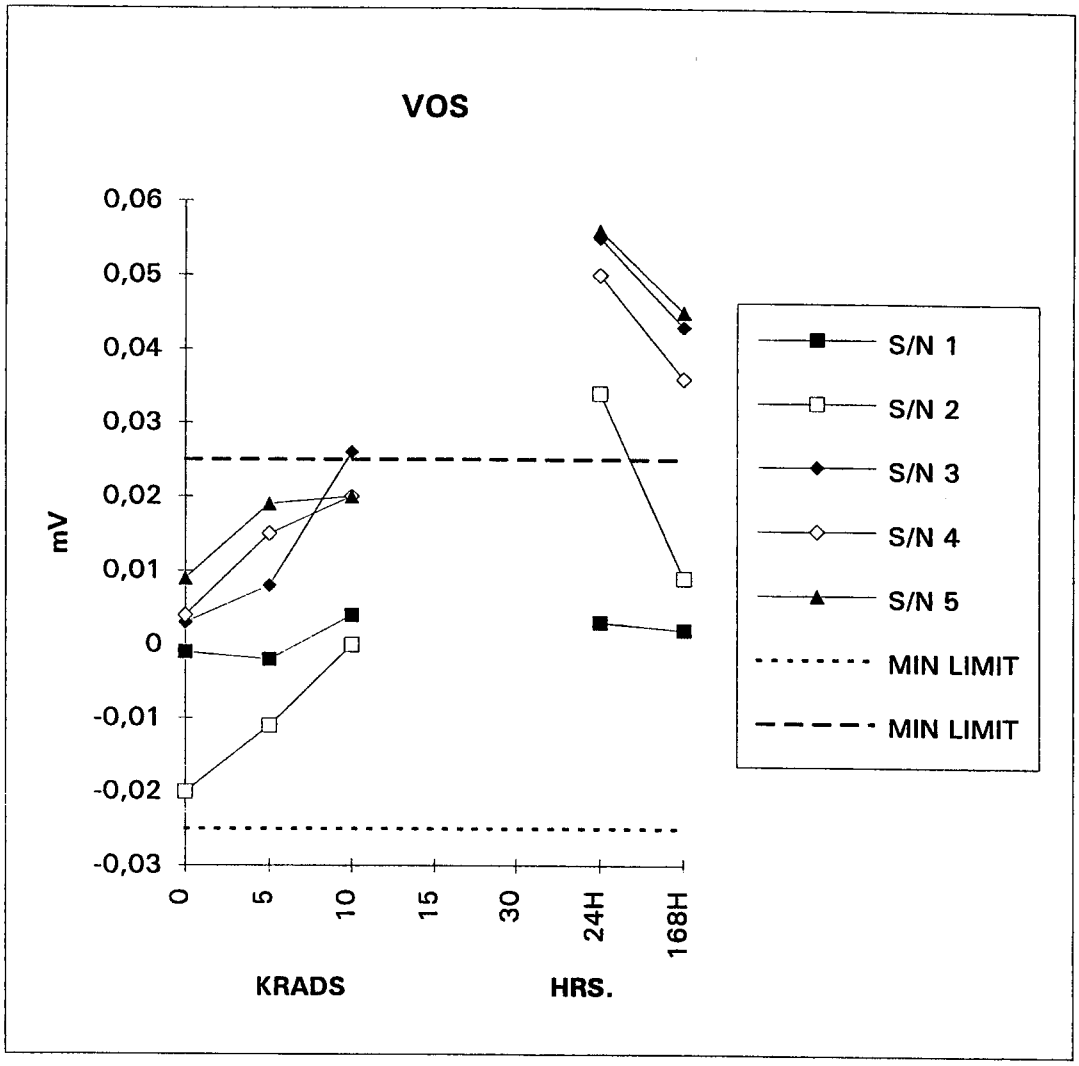
-Input Bias Current oversteps specification at the first step 5 KRad. Recovering effects are observed after 24h and 168h of annealing.

-Common Mode Rejection Ratio stays out of the specification limit at 30 KRad and recovers after annealings.

The electrical parameter Input Offset Current has not been measured but can be calculated taking values of I_{B+} and I_{B-}. The values of I_{B+} and I_{B-} at 30 KRad and annealing 24h are greater than 20nA. These values have not been measured.

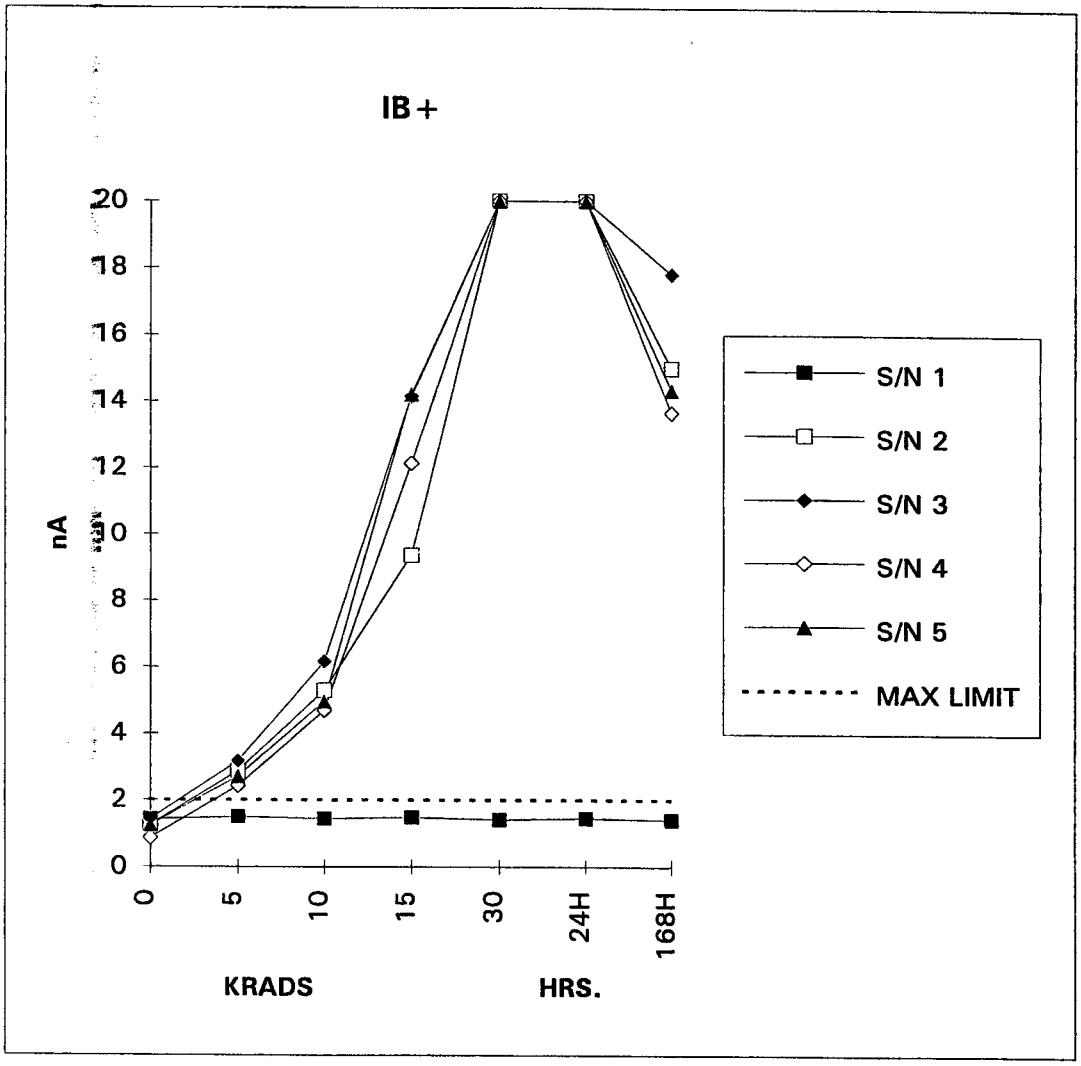
Test Step	Description	Result or Actual Test Condition	Time in	Time Out	Exposure
1	Sample serialization	CONTROL R1, R2,R3,R4,R5.			
2	Initial Electrical Measurements	See 0 krad(Si) values in respective Parameter Data Tables			
3	Set-up of Test	Bias circuit verified according to Fig. 1			
4	Irradiation Exposure	Cumulative Dose: 5 krad(Si) Dose Rate: 20 kRad(Si)/h Temperature: 19.75 °C	12:25	12:40	15 min.
5	Intermediate Electrical Measurements	See 5 krad(Si) values in respective Parameter Data Tables	12:48	13:05	
6	Set-up of Test	Bias circuit verified according to Fig. 1			
7	Irradiation Exposure	Cumulative Dose: 10 krad(Si) Dose Rate: 20 kRad(Si)/h Temperature: 20.15 °C	13:15	13:30	15 min.
8	Intermediate Electrical Measurements	See 10 krad(Si) values in respective Parameter Data Tables	13:39	13:54	
9	Set-up of Test	Bias circuit verified according to Fig. 1			
10	Irradiation Exposure	Cumulative Dose: 15 krad(Si) Dose Rate: 20 kRad(Si)/h Temperature: 19.95 °C	14:00	14:15	15 min.
11	Intermediate Electrical Measurements	See 15 krad(Si) values in respective Parameter Data Tables	14:22	14:37	
12	Set-up of Test	Bias circuit verified according to Fig. 1			

Test Step	Description	Result or Actual Test Condition	Time in	Time Out	Exposure
13	Irradiation Exposure	Cumulative Dose: 30 krad(Si) Dose Rate: 20 kRad(Si)/h Temperature: 20.1 °C	14:45	15:30	45 min.
14	Intermediate Electrical Measurements	See 30 krad(Si) values in respective Parameter Data Tables	15:38	15:55	
15	Annealing	Bias circuit verified according to Fig. 1. Temperature: 20.5 °C (average)	16:05 09/03	16:05 10/03	24 h
16	Electrical Measurements	See 24 h values in respective Parameter Data Tables	16:13	16:25	
17	Annealing	Bias circuit verified according to Fig. 1. Temperature: 21.8 °C (average)	16:30 17/03	16:30 17/03	168 h
18	Electrical Measurements	See 168 h values in respective Parameter Data Tables			

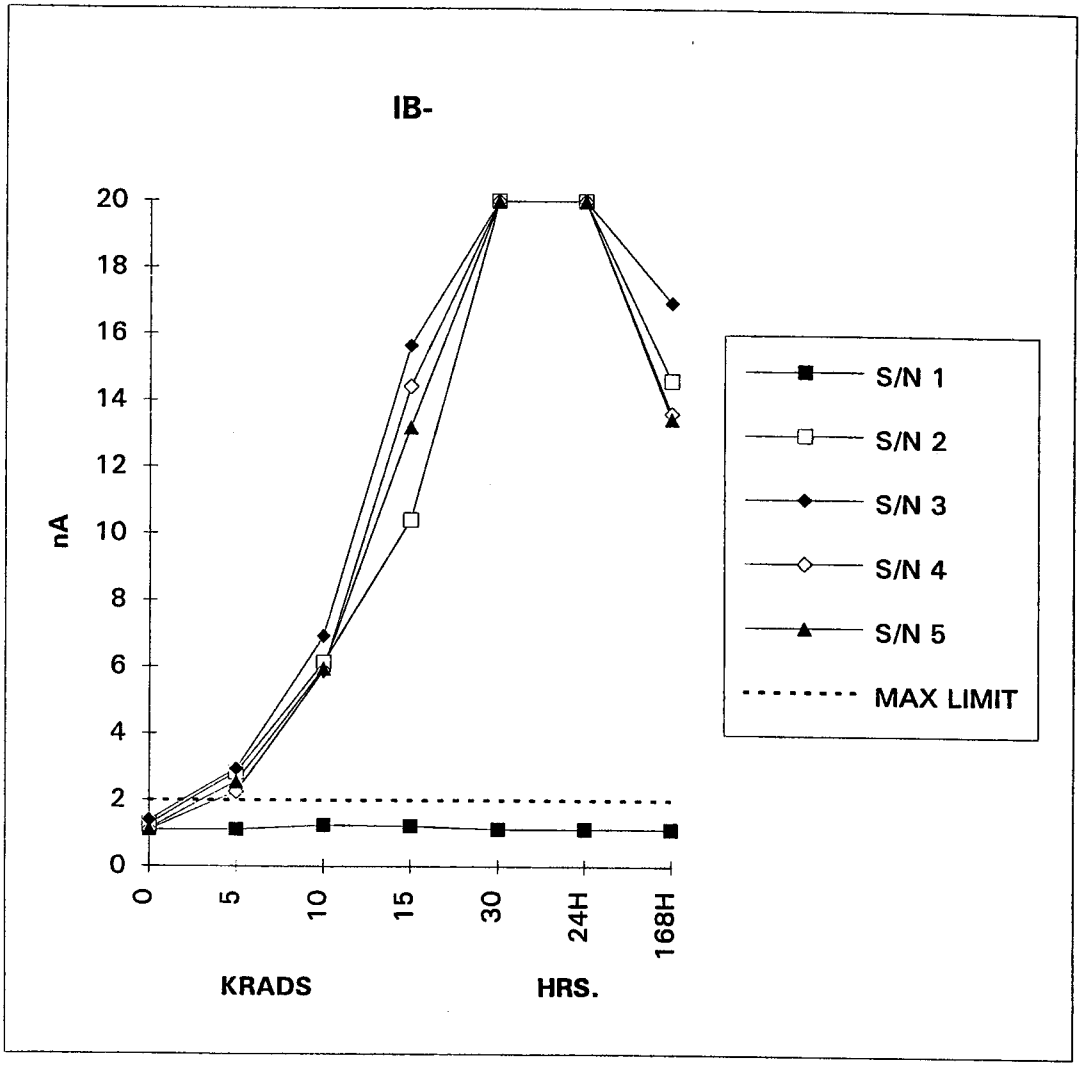


Not avalable results for irradiation devices at 15 and 30 Krads

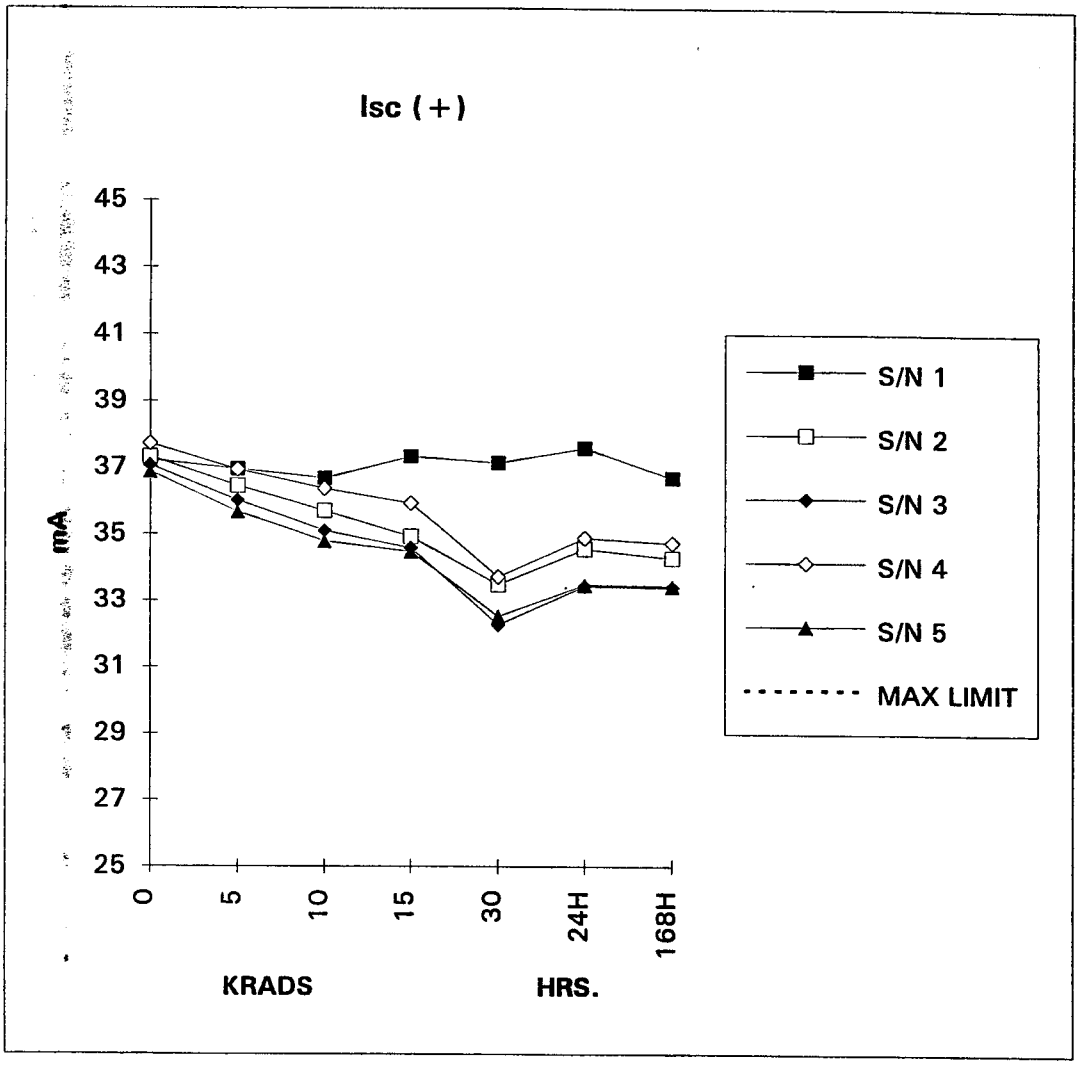
VOS	0	5	10	15	30	24H	168H
S/N 1	-0,001	-0,002	0,004			0,003	0,002
S/N 2	-0,02	-0,011	0			0,034	0,009
S/N 3	0,003	0,008	0,026			0,055	0,043
S/N 4	0,004	0,015	0,02			0,05	0,036
S/N 5	0,009	0,019	0,02			0,056	0,045
MAX LIMIT	0,025	0,025	0,025	0,025	0,025	0,025	0,025
MIN LIMIT	-0,025	-0,025	-0,025	-0,025	-0,025	-0,025	-0,025



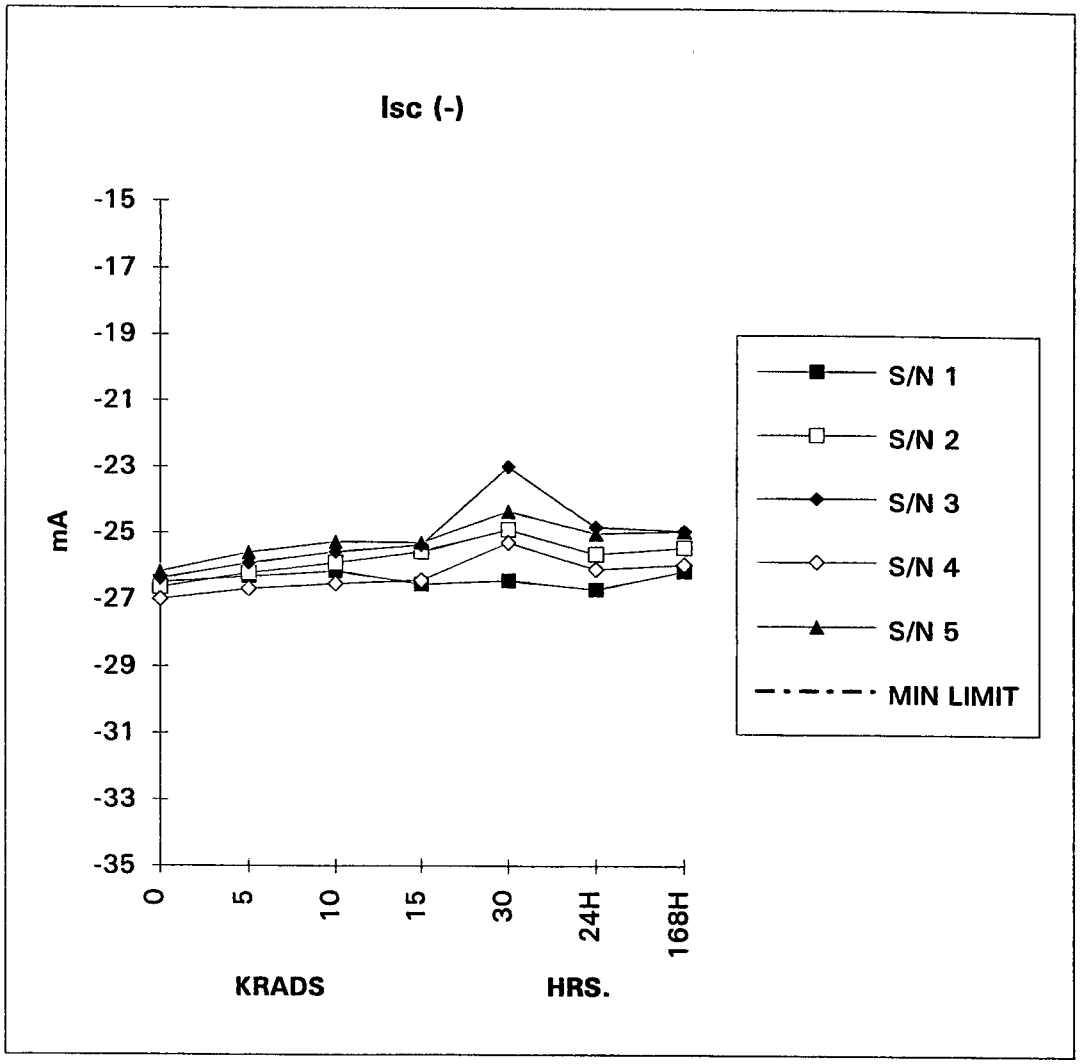
IB+	0	5	10	15	30	24H	168H
S/N 1	1,424	1,497	1,442	1,476	1,409	1,452	1,402
S/N 2	1,252	2,879	5,299	9,352	>20	>20	14,994
S/N 3	1,429	3,174	6,158	14,151	> 20	> 20	17,807
S/N 4	0,866	2,424	4,692	12,137	> 20	> 20	13,657
S/N 5	1,245	2,714	4,964	14,201	> 20	> 20	14,331
MAX LIMIT	2	2	2	2	2	2	2



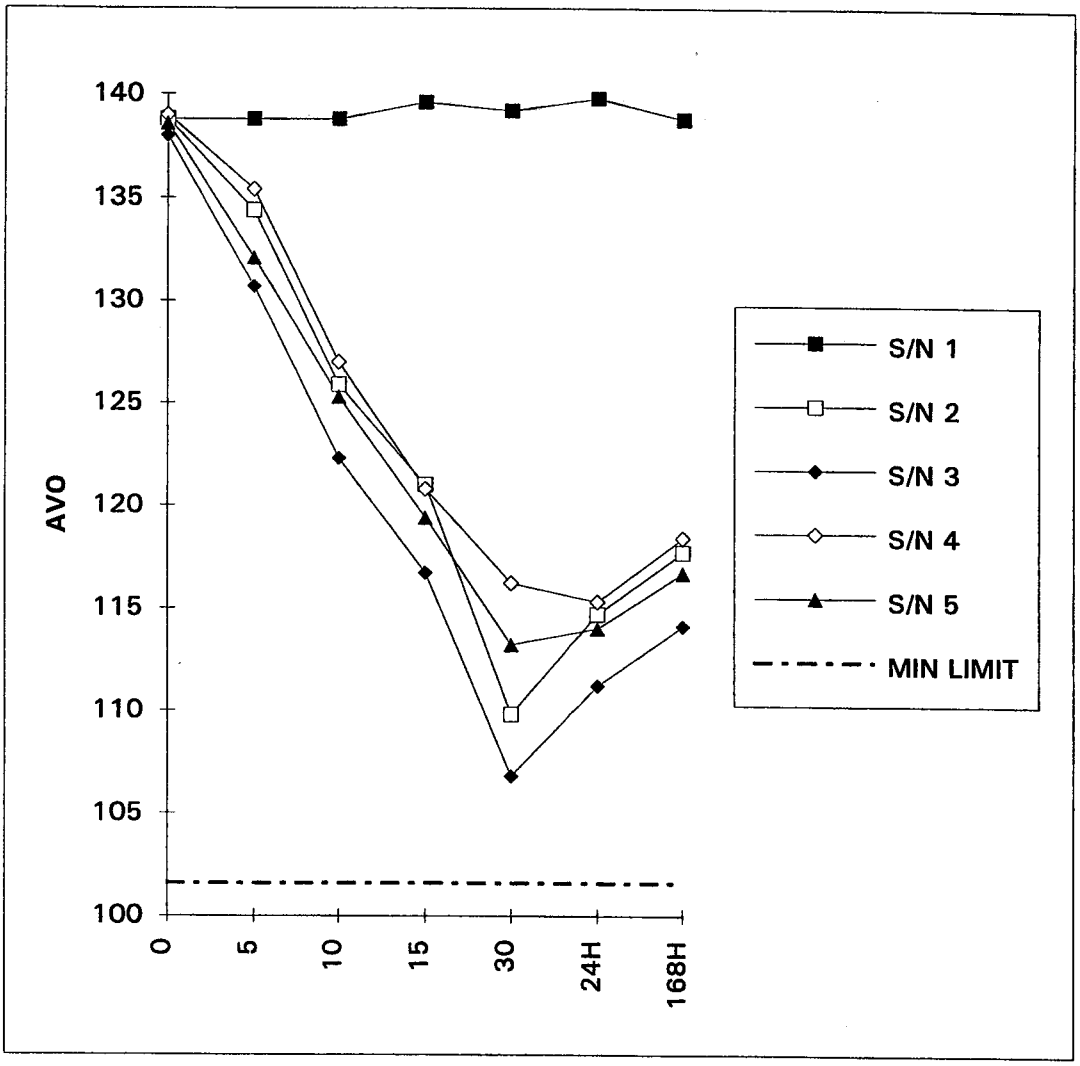
IB-	0	5	10	15	30	24H	168H
S/N 1	1,109	1,112	1,245	1,22	1,128	1,123	1,124
S/N 2	1,267	2,835	6,125	10,4	>20	>20	14,6
S/N 3	1,395	2,947	6,925	15,65	>20	>20	16,948
S/N 4	1,102	2,249	5,894	14,42	>20	>20	13,623
S/N 5	1,135	2,562	5,947	13,2	> 20	>20	13,462
MAX LIMIT	2	2	2	2	2	2	2



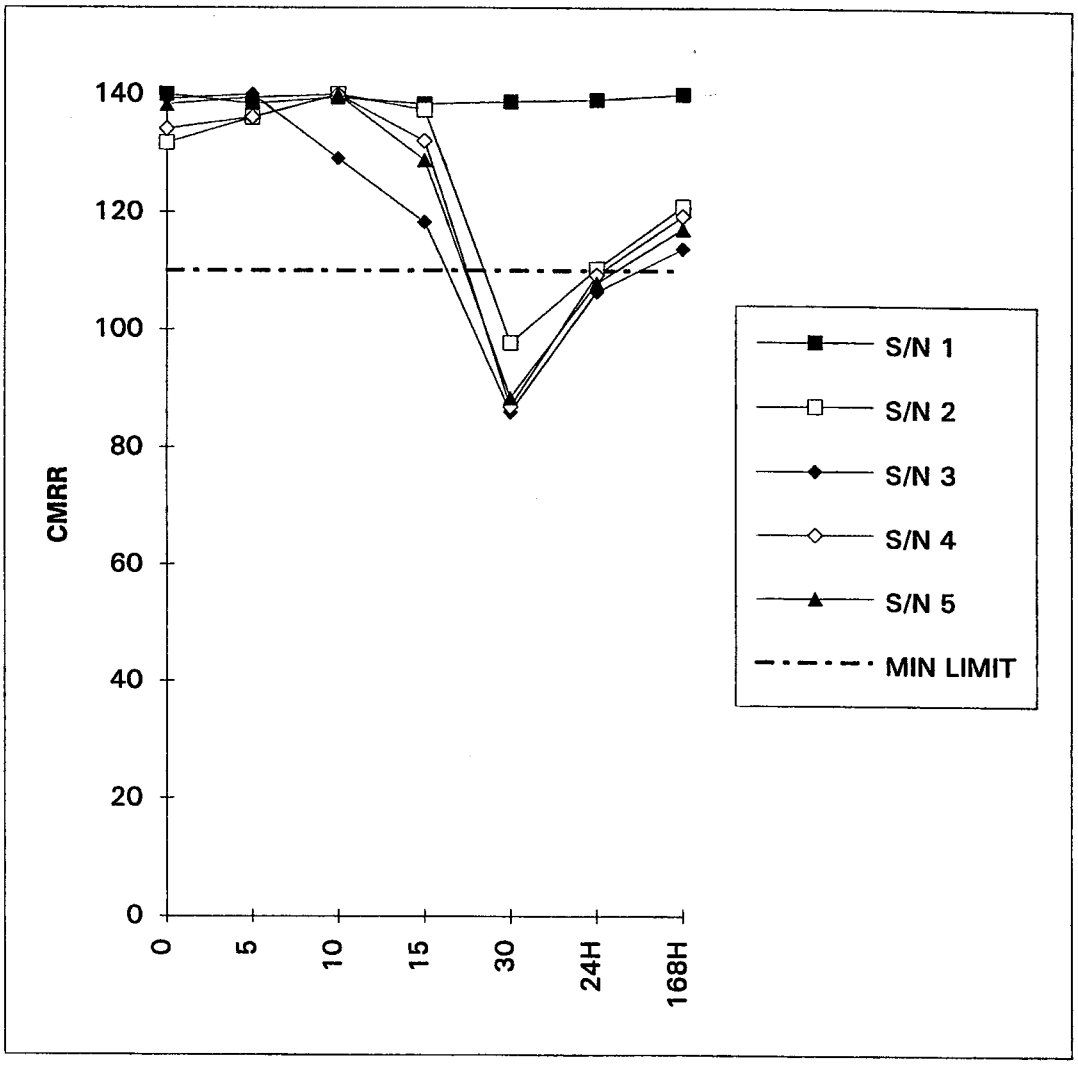
Isc (+)	0	5	10	15	30	24H	168H
S/N 1	37,23	36,95	36,67	37,33	37,14	37,58	36,68
S/N 2	37,32	36,45	35,69	34,92	33,48	34,56	34,28
S/N 3	37,07	36	35,09	34,59	32,26	33,44	33,41
S/N 4	37,72	36,93	36,36	35,92	33,71	34,88	34,73
S/N 5	36,88	35,66	34,79	34,47	32,52	33,48	33,44
MAX LIMIT	65	65	65	65	65	65	65



Isc (-)	0	5	10	15	30	24H	168H
S/N 1	-26,49	-26,31	-26,15	-26,54	-26,44	-26,7	-26,15
S/N 2	-26,63	-26,21	-25,9	-25,58	-24,91	-25,64	-25,44
S/N 3	-26,37	-25,91	-25,58	-25,38	-23	-24,83	-24,94
S/N 4	-26,99	-26,68	-26,52	-26,43	-25,3	-26,1	-25,95
S/N 5	-26,16	-25,59	-25,27	-25,3	-24,35	-25,02	-24,94
MIN LIMIT	-65	-65	-65	-65	-65	-65	-65



AVO	0	5	10	15	30	24H	168H
S/N 1	138,8	138,8	138,8	139,6	139,2	139,8	138,8
S/N 2	138,8	134,4	125,9	121	109,8	114,7	117,7
S/N 3	138	130,7	122,3	116,7	106,8	111,2	114,1
S/N 4	139	135,4	127	120,8	116,2	115,3	118,4
S/N 5	138,6	132,1	125,3	119,4	113,2	114	116,7
MIN LIMIT	101,6	101,6	101,6	101,6	101,6	101,6	101,6



CMRR	0	5	10	15	30	24H	168H
S/N 1	140	138,48	139,55	138,41	138,79	139,1	140
S/N 2	131,78	136,12	140	137,41	97,71	110,25	120,9
S/N 3	139,28	140	129,12	118,24	85,94	106,39	113,72
S/N 4	134,18	136,19	140	132,15	86,88	109,22	119,26
S/N 5	138,31	139,48	140	128,88	88,38	107,84	117,1
MIN LIMIT	110	110	110	110	110	110	110