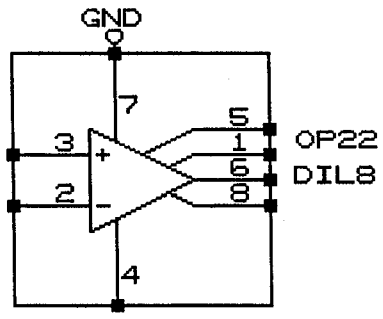
Tecnologica	**TOTAL DOSE RADIATION TEST REPORT No. HUY-RR-TL-042**	Issue: 1 Rev.: Date: 01/02/95 Page: 1/14

SCC Component No.: **HUYTL2802B**	Component Designation: **OP22AZ**	Irradiation Spec. No.: **ESA/SCC 22900 Iss. 3**
Gen. Spec.: **SCC 9000 Iss.8** Det. Spec.: **HUY-SP-TL-028 2A** Amend.:	Evaluation: - Acceptance Difussion: - Acceptance Lot: **X**	Project/Programme: **HUYGENS**
Family: **08** / Group: **09**	Functional Assignment: **PROG. μPOWER OPERATIONAL AMP.**	Package: **DIL-8**
Manuf.Name: **A.D./P.M.I.** Address: **SANTA CLARA (USA)**	Irradiation Facility: **CIEMAT** Address: **MADRID (SPAIN)**	Test House: **CIEMAT** Address: **MADRID (SPAIN)**
Radiation Test Plan No.: **HUY-IP-TL-028**	Sample Size: **4** Irradiation Devices: **3** Control Devices: **1**	Date Code: **9403A** Diffusion LOT: **H8014501** Wafer N°: **2**
Radiation Source: **Cobalt-60**	Energy: **1,33/1,17 MeV** Average Dose Rate: **10,075 Rad/h**	Date of Test: **01/95**

Electrical Measurements. Parameters Tested:
Input offset Voltage (V_{OS}), Input Offset Current (I_{OS}), Input Bias Current (I_B), Common Mode Rejection Ratio (CMRR), Power Supply Rejection Ratio (PSRR), Large Signal Voltage Gain (A_{VO}), Output Voltage Swing (V_O+ & V_O-) and Supply Current (I_{SY}).

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

Figure 1:



Irradiat. Respons.: J.M. VALVERDE Date: 01/02/95 Signature:	Electr. Test Resp.: J.A VAQUERO Date: 01/02/95 Signature:	Approved by QA: I. ALARCÓN Date: 08/02/95 Signature:

SUMMARY

Total dose steady-state irradiation test has been carried out on **PROG. μPOWER OPERATIONAL AMPLIFIER OP22AZ** from **ANALOG DEVICES** date code 9403A, diffusion lot H8014501 and wafer n° 2. The irradiated parts were labelled as follows: R2= S/N 64, R3= S/N 65, R4= S/N 66, irradiation devices and R1= S/N 67 control device.

DEVIATIONS TO THE PLAN

Due to the results of the evaluation, in order to characterize better the lot, irradiation test has been performed at 6.7, 10, 13.3 and 20 Krads.

RESULTS

The next table shows a results resume of the irradiation test:

	00 KRAD	6,7 KRAD	10 KRAD	13,3 KRAD	20 KRAD	ANN48	ANN168
VOS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
IOS	PASS	PASS	PASS	PASS	PASS 2 FAIL 1	PASS 2 FAIL 1	PASS 2 FAIL 1
IB	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL
CMRR	PASS	PASS	PASS	PASS	PASS 1 FAIL 2	PASS 1 FAIL 2	PASS 1 FAIL 2
PSRR	PASS	PASS	PASS	PASS	PASS	PASS	PASS
AVO	PASS	PASS	FAIL	FAIL	FAIL	FAIL	FAIL
VO+	PASS	PASS	PASS	PASS	PASS	PASS	PASS
VO-	PASS	PASS	PASS 1 FAIL 2	FAIL	FAIL	FAIL	FAIL
ISY	PASS	PASS	PASS	PASS	PASS	PASS	PASS

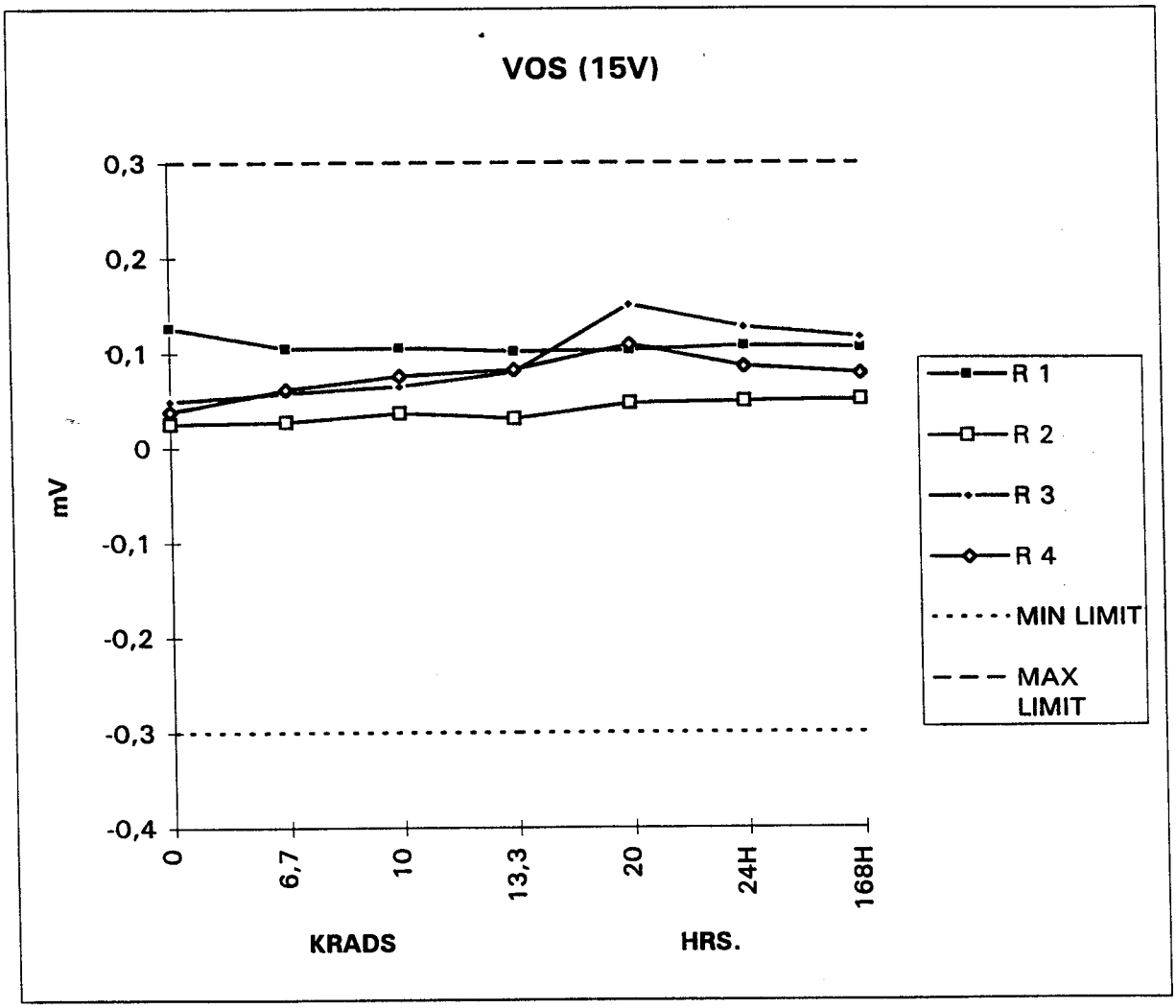
CONCLUSION

The results indicates that:

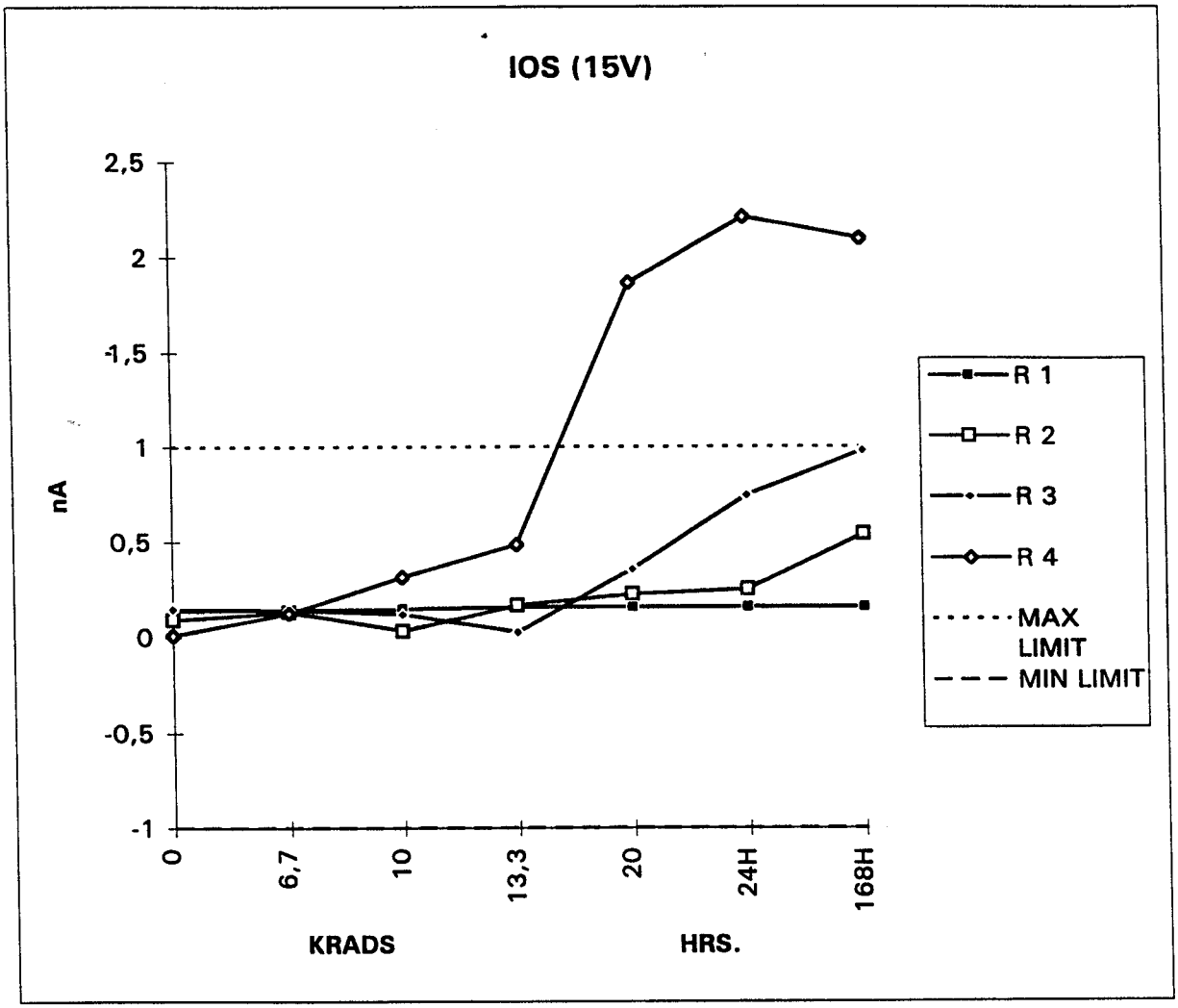
- One device (R2) fails in input offset current measurements at 20 Krads. It recover slightly during the annealing.
- All devices fail in input bias current at 10 Krads and recover during the annealing.
- Negative output voltage fails in all devices beetwen 6.7 and 13.3 Krads, reaching values about -8 V at 20 Krads.
- Open loop gain measurements fails at 10 KRads in all devices. This failure is due to the limit in the negative output voltage. After last annealing was measured again with the condition $V_{OUT} = \pm 5V$, resulting a value within spec.
- Common Mode Reflection Ratio fails at 20 Krads with a little significant desviation.
- All the other measurements remains under specs during all the irradiation test.

Test Step	Description	Result or Actual Test Condition	Time in	Time Out	Exposure
1	Sample serialization	CONTROL R1. IRR. DEVICES R2,R3,R4.			
2	Initial Electrical Measurements	See 0 krad(Si) values in respective Parameter Data Tables Temperature: 14.9°C Humidity = 38.5%	10:00 19/01	10:10 19/01	10 min.
3	Set-up of Test	Bias circuit verified according to Fig. 1			
4	Irradiation Exposure	Dose: 6.579 Krad(Si) Cumulative Dose: 6.579 Krad(Si) Dose Rate: 9,869 Rad(Si)/h Temperature: 16.3°C	10:15	10:55	40 min.
5	Intermediate Electrical Measurements	See 6,7 krad(Si) values in respective Parameter Data Tables Temperature: 15.7°C Humidity: 45%	11:00	11:15	10 min.
6	Set-up of Test	Bias circuit verified according to Fig. 1			
7	Irradiation Exposure	Dose: 3.370 Krad(Si) Cumulative Dose: 9,949 krad(Si) Dose Rate: 10,109 Rad(Si)/h Temperature: 17.65°C	11:20	11:40	20 min.
8	Intermediate Electrical Measurements	See 10 krad(Si) values in respective Parameter Data Tables Temperature: 16.5 °C Humidity: 45%	11:45	11:55	10 min.
9	Set-up of Test	Bias circuit verified according to Fig. 1			
10	Irradiation Exposure	Dose: 3.321 Krad(Si) Cumulative Dose: 13.270 krad(Si) Dose Rate: 9,964 Rad(Si)/h Temperature: 17.6°C	12:00	12:20	20 min.
11	Intermediate Electrical Measurements	See 13.3 Krad(Si) values in respective Parameter Data Tables Temperature: 17.7°C Humidity: 44.3%	12:30	12:45	20 min.

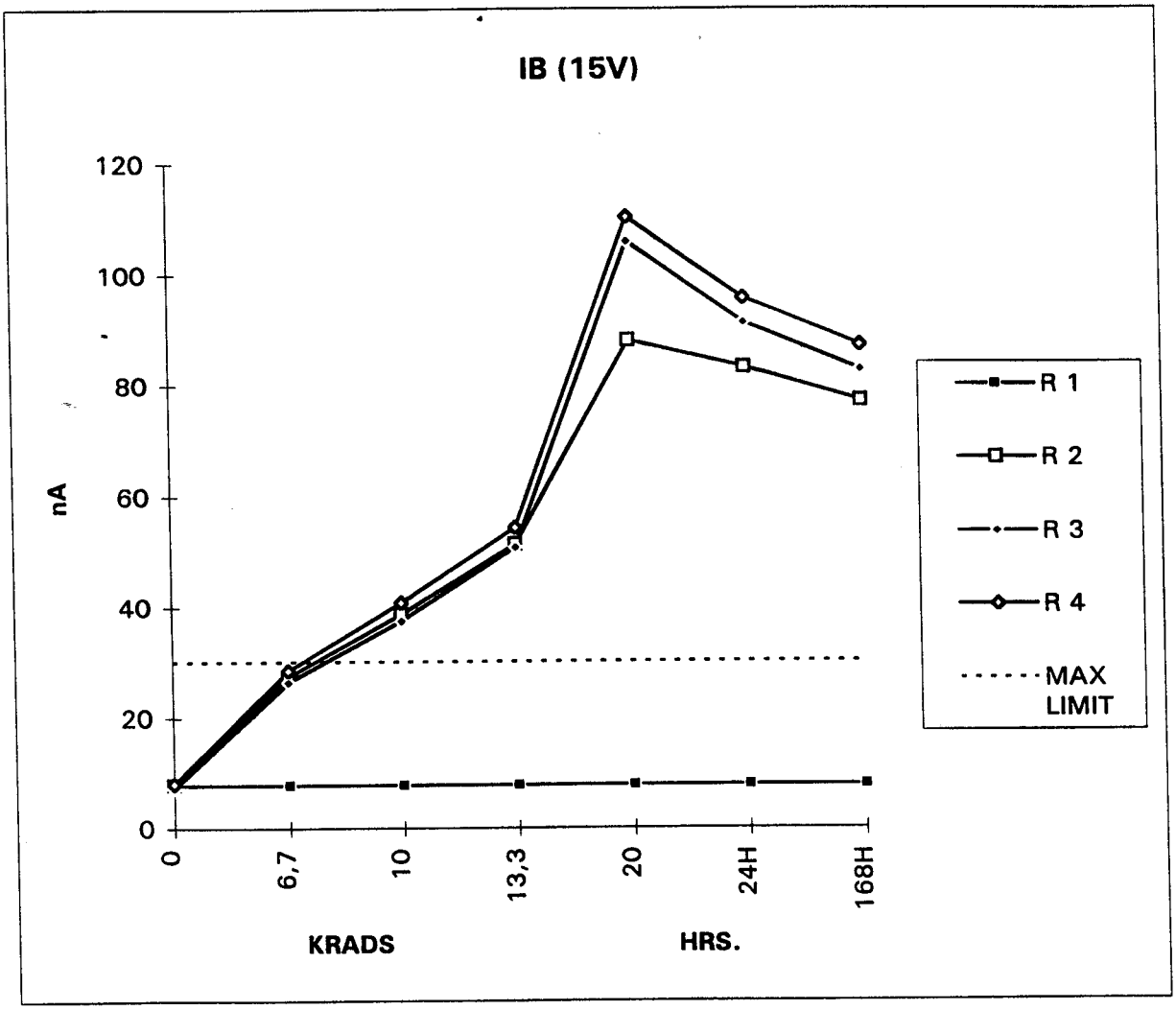
Test Step	Description	Result or Actual Test Condition	Time in	Time Out	Exposure
12	Set-up of Test	Bias circuit verified according to Fig. 1			
13	Irradiation Exposure	Dose: 6.754 Krad(Si) Cumulative Dose: 20.024 Krad(Si) Dose Rate: 10,131 Rad(Si)/h Temperature: 18.5°C	12:50	13:30	40 min.
14	Intermediate Electrical Measurements	See 20 Krad(Si) values in respective Parameter Data Tables Temperature: 19.1°C Humidity: 40,1%	13:40	13:55	15 min.
15	Annealing	Bias circuit verified according to Fig. 1. Temperature: 23°C (average)	13:55	13:55 20/01	24h
16	Electrical Measurements	See 24 h values in respective Parameter Data Tables Temperature: 24.6°C Humidity: 32.8%	14:00 20/01	14:15 20/01	15 min.
17	Annealing	Bias circuit verified according to Fig. 1. Temperature: 26°C	14:15 20/01	14:15 27/01	168 h
18	Electrical Measurements	See 168 h values in respective Parameter Data Tables Temperature: 25°C Humidity: 33%	14:00 27/01	14:15 27/01	15 min.



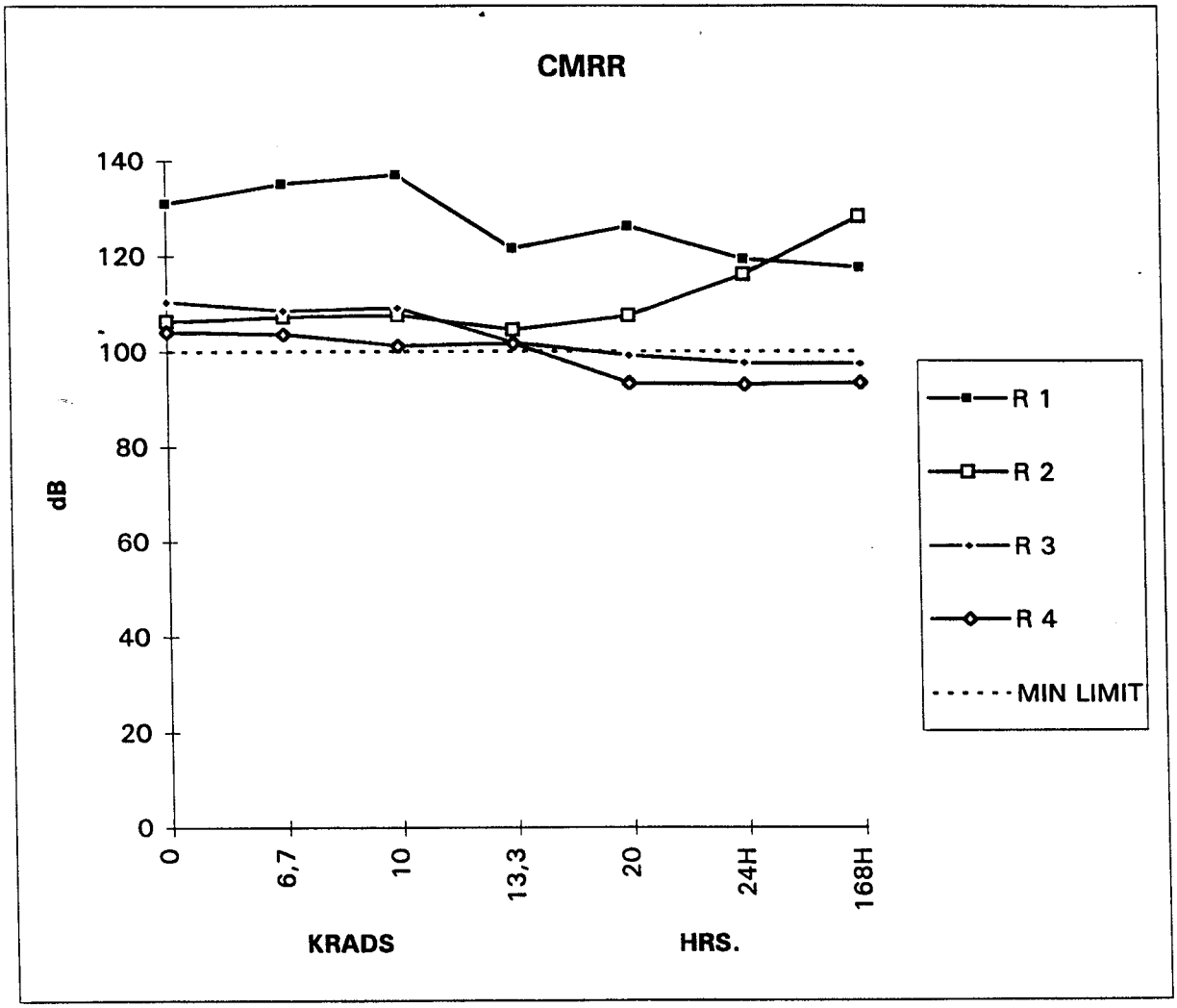
VOS (15V)	0	6,7	10	13,3	20	24H	168H
R 1	0,126	0,104	0,105	0,101	0,102	0,107	0,105
R 2	0,025	0,027	0,036	0,03	0,046	0,048	0,05
R 3	0,049	0,057	0,064	0,079	0,15	0,126	0,116
R 4	0,038	0,061	0,075	0,082	0,108	0,085	0,078
MAX LIMIT	0,3	0,3	0,3	0,3	0,3	0,3	0,3
MIN LIMIT	-0,3	-0,3	-0,3	-0,3	-0,3	-0,3	-0,3



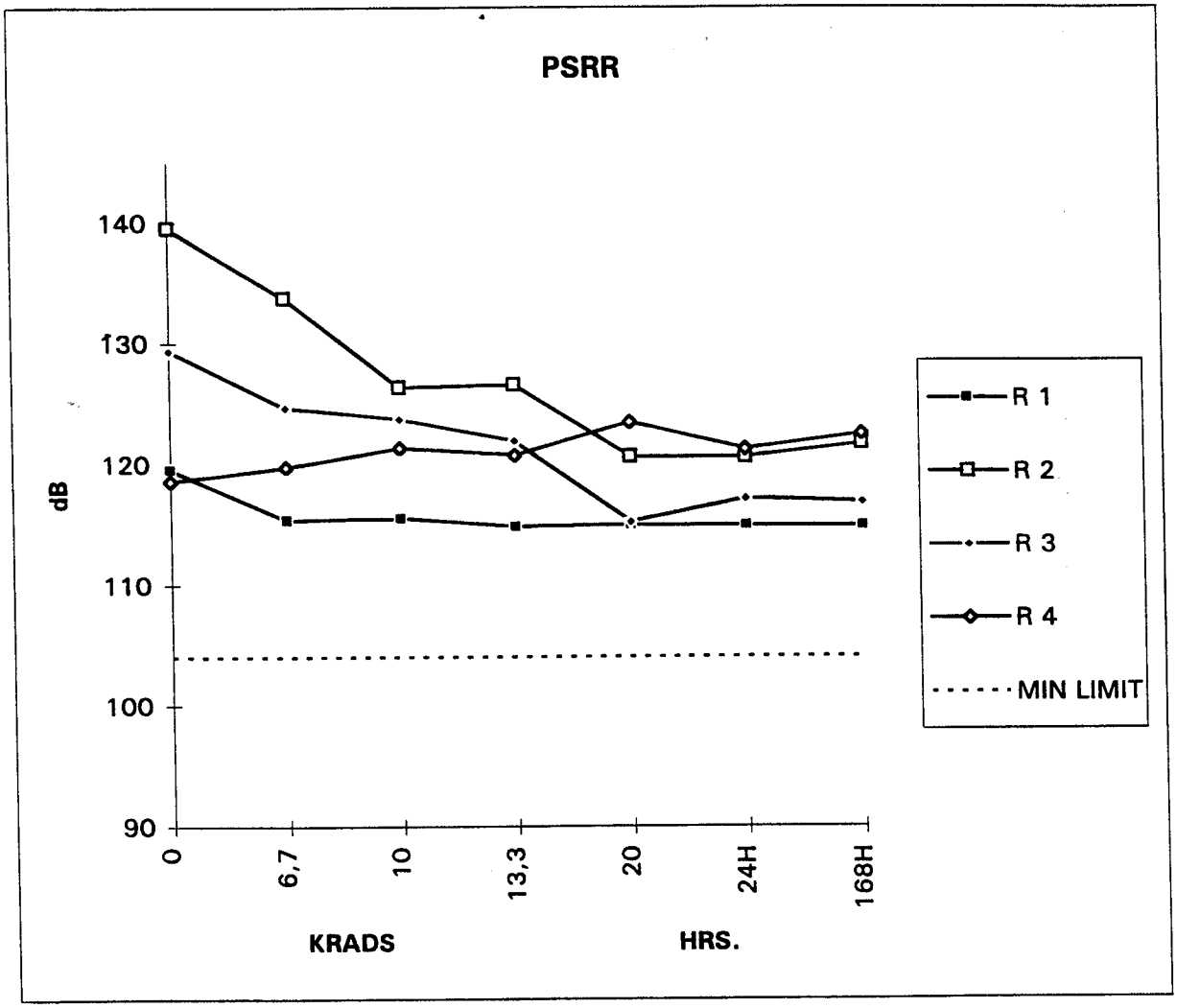
IOS (15V)	0	6,7	10	13,3	20	24H	168H
R 1	0,139	0,147	0,15	0,16	0,159	0,158	0,159
R 2	0,091	0,135	0,034	0,17	0,226	0,251	0,541
R 3	0,149	0,144	0,122	0,026	0,36	0,746	0,979
R 4	0,011	0,126	0,316	0,486	1,867	2,214	2,101
MIN LIMIT	-1	-1	-1	-1	-1	-1	-1
MAX LIMIT	1	1	1	1	1	1	1



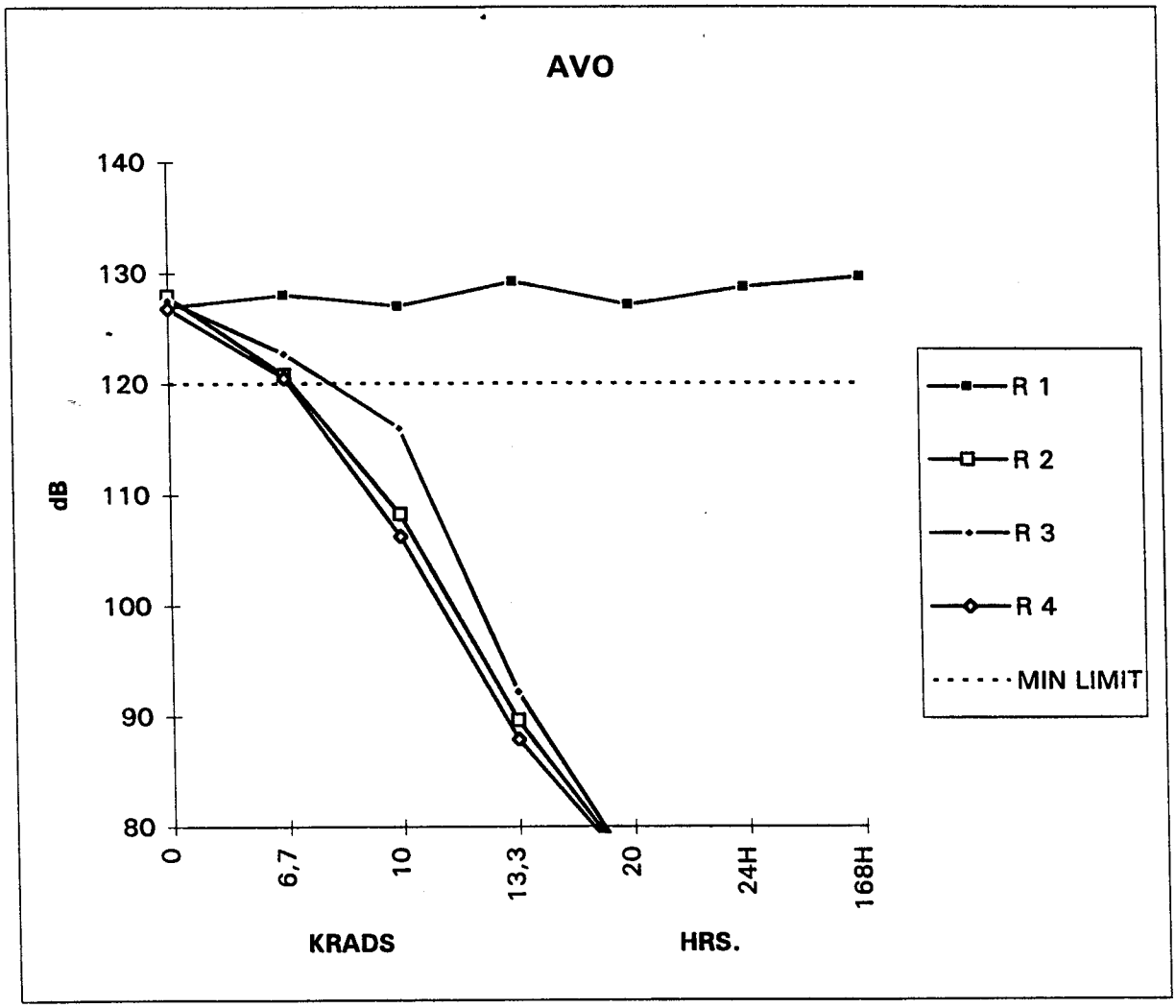
IB (15V)	0	6,7	10	13,3	20	24H	168H
R 1	7,79	7,77	7,76	7,69	7,71	7,68	7,7
R 2	7,79	27,34	38,69	51,17	87,95	83,1	77,11
R 3	7,33	26,43	37,39	50,62	105,87	91,19	82,69
R 4	8,06	28,43	40,79	54,19	110,31	95,65	87,15
MAX LIMIT	30	30	30	30	30	30	30



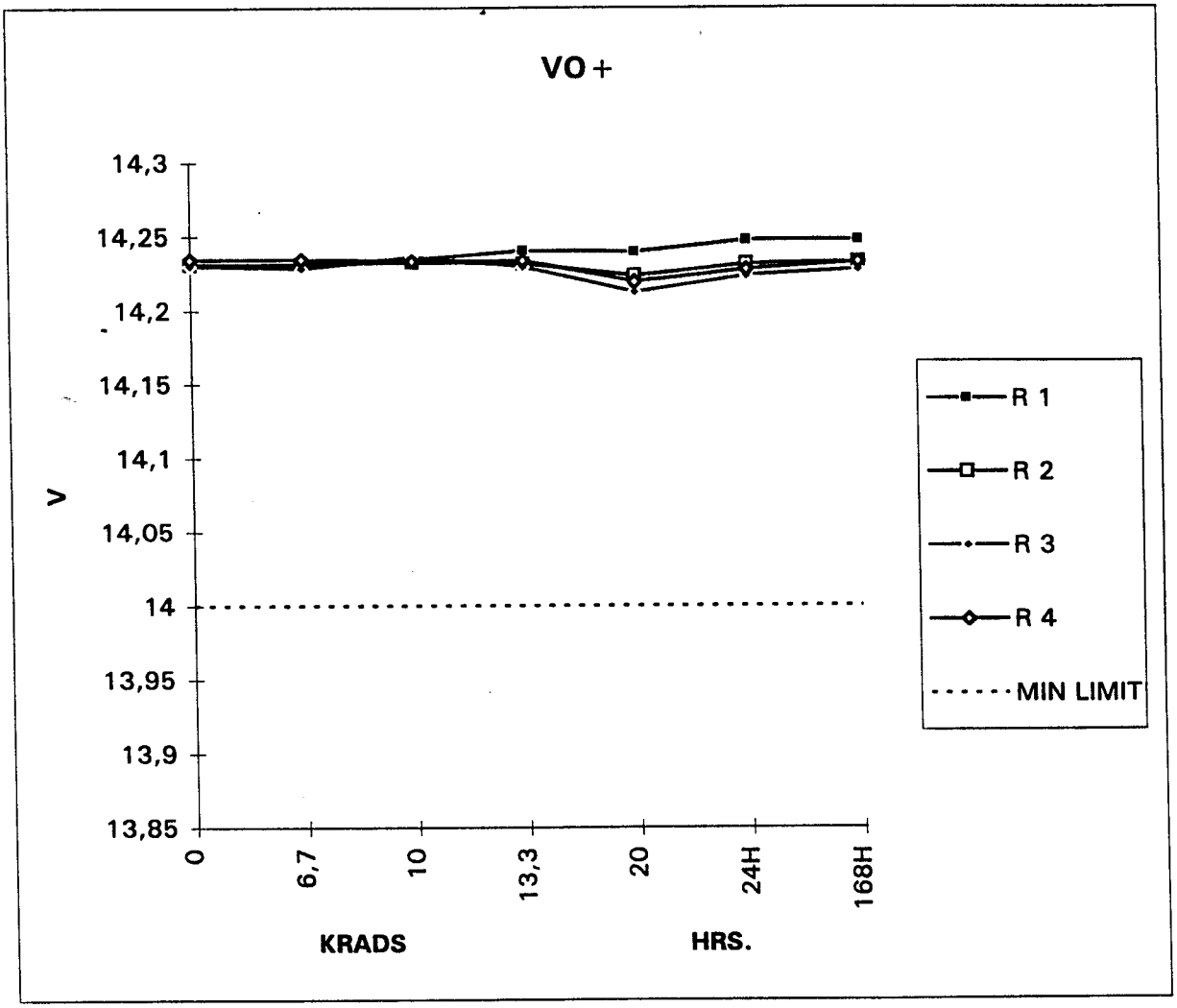
CMRR	0	6,7	10	13,3	20	24H	168H
R 1	131	135,1	137,1	121,5	126,2	119,2	117,5
R 2	106,2	107,2	107,5	104,4	107,4	116	128,3
R 3	110,4	108,5	109,1	101,8	99,1	97,5	97,4
R 4	104,1	103,5	101,1	101,6	93,3	93	93,4
MIN LIMIT	100	100	100	100	100	100	100



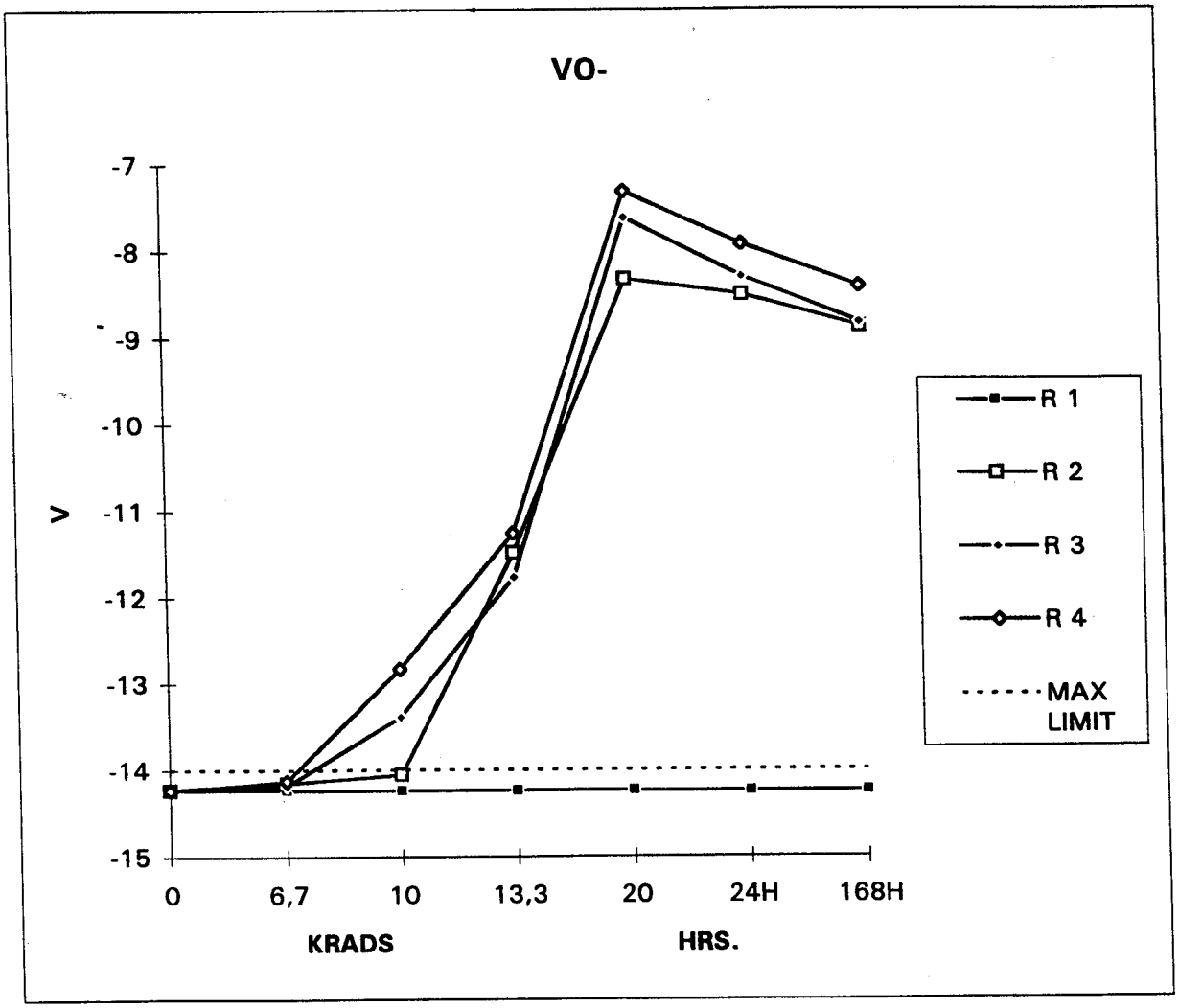
PSRR	0	6,7	10	13,3	20	24H	168H
R 1	119,54	115,33	115,5	114,8	114,97	114,9	114,86
R 2	139,53	133,71	126,34	126,54	120,61	120,56	121,65
R 3	129,37	124,64	123,7	121,89	115,18	117,11	116,83
R 4	118,59	119,73	121,3	120,7	123,47	121,2	122,47
MIN LIMIT	104	104	104	104	104	104	104



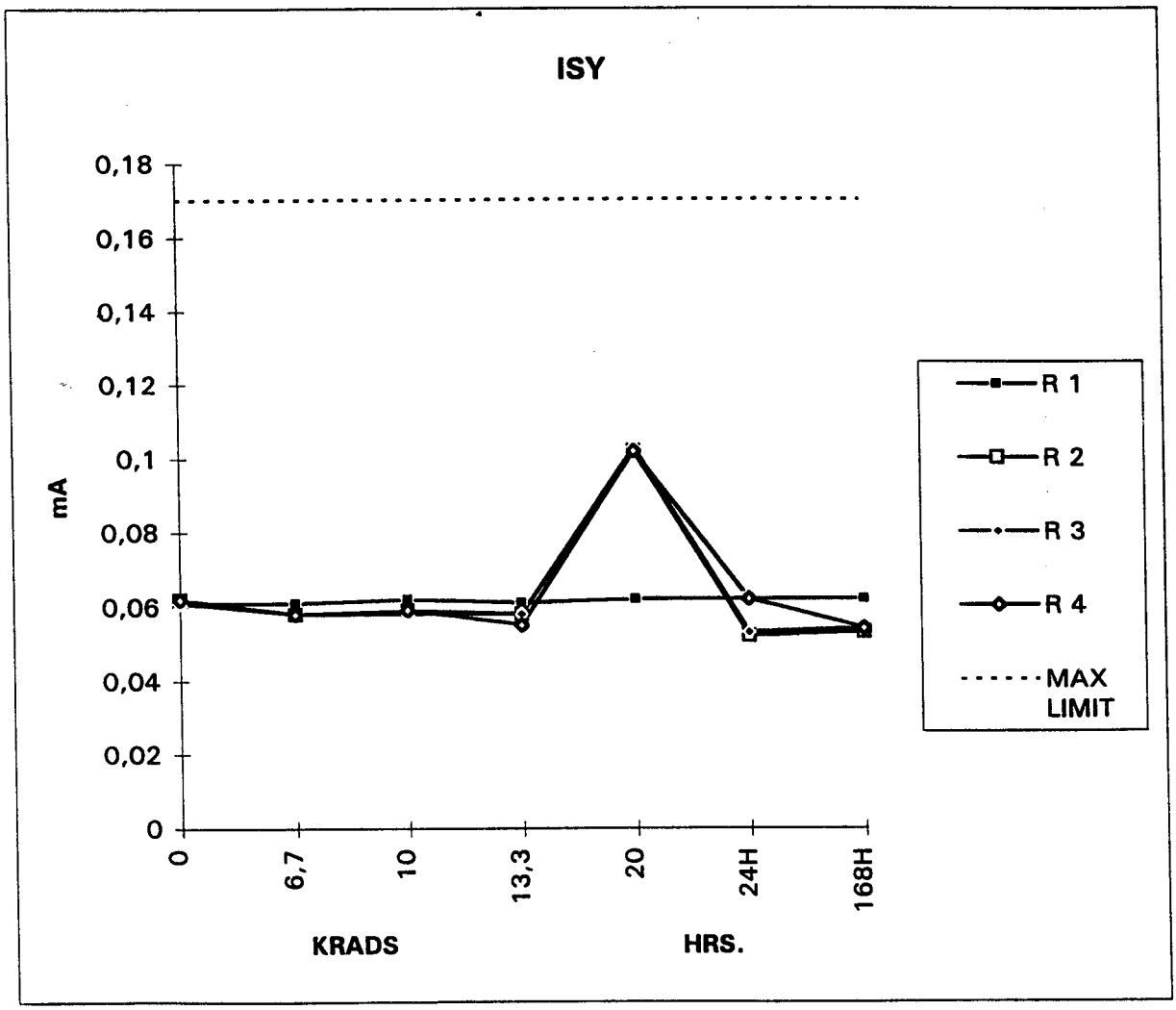
AVO	0	6,7	10	13,3	20	24H	168H
R 1	126,9	128	127	129,2	127,1	128,7	129,6
R 2	127,9	120,8	108,2	89,6	< 75,7	< 75,7	< 75,7
R 3	127,5	122,7	116	92,2	< 75,6	< 75,6	< 75,6
R 4	126,8	120,5	106,2	87,9	< 75,6	< 75,6	< 75,6
MIN LIMIT	120	120	120	120	120	120	120



VO+	0	6,7	10	13,3	20	24H	168H
R 1	14,23	14,231	14,234	14,24	14,239	14,247	14,247
R 2	14,231	14,231	14,232	14,231	14,223	14,231	14,232
R 3	14,23	14,228	14,236	14,229	14,212	14,223	14,227
R 4	14,234	14,234	14,233	14,233	14,219	14,227	14,232
MIN LIMIT	14	14	14	14	14	14	14



VO-	0	6,7	10	13,3	20	24H	168H
R 1	-14,231	-14,233	-14,235	-14,24	-14,24	-14,246	-14,246
R 2	-14,23	-14,15	-14,056	-11,496	-8,334	-8,516	-8,885
R 3	-14,238	-14,18	-13,385	-11,773	-7,62	-8,302	-8,834
R 4	-14,232	-14,122	-12,832	-11,266	-7,317	-7,934	-8,42
MAX LIMIT	-14	-14	-14	-14	-14	-14	-14



ISY	0	6,7	10	13,3	20	24H	168H
R 1	0,061	0,061	0,062	0,061	0,062	0,062	0,062
R 2	0,062	0,058	0,059	0,058	0,102	0,052	0,053
R 3	0,061	0,058	0,058	0,058	0,103	0,053	0,054
R 4	0,062	0,058	0,059	0,055	0,102	0,062	0,054
MAX LIMIT	0,17	0,17	0,17	0,17	0,17	0,17	0,17