Irradiation Test
Report
COTS parts

Total Ionization Dose (TID)

Reference no.:	KN-DLR-TID-250214-02B
Dose Rate:	0.01 - 0.1 rad (Si) / s

Device Under Test (DUT)

Part:	LTC6244
Description:	Dual Low Noise Rail to Rail OPAMP
Factory:	Linear Technology Corporation
Date Code (DC):	0630

Performed by Spectrum ARC GmbH

Prepared by:	Dr. Michael Schlüter
Checked by:	Radiation team
Date:	04.08.2015

Report

TABLE OF CONTENT

1. OVERVIEW

1.1. PURPOSE

Report:	Irradiation test report for information only
Effect:	Total Ionizing Dose (TID)
Test specification:	ESCC-22900
Customer:	KN / DLR

1.2. DUT / SAMPLE

Part:	LTC6244
Description:	Dual Low Noise Rail to Rail OPAMP
Factory:	Linear Technology Corporation
Technology:	CMOS
Detail specification:	data sheet
Qual. Level:	COTS
Date Code no.:	0630
Lot no.:	not provided by customer
Device marking:	not provided by customer
Package:	16-SSOP
Quantity:	11 (1 reference & 10 irradiated: 5 on, 5 off)
Serial no.:	not provided by customer

1.3. ELECTRICAL MEASUREMENTS

Test hardware:	UNIMET M3000
Electrical parameters:	20 parameters, e.g. supply current, offset voltage, offset current, bias current, CCMR, slew rate, large signal gain, output swing See chapter 5

1.4. IRRADIATION

Date:	03.04.2015 - 30.04.2015
Irradiation source:	Co-60 gamma ray (1,3 MeV), see chapter 4
TID rate:	0.01 and 0.1 rad (Si) / s
TID final:	65 krad (Si)
TID steps:	8 (no. of irradiation steps only). See chapter 3
Bias condition:	ON/OFF-Mode. See chapter 4

1-5. TEMPERATURE

Irradiation test:	19.6 ± 0.3 °C
Annealing I & II:	20 ± 2 °C & 100 ± 2 °C respectively

1.6. RESULTS

Summary:	an comparative analysis of all tested parameters in chapter 2
Measurement details:	incl. Statistical analysis for each parameter in chapter 6

2. TEST RESULTS SUMMARY

2.1. ABSTRACT

A Total Ionizing Dose (TID) test with a dose rate of 0.01 rad/s (steps 1 to 6) followed by 0.1 rad/s (steps 7 and 8) has been done in order to verify the electrical behavior of the LTC6244 from Linear Technologies up to a TID of 65 krad (Si). Accordingly to ESCC-22900 a group of 10 parts (5 biased on, 5 biased off) have been irradiated and electrical measurements have been performed at 8 intermediate TID values. Finally post-irradiation aging effects can be analyzed after successive annealing* done at 20°C (24 hours) and 100°C (7 days).

2.2. RESULTS

One part **fail completely** after step 4, i.e. between **11.24 and 14.35 krad (Si).**
Some parameters were out of spec even before irradiation test. Discarding the only non-functional part, all other parameters except Is, CMRR1&2 and SR show degradation. Most parameters show a strong degradation after step 6.

To evaluate the TID degradation (if any) four index levels have been introduced:

(A) OK, no significant changees (<10%):	all parts	infill:	
(B) Degradation within specification Min-Max:	at least one part	infill:	
(C) Out of specification:	at least one part	infill:	
(D) No functionality:	at least one part	symbol:	X

The table below summarizes the TID tolerances of all parameters according to the index level definition. The right column shows the worst case (wc) index level.

no.	Parameter	mode	Step										WC index
			0	1	2	3	4	5	6	7	8	9	10	
1	I_s^+	on						X	X	X	X	X	X	D
		off												A
2	I_s^-	on						X	X	X	X	X	X	D
		off												A
3	$V_{OS,1}$	on						X	X	X	X	X	X	D
		off												C
4	$I_{B,1}$	on						X	X	X	X	X	X	D
		off												A
5	$I_{OS,1}$	on						X	X	X	X	X	X	D
		off												A
6	$CMRR_1$	on						X	X	X	X	X	X	D
		off												A
7	SR^+_1	on						X	X	X	X	X	X	D
		off												A
8	SR^-_1	on						X	X	X	X	X	X	D
		off												A
9	$A_{VO,1}$	on						X	X	X	X	X	X	D
		off												C
10	$V^+_{O,1}$	on						X	X	X	X	X	X	D
		off												C
11	$V^-_{O,1}$	on						X	X	X	X	X	X	D
		off												C
12	$V_{OS,2}$	on						X	X	X	X	X	X	D
		off												C
13	$I_{B,2}$	on						X	X	X	X	X	X	D
		off												A
14	$I_{OS,2}$	on						X	X	X	X	X	X	D
		off												A
15	$CMRR_2$	on						X	X	X	X	X	X	D
		off												A
16	SR^+_2	on						X	X	X	X	X	X	D
		off												A
17	SR^-_2	on						X	X	X	X	X	X	D
		off												A
18	$A_{VO,2}$	on						X	X	X	X	X	X	D
		off												C
19	$V^+_{O,2}$	on						X	X	X	X	X	X	D
		off												C
20	$V^-_{O,2}$	on						X	X	X	X	X	X	D
		off												C

Note: Annealing values are for information purposes only and not a criteria for a Lot acceptance test.

3. TEST SCHEDULE

- Test start time (incl. preliminary measurements): 2015-04-03 15:20 CEST
- Test finish time: 2015-05-08 15:00 CEST

3.1. IRRADIATION

- Irradiation start time: 2015-04-03 15:20 CEST
- Irradiation stop time: 2015-04-30 13:16 CEST

TID rate: 0.01 rad / s

TID rate: 0.1 rad / s

Temperature during irradiation: 19.6 ± 0.3 °C

										Unit
Step no.	0	1	2	3	4	5	6	7	8	-
TID	**0**	**3.39**	**5.67**	**8.92**	**11.24**	**14.35**	**16.74**	**48.81**	**64.75**	krad(Si)
Dose step	3.391	2.277	3.247	2.322	3.117	2.381	32.077	15.940		krad(Si)
Rad-time	4:01:06	2:18:14	3:22:58	2:20:03	3:19:41	2:22:49	03:20:24	01:21:55		d:h:m *
M-time	n.a.	1:22	1:52	1:40	1:40	2:06	2:32	1:55	n.a.	h:m *

The Rad-time is the irradiation exposition time.

The M-time is the irradiation break time between irradiation steps due to electrical measurements.

n.a.: not applicable

3.2. ANNEALING

Annealing start time: 2015-04-30 13:16 CEST

Annealing stop time: 2015-05-08 15:00 CEST

Final accumulated TID is: 65 krad(Si)

No more irradiation

			Unit
Step no.	9	10	-
Temperature	**20 ± 2**	**100 ± 2**	°C
Ann-time	1:00:02	7:00:11	d:h:m *
M-time	1:21	1:37	h:m *

The Ann-time is the annealing time.

The M-time is the break time due to electrical measurements.

Note:

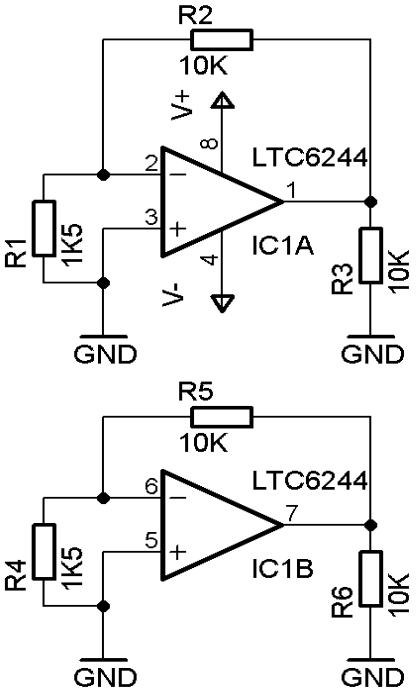
*) The time is measured in days (d), hours (h) and minutes (m).

4. TEST CONDITIONS

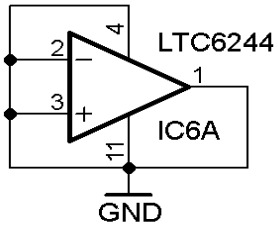
4.1. BIAS CONDITIONS

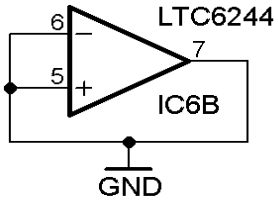
The following bias configuration were used during Irradiation and Annealing.
5 parts were biased in static ON mode and 5 parts were biased in static OFF mode.

ON mode



OFF mode

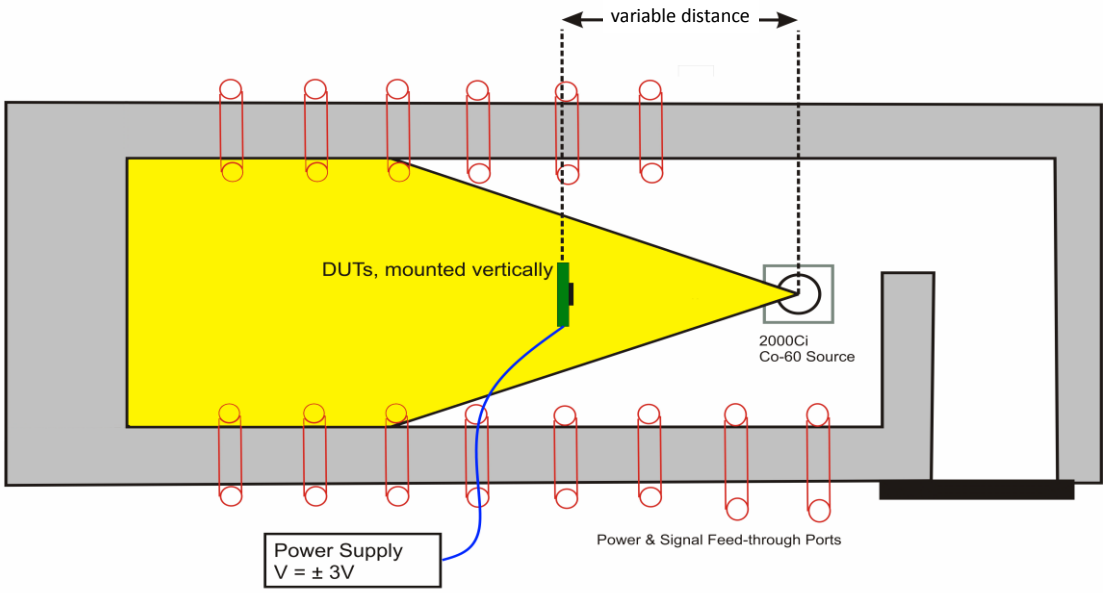




V+ = 3V
V- = -3V
GND = 0V

T = 20°C

4.2. IRRADIATION CONDITIONS



The figure above shows the irradiation configuration. The 10 irradiated devices, referred to as DUT, were soldered onto small adapter boards for easy exchangability during testing. A large PCB, referred to as biasing board, is populated with the on mode resistors, 4mm sockets for power, and pin headers to connect to the adapter boards.
All biasing boards are mounted vertically on a wooden board with the devices facing the Cobalt-60 source.
The distance between the irradiator and the DUTs has been changed in order to establish a dose rate of 0.01 rad/s during steps 1 to 6 followed by 0.1 rad/s for the steps 7 and 8.
The DUTs in on mode are connected to a high precision power supply (HAMEG HMP4040)

Irradiator (details see annex):

4.3. ANNEALING CONDITIONS

- **Annealing I:** Biasing as indicated above during 24 hours at 20 ± 2 °C. Temperature regulated via room air conditioning (room temperature).
- **Annealing II:** Biasing as indicated above during 7 days at 100 ± 2 °C. Temperature electronically regulated in a oven.

5. TESTED PARAMETERS

All electrical measurements were made within 2 hours after termination of the irradiation step (ESCC-22900).

Following electrical measurements have been tested accordingly to the test plan provided by the customer:

no.	Parameter name	Symbol	Test conditions	Min	Max.	Unit
1	Positive Supply Current	I_S^+	V^+ = 5V; V^- = 0V	0	14.8	mA
2	Negative Supply Current	I_S^-	V^+ = 5V; V^- = 0V	0	14.8	mA
3	Offset Voltage of Amplifier 1	$V_{OS,1}$	V^+ = 5V; V^- = 0V	-0.1	0.1	mV
4	Input Bias Current of Amplifier 1	$I_{B,1}$	V^+ = 5V; V^- = 0V	-0.075	0.075	nA
5	Input Offset Current of Amplifier 1	$I_{OS,1}$	V^+ = 5V; V^- = 0V	-0.075	0.075	nA
6	Common Mode Rejection Ratio of Amplifier 1	$CMRR_1$	V^+ = 5V; V^- = 0V	74	-	dB
7	Positive Slew Rate of Amplifier 1	SR^+_1	V^+ = 5V; V^- = 0V	18	-	V/µs
8	Negative Slew Rate of Amplifier 1	SR^-_1	V^+ = 5V; V^- = 0V	18	-	V/µs
9	Large Signal Voltage Gain of Amplifier 1	$A_{VO,1}$	V^+ = 5V; V^- = 0V	109,5*	-	dB
10	Positive Output Voltage Swing of Amplifier 1	$V^+_{O,1}$	V^+ = 5V; V^- = 0V	4.965	-	V
11	Negative Output Voltage Swing of Amplifier 1	$V^-_{O,1}$	V^+ = 5V; V^- = 0V	-	0.035	V
12	Offset Voltage of Amplifier 2	$V_{OS,2}$	V^+ = 5V; V^- = 0V	-0.1	0.1	mV
13	Input Bias Current of Amplifier 2	$I_{B,2}$	V^+ = 5V; V^- = 0V	-0.075	0.075	nA
14	Input Offset Current of Amplifier 2	$I_{OS,2}$	V^+ = 5V; V^- = 0V	-0.075	0.075	nA
15	Common Mode Rejection Ratio of Amplifier 2	$CMRR_2$	V^+ = 5V; V^- = 0V	74	-	dB
16	Positive Slew Rate of Amplifier 2	SR^+_2	V^+ = 5V; V^- = 0V	18	-	V/µs
17	Negative Slew Rate of Amplifier 2	SR^-_2	V^+ = 5V; V^- = 0V	18	-	V/µs
18	Large Signal Voltage Gain of Amplifier 2	$A_{VO,2}$	V^+ = 5V; V^- = 0V	109,5*	-	dB
19	Positive Output Voltage Swing of Amplifier 2	$V^+_{O,2}$	V^+ = 5V; V^- = 0V	4.965	-	V
20	Negative Output Voltage Swing of Amplifier 2	$V^-_{O,2}$	V^+ = 5V; V^- = 0V	-	0.035	V

Notes:

*) The value 300V/mV denoted in the data sheet was converted to dB using the formula 20*log(300,000 V/V)

The device consists of two operational amplifiers with a common power supply. Hence, the op-amp characteristics are provided for each amplifier. The supply currents are provided for the whole device.

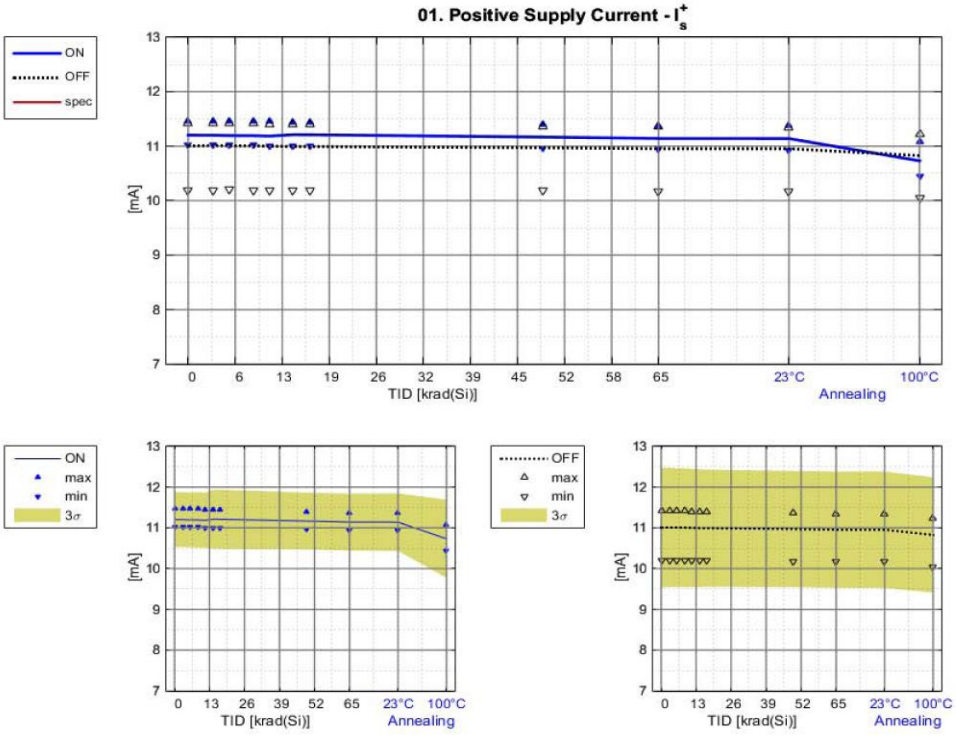
Where applicable, values for operation at T_A = 25°C have been derived from the datasheet.

Ambient temperature during irradiation was 19.6 ± 0.3 °C, ambient temperature during testing was 20 ±1 °C.

The following chapter 6 shows the electrical measurements for each parameter in detail.

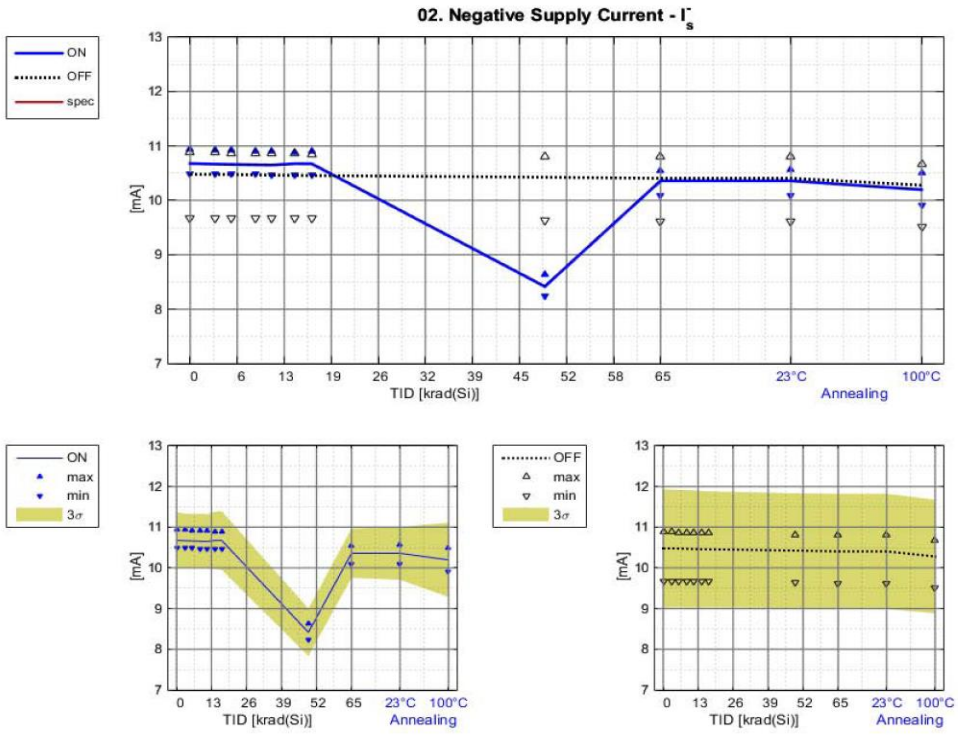
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			1. Positive Supply Current									I_S^+		unit mA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										14.8	mA
			Min										-	mA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	11.429	11.421	11.414	11.420	11.412	11.397	11.398	11.340	11.318	11.312	11.074	mA
		sn2	11.041	11.038	11.032	11.026	11.019	11.007	11.002	10.966	10.947	10.943	10.449	mA
		sn3	11.058	11.056	11.044	11.041	11.036	0.000	0.000	0.000	0.000	0.000	0.000	mA
		sn4	11.467	11.469	11.465	11.463	11.452	11.439	11.439	11.395	11.368	11.373	10.932	mA
		sn5	11.016	11.017	11.018	11.015	11.006	10.998	10.999	10.968	10.935	10.931	10.467	mA
	OFF	sn6	11.028	11.034	11.034	11.030	11.024	11.014	11.015	10.996	10.976	10.978	10.851	mA
		sn7	10.187	10.198	10.199	10.198	10.194	10.193	10.195	10.180	10.163	10.164	10.048	mA
		sn8	11.357	11.369	11.359	11.357	11.346	11.339	11.334	11.315	11.302	11.307	11.175	mA
		sn9	11.037	11.039	11.038	11.033	11.028	11.024	11.026	10.998	10.975	10.971	10.830	mA
		sn10	11.413	11.413	11.411	11.412	11.406	11.399	11.395	11.367	11.351	11.350	11.227	mA
	reference	sn11	9.977	9.975	9.980	9.980	9.967	9.973	9.973	9.968	9.962	9.964	9.968	mA
Statistical analysis [see annex]	ON	Max	11.467	11.469	11.465	11.463	11.452	11.439	11.439	11.395	11.368	11.373	11.074	mA
		Min	11.016	11.017	11.018	11.015	11.006	10.998	10.999	10.966	10.935	10.931	10.449	mA
		Mean	**11.202**	**11.200**	**11.195**	**11.193**	**11.185**	**11.210**	**11.210**	**11.167**	**11.142**	**11.140**	**10.731**	mA
		St. dev	0.225	0.225	0.224	0.228	0.226	0.241	0.242	0.232	0.233	0.235	0.320	mA
		Lmax	11.820	11.816	11.810	11.817	11.805	11.870	11.873	11.804	11.781	11.785	11.608	mA
		Lmin	10.584	10.585	10.579	10.569	10.565	10.551	10.546	10.530	10.503	10.494	9.853	mA
	OFF	Max	11.413	11.413	11.411	11.412	11.406	11.399	11.395	11.367	11.351	11.350	11.227	mA
		Min	10.187	10.198	10.199	10.198	10.194	10.193	10.195	10.180	10.163	10.164	10.048	mA
		Mean	**11.004**	**11.011**	**11.008**	**11.006**	**11.000**	**10.994**	**10.993**	**10.971**	**10.953**	**10.954**	**10.826**	mA
		St. dev	0.490	0.488	0.485	0.485	0.484	0.481	0.479	0.475	0.476	0.476	0.471	mA
		Lmax	12.348	12.348	12.339	12.337	12.326	12.313	12.305	12.273	12.258	12.259	12.119	mA
		Lmin	9.660	9.673	9.678	9.675	9.674	9.675	9.681	9.669	9.649	9.649	9.534	mA



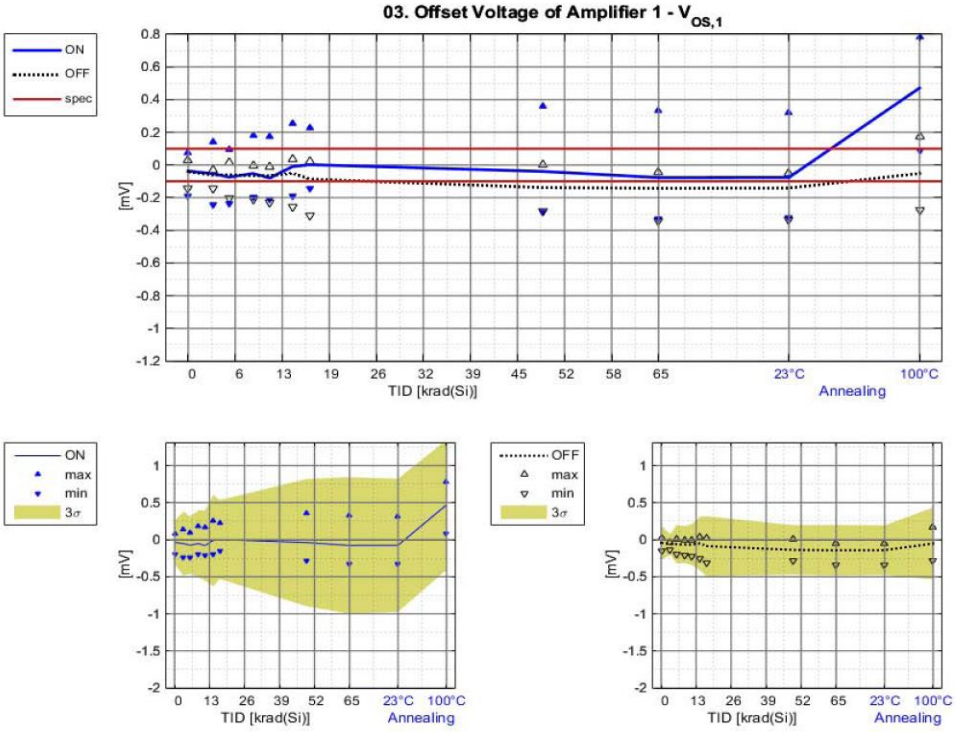
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			2. Negative Supply Current									I_S^-		unit mA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										14.8	mA
			Min										-	mA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	10.914	10.885	10.883	10.884	10.878	10.866	10.862	8.646	10.554	10.568	10.500	mA
		sn2	10.514	10.508	10.497	10.490	10.486	10.474	10.467	8.262	10.080	10.085	9.950	mA
		sn3	10.530	10.524	10.511	10.504	10.500	0.000	0.000	0.000	0.000	0.000	0.000	mA
		sn4	10.941	10.931	10.922	10.913	10.906	10.890	10.898	8.510	10.365	10.289	10.415	mA
		sn5	10.487	10.484	10.491	10.477	10.475	10.465	10.463	8.246	10.437	10.491	9.919	mA
	OFF	sn6	10.502	10.497	10.503	10.495	10.490	10.483	10.474	10.455	10.434	10.431	10.313	mA
		sn7	9.671	9.675	9.673	9.668	9.664	9.664	9.665	9.642	9.620	9.621	9.507	mA
		sn8	10.826	10.825	10.819	10.812	10.805	10.796	10.797	10.763	10.748	10.753	10.622	mA
		sn9	10.508	10.509	10.504	10.499	10.490	10.486	10.489	10.452	10.424	10.425	10.283	mA
		sn10	10.880	10.880	10.874	10.868	10.867	10.861	10.854	10.813	10.800	10.797	10.667	mA
	reference	sn11	9.456	9.464	9.460	9.454	9.450	9.453	9.455	9.452	9.456	9.449	9.457	mA
Statistical analysis [see annex]	ON	Max	10.941	10.931	10.922	10.913	10.906	10.890	10.898	8.646	10.554	10.568	10.500	mA
		Min	10.487	10.484	10.491	10.477	10.475	10.465	10.463	8.246	10.080	10.085	9.919	mA
		Mean	**10.677**	**10.666**	**10.661**	**10.654**	**10.649**	**10.674**	**10.673**	**8.416**	**10.359**	**10.358**	**10.196**	mA
		St. dev	0.229	0.222	0.221	0.224	0.222	0.236	0.240	0.195	0.202	0.217	0.304	mA
		Lmax	11.306	11.274	11.267	11.268	11.258	11.321	11.331	8.951	10.912	10.953	11.030	mA
		Lmin	10.049	10.059	10.054	10.039	10.040	10.026	10.014	7.881	9.806	9.764	9.362	mA
	OFF	Max	10.880	10.880	10.874	10.868	10.867	10.861	10.854	10.813	10.800	10.797	10.667	mA
		Min	9.671	9.675	9.673	9.668	9.664	9.664	9.665	9.642	9.620	9.621	9.507	mA
		Mean	**10.477**	**10.477**	**10.475**	**10.468**	**10.463**	**10.458**	**10.456**	**10.425**	**10.405**	**10.405**	**10.278**	mA
		St. dev	0.484	0.482	0.480	0.480	0.480	0.477	0.475	0.469	0.472	0.472	0.465	mA
		Lmax	11.803	11.798	11.791	11.783	11.778	11.765	11.758	11.711	11.699	11.699	11.554	mA
		Lmin	9.151	9.156	9.158	9.153	9.148	9.151	9.154	9.139	9.111	9.112	9.003	mA



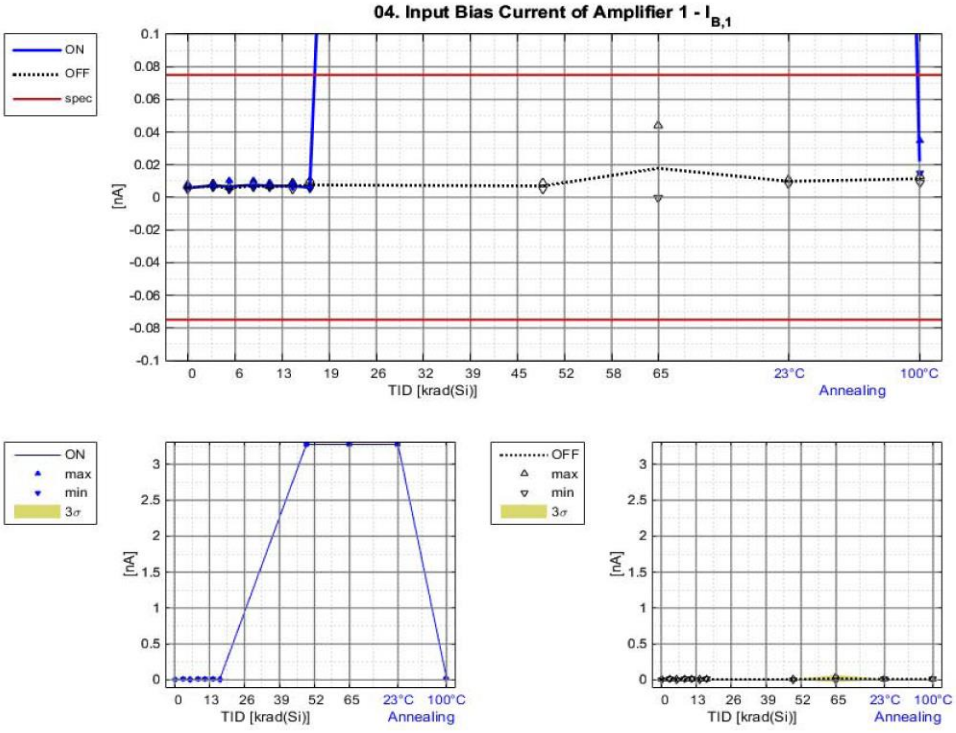
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			3. Offset Voltage of Amplifier 1									$V_{OS,1}$		unit mV
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										0.1	mV
			Min										-0.1	mV
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.074	0.144	0.097	0.184	0.172	0.252	0.230	0.358	0.334	0.320	0.558	mV
		sn2	-0.193	-0.240	-0.165	-0.154	-0.187	-0.156	-0.130	-0.289	-0.293	-0.292	0.786	mV
		sn3	-0.010	-0.013	-0.035	-0.083	-0.151	-3.277	-3.277	-3.277	-3.277	-3.277	-3.277	mV
		sn4	-0.032	-0.017	-0.036	-0.009	-0.025	0.057	0.054	-0.028	-0.021	-0.009	0.455	mV
		sn5	-0.024	-0.141	-0.234	-0.199	-0.207	-0.192	-0.147	-0.199	-0.329	-0.323	0.085	mV
	OFF	sn6	0.029	-0.053	0.007	-0.039	-0.027	-0.055	-0.106	-0.159	-0.123	-0.116	-0.095	mV
		sn7	0.002	-0.032	-0.055	-0.021	-0.052	-0.018	-0.037	-0.189	-0.047	-0.054	0.171	mV
		sn8	0.011	-0.037	0.014	-0.006	-0.012	0.037	-0.003	-0.064	-0.108	-0.102	-0.049	mV
		sn9	-0.102	-0.046	-0.068	-0.051	-0.012	0.037	0.024	0.004	-0.095	-0.098	-0.007	mV
		sn10	-0.146	-0.142	-0.200	-0.210	-0.229	-0.253	-0.311	-0.283	-0.340	-0.336	-0.278	mV
	reference	sn11	-0.062	-0.059	-0.052	-0.054	-0.058	-0.063	-0.057	-0.058	-0.051	-0.058	-0.064	mV
Statistical analysis [see annex]	ON	Max	0.074	0.144	0.097	0.184	0.172	0.252	0.230	0.358	0.334	0.320	0.786	mV
		Min	-0.193	-0.240	-0.234	-0.199	-0.207	-0.192	-0.147	-0.289	-0.329	-0.323	0.085	mV
		Mean	**-0.037**	**-0.053**	**-0.075**	**-0.052**	**-0.080**	**-0.010**	**0.002**	**-0.040**	**-0.077**	**-0.076**	**0.471**	mV
		St. dev	0.097	0.145	0.129	0.150	0.157	0.206	0.177	0.286	0.307	0.299	0.292	mV
		Lmax	0.229	0.345	0.278	0.360	0.352	0.556	0.488	0.745	0.764	0.745	1.272	mV
		Lmin	-0.303	-0.452	-0.427	-0.465	-0.511	-0.575	-0.484	-0.824	-0.918	-0.897	-0.330	mV
	OFF	Max	0.029	-0.032	0.014	-0.006	-0.012	0.037	0.024	0.004	-0.047	-0.054	0.171	mV
		Min	-0.146	-0.142	-0.200	-0.210	-0.229	-0.253	-0.311	-0.283	-0.340	-0.336	-0.278	mV
		Mean	**-0.041**	**-0.062**	**-0.060**	**-0.065**	**-0.066**	**-0.050**	**-0.087**	**-0.138**	**-0.143**	**-0.141**	**-0.052**	mV
		St. dev	0.078	0.045	0.086	0.083	0.092	0.120	0.135	0.111	0.114	0.111	0.162	mV
		Lmax	0.172	0.063	0.176	0.161	0.187	0.278	0.282	0.167	0.170	0.164	0.392	mV
		Lmin	-0.254	-0.187	-0.296	-0.292	-0.320	-0.379	-0.456	-0.444	-0.455	-0.447	-0.495	mV



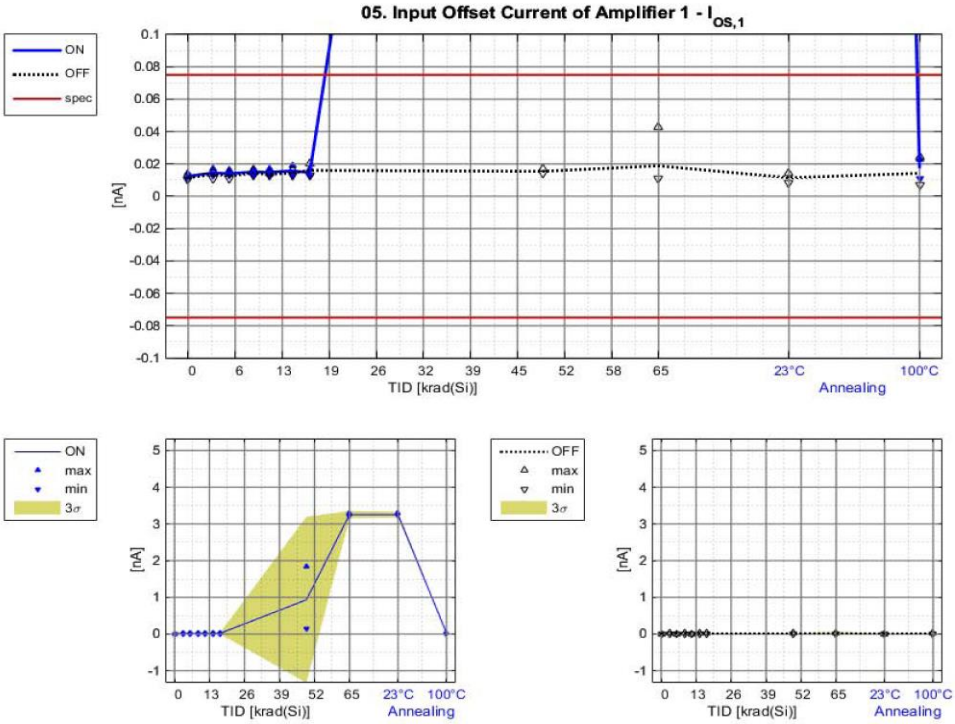
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			4. Input Bias Current of Amplifier 1									$I_{B,1}$		unit nA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										0.075	nA
			Min										-0.075	nA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.008	0.009	0.010	0.010	0.009	0.008	0.007	3.277	3.277	3.277	0.015	nA
		sn2	0.006	0.008	0.006	0.008	0.007	0.007	0.007	3.277	3.277	3.277	0.035	nA
		sn3	0.005	0.007	0.006	0.006	0.007	0.000	0.000	0.000	0.000	0.000	0.000	nA
		sn4	0.005	0.006	0.006	0.007	0.006	0.007	0.005	3.277	3.277	3.277	0.024	nA
		sn5	0.005	0.006	0.005	0.007	0.006	0.006	0.005	3.277	3.277	3.277	0.018	nA
	OFF	sn6	0.006	0.006	0.006	0.006	0.006	0.007	0.007	0.006	0.024	0.008	0.010	nA
		sn7	0.005	0.006	0.005	0.006	0.006	0.005	0.010	0.009	0.000	0.009	0.009	nA
		sn8	0.007	0.007	0.006	0.008	0.007	0.009	0.008	0.008	0.044	0.011	0.013	nA
		sn9	0.006	0.008	0.006	0.008	0.007	0.007	0.006	0.007	0.009	0.010	0.012	nA
		sn10	0.006	0.007	0.006	0.007	0.007	0.006	0.007	0.005	0.012	0.011	0.013	nA
	reference	sn11	0.006	0.006	0.006	0.007	0.006	0.006	0.006	0.006	0.011	0.008	0.006	nA
Statistical analysis [see annex]	ON	Max	0.008	0.009	0.010	0.010	0.009	11.439	11.439	11.395	11.368	11.373	11.074	nA
		Min	0.005	0.006	0.005	0.006	0.006	10.998	10.999	10.966	10.935	10.931	10.449	nA
		Mean	**0.006**	**0.007**	**0.007**	**0.008**	**0.007**	**11.210**	**11.210**	**11.167**	**11.142**	**11.140**	**10.731**	nA
		St. dev	0.001	0.001	0.002	0.002	0.001	0.241	0.242	0.232	0.233	0.235	0.320	nA
		Lmax	0.009	0.011	0.012	0.012	0.010	11.870	11.873	11.804	11.781	11.785	11.608	nA
		Lmin	0.002	0.004	0.001	0.003	0.004	10.551	10.546	10.530	10.503	10.494	9.853	nA
	OFF	Max	0.007	0.008	0.006	0.008	0.007	0.009	0.010	0.009	0.044	0.011	0.013	nA
		Min	0.005	0.006	0.005	0.006	0.006	0.005	0.006	0.005	0.000	0.008	0.009	nA
		Mean	**0.006**	**0.007**	**0.006**	**0.007**	**0.007**	**0.007**	**0.008**	**0.007**	**0.018**	**0.010**	**0.011**	nA
		St. dev	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.002	0.017	0.001	0.002	nA
		Lmax	0.008	0.009	0.007	0.010	0.008	0.011	0.012	0.011	0.064	0.013	0.016	nA
		Lmin	0.004	0.005	0.005	0.004	0.005	0.003	0.003	0.003	-0.029	0.006	0.006	nA



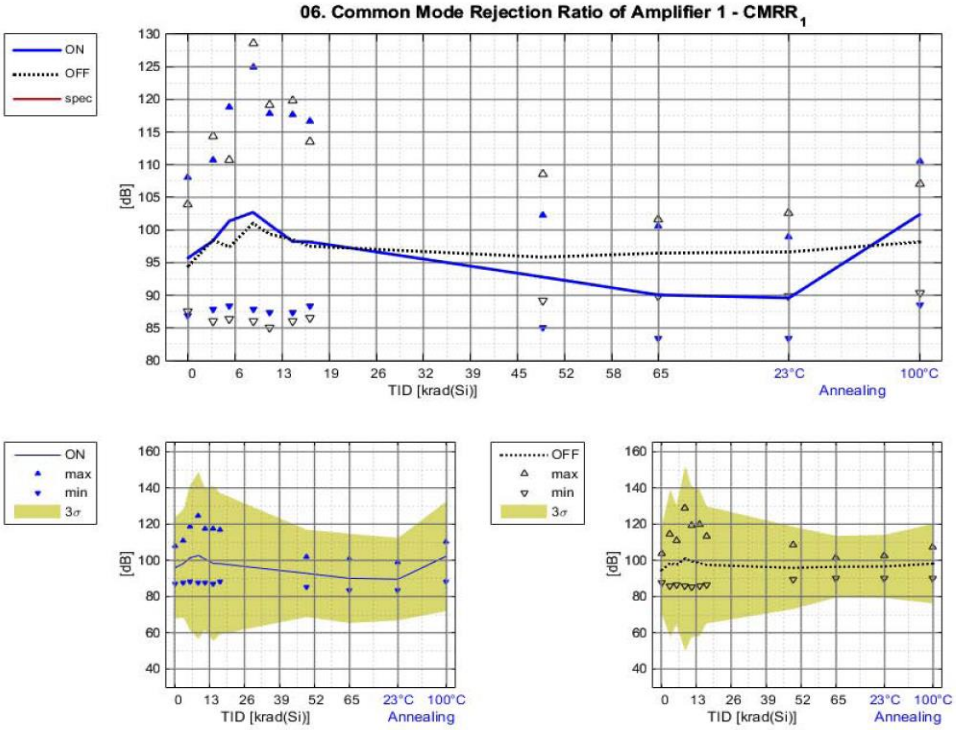
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			5. Input Offset Current of Amplifier 1									$I_{OS,1}$		unit nA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										0.075	nA
			Min										-0.075	nA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.014	0.017	0.016	0.017	0.016	0.019	0.016	1.197	3.212	3.229	0.011	nA
		sn2	0.013	0.016	0.014	0.015	0.017	0.017	0.017	0.133	3.266	3.259	0.023	nA
		sn3	0.012	0.013	0.013	0.014	0.013	0.000	0.000	0.000	0.000	0.000	0.000	nA
		sn4	0.012	0.013	0.014	0.016	0.014	0.014	0.013	0.547	3.245	3.235	0.023	nA
		sn5	0.011	0.013	0.013	0.013	0.014	0.013	0.012	1.853	3.290	3.287	0.016	nA
	OFF	sn6	0.010	0.011	0.011	0.013	0.013	0.013	0.015	0.014	0.015	0.012	0.014	nA
		sn7	0.010	0.012	0.012	0.013	0.013	0.013	0.020	0.017	0.014	0.014	0.024	nA
		sn8	0.012	0.015	0.014	0.015	0.014	0.016	0.016	0.016	0.043	0.013	0.007	nA
		sn9	0.012	0.015	0.013	0.014	0.014	0.016	0.013	0.015	0.011	0.010	0.012	nA
		sn10	0.013	0.015	0.013	0.016	0.014	0.014	0.016	0.015	0.011	0.008	0.014	nA
	reference	sn11	0.011	0.012	0.012	0.012	0.013	0.012	0.013	0.012	0.016	0.015	0.009	nA
Statistical analysis [see annex]	ON	Max	0.014	0.017	0.016	0.017	0.017	0.019	0.017	1.853	3.290	3.287	0.023	nA
		Min	0.011	0.013	0.013	0.013	0.013	0.013	0.012	0.133	3.212	3.229	0.011	nA
		Mean	**0.012**	**0.014**	**0.014**	**0.015**	**0.015**	**0.016**	**0.015**	**0.933**	**3.253**	**3.253**	**0.018**	nA
		St. dev	0.001	0.002	0.001	0.002	0.002	0.003	0.002	0.754	0.033	0.026	0.006	nA
		Lmax	0.016	0.020	0.017	0.019	0.019	0.023	0.021	3.000	3.344	3.325	0.034	nA
		Lmin	0.009	0.009	0.011	0.011	0.010	0.008	0.008	-1.135	3.163	3.180	0.002	nA
	OFF	Max	0.013	0.015	0.014	0.016	0.014	0.016	0.020	0.017	0.043	0.014	0.024	nA
		Min	0.010	0.011	0.011	0.013	0.013	0.013	0.013	0.014	0.011	0.008	0.007	nA
		Mean	**0.011**	**0.014**	**0.013**	**0.014**	**0.014**	**0.014**	**0.016**	**0.015**	**0.019**	**0.011**	**0.014**	nA
		St. dev	0.001	0.002	0.001	0.001	0.001	0.002	0.003	0.001	0.014	0.002	0.006	nA
		Lmax	0.015	0.019	0.016	0.018	0.015	0.019	0.023	0.019	0.056	0.018	0.031	nA
		Lmin	0.008	0.008	0.009	0.011	0.012	0.010	0.009	0.012	-0.019	0.005	-0.003	nA



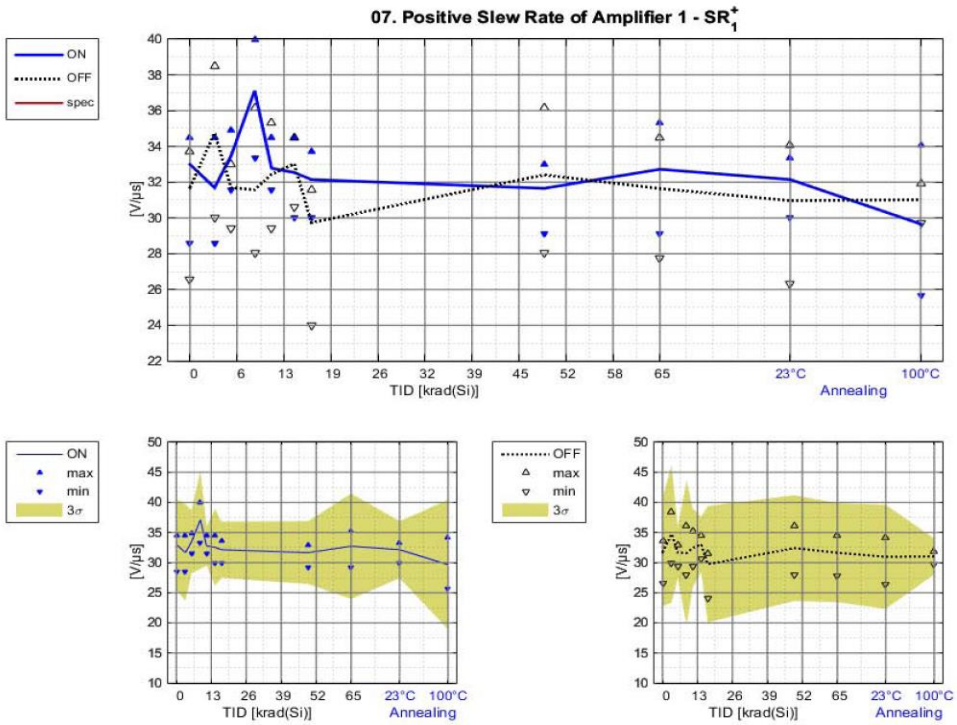
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			6. Common Mode Rejection Ratio of Amplifier 1									$CMRR_1$		unit
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		dB
			Min									74		dB
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	87.530	87.874	88.437	87.799	87.791	87.777	89.557	87.170	83.680	83.373	109.220	dB
		sn2	86.831	89.068	90.288	88.284	87.360	87.336	88.369	85.127	83.366	83.509	88.524	dB
		sn3	108.081	105.561	118.840	124.907	104.931	81.938	81.875	80.971	80.904	80.913	81.777	dB
		sn4	93.923	98.369	98.033	106.626	106.007	100.159	98.154	96.633	100.619	99.022	110.534	dB
		sn5	102.254	110.770	111.308	105.886	117.786	117.745	116.636	102.258	92.560	92.476	101.148	dB
	OFF	sn6	87.528	85.967	86.376	85.989	84.979	86.024	86.539	89.144	89.836	89.788	90.999	dB
		sn7	103.880	114.292	107.565	105.854	107.937	103.047	113.537	93.542	98.598	99.598	99.839	dB
		sn8	88.026	89.233	91.500	92.229	93.272	93.511	95.387	108.565	101.392	100.183	107.120	dB
		sn9	101.584	112.298	110.742	128.667	119.198	119.828	102.446	96.381	101.579	102.593	102.611	dB
		sn10	91.258	90.425	90.765	92.387	91.447	90.356	89.700	91.585	90.898	91.045	90.281	dB
	reference	sn11	109.306	108.006	107.347	106.781	108.813	108.230	108.223	109.166	107.945	108.667	112.266	dB
Statistical analysis [see annex]	ON	Max	108.081	110.770	118.840	124.907	117.786	117.745	116.636	102.258	100.619	99.022	110.534	dB
		Min	86.831	87.874	88.437	87.799	87.360	87.336	88.369	85.127	83.366	83.373	88.524	dB
		Mean	**95.724**	**98.328**	**101.381**	**102.700**	**100.775**	**98.254**	**98.179**	**92.797**	**90.056**	**89.595**	**102.357**	dB
		St. dev	9.284	10.027	13.278	15.399	13.063	14.289	13.054	8.056	8.231	7.592	10.112	dB
		Lmax	121.182	125.822	137.788	144.926	136.594	137.434	133.974	114.888	112.626	110.413	130.085	dB
		Lmin	70.266	70.835	64.974	60.475	64.956	59.075	62.384	70.706	67.486	68.777	74.628	dB
	OFF	Max	103.880	114.292	110.742	128.667	119.198	119.828	113.537	108.565	101.579	102.593	107.120	dB
		Min	87.528	85.967	86.376	85.989	84.979	86.024	86.539	89.144	89.836	89.788	90.281	dB
		Mean	**94.455**	**98.443**	**97.390**	**101.025**	**99.367**	**98.553**	**97.522**	**95.843**	**96.461**	**96.641**	**98.170**	dB
		St. dev	7.733	13.674	10.974	17.069	13.907	13.439	10.806	7.590	5.699	5.809	7.353	dB
		Lmax	115.659	135.937	127.480	147.830	137.499	135.403	127.152	116.656	112.087	112.571	118.332	dB
		Lmin	73.252	60.949	67.299	54.221	61.234	61.704	67.891	75.031	80.834	80.712	78.008	dB



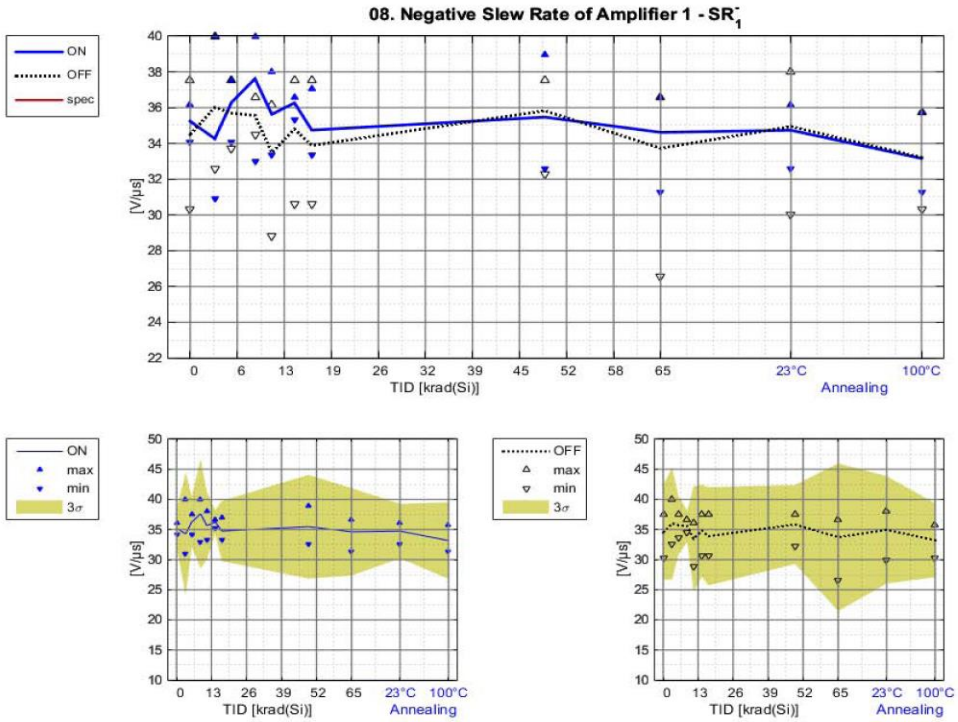
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			7. Positive Slew Rate of Amplifier 1									SR^+_1		unit V/µs
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										-	V/µs
			Min										18	V/µs
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	34.091	30.303	34.884	40.000	34.483	34.483	33.708	29.126	35.294	33.333	34.091	V/µs
		sn2	33.333	34.483	34.884	38.462	31.579	30.000	32.609	32.967	31.579	33.333	30.612	V/µs
		sn3	34.483	34.483	34.483	33.333	32.609	40.000	-40.000	-40.000	40.000	-40.000	40.000	V/µs
		sn4	34.483	30.612	31.579	38.462	32.258	31.579	32.258	31.915	34.884	30.000	28.302	V/µs
		sn5	28.571	28.571	31.579	35.294	32.967	34.091	30.000	32.609	29.126	31.915	25.641	V/µs
	OFF	sn6	32.609	38.462	32.967	28.037	31.579	34.483	30.928	32.609	30.928	30.928	30.303	V/µs
		sn7	26.549	30.000	29.412	29.126	29.412	30.612	24.000	28.037	27.778	26.316	29.703	V/µs
		sn8	33.708	37.975	31.579	35.714	35.294	32.609	30.928	31.915	34.091	34.091	31.915	V/µs
		sn9	31.915	31.579	31.915	28.846	32.609	33.333	31.579	33.333	30.928	31.250	31.250	V/µs
		sn10	33.708	35.714	32.609	36.145	33.333	34.091	31.250	36.145	34.483	32.258	31.915	V/µs
	reference	sn11	25.862	27.273	29.703	23.256	26.786	27.027	26.786	25.210	28.037	28.302	27.778	V/µs
Statistical analysis [see annex]	ON	Max	34.483	34.483	34.884	40.000	34.483	34.483	33.708	32.967	35.294	33.333	34.091	V/µs
		Min	28.571	28.571	31.579	33.333	31.579	30.000	30.000	29.126	29.126	30.000	25.641	V/µs
		Mean	**32.992**	**31.690**	**33.482**	**37.110**	**32.779**	**32.538**	**32.144**	**31.654**	**32.721**	**32.145**	**29.662**	V/µs
		St. dev	2.516	2.665	1.745	2.719	1.082	2.126	1.557	1.741	2.917	1.579	3.584	V/µs
		Lmax	39.890	38.999	38.266	44.566	35.745	38.367	36.413	36.429	40.719	36.474	39.489	V/µs
		Lmin	26.094	24.382	28.698	29.655	29.813	26.710	27.875	26.880	24.722	27.817	19.834	V/µs
	OFF	Max	33.708	38.462	32.967	36.145	35.294	34.483	31.579	36.145	34.483	34.091	31.915	V/µs
		Min	26.549	30.000	29.412	28.037	29.412	30.612	24.000	28.037	27.778	26.316	29.703	V/µs
		Mean	**31.698**	**34.746**	**31.696**	**31.574**	**32.445**	**33.026**	**29.737**	**32.408**	**31.642**	**30.969**	**31.017**	V/µs
		St. dev	2.978	3.799	1.390	3.999	2.173	1.529	3.218	2.924	2.739	2.878	0.988	V/µs
		Lmax	39.863	45.163	35.508	42.540	38.403	37.218	38.562	40.427	39.153	38.861	33.726	V/µs
		Lmin	23.533	24.329	27.885	20.607	26.488	28.833	20.912	24.389	24.130	23.076	28.308	V/µs



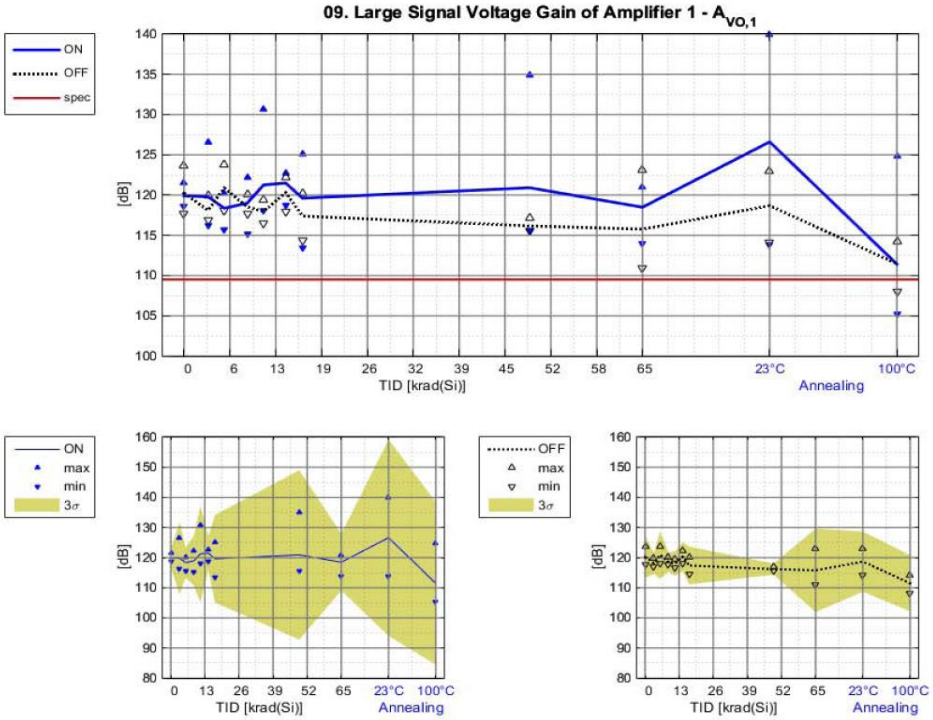
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			8. Negative Slew Rate of Amplifier 1									SR^-_1		unit V/µs
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										-	V/µs
			Min										18	V/µs
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	35.714	33.333	36.145	38.961	37.037	36.585	37.037	36.585	34.483	34.884	35.714	V/µs
		sn2	34.091	40.000	37.500	40.000	33.333	36.585	34.884	33.708	31.250	32.609	31.579	V/µs
		sn3	34.091	33.333	34.091	32.967	35.294	40.000	40.000	40.000	0.000	0.000	-40.000	V/µs
		sn4	36.145	33.708	36.145	36.145	37.975	36.585	33.333	38.961	36.145	35.294	34.091	V/µs
		sn5	36.145	30.928	37.500	40.000	34.483	35.294	33.708	32.609	36.585	36.145	31.250	V/µs
	OFF	sn6	34.483	34.884	37.500	35.714	35.294	35.294	32.609	37.500	34.483	35.294	34.483	V/µs
		sn7	30.303	38.462	33.708	36.585	28.846	30.612	30.612	32.258	26.549	30.000	30.303	V/µs
		sn8	37.500	40.000	34.483	34.483	32.609	37.500	37.500	36.585	35.294	35.294	32.967	V/µs
		sn9	34.884	32.609	37.037	34.884	34.483	34.884	32.967	35.294	36.585	36.145	32.609	V/µs
		sn10	35.294	34.091	35.714	36.145	36.145	35.714	35.714	37.500	35.714	37.975	35.714	V/µs
	reference	sn11	28.571	31.915	29.126	27.778	30.000	31.250	33.333	28.571	32.258	29.703	29.126	V/µs
Statistical analysis [see annex]	ON	Max	36.145	40.000	37.500	40.000	37.975	36.585	37.037	38.961	36.585	36.145	35.714	V/µs
		Min	34.091	30.928	34.091	32.967	33.333	35.294	33.333	32.609	31.250	32.609	31.250	V/µs
		Mean	**35.237**	**34.260**	**36.276**	**37.615**	**35.624**	**36.262**	**34.741**	**35.466**	**34.616**	**34.733**	**33.159**	V/µs
		St. dev	1.061	3.394	1.397	3.039	1.883	0.646	1.667	2.871	2.420	1.510	2.124	V/µs
		Lmax	38.147	43.566	40.106	45.949	40.788	38.032	39.313	43.337	41.250	38.874	38.983	V/µs
		Lmin	32.328	24.954	32.446	29.280	30.461	34.492	30.168	27.595	27.981	30.592	27.334	V/µs
	OFF	Max	37.500	40.000	37.500	36.585	36.145	37.500	37.500	37.500	36.585	37.975	35.714	V/µs
		Min	30.303	32.609	33.708	34.483	28.846	30.612	30.612	32.258	26.549	30.000	30.303	V/µs
		Mean	**34.493**	**36.009**	**35.688**	**35.562**	**33.475**	**34.801**	**33.880**	**35.827**	**33.725**	**34.942**	**33.215**	V/µs
		St. dev	2.617	3.100	1.618	0.871	2.900	2.545	2.720	2.191	4.082	2.971	2.047	V/µs
		Lmax	41.668	44.510	40.126	37.950	41.426	41.780	41.339	41.834	44.919	43.089	38.828	V/µs
		Lmin	27.317	27.508	31.251	33.174	25.525	27.821	26.422	29.821	22.531	26.794	27.602	V/µs



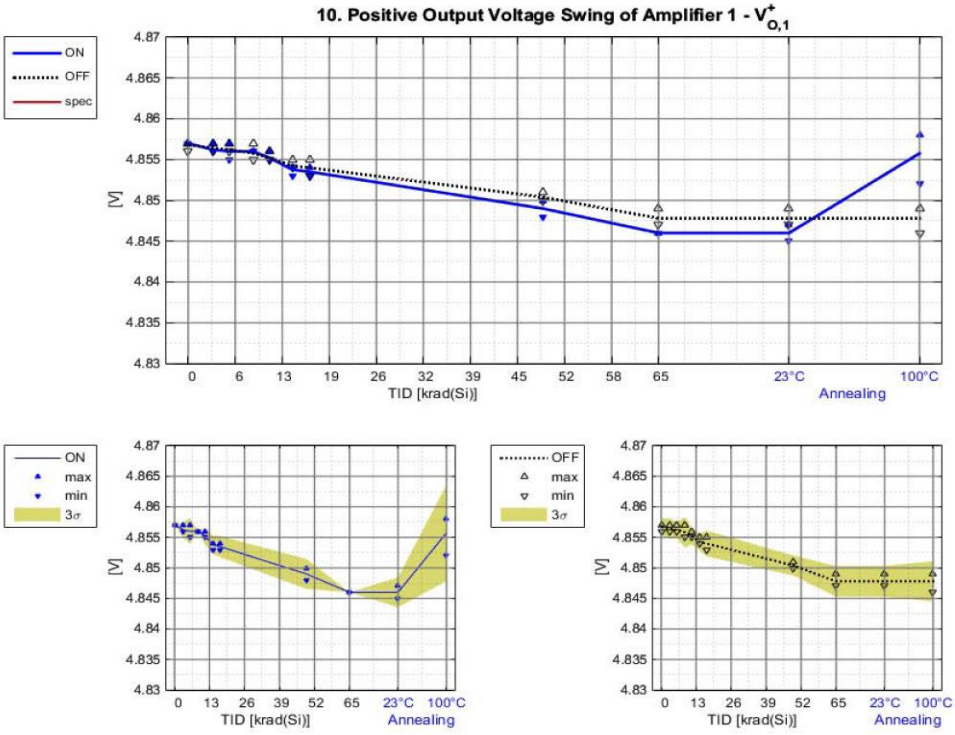
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			9. Large Signal Voltage Gain of Amplifier 1									$A_{VO,1}$		unit dB
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		dB
			Min									109.5		dB
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	121.483	119.587	118.360	121.000	130.657	122.402	125.105	115.972	119.963	140.000	105.272	dB
		sn2	119.593	117.650	115.638	119.282	118.080	122.078	113.492	117.140	113.911	128.774	107.654	dB
		sn3	119.773	116.251	118.869	115.197	118.458	140.000	140.000	140.000	140.000	140.000	140.000	dB
		sn4	120.075	126.580	120.144	122.159	120.857	122.737	121.044	134.933	119.102	113.883	107.932	dB
		sn5	118.632	118.902	118.780	117.289	118.237	118.728	118.793	115.589	120.953	123.768	124.808	dB
	OFF	sn6	121.265	116.906	123.273	120.075	116.534	121.108	116.986	116.373	123.094	118.664	108.170	dB
		sn7	123.600	119.889	123.816	117.738	119.175	122.247	114.385	116.107	113.160	114.083	114.258	dB
		sn8	120.214	117.321	118.071	117.786	116.686	117.898	117.981	115.567	110.964	117.316	113.992	dB
		sn9	118.432	118.211	118.396	119.220	118.036	120.019	120.214	117.100	116.772	120.285	112.854	dB
		sn10	117.685	118.206	120.905	117.839	119.416	120.285	117.376	115.691	114.812	123.040	108.064	dB
	reference	sn11	119.827	123.255	123.040	127.866	120.586	120.298	123.522	119.988	131.296	122.119	119.289	dB
Statistical analysis [see annex]	ON	Max	121.483	126.580	120.144	122.159	130.657	122.737	125.105	134.933	120.953	140.000	124.808	dB
		Min	118.632	116.251	115.638	115.197	118.080	118.728	113.492	115.589	113.911	113.883	105.272	dB
		Mean	**119.911**	**119.794**	**118.358**	**118.985**	**121.258**	**121.486**	**119.609**	**120.909**	**118.482**	**126.606**	**111.417**	dB
		St. dev	1.031	4.001	1.660	2.804	5.375	1.858	4.842	9.373	3.140	10.863	9.007	dB
		Lmax	122.739	130.765	122.911	126.674	135.996	126.582	132.887	146.609	127.092	156.393	136.114	dB
		Lmin	117.083	108.823	113.805	111.297	106.519	116.390	106.330	95.208	109.873	96.819	86.719	dB
	OFF	Max	123.600	119.889	123.816	120.075	119.416	122.247	120.214	117.100	123.094	123.040	114.258	dB
		Min	117.685	116.906	118.071	117.738	116.534	117.898	114.385	115.567	110.964	114.083	108.064	dB
		Mean	**120.239**	**118.107**	**120.892**	**118.532**	**117.969**	**120.311**	**117.388**	**116.168**	**115.760**	**118.678**	**111.468**	dB
		St. dev	2.353	1.146	2.665	1.063	1.347	1.604	2.093	0.613	4.623	3.338	3.104	dB
		Lmax	126.690	121.250	128.199	121.447	121.663	124.710	123.127	117.848	128.435	127.831	119.979	dB
		Lmin	113.789	114.963	113.585	115.616	114.276	115.913	111.650	114.487	103.085	109.524	102.956	dB



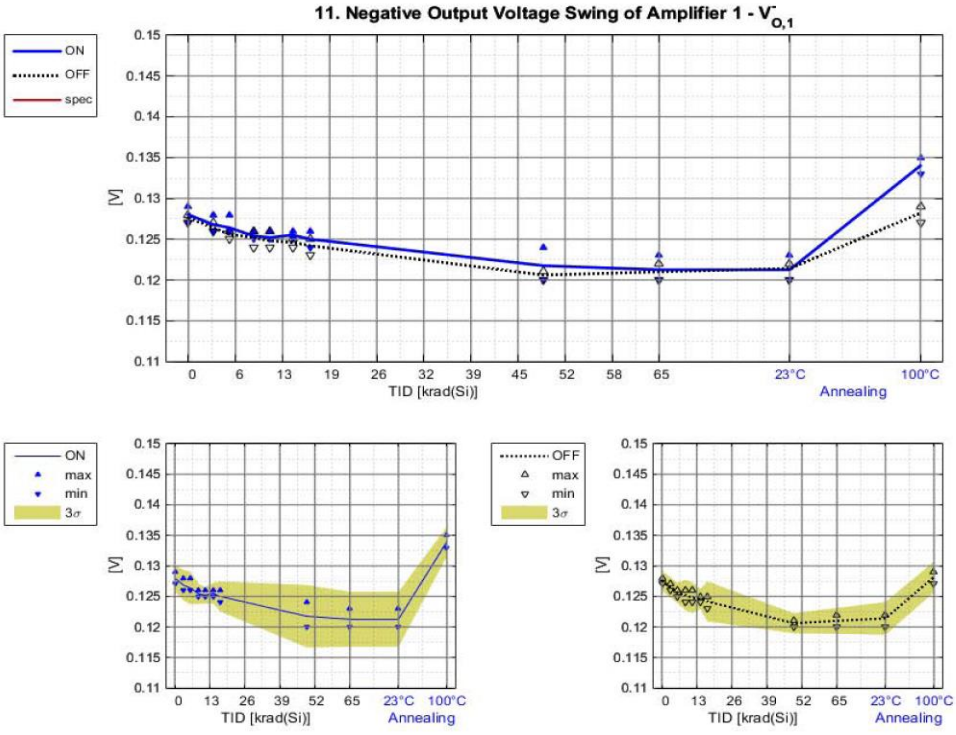
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			10. Positive Output Voltage Swing of Amplifier 1									$V^+_{O,1}$		unit V
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		V
			Min									4.965		V
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	4.857	4.856	4.855	4.856	4.855	4.854	4.854	4.848	4.846	4.846	4.858	V
		sn2	4.857	4.856	4.856	4.856	4.855	4.854	4.853	4.849	4.846	4.846	4.856	V
		sn3	4.857	4.856	4.856	4.856	4.855	-0.690	-0.695	-0.694	-0.688	-0.687	-0.695	V
		sn4	4.857	4.857	4.857	4.856	4.856	4.854	4.854	4.850	4.846	4.847	4.857	V
		sn5	4.857	4.856	4.856	4.856	4.855	4.853	4.853	4.849	4.846	4.845	4.852	V
	OFF	sn6	4.856	4.856	4.856	4.855	4.855	4.854	4.853	4.850	4.847	4.847	4.848	V
		sn7	4.857	4.857	4.857	4.857	4.856	4.855	4.855	4.851	4.849	4.849	4.849	V
		sn8	4.857	4.856	4.856	4.855	4.855	4.854	4.854	4.850	4.848	4.848	4.848	V
		sn9	4.857	4.856	4.856	4.856	4.855	4.854	4.854	4.850	4.847	4.847	4.848	V
		sn10	4.857	4.857	4.856	4.856	4.855	4.854	4.854	4.851	4.848	4.848	4.846	V
	reference	sn11	4.857	4.857	4.858	4.858	4.856	4.857	4.857	4.856	4.856	4.856	4.857	V
Statistical analysis [see annex]	ON	Max	4.857	4.857	4.857	4.856	4.856	4.854	4.854	4.850	4.846	4.847	4.858	V
		Min	4.857	4.856	4.855	4.856	4.855	4.853	4.853	4.848	4.846	4.845	4.852	V
		Mean	**4.857**	**4.856**	**4.856**	**4.856**	**4.855**	**4.854**	**4.854**	**4.849**	**4.846**	**4.846**	**4.856**	V
		St. dev	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.000	0.001	0.003	V
		Lmax	4.857	4.857	4.858	4.856	4.856	4.855	4.855	4.851	4.846	4.848	4.863	V
		Lmin	4.857	4.855	4.854	4.856	4.854	4.852	4.852	4.847	4.846	4.844	4.849	V
	OFF	Max	4.857	4.857	4.857	4.857	4.856	4.855	4.855	4.851	4.849	4.849	4.849	V
		Min	4.856	4.856	4.856	4.855	4.855	4.854	4.853	4.850	4.847	4.847	4.846	V
		Mean	**4.857**	**4.856**	**4.856**	**4.856**	**4.855**	**4.854**	**4.854**	**4.850**	**4.848**	**4.848**	**4.848**	V
		St. dev	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.001	0.001	0.001	0.001	V
		Lmax	4.858	4.858	4.857	4.858	4.856	4.855	4.856	4.852	4.850	4.850	4.851	V
		Lmin	4.856	4.855	4.855	4.854	4.854	4.853	4.852	4.849	4.846	4.846	4.845	V



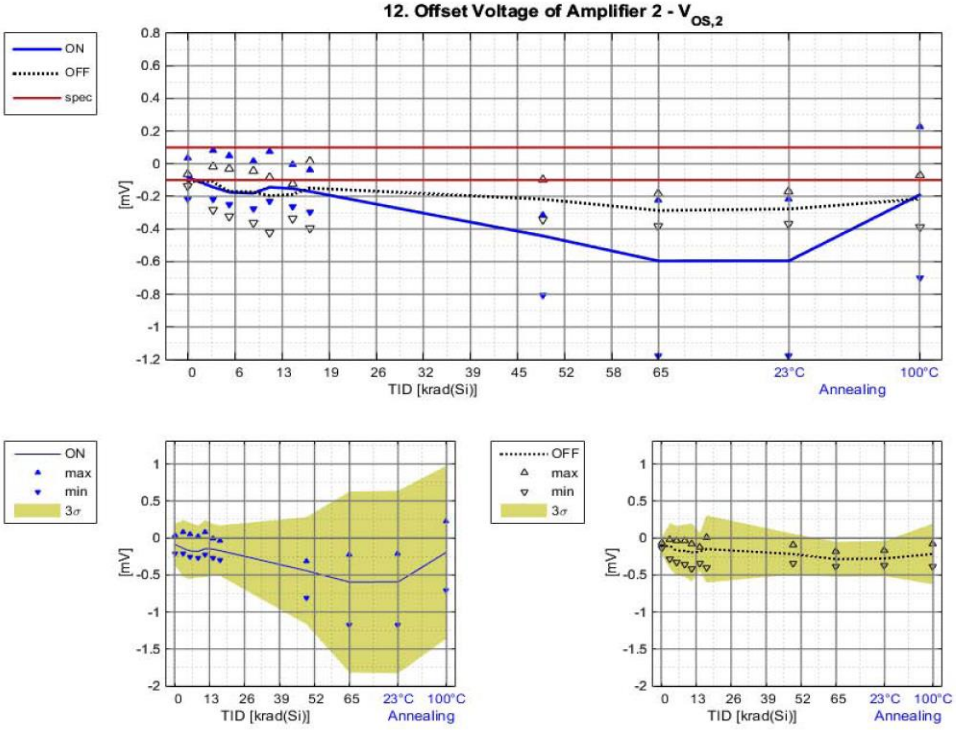
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			11. Negative Output Voltage Swing of Amplifier 1									$V^-_{O,1}$		unit V
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									0.035		V
			Min									-		V
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.129	0.128	0.128	0.126	0.126	0.126	0.126	0.124	0.123	0.123	0.134	V
		sn2	0.128	0.127	0.126	0.125	0.125	0.125	0.125	0.121	0.120	0.120	0.133	V
		sn3	0.128	0.127	0.126	0.126	0.125	1.638	1.638	1.638	1.638	1.638	1.638	V
		sn4	0.128	0.126	0.126	0.125	0.125	0.126	0.125	0.122	0.122	0.122	0.134	V
		sn5	0.127	0.126	0.126	0.125	0.125	0.125	0.124	0.120	0.120	0.120	0.135	V
	OFF	sn6	0.128	0.126	0.125	0.125	0.124	0.124	0.123	0.120	0.120	0.120	0.127	V
		sn7	0.127	0.126	0.125	0.124	0.124	0.124	0.123	0.120	0.121	0.121	0.128	V
		sn8	0.128	0.127	0.126	0.126	0.126	0.125	0.125	0.121	0.122	0.122	0.129	V
		sn9	0.128	0.127	0.126	0.126	0.125	0.125	0.125	0.121	0.121	0.122	0.128	V
		sn10	0.127	0.126	0.126	0.125	0.125	0.125	0.125	0.121	0.121	0.122	0.129	V
	reference	sn11	0.127	0.127	0.126	0.126	0.128	0.127	0.127	0.128	0.128	0.128	0.127	V
Statistical analysis [see annex]	ON	Max	0.129	0.128	0.128	0.126	0.126	0.126	0.126	0.124	0.123	0.123	0.135	V
		Min	0.127	0.126	0.126	0.125	0.125	0.125	0.124	0.120	0.120	0.120	0.133	V
		Mean	**0.128**	**0.127**	**0.126**	**0.125**	**0.125**	**0.126**	**0.125**	**0.122**	**0.121**	**0.121**	**0.134**	V
		St. dev	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.002	0.002	0.001	V
		Lmax	0.130	0.129	0.129	0.127	0.126	0.127	0.127	0.126	0.125	0.125	0.136	V
		Lmin	0.126	0.125	0.124	0.124	0.124	0.124	0.123	0.117	0.117	0.117	0.132	V
	OFF	Max	0.128	0.127	0.126	0.126	0.126	0.125	0.125	0.121	0.122	0.122	0.129	V
		Min	0.127	0.126	0.125	0.124	0.124	0.124	0.123	0.120	0.120	0.120	0.127	V
		Mean	**0.128**	**0.126**	**0.126**	**0.125**	**0.125**	**0.125**	**0.124**	**0.121**	**0.121**	**0.121**	**0.128**	V
		St. dev	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	V
		Lmax	0.129	0.128	0.127	0.127	0.127	0.126	0.127	0.122	0.123	0.124	0.130	V
		Lmin	0.126	0.125	0.124	0.123	0.123	0.123	0.121	0.119	0.119	0.119	0.126	V



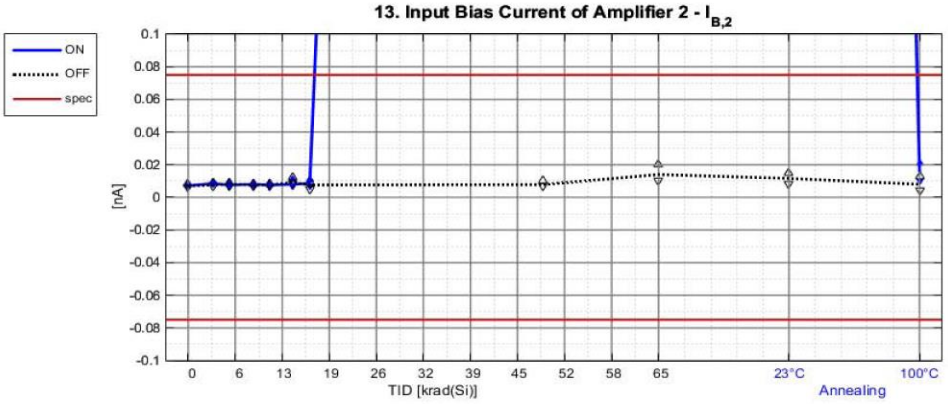
6. ELECTRICAL MEASUREMENTS

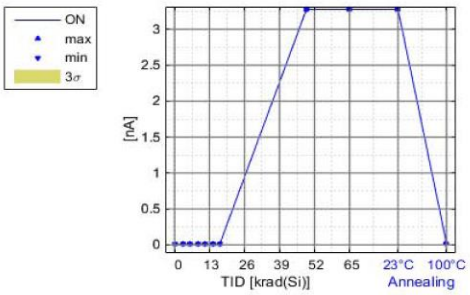
TEST PARAMETER			12. Offset Voltage of Amplifier 2									$V_{OS,2}$		unit mV
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									0.1		mV
			Min									-0.1		mV
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	-0.053	-0.169	-0.244	-0.189	-0.231	-0.213	-0.222	-0.804	-1.177	-1.179	-0.703	mV
		sn2	-0.074	-0.216	-0.252	-0.274	-0.221	-0.266	-0.296	-0.314	-0.501	-0.503	-0.070	mV
		sn3	-0.117	-0.200	-0.183	-0.205	-0.139	-3.277	-3.277	-3.277	-3.277	-3.277	-3.277	mV
		sn4	0.037	0.084	0.048	0.017	0.078	-0.005	-0.036	-0.334	-0.483	-0.484	-0.223	mV
		sn5	-0.215	-0.214	-0.243	-0.253	-0.208	-0.126	-0.126	-0.318	-0.223	-0.214	0.230	mV
	OFF	sn6	-0.124	-0.017	-0.029	-0.043	-0.084	-0.149	-0.083	-0.344	-0.252	-0.249	-0.179	mV
		sn7	-0.063	-0.094	-0.154	-0.123	-0.133	-0.170	0.014	-0.098	-0.184	-0.170	-0.109	mV
		sn8	-0.139	-0.283	-0.321	-0.363	-0.422	-0.338	-0.395	-0.258	-0.349	-0.341	-0.388	mV
		sn9	-0.085	-0.038	-0.122	-0.179	-0.179	-0.121	-0.153	-0.182	-0.268	-0.258	-0.074	mV
		sn10	-0.124	-0.115	-0.228	-0.159	-0.162	-0.161	-0.129	-0.205	-0.380	-0.369	-0.330	mV
	reference	sn11	-0.175	-0.171	-0.163	-0.161	-0.174	-0.174	-0.171	-0.175	-0.163	-0.174	-0.187	mV
Statistical analysis [see annex]	ON	Max	0.037	0.084	0.048	0.017	0.078	-0.005	-0.036	-0.314	-0.223	-0.214	0.230	mV
		Min	-0.215	-0.216	-0.252	-0.274	-0.231	-0.266	-0.296	-0.804	-1.177	-1.179	-0.703	mV
		Mean	**-0.084**	**-0.143**	**-0.175**	**-0.181**	**-0.144**	**-0.153**	**-0.170**	**-0.443**	**-0.596**	**-0.595**	**-0.192**	mV
		St. dev	0.092	0.128	0.128	0.116	0.129	0.114	0.113	0.241	0.408	0.411	0.389	mV
		Lmax	0.168	0.209	0.175	0.137	0.210	0.160	0.141	0.219	0.522	0.532	0.876	mV
		Lmin	-0.337	-0.495	-0.525	-0.498	-0.499	-0.465	-0.481	-1.104	-1.714	-1.722	-1.259	mV
	OFF	Max	-0.063	-0.017	-0.029	-0.043	-0.084	-0.121	0.014	-0.098	-0.184	-0.170	-0.074	mV
		Min	-0.139	-0.283	-0.321	-0.363	-0.422	-0.338	-0.395	-0.344	-0.380	-0.369	-0.388	mV
		Mean	**-0.107**	**-0.109**	**-0.171**	**-0.173**	**-0.196**	**-0.188**	**-0.149**	**-0.217**	**-0.287**	**-0.277**	**-0.216**	mV
		St. dev	0.032	0.105	0.110	0.118	0.131	0.086	0.152	0.091	0.079	0.079	0.137	mV
		Lmax	-0.020	0.178	0.131	0.150	0.164	0.048	0.266	0.033	-0.071	-0.060	0.161	mV
		Lmin	-0.194	-0.397	-0.473	-0.497	-0.556	-0.424	-0.565	-0.468	-0.502	-0.495	-0.593	mV

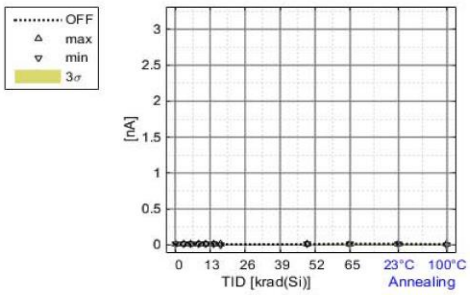


6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			13. Input Bias Current of Amplifier 2									$I_{B,2}$		unit nA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										**0.075**	nA
			Min										**-0.075**	nA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	**3.39**	**5.67**	**8.92**	**11.24**	**14.35**	**16.74**	**48.81**	**64.75**	**0**	**0**	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.006	0.008	0.007	0.007	0.007	0.007	0.009	3.277	3.277	3.277	0.010	nA
		sn2	0.007	0.008	0.007	0.008	0.007	0.007	0.007	3.277	3.277	3.277	0.016	nA
		sn3	0.008	0.009	0.008	0.008	0.008	0.000	0.000	0.000	0.000	0.000	0.000	nA
		sn4	0.007	0.008	0.007	0.008	0.007	0.007	0.007	3.277	3.277	3.277	0.021	nA
		sn5	0.008	0.009	0.009	0.009	0.009	0.011	0.011	3.277	3.277	3.277	0.019	nA
	OFF	sn6	0.008	0.008	0.009	0.008	0.008	0.008	0.009	0.007	0.012	0.011	0.008	nA
		sn7	0.006	0.007	0.008	0.008	0.008	0.009	0.008	0.007	0.010	0.008	0.006	nA
		sn8	0.007	0.007	0.007	0.007	0.007	0.008	0.005	0.008	0.014	0.015	0.004	nA
		sn9	0.008	0.009	0.009	0.008	0.008	0.012	0.009	0.010	0.020	0.014	0.009	nA
		sn10	0.006	0.007	0.007	0.008	0.007	0.008	0.007	0.007	0.014	0.010	0.013	nA
	reference	sn11	0.006	0.007	0.006	0.007	0.006	0.006	0.006	0.006	0.005	0.005	0.005	nA
Statistical analysis [see annex]	ON	Max	0.008	0.009	0.009	0.009	0.009	0.011	0.011	3.277	3.277	3.277	0.021	nA
		Min	0.006	0.008	0.007	0.007	0.007	0.007	0.007	3.277	3.277	3.277	0.010	nA
		Mean	**0.007**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.009**	**3.277**	**3.277**	**3.277**	**0.017**	nA
		St. dev	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.000	0.000	0.000	0.005	nA
		Lmax	0.009	0.010	0.010	0.010	0.010	0.013	0.014	3.277	3.277	3.277	0.030	nA
		Lmin	0.005	0.007	0.005	0.006	0.005	0.003	0.003	3.277	3.277	3.277	0.003	nA
	OFF	Max	0.008	0.009	0.009	0.008	0.008	0.012	0.009	0.010	0.020	0.015	0.013	nA
		Min	0.006	0.007	0.007	0.007	0.007	0.008	0.005	0.007	0.010	0.008	0.004	nA
		Mean	**0.007**	**0.008**	**0.008**	**0.008**	**0.008**	**0.009**	**0.008**	**0.008**	**0.014**	**0.012**	**0.008**	nA
		St. dev	0.001	0.001	0.001	0.000	0.001	0.002	0.002	0.001	0.004	0.003	0.003	nA
		Lmax	0.010	0.010	0.011	0.009	0.009	0.014	0.012	0.011	0.024	0.019	0.017	nA
		Lmin	0.004	0.005	0.005	0.007	0.006	0.004	0.003	0.004	0.004	0.004	-0.001	nA

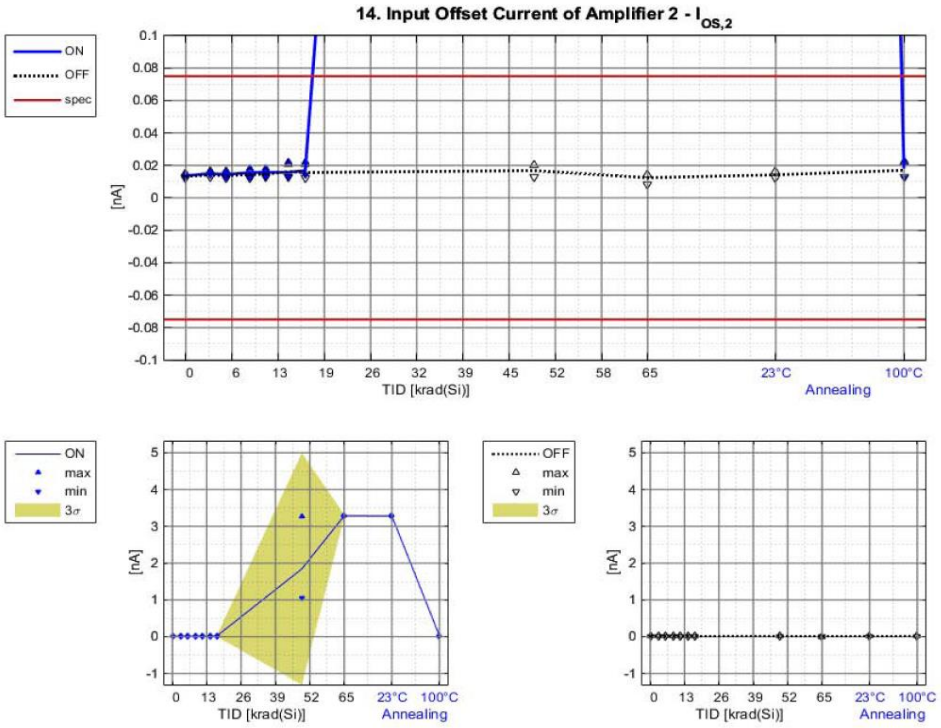






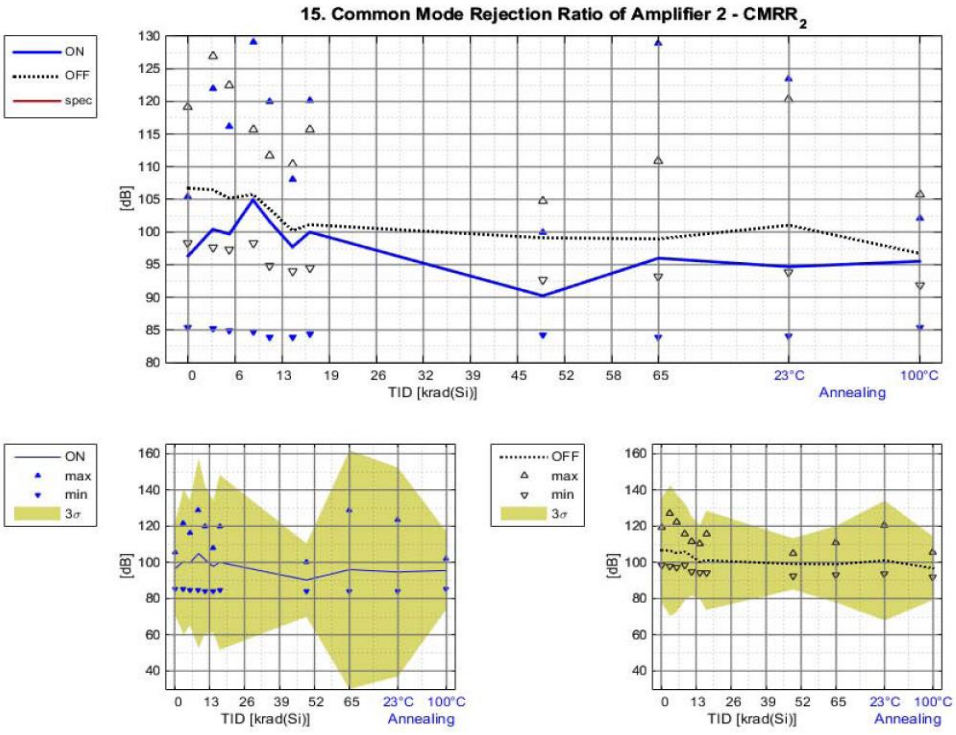
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			14. Input Offset Current of Amplifier 2									$I_{OS,2}$		unit nA
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										0.075	nA
			Min										-0.075	nA
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.012	0.014	0.013	0.015	0.015	0.013	0.017	3.275	3.269	3.267	0.012	nA
		sn2	0.013	0.016	0.016	0.015	0.017	0.014	0.014	1.042	3.296	3.293	0.019	nA
		sn3	0.015	0.015	0.014	0.018	0.016	0.000	0.000	0.000	0.000	0.000	0.000	nA
		sn4	0.013	0.014	0.013	0.013	0.013	0.014	0.014	1.068	3.283	3.285	0.023	nA
		sn5	0.015	0.016	0.016	0.017	0.018	0.022	0.022	1.995	3.290	3.282	0.022	nA
	OFF	sn6	0.014	0.015	0.015	0.016	0.015	0.015	0.015	0.017	0.014	0.014	0.013	nA
		sn7	0.013	0.014	0.013	0.015	0.016	0.018	0.016	0.016	0.014	0.015	0.022	nA
		sn8	0.012	0.013	0.012	0.012	0.013	0.014	0.012	0.013	0.008	0.012	0.018	nA
		sn9	0.015	0.016	0.016	0.016	0.015	0.021	0.021	0.020	0.013	0.014	0.016	nA
		sn10	0.012	0.013	0.012	0.013	0.014	0.013	0.014	0.018	0.013	0.016	0.016	nA
	reference	sn11	0.013	0.013	0.013	0.015	0.013	0.013	0.011	0.012	0.010	0.011	0.012	nA
Statistical analysis [see annex]	ON	Max	0.015	0.016	0.016	0.018	0.018	0.022	0.022	3.275	3.296	3.293	0.023	nA
		Min	0.012	0.014	0.013	0.013	0.013	0.013	0.014	1.042	3.269	3.267	0.012	nA
		Mean	**0.014**	**0.015**	**0.014**	**0.016**	**0.016**	**0.016**	**0.017**	**1.845**	**3.285**	**3.282**	**0.019**	nA
		St. dev	0.001	0.001	0.002	0.002	0.002	0.004	0.004	1.051	0.012	0.011	0.005	nA
		Lmax	0.017	0.018	0.019	0.021	0.021	0.027	0.027	4.728	3.316	3.312	0.033	nA
		Lmin	0.010	0.012	0.010	0.010	0.011	0.004	0.006	-1.038	3.253	3.252	0.005	nA
	OFF	Max	0.015	0.016	0.016	0.016	0.016	0.021	0.021	0.020	0.014	0.016	0.022	nA
		Min	0.012	0.013	0.012	0.012	0.013	0.013	0.012	0.013	0.008	0.012	0.013	nA
		Mean	**0.013**	**0.014**	**0.014**	**0.014**	**0.015**	**0.016**	**0.016**	**0.017**	**0.012**	**0.014**	**0.017**	nA
		St. dev	0.001	0.001	0.002	0.002	0.001	0.003	0.003	0.003	0.003	0.001	0.003	nA
		Lmax	0.017	0.018	0.019	0.019	0.018	0.025	0.025	0.024	0.019	0.018	0.026	nA
		Lmin	0.010	0.011	0.009	0.009	0.011	0.007	0.006	0.010	0.006	0.010	0.008	nA



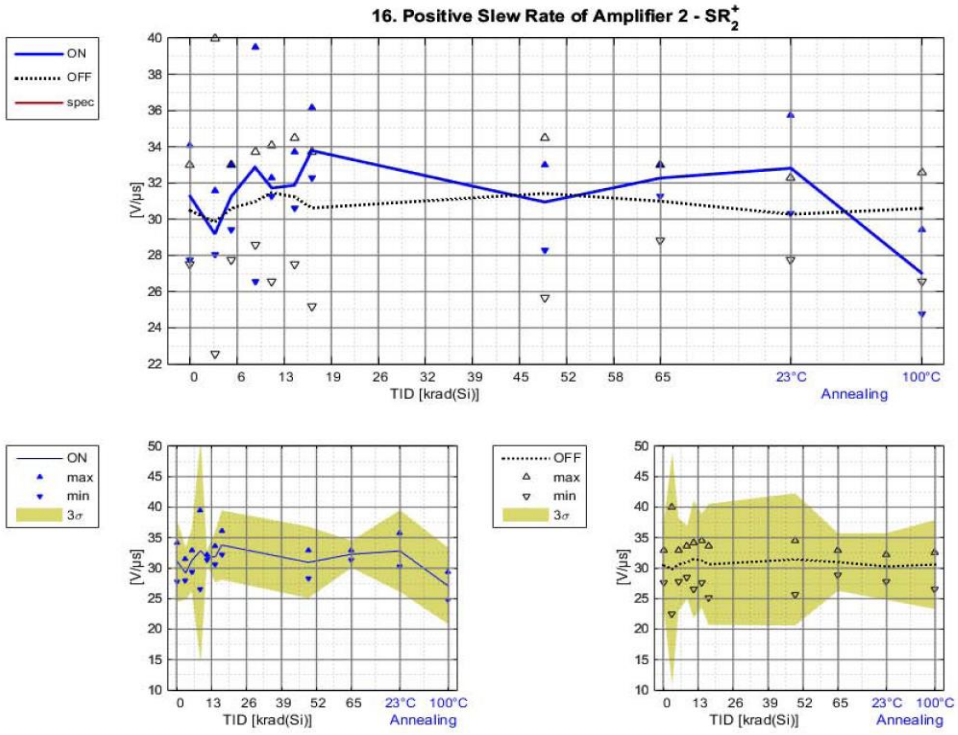
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			15. Common Mode Rejection Ratio of Amplifier 2									$CMRR_2$		unit dB
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										-	dB
			Min										74	dB
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	101.640	100.822	102.120	114.474	119.934	108.134	120.094	88.878	83.851	84.018	98.102	dB
		sn2	99.065	98.203	100.837	102.752	101.653	107.677	105.525	99.909	128.962	123.482	102.025	dB
		sn3	105.490	121.985	116.220	129.118	108.216	81.944	81.900	81.819	81.770	81.798	81.800	dB
		sn4	85.321	85.182	84.892	84.706	83.859	83.834	84.397	84.239	85.751	85.753	85.453	dB
		sn5	90.199	95.876	94.346	93.488	94.233	91.203	89.942	87.865	85.401	85.460	96.476	dB
	OFF	sn6	114.746	126.905	109.197	115.676	110.321	103.578	104.584	97.077	94.222	94.201	93.665	dB
		sn7	98.978	97.553	99.121	101.069	111.776	110.365	115.710	102.589	110.798	120.285	105.735	dB
		sn8	98.291	99.492	97.381	98.269	100.500	98.089	95.433	98.490	93.225	93.817	91.784	dB
		sn9	119.101	107.820	122.539	115.058	100.056	95.124	94.423	104.713	99.497	99.873	99.502	dB
		sn10	102.517	100.531	97.596	98.710	94.769	93.924	95.467	92.676	97.003	97.066	92.994	dB
	reference	sn11	89.836	89.892	90.061	89.976	89.663	89.724	89.809	89.558	89.814	89.695	89.295	dB
Statistical analysis [see annex]	ON	Max	105.490	121.985	116.220	129.118	119.934	108.134	120.094	99.909	128.962	123.482	102.025	dB
		Min	85.321	85.182	84.892	84.706	83.859	83.834	84.397	84.239	83.851	84.018	85.453	dB
		Mean	**96.343**	**100.414**	**99.683**	**104.908**	**101.579**	**97.712**	**99.990**	**90.223**	**95.991**	**94.678**	**95.514**	dB
		St. dev	8.342	13.444	11.489	17.470	13.683	12.150	16.113	6.758	21.996	19.217	7.100	dB
		Lmax	119.217	137.277	131.186	152.811	139.098	131.028	144.172	108.752	156.304	147.373	114.983	dB
		Lmin	73.469	63.550	68.180	57.005	64.060	64.396	55.807	71.693	35.678	41.984	76.045	dB
	OFF	Max	119.101	126.905	122.539	115.676	111.776	110.365	115.710	104.713	110.798	120.285	105.735	dB
		Min	98.291	97.553	97.381	98.269	94.769	93.924	94.423	92.676	93.225	93.817	91.784	dB
		Mean	**106.727**	**106.460**	**105.167**	**105.756**	**103.484**	**100.216**	**101.123**	**99.109**	**98.949**	**101.048**	**96.736**	dB
		St. dev	9.570	12.072	10.869	8.840	7.282	6.789	9.138	4.728	7.064	11.028	5.844	dB
		Lmax	132.968	139.560	134.969	129.996	123.452	118.831	126.180	112.073	118.318	131.287	112.759	dB
		Lmin	80.485	73.360	75.365	81.516	83.517	81.601	76.067	86.145	79.580	70.810	80.713	dB



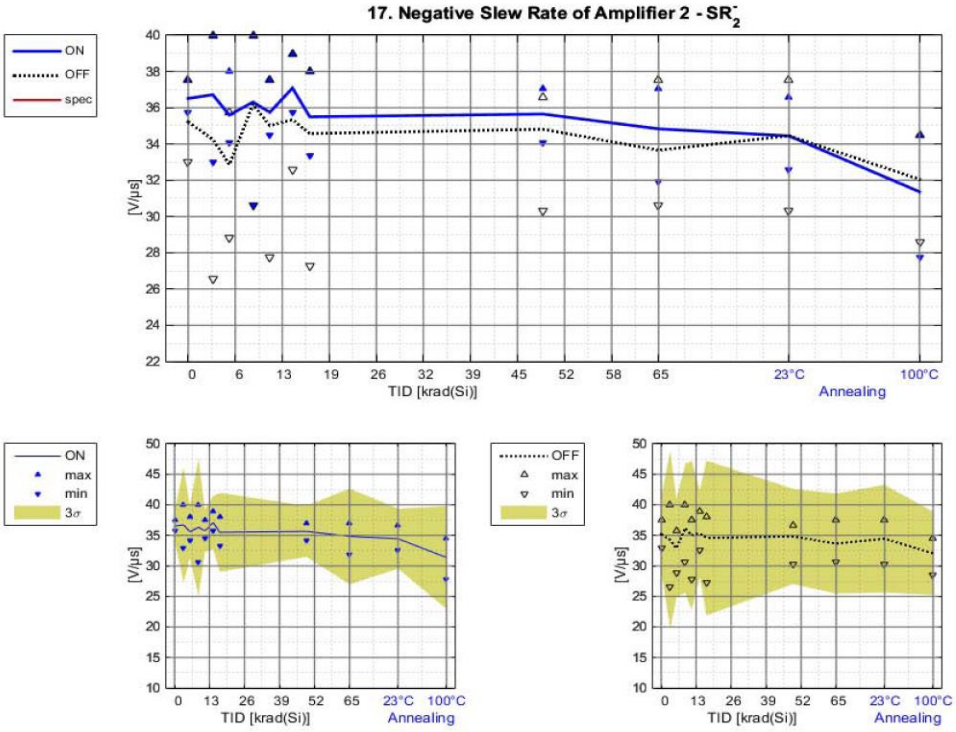
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			16. Positive Slew Rate of Amplifier 2									SR^{+}_{2}		unit V/µs
TEST CONDITIONS			V^{+} = 5V; V^{-} = 0V											
SPECIFICATION LIMITS [see test plan]			Max										-	V/µs
			Min										18	V/µs
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	31.915	28.571	32.967	39.474	31.579	33.708	32.258	32.967	32.967	32.967	24.793	V/µs
		sn2	27.778	28.302	32.967	39.474	32.258	30.928	32.258	30.928	31.250	32.258	29.412	V/µs
		sn3	30.928	28.037	29.703	29.412	31.579	-40.000	40.000	-40.000	-40.000	40.000	40.000	V/µs
		sn4	34.091	31.579	29.412	29.412	31.915	32.258	34.483	31.579	32.258	35.714	28.037	V/µs
		sn5	31.579	29.412	31.250	26.549	31.250	30.612	36.145	28.302	32.609	30.303	25.862	V/µs
	OFF	sn6	32.967	30.000	28.037	29.703	30.000	32.258	31.915	31.250	30.303	29.126	30.303	V/µs
		sn7	27.523	22.556	27.778	33.708	26.549	27.523	25.210	25.641	28.846	27.778	26.549	V/µs
		sn8	30.303	27.523	32.967	30.928	34.091	31.579	33.708	31.250	31.915	30.612	32.609	V/µs
		sn9	29.703	29.126	31.250	28.571	32.609	30.303	30.000	34.483	32.967	32.258	31.250	V/µs
		sn10	31.915	40.000	32.967	31.915	34.091	34.483	32.258	34.483	30.928	31.579	32.258	V/µs
	reference	sn11	27.273	32.967	25.424	31.915	28.302	26.786	29.126	26.786	27.778	27.027	27.027	V/µs
Statistical analysis [see annex]	ON	Max	34.091	31.579	32.967	39.474	32.258	33.708	36.145	32.967	32.967	35.714	29.412	V/µs
		Min	27.778	28.037	29.412	26.549	31.250	30.612	32.258	28.302	31.250	30.303	24.793	V/µs
		Mean	**31.258**	**29.180**	**31.260**	**32.864**	**31.716**	**31.877**	**33.786**	**30.944**	**32.271**	**32.811**	**27.026**	V/µs
		St. dev	2.279	1.437	1.708	6.146	0.383	1.414	1.890	1.956	0.740	2.240	2.086	V/µs
		Lmax	37.508	33.120	35.943	49.717	32.768	35.754	38.969	36.307	34.299	38.952	32.746	V/µs
		Lmin	25.009	25.241	26.577	16.012	30.665	27.999	28.603	25.581	30.243	26.669	21.306	V/µs
	OFF	Max	32.967	40.000	32.967	33.708	34.091	34.483	33.708	34.483	32.967	32.258	32.609	V/µs
		Min	27.523	22.556	27.778	28.571	26.549	27.523	25.210	25.641	28.846	27.778	26.549	V/µs
		Mean	**30.482**	**29.841**	**30.600**	**30.965**	**31.468**	**31.229**	**30.618**	**31.421**	**30.992**	**30.271**	**30.594**	V/µs
		St. dev	2.099	6.368	2.557	1.984	3.218	2.567	3.300	3.613	1.568	1.824	2.434	V/µs
		Lmax	36.238	47.301	37.612	36.406	40.291	38.268	39.666	41.329	35.292	35.271	37.269	V/µs
		Lmin	24.727	12.381	23.587	25.524	22.645	24.190	21.571	21.514	26.692	25.270	23.919	V/µs



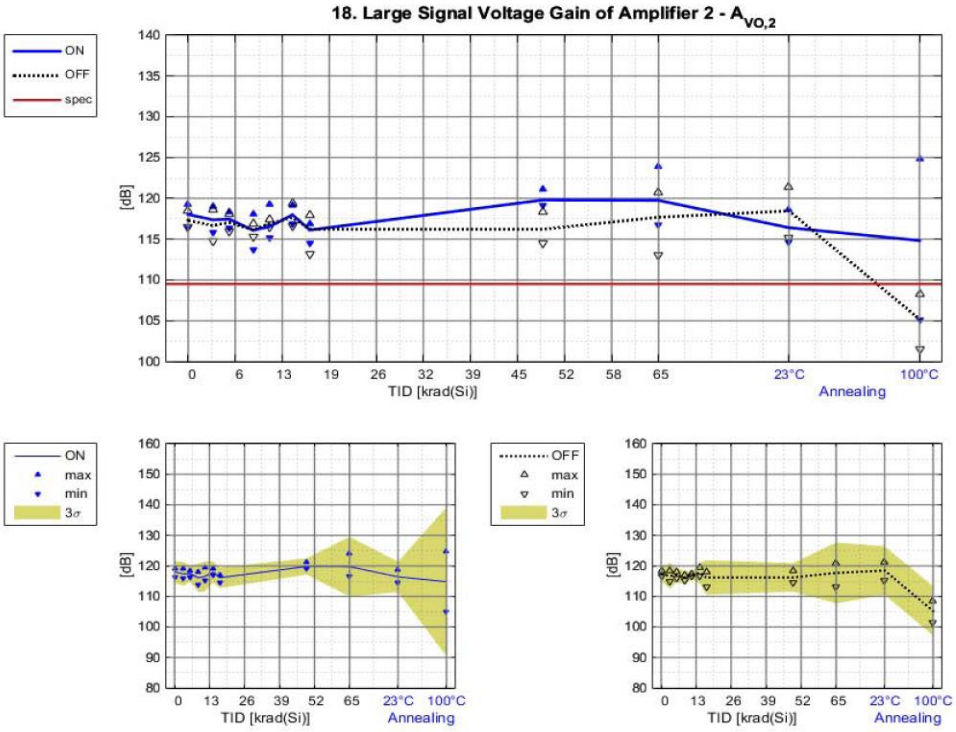
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			17. Negative Slew Rate of Amplifier 2									SR^-_2		unit V/µs
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		V/µs
			Min									18		V/µs
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	37.037	34.884	37.975	40.000	35.294	38.961	34.091	36.585	37.037	34.483	30.928	V/µs
		sn2	36.585	32.967	35.294	37.975	34.483	36.145	33.333	34.091	31.915	32.609	32.258	V/µs
		sn3	35.714	35.714	34.091	30.612	35.294	40.000	40.000	-40.000	-40.000	40.000	40.000	V/µs
		sn4	37.500	40.000	35.294	38.462	37.500	37.500	36.585	37.037	37.037	36.585	34.483	V/µs
		sn5	35.714	40.000	35.294	34.483	36.145	35.714	37.975	34.884	33.333	34.091	27.778	V/µs
	OFF	sn6	37.500	35.714	32.258	30.612	37.500	34.091	37.975	34.884	32.258	34.091	32.609	V/µs
		sn7	32.967	26.549	28.846	35.714	27.778	32.609	27.273	30.303	30.612	30.303	28.571	V/µs
		sn8	36.585	34.091	34.884	36.585	37.037	35.714	36.145	36.145	35.294	37.500	34.483	V/µs
		sn9	33.333	40.000	32.609	40.000	36.145	35.294	34.884	36.585	32.609	33.333	31.250	V/µs
		sn10	35.714	34.884	35.714	37.975	36.585	38.961	36.585	36.145	37.500	37.037	33.333	V/µs
	reference	sn11	29.703	39.474	33.333	37.037	29.412	30.928	32.967	29.412	28.571	28.846	29.126	V/µs
Statistical analysis [see annex]	ON	Max	37.500	40.000	37.975	40.000	37.500	38.961	37.975	37.037	37.037	36.585	34.483	V/µs
		Min	35.714	32.967	34.091	30.612	34.483	35.714	33.333	34.091	31.915	32.609	27.778	V/µs
		Mean	**36.510**	**36.713**	**35.590**	**36.306**	**35.743**	**37.080**	**35.496**	**35.649**	**34.831**	**34.442**	**31.362**	V/µs
		St. dev	0.795	3.162	1.432	3.769	1.144	1.467	2.159	1.392	2.613	1.641	2.803	V/µs
		Lmax	38.691	45.382	39.515	46.641	38.881	41.102	41.416	39.467	41.995	38.941	39.049	V/µs
		Lmin	34.329	28.044	31.664	25.972	32.605	33.058	29.576	31.832	27.666	29.943	23.675	V/µs
	OFF	Max	37.500	40.000	35.714	40.000	37.500	38.961	37.975	36.585	37.500	37.500	34.483	V/µs
		Min	32.967	26.549	28.846	30.612	27.778	32.609	27.273	30.303	30.612	30.303	28.571	V/µs
		Mean	**35.220**	**34.248**	**32.862**	**36.177**	**35.009**	**35.334**	**34.572**	**34.812**	**33.655**	**34.453**	**32.049**	V/µs
		St. dev	1.996	4.872	2.682	3.507	4.074	2.360	4.227	2.600	2.728	2.940	2.271	V/µs
		Lmax	40.694	47.606	40.217	45.794	46.179	41.804	46.164	41.941	41.136	42.514	38.275	V/µs
		Lmin	29.746	20.889	25.507	26.561	23.839	28.864	22.981	27.684	26.173	26.392	25.823	V/µs



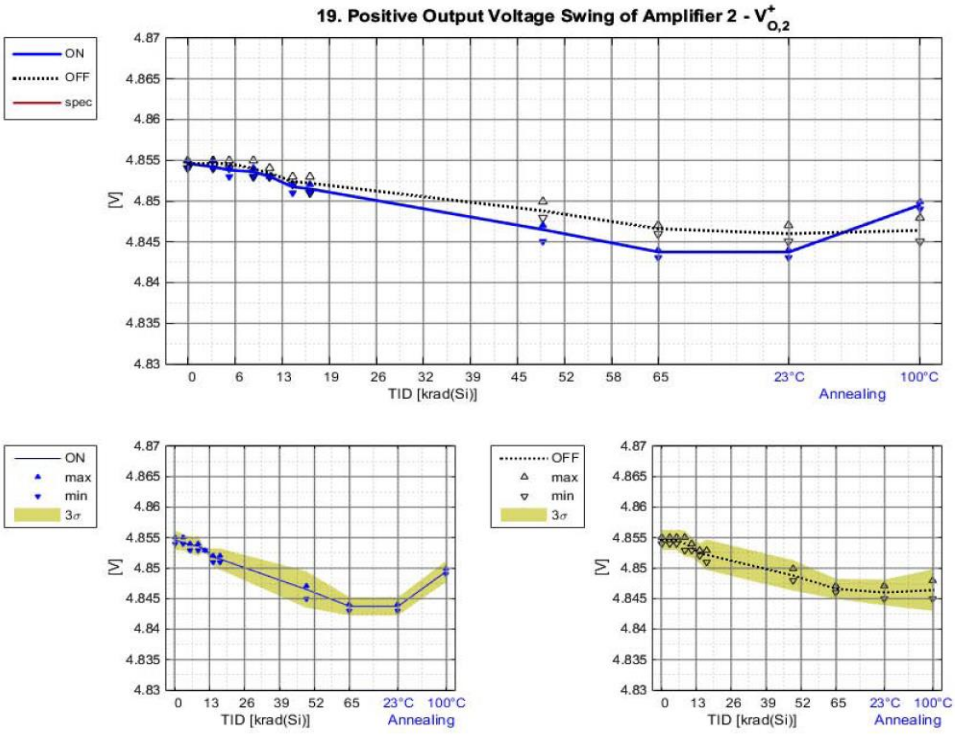
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			18. Large Signal Voltage Gain of Amplifier 2									$A_{VO,2}$		unit dB
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		dB
			Min									**109.5**		dB
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	**3.39**	**5.67**	**8.92**	**11.24**	**14.35**	**16.74**	**48.81**	**64.75**	**0**	**0**	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	117.358	116.514	118.283	118.036	119.306	116.864	114.482	119.335	117.619	115.972	116.295	dB
		sn2	116.312	118.323	116.784	113.680	116.332	119.096	116.239	121.092	120.653	118.605	124.786	dB
		sn3	119.260	115.782	118.303	116.106	115.511	140.000	140.000	140.000	140.000	140.000	140.000	dB
		sn4	118.793	118.985	117.548	116.516	115.147	118.858	116.949	119.158	123.953	116.439	105.102	dB
		sn5	118.437	117.239	116.316	116.095	116.431	117.149	116.789	119.587	116.772	114.595	113.118	dB
	OFF	sn6	118.500	114.808	118.041	115.364	116.522	116.754	117.962	117.266	118.385	116.819	101.589	dB
		sn7	117.289	118.579	117.091	116.593	116.539	116.656	113.213	115.108	113.056	121.359	103.559	dB
		sn8	116.509	117.497	117.390	116.893	117.381	119.469	115.721	118.318	120.754	117.942	106.967	dB
		sn9	116.901	116.146	116.012	115.324	117.298	118.071	116.712	114.529	120.619	120.988	105.559	dB
		sn10	117.298	116.328	116.695	116.547	116.746	117.284	117.455	115.863	115.634	115.212	108.320	dB
	reference	sn11	115.819	116.501	117.015	118.313	114.615	116.514	116.547	115.710	116.340	116.451	116.551	dB
Statistical analysis [see annex]	ON	Max	119.260	118.985	118.303	118.036	119.306	119.096	116.949	121.092	123.953	118.605	124.786	dB
		Min	116.312	115.782	116.316	113.680	115.147	116.864	114.482	119.158	116.772	114.595	105.102	dB
		Mean	**118.032**	**117.369**	**117.447**	**116.087**	**116.545**	**117.992**	**116.115**	**119.793**	**119.749**	**116.403**	**114.825**	dB
		St. dev	1.190	1.303	0.889	1.563	1.636	1.148	1.130	0.884	3.260	1.664	8.141	dB
		Lmax	121.295	120.941	119.884	120.373	121.031	121.139	119.214	122.216	128.689	120.965	137.148	dB
		Lmin	114.769	113.797	115.009	111.800	112.060	114.845	113.016	117.370	110.809	111.841	92.502	dB
	OFF	Max	118.500	118.579	118.041	116.893	117.381	119.469	117.962	118.318	120.754	121.359	108.320	dB
		Min	116.509	114.808	116.012	115.324	116.522	116.656	113.213	114.529	113.056	115.212	101.589	dB
		Mean	**117.299**	**116.672**	**117.046**	**116.144**	**116.897**	**117.647**	**116.213**	**116.217**	**117.690**	**118.464**	**105.199**	dB
		St. dev	0.746	1.431	0.759	0.743	0.414	1.163	1.877	1.559	3.322	2.660	2.679	dB
		Lmax	119.344	120.594	119.126	118.180	118.033	120.836	121.359	120.491	126.799	125.758	112.546	dB
		Lmin	115.254	112.749	114.965	114.108	115.761	114.458	111.066	111.943	108.580	111.170	97.852	dB



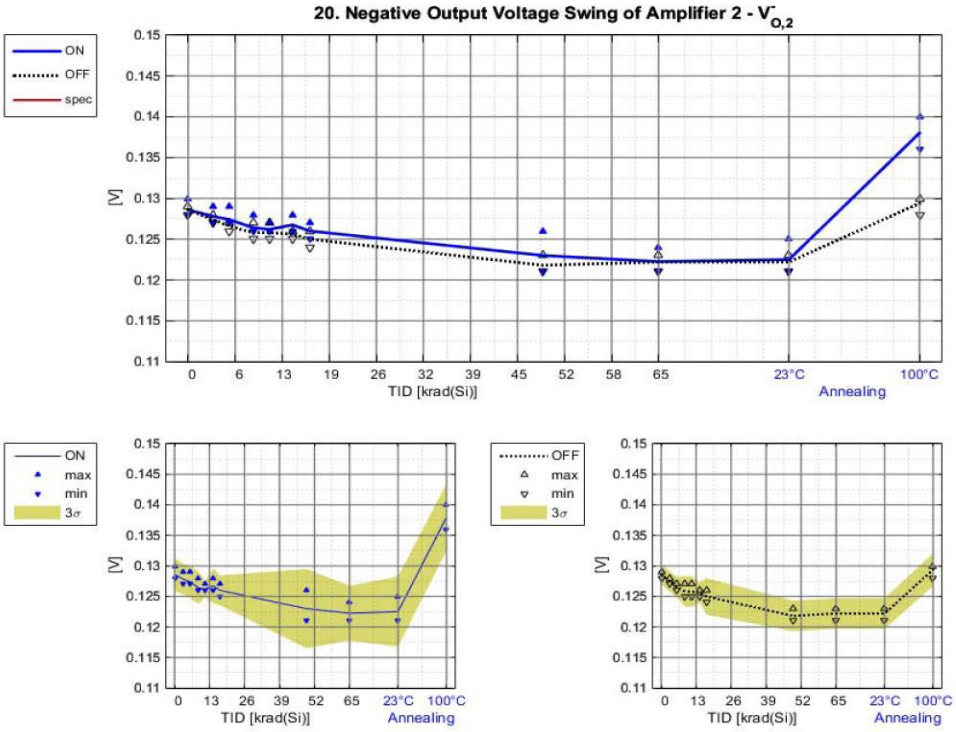
6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			19. Positive Output Voltage Swing of Amplifier 2									$V^+_{O,2}$		unit V
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max									-		V
			Min									**4.965**		V
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	**3.39**	**5.67**	**8.92**	**11.24**	**14.35**	**16.74**	**48.81**	**64.75**	**0**	**0**	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	4.854	4.854	4.853	4.853	4.853	4.851	4.851	4.845	4.843	4.843	4.849	V
		sn2	4.855	4.854	4.854	4.854	4.853	4.852	4.851	4.847	4.844	4.844	4.850	V
		sn3	4.855	4.854	4.854	4.854	4.853	-0.689	-0.693	-0.694	-0.688	-0.688	-0.693	V
		sn4	4.855	4.855	4.854	4.854	4.853	4.852	4.852	4.847	4.844	4.844	4.849	V
		sn5	4.854	4.854	4.854	4.853	4.853	4.852	4.852	4.847	4.844	4.844	4.850	V
	OFF	sn6	4.854	4.854	4.854	4.854	4.853	4.852	4.852	4.848	4.846	4.845	4.846	V
		sn7	4.855	4.855	4.855	4.855	4.854	4.853	4.853	4.850	4.847	4.847	4.848	V
		sn8	4.854	4.854	4.854	4.853	4.853	4.852	4.851	4.848	4.846	4.846	4.846	V
		sn9	4.855	4.855	4.855	4.854	4.854	4.853	4.853	4.849	4.847	4.846	4.847	V
		sn10	4.855	4.855	4.855	4.854	4.853	4.852	4.852	4.849	4.847	4.846	4.845	V
	reference	sn11	4.855	4.855	4.855	4.855	4.854	4.855	4.855	4.854	4.854	4.853	4.855	V
Statistical analysis [see annex]	ON	Max	4.855	4.855	4.854	4.854	4.853	4.852	4.852	4.847	4.844	4.844	4.850	V
		Min	4.854	4.854	4.853	4.853	4.853	4.851	4.851	4.845	4.843	4.843	4.849	V
		Mean	**4.855**	**4.854**	**4.854**	**4.854**	**4.853**	**4.852**	**4.852**	**4.847**	**4.844**	**4.844**	**4.850**	V
		St. dev	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	V
		Lmax	4.856	4.855	4.855	4.855	4.853	4.853	4.853	4.849	4.845	4.845	4.851	V
		Lmin	4.853	4.853	4.853	4.852	4.853	4.850	4.850	4.844	4.842	4.842	4.848	V
	OFF	Max	4.855	4.855	4.855	4.855	4.854	4.853	4.853	4.850	4.847	4.847	4.848	V
		Min	4.854	4.854	4.854	4.853	4.853	4.852	4.851	4.848	4.846	4.845	4.845	V
		Mean	**4.855**	**4.855**	**4.855**	**4.854**	**4.853**	**4.852**	**4.852**	**4.849**	**4.847**	**4.846**	**4.846**	V
		St. dev	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	V
		Lmax	4.856	4.856	4.856	4.856	4.855	4.854	4.854	4.851	4.848	4.848	4.850	V
		Lmin	4.853	4.853	4.853	4.852	4.852	4.851	4.850	4.847	4.845	4.844	4.843	V



6. ELECTRICAL MEASUREMENTS

TEST PARAMETER			20. Negative Output Voltage Swing of Amplifier 2									$V^-_{O,2}$		unit V
TEST CONDITIONS			V^+ = 5V; V^- = 0V											
SPECIFICATION LIMITS [see test plan]			Max										0.035	V
			Min										-	V
TEST STEPS			Irradiation steps									Anneal I	Anneal II	
			20									20	100	°C
			0	3.39	5.67	8.92	11.24	14.35	16.74	48.81	64.75	0	0	krad (Si)
Electrical measurements [sn: serial number]	ON	sn1	0.130	0.129	0.129	0.128	0.127	0.128	0.127	0.126	0.124	0.125	0.140	V
		sn2	0.128	0.128	0.127	0.126	0.126	0.126	0.126	0.122	0.121	0.121	0.137	V
		sn3	0.129	0.128	0.127	0.126	0.126	1.638	1.638	1.638	1.638	1.638	1.638	V
		sn4	0.128	0.127	0.127	0.126	0.126	0.127	0.126	0.123	0.123	0.123	0.139	V
		sn5	0.128	0.127	0.127	0.126	0.126	0.126	0.125	0.121	0.121	0.121	0.136	V
	OFF	sn6	0.128	0.127	0.126	0.125	0.125	0.125	0.124	0.121	0.121	0.121	0.128	V
		sn7	0.128	0.127	0.126	0.125	0.125	0.125	0.124	0.121	0.122	0.122	0.130	V
		sn8	0.129	0.127	0.127	0.127	0.127	0.126	0.126	0.123	0.123	0.123	0.130	V
		sn9	0.129	0.128	0.127	0.126	0.126	0.126	0.125	0.122	0.122	0.122	0.129	V
		sn10	0.129	0.128	0.127	0.126	0.126	0.126	0.126	0.122	0.123	0.123	0.130	V
	reference	sn11	0.128	0.128	0.127	0.127	0.129	0.128	0.128	0.129	0.129	0.129	0.128	V
Statistical analysis [see annex]	ON	Max	0.130	0.129	0.129	0.128	0.127	0.128	0.127	0.126	0.124	0.125	0.140	V
		Min	0.128	0.127	0.127	0.126	0.126	0.126	0.125	0.121	0.121	0.121	0.136	V
		Mean	**0.129**	**0.128**	**0.127**	**0.126**	**0.126**	**0.127**	**0.126**	**0.123**	**0.122**	**0.123**	**0.138**	V
		St. dev	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.002	0.002	0.002	V
		Lmax	0.131	0.130	0.130	0.129	0.127	0.129	0.128	0.129	0.126	0.128	0.143	V
		Lmin	0.126	0.126	0.125	0.124	0.125	0.124	0.124	0.117	0.118	0.117	0.133	V
	OFF	Max	0.129	0.128	0.127	0.127	0.127	0.126	0.126	0.123	0.123	0.123	0.130	V
		Min	0.128	0.127	0.126	0.125	0.125	0.125	0.124	0.121	0.121	0.121	0.128	V
		Mean	**0.129**	**0.127**	**0.127**	**0.126**	**0.126**	**0.126**	**0.125**	**0.122**	**0.122**	**0.122**	**0.129**	V
		St. dev	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	V
		Lmax	0.130	0.129	0.128	0.128	0.128	0.127	0.128	0.124	0.124	0.124	0.132	V
		Lmin	0.127	0.126	0.125	0.124	0.124	0.124	0.122	0.120	0.120	0.120	0.127	V



ANNEX

1 ESTEC Irradiation Test Campaign Details

see attached report

2 STATISTICAL ANALYSIS

Max, Min:	Parameter range limits Maximum (Max), Minimum (Min)
Mean value:	arithmetic average of a group of values
Lmax Lmin:	limits for a statistic calculation using very low sample size (n<10). Accordingly to MIL HDBK 814 those limits define that a parameter value is within this range with a probability P of 90% and a confidential level of 90%