Radiation Assured Devices
5017 N. 30th Street
Colorado Springs, CO 80919
(719) 531-0800

Radiation Lot Acceptance Testing (RLAT) of the RH1013MW Dual Precision Operational Amplifier for Linear Technology

Customer: Linear Technology, PO# 55227L

RAD Job Number: 10-055

Part Type Tested: Linear Technology RH1013MW Dual Precision Operational Amplifier

Commercial Part Number: RH1013MW

Traceability Information: Fab Lot# W10722836.1, Wafer 13, Assembly Lot #547884.1. Information obtained from Linear Technology PO#55227L. Date code marking on the package is 0944A, see Appendix A for a photograph of the device and part markings.

Quantity of Units: 12 units total, 5 units for biased irradiation, 5 units for unbiased irradiation (all pins tied to ground) and 2 control units. Serial numbers 41, 116, 182, 241, and 325 were biased during irradiation. Serial numbers 408, 492, 724, 786, and 868 were unbiased during irradiation (all pins tied to ground). Serial numbers 929 and 1012 were used as controls. See Appendix B for the radiation bias connection table.

Pre-Irradiation Burn-In: Burn-In performed by Linear Technology prior to receipt by RAD.

TID Dose Rate and Test Increments: 50-300rad(Si)/s with readings at pre-irradiation, 20, 50, 100, and 200krad(Si).

TID Overtest and Post-Irradiation Anneal: No overtest or anneal.

TID Test Standard: MIL-STD-883G, Method 1019.7, Condition A

TID Electrical Test Conditions: Pre-irradiation, and within one hour following each radiation exposure.

Test Programs: RH1013LT.SRC

Test Hardware: LTS2020 Tester, 2101 Family Board, 0600 Fixture, and RH1013 LTS0325 DUT Board

Facility and Radiation Source: Radiation Assured Devices Longmire Laboratories, Colorado Springs, CO using the JLSA 81-24 high dose rate Co60 source. Dosimetry performed by CaF_2 TLDs traceable to NIST. RAD's dosimetry has been audited by DSCC and RAD has been awarded Laboratory Suitability for MIL-STD-750 TM 1019.5.

Irradiation and Test Temperature: Ambient room temperature for irradiation and test controlled to 24°C±6°C per MIL-STD-883.

RLAT Result: PASSED. Units pass to 100krad(Si) and 200krad(Si) with all parameters remaining within their post-irradiation specifications including after application of the KTL statistics.

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1.0. Overview and Background

It is well known that total dose ionizing radiation can cause parametric degradation and ultimately functional failure in electronic devices. The damage occurs via electron-hole pair production, transport and trapping in the dielectric and interface regions. In discrete devices the bulk of the damage is frequently manifested as a reduction in the gain and/or breakdown voltage of the device. The damage will usually anneal with time following the end of the radiation exposure. Due to this annealing, and to ensure a worst-case test condition MIL-STD-883 TM1019.7 calls out a dose rate of 50 to 300rad(Si)/s as Condition A and further specifies that the time from the end of an incremental radiation exposure and electrical testing shall be 1-hour or less and the total time from the end of one incremental irradiation to the beginning of the next incremental radiation step should be 2-hours or less. The work described in this report was performed to meet MIL-STD-883 TM1019.7 Condition A.

2.0. Radiation Test Apparatus

The total ionizing dose testing described in this final report was performed using the facilities at Radiation Assured Devices' Longmire Laboratories in Colorado Springs, CO. The high dose rate total ionizing dose (TID) source is a JLSA 84-21 irradiator modified to provide a panoramic exposure. The Co-60 rods are held in the base of the irradiator heavily shielded by lead, during the radiation exposures the rod is raised by an electronic timer/controller and the exposure is performed in air. The dose rate for this irradiator in this configuration ranges from <1rad(Si)/s to a maximum of approximately 120rad(Si)/s, determined by the distance from the source. For high-dose rate experiments the bias boards are placed in a radial fashion equidistant from the raised Co-60 rods with the distance adjusted to provide the required dose rate. The irradiator calibration is maintained by Radiation Assured Devices Longmire Laboratories using thermoluminescent dosimeters (TLDs)) traceable to the National Institute of Standards and Technology (NIST). Figure 2.1 shows a photograph of the JLSA 81-24 Co-60 irradiator at RAD's Longmire Laboratory facility.

RAD is currently certified by the Defense Supply Center Columbus (DSCC) for Laboratory Suitability under MIL STD 750. Additional details regarding Radiation Assured Devices dosimetry for TM1019 Condition A testing are available in RAD's report to DSCC entitled: "Dose Rate Mapping of the J.L. Shepherd and Associates Model 81 Irradiator Installed by Radiation Assured Devices"

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Figure 2.1. Radiation Assured Devices' high dose rate Co-60 irradiator. The dose rate is obtained by positioning the device-under-test at a fixed distance from the gamma cell. The dose rate for this irradiator varies from approximately 120rad(Si)/s close to the rods down to 1rad(Si)/s at a distance of approximately 2-feet.

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3.0. Radiation Test Conditions

The RH1013M dual operational amplifier described in this final report was irradiated using a split 15V supply and with all pins tied to ground, that is biased and unbiased. See the TID Bias Table in Appendix B for the full bias circuits. These bias circuits satisfy the requirements of MIL-STD-883G TM1019.7 Section 3.9.3 Bias and Loading Conditions which states "The bias applied to the test devices shall be selected to produce the greatest radiation induced damage or the worst-case damage for the intended application, if known. While maximum voltage is often worst case some bipolar linear device parameters (e.g. input bias current or maximum output load current) exhibit more degradation with 0 V bias."

The devices were irradiated to a maximum total ionizing dose level of 200krad(Si) with incremental readings at 20, 50, 100 and 200krad(Si) for all electrical tests using the ±15V supply and with incremental readings at 20, 50 and 100krad(Si) for all electrical tests using the +5V and 0V supply conditions (See LINEAR TECHNOLOGY CORPORATION RH1013M Dual Precision Operational Amplifier Datasheet Page 3, Note 2). Electrical testing occurred within one hour following the end of each irradiation segment. For intermediate irradiations, the parts were tested and returned to total dose exposure within two hours from the end of the previous radiation increment. Note that the RH1013 is specified to 100krad(Si) in the $+V_S$=5V, $-V_S$=0 supply conditions. The 200krad(Si) data shown in this report for those parameters should be used for reference only.

The TID bias board was positioned in the Co-60 cell to provide the required minimum of 50rad(Si)/s and was located inside a lead-aluminum enclosure. The lead-aluminum enclosure is required under MIL-STD-883G TM1019.7 Section 3.4 that reads as follows: "Lead/Aluminum (Pb/Al) container. Test specimens shall be enclosed in a Pb/Al container to minimize dose enhancement effects caused by low-energy, scattered radiation. A minimum of 1.5 mm Pb, surrounding an inner shield of at least 0.7 mm Al, is required. This Pb/Al container produces an approximate charged particle equilibrium for Si and for TLDs such as CaF2. The radiation field intensity shall be measured inside the Pb/Al container (1) initially, (2) when the source is changed, or (3) when the orientation or configuration of the source, container, or test-fixture is changed. This measurement shall be performed by placing a dosimeter (e.g., a TLD) in the device-irradiation container at the approximate test-device position. If it can be demonstrated that low energy scattered radiation is small enough that it will not cause dosimetry errors due to dose enhancement, the Pb/Al container may be omitted".

The final dose rate within the high dose rate lead-aluminum enclosure was determined based on TLD dosimetry measurements (see previous section). The final dose rate for this work was 56.0rad(Si)/s with a precision of ±5%.

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4.0. Tested Parameters

During the radiation lot acceptance testing the following pre- and post-irradiation electrical parameters were measured:

±15V Tests

1. Positive Supply Current (ICC+)
2. Negative Supply Current (IEE-)
3. Input Offset Voltage (V_{OS} Channel A and B)
4. Input Offset Current (I_{OS} Channel A and B)
5. + Input Bias Current (I_{B+} Channel A and B)
6. - Input Bias Current (I_{B-} Channel A and B)
7. Common Mode Rejection Ratio (CMRR Channel A and B)
8. Power Supply Rejection Ratio (PSRR Channel A and B)
9. Large Signal Voltage Gain (A_{VOL} Channel A and B)
10. Positive Output Voltage Swing, No Load (V_{OUT} Channel A and B)
11. Positive Output Voltage Swing, 600Ω (V_{OUT} Channel A and B)
12. Negative Output Voltage Swing, No Load (V_{OUT} Channel A and B)
13. Negative Output Voltage Swing, 600Ω (V_{OUT} Channel A and B)
14. Positive Slew Rate (SlewRate+ Channel A and B)
15. Negative Slew Rate (SlewRate- Channel A and B)

+5V Tests

16. Positive Supply Current (ICC+2)
17. Negative Supply Current (IEE-2)
18. Input Offset Voltage (V_{OS} Channel A and B)
19. Input Offset Current (I_{OS} Channel A and B)
20. + Input Bias Current (I_{B+} Channel A and B)
21. - Input Bias Current (I_{B-} Channel A and B)
22. Output Voltage High, No Load (V_{OUT} Channel A and B)
23. Output Voltage High, 600Ω (V_{OUT} Channel A and B)
24. Output Voltage Low, No Load (V_{OUT} Channel A and B)
25. Output Voltage Low, 600Ω (V_{OUT} Channel A and B)
26. Output Voltage Low, 1mA (V_{OUT} Channel A and B)

The parametric data was obtained as read and record and all the raw data plus an attributes summary are contained in a separate Excel file. The attributes data contains the average, standard deviation and the average with the KTL values applied. The KTL value used is 2.742 per MIL HDBK 814 using one sided tolerance limits of 90/90 and a 5-piece sample size. Note that the following criteria must be met for a device to pass the RLAT: following the radiation exposure each of the 5 pieces shall pass the

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specification value and the average value for the ten-piece sample must pass the specification value when the KTL limits are applied. If either of these conditions is not satisfied following the radiation exposure, then the lot could be logged as a failure.

5.0. Total Ionizing Dose Test Results

The RH1013M operational amplifiers from the lot of material described on the first page of this report passed the RLAT to the maximum tested level of 100krad(Si) and 200krad(Si) without significant degradation to most of the measured parameters. As seen in the data plots, several parameters suffered measurable radiation-induced degradation, however in no case was the degradation sufficient to cause the parameters to go out of specification even after application of the KTL statistics. Note that PSSR for Channel A was out of specification pre-irradiation and at the first two dose levels. In our opinion this is due to the distribution within the sample population and is not reflective of radiation-induced degradation of the parameter. Further note that RH1013 is specified to 100krad(Si) in the +VS=5V, -VS=0 supply conditions and the 200krad(Si) data shown in this report for those parameters should be used for reference only.

Figures 5.1 and 5.44 show plots of all the measured parameters versus total ionizing dose while Tables 5.1 – 5.44 show the corresponding raw data for each of these parameters. Appendix D lists the figure numbers and titles for convenience.

In the data plots the solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

The control units, as expected, show no significant changes to any of the parameters. Therefore we can conclude that the electrical testing remained in control throughout the duration of the tests and that any observed degradation was due to the radiation exposure.

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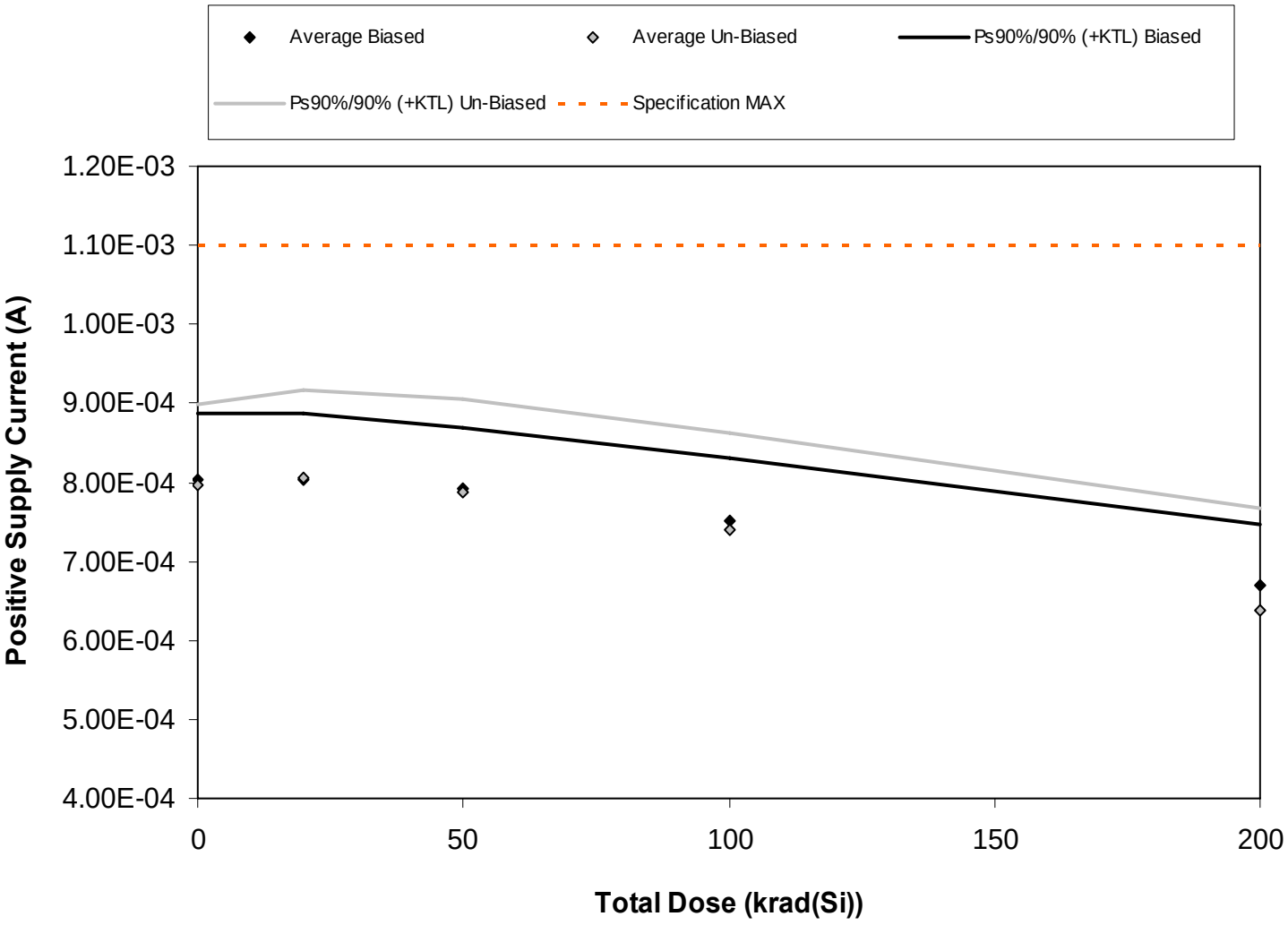

Figure 5.1. Plot of positive supply current (±15V) versus total dose. The data shows a general improvement with radiation. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.1. Raw data for Positive Supply Current (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Supply Current (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	7.80E-04	7.79E-04	7.65E-04	7.20E-04	6.38E-04
116	7.88E-04	7.89E-04	7.86E-04	7.48E-04	6.70E-04
182	8.25E-04	8.24E-04	8.10E-04	7.66E-04	6.84E-04
241	8.46E-04	8.47E-04	8.31E-04	7.92E-04	7.09E-04
325	7.78E-04	7.79E-04	7.71E-04	7.30E-04	6.48E-04
408	7.65E-04	7.73E-04	7.53E-04	7.06E-04	6.05E-04
492	7.87E-04	7.93E-04	7.76E-04	7.28E-04	6.22E-04
724	7.90E-04	7.96E-04	7.74E-04	7.26E-04	6.29E-04
786	7.85E-04	7.89E-04	7.69E-04	7.19E-04	6.15E-04
868	8.61E-04	8.77E-04	8.62E-04	8.18E-04	7.21E-04
929	8.11E-04	8.13E-04	8.12E-04	8.14E-04	8.14E-04
1012	8.14E-04	8.18E-04	8.18E-04	8.18E-04	8.19E-04
Biased Statistics					
Average Biased	8.03E-04	8.04E-04	7.93E-04	7.51E-04	6.70E-04
Std Dev Biased	3.05E-05	3.05E-05	2.76E-05	2.88E-05	2.84E-05
Ps90%/90% (+KTL) Biased	8.87E-04	8.87E-04	8.68E-04	8.30E-04	7.48E-04
Ps90%/90% (-KTL) Biased	7.20E-04	7.20E-04	7.17E-04	6.72E-04	5.92E-04
Un-Biased Statistics					
Average Un-Biased	7.98E-04	8.06E-04	7.87E-04	7.39E-04	6.38E-04
Std Dev Un-Biased	3.68E-05	4.09E-05	4.30E-05	4.48E-05	4.70E-05
Ps90%/90% (+KTL) Un-Biased	8.98E-04	9.18E-04	9.05E-04	8.62E-04	7.67E-04
Ps90%/90% (-KTL) Un-Biased	6.97E-04	6.93E-04	6.69E-04	6.17E-04	5.09E-04
Specification MAX	1.10E-03	1.10E-03	1.10E-03	1.10E-03	1.10E-03
Status	PASS	PASS	PASS	PASS	PASS

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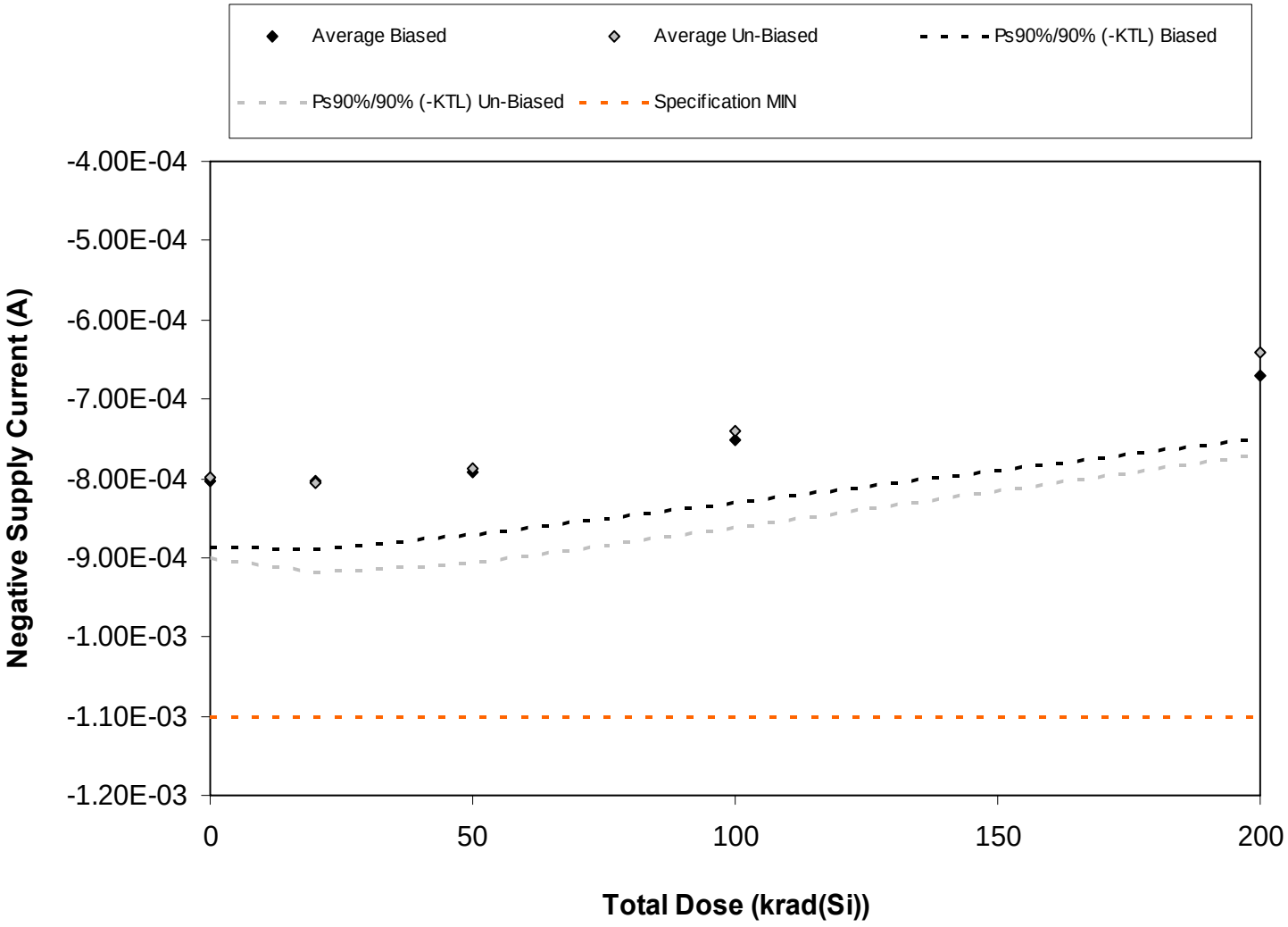

Figure 5.2. Plot of Negative Supply Current @ +/-15V (A) versus total dose. The data show a general improvement with radiation. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.2. Raw data for Negative Supply Current (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Supply Current (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-7.80E-04	-7.79E-04	-7.64E-04	-7.20E-04	-6.38E-04
116	-7.89E-04	-7.89E-04	-7.84E-04	-7.47E-04	-6.69E-04
182	-8.25E-04	-8.24E-04	-8.11E-04	-7.68E-04	-6.86E-04
241	-8.46E-04	-8.48E-04	-8.33E-04	-7.91E-04	-7.10E-04
325	-7.78E-04	-7.80E-04	-7.71E-04	-7.30E-04	-6.50E-04
408	-7.66E-04	-7.72E-04	-7.54E-04	-7.07E-04	-6.05E-04
492	-7.87E-04	-7.93E-04	-7.77E-04	-7.29E-04	-6.26E-04
724	-7.88E-04	-7.98E-04	-7.74E-04	-7.26E-04	-6.31E-04
786	-7.86E-04	-7.92E-04	-7.68E-04	-7.18E-04	-6.17E-04
868	-8.62E-04	-8.77E-04	-8.64E-04	-8.18E-04	-7.23E-04
929	-8.11E-04	-8.15E-04	-8.12E-04	-8.14E-04	-8.15E-04
1012	-8.17E-04	-8.18E-04	-8.18E-04	-8.18E-04	-8.17E-04
Biased Statistics					
Average Biased	-8.04E-04	-8.04E-04	-7.93E-04	-7.51E-04	-6.71E-04
Std Dev Biased	3.03E-05	3.07E-05	2.88E-05	2.88E-05	2.86E-05
Ps90%/90% (+KTL) Biased	-7.20E-04	-7.20E-04	-7.13E-04	-6.72E-04	-5.92E-04
Ps90%/90% (-KTL) Biased	-8.87E-04	-8.88E-04	-8.72E-04	-8.30E-04	-7.49E-04
Un-Biased Statistics					
Average Un-Biased	-7.98E-04	-8.06E-04	-7.87E-04	-7.40E-04	-6.40E-04
Std Dev Un-Biased	3.70E-05	4.07E-05	4.37E-05	4.46E-05	4.72E-05
Ps90%/90% (+KTL) Un-Biased	-6.96E-04	-6.95E-04	-6.68E-04	-6.17E-04	-5.11E-04
Ps90%/90% (-KTL) Un-Biased	-8.99E-04	-9.18E-04	-9.07E-04	-8.62E-04	-7.70E-04
Specification MIN	-1.10E-03	-1.10E-03	-1.10E-03	-1.10E-03	-1.10E-03
Status	PASS	PASS	PASS	PASS	PASS

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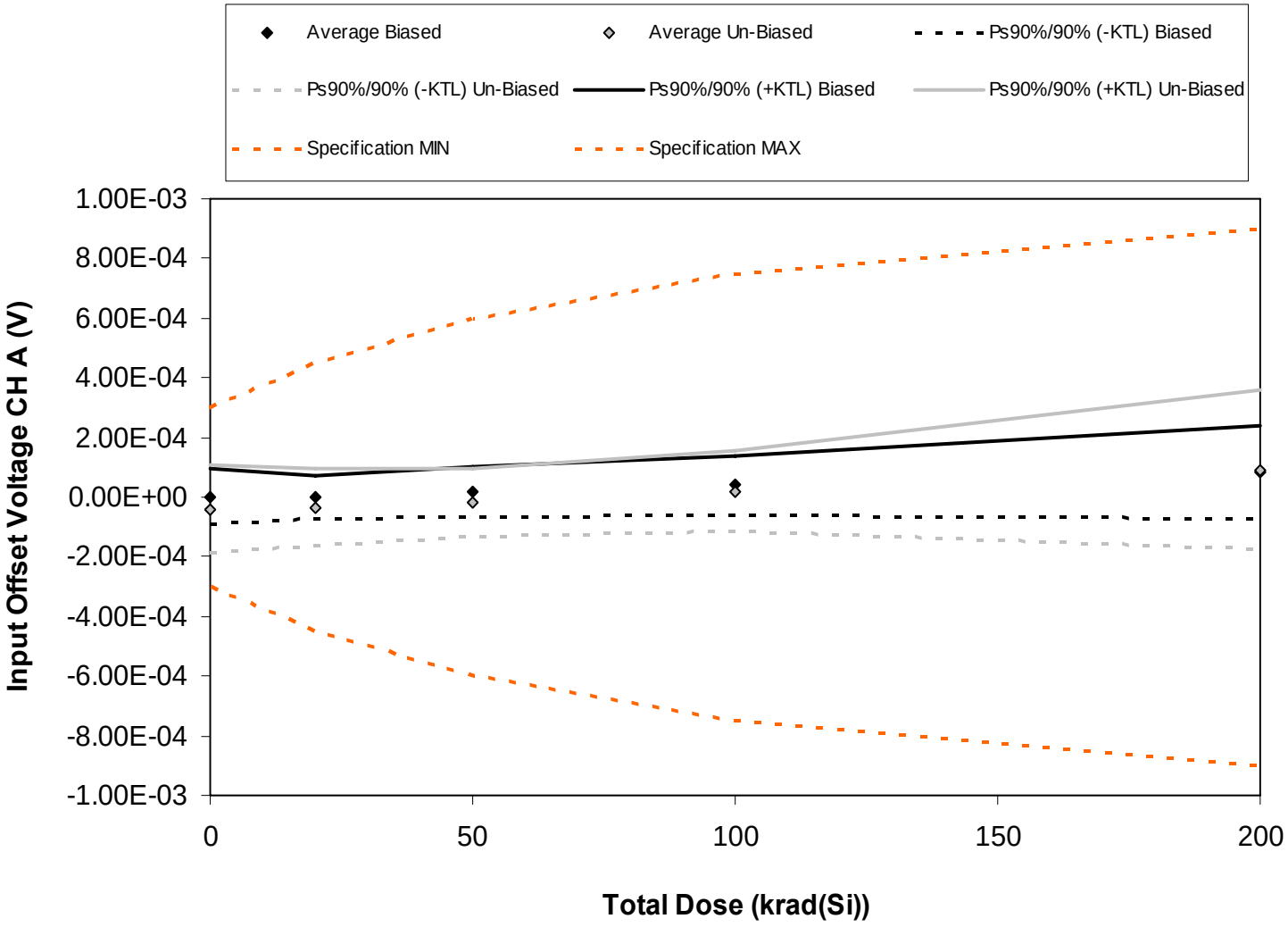

Figure 5.3. Plot of input offset voltage for channel A @ +/-15V (A) versus total dose. The data show some increase with radiation, however it is not sufficient for the parameter to exceed the post-irradiation specification limits. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan

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Table 5.3. Raw data for Input Offset Voltage CH A (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Voltage CH A (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	5.30E-05	3.44E-05	5.48E-05	8.40E-05	1.48E-04
116	-2.36E-05	-2.14E-05	-1.91E-05	-1.15E-05	-4.60E-06
182	-3.24E-05	-2.79E-05	-7.85E-06	2.28E-05	7.55E-05
241	9.60E-07	7.48E-06	2.37E-05	4.78E-05	1.08E-04
325	1.51E-05	1.77E-05	3.42E-05	5.23E-05	9.56E-05
408	-6.69E-05	-5.12E-05	-2.23E-05	2.93E-05	1.29E-04
492	2.25E-05	1.88E-05	3.62E-05	7.26E-05	1.59E-04
724	-2.51E-05	-1.70E-05	2.05E-06	5.36E-05	1.49E-04
786	-1.16E-04	-1.07E-04	-7.72E-05	-1.46E-05	1.04E-04
868	-1.12E-05	-1.76E-05	-2.78E-05	-4.76E-05	-7.82E-05
929	-8.46E-06	-6.89E-06	-6.52E-06	-6.64E-06	-6.16E-06
1012	5.32E-05	5.38E-05	5.36E-05	5.34E-05	5.41E-05
Biased Statistics					
Average Biased	2.63E-06	2.07E-06	1.71E-05	3.91E-05	8.45E-05
Std Dev Biased	3.39E-05	2.63E-05	3.04E-05	3.57E-05	5.65E-05
Ps90%/90% (+KTL) Biased	9.57E-05	7.42E-05	1.00E-04	1.37E-04	2.39E-04
Ps90%/90% (-KTL) Biased	-9.04E-05	-7.01E-05	-6.61E-05	-5.87E-05	-7.04E-05
Un-Biased Statistics					
Average Un-Biased	-3.93E-05	-3.48E-05	-1.78E-05	1.87E-05	9.25E-05
Std Dev Un-Biased	5.34E-05	4.73E-05	4.17E-05	4.93E-05	9.78E-05
Ps90%/90% (+KTL) Un-Biased	1.07E-04	9.49E-05	9.65E-05	1.54E-04	3.61E-04
Ps90%/90% (-KTL) Un-Biased	-1.86E-04	-1.64E-04	-1.32E-04	-1.17E-04	-1.76E-04
Specification MIN	-3.00E-04	-4.50E-04	-6.00E-04	-7.50E-04	-9.00E-04
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-04	4.50E-04	6.00E-04	7.50E-04	9.00E-04
Status	PASS	PASS	PASS	PASS	PASS

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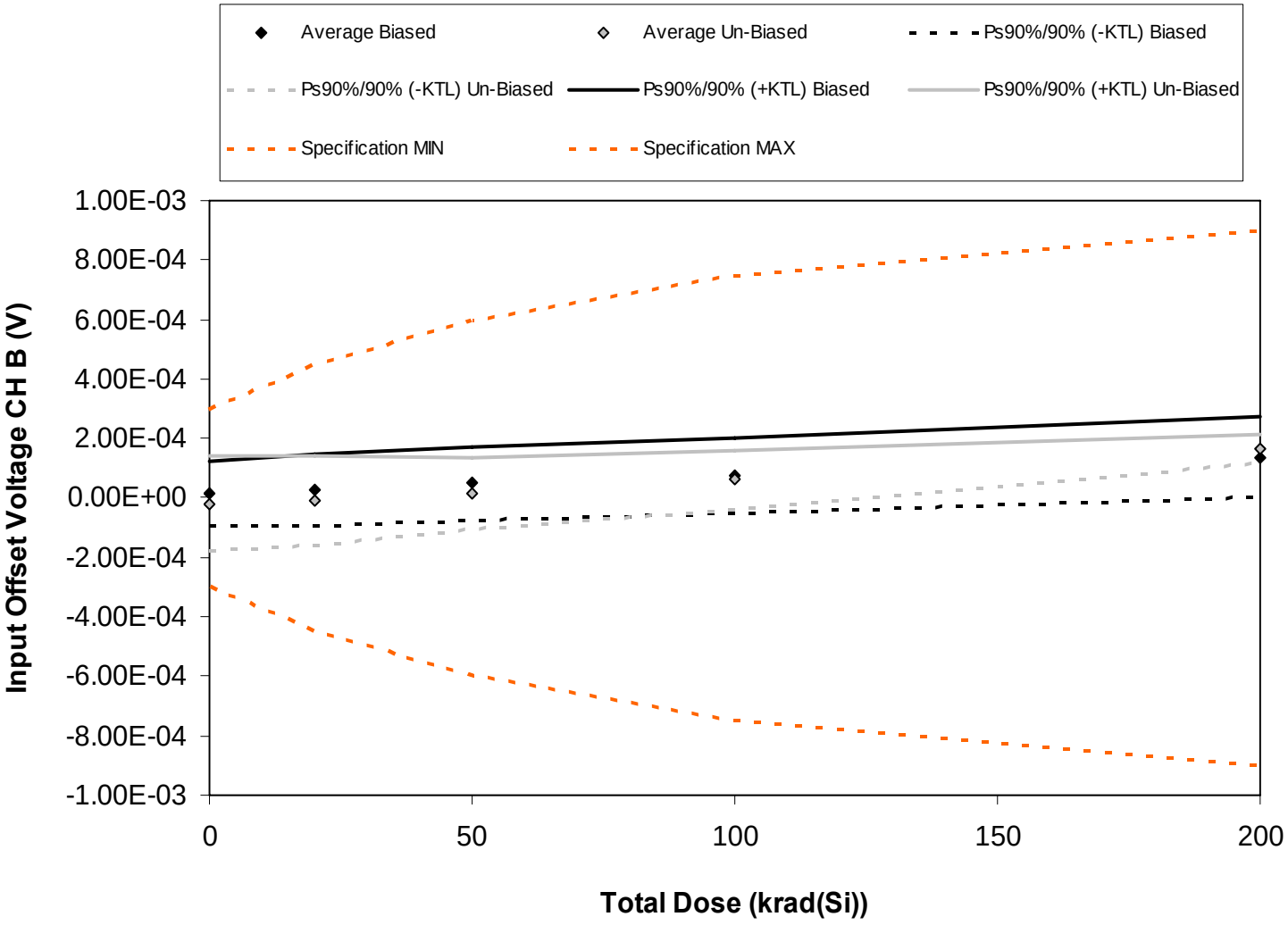

Figure 5.4. Plot of input offset voltage for channel B @ +/-15V (A) versus total dose. The data show some increase with radiation, however it is not sufficient for the parameter to exceed the post-irradiation specification limits. The solid diamonds are the average of the measured data points for the sample irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the units irradiated with all pins tied to ground. The black lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the biased condition while the shaded lines (solid or dashed) are the average of the data points after application of the KTL statistics on the sample irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.4. Raw data for Input Offset Voltage CH B (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Voltage CH B (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-2.49E-05	-1.85E-05	3.50E-06	3.65E-05	9.51E-05
116	4.25E-05	5.82E-05	7.55E-05	9.70E-05	1.46E-04
182	-3.33E-05	-2.32E-05	-3.02E-06	2.23E-05	8.42E-05
241	4.84E-05	6.92E-05	9.45E-05	1.32E-04	2.06E-04
325	3.84E-05	5.24E-05	6.99E-05	9.92E-05	1.55E-04
408	-4.91E-05	-4.84E-05	-1.47E-05	3.83E-05	1.59E-04
492	5.42E-05	5.65E-05	7.16E-05	1.11E-04	1.95E-04
724	-5.93E-05	-4.20E-05	-1.10E-05	4.60E-05	1.55E-04
786	-7.28E-05	-5.89E-05	-2.67E-05	2.25E-05	1.53E-04
868	3.02E-05	4.06E-05	5.35E-05	8.72E-05	1.55E-04
929	1.53E-05	1.58E-05	1.63E-05	1.67E-05	1.67E-05
1012	-3.14E-05	-3.19E-05	-3.19E-05	-3.07E-05	-3.09E-05
Biased Statistics					
Average Biased	1.42E-05	2.76E-05	4.81E-05	7.73E-05	1.37E-04
Std Dev Biased	3.98E-05	4.47E-05	4.47E-05	4.61E-05	4.93E-05
Ps90%/90% (+KTL) Biased	1.23E-04	1.50E-04	1.71E-04	2.04E-04	2.73E-04
Ps90%/90% (-KTL) Biased	-9.50E-05	-9.49E-05	-7.44E-05	-4.91E-05	1.96E-06
Un-Biased Statistics					
Average Un-Biased	-1.94E-05	-1.05E-05	1.45E-05	6.10E-05	1.63E-04
Std Dev Un-Biased	5.75E-05	5.45E-05	4.47E-05	3.69E-05	1.77E-05
Ps90%/90% (+KTL) Un-Biased	1.38E-04	1.39E-04	1.37E-04	1.62E-04	2.12E-04
Ps90%/90% (-KTL) Un-Biased	-1.77E-04	-1.60E-04	-1.08E-04	-4.00E-05	1.15E-04
Specification MIN	-3.00E-04	-4.50E-04	-6.00E-04	-7.50E-04	-9.00E-04
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-04	4.50E-04	6.00E-04	7.50E-04	9.00E-04
Status	PASS	PASS	PASS	PASS	PASS

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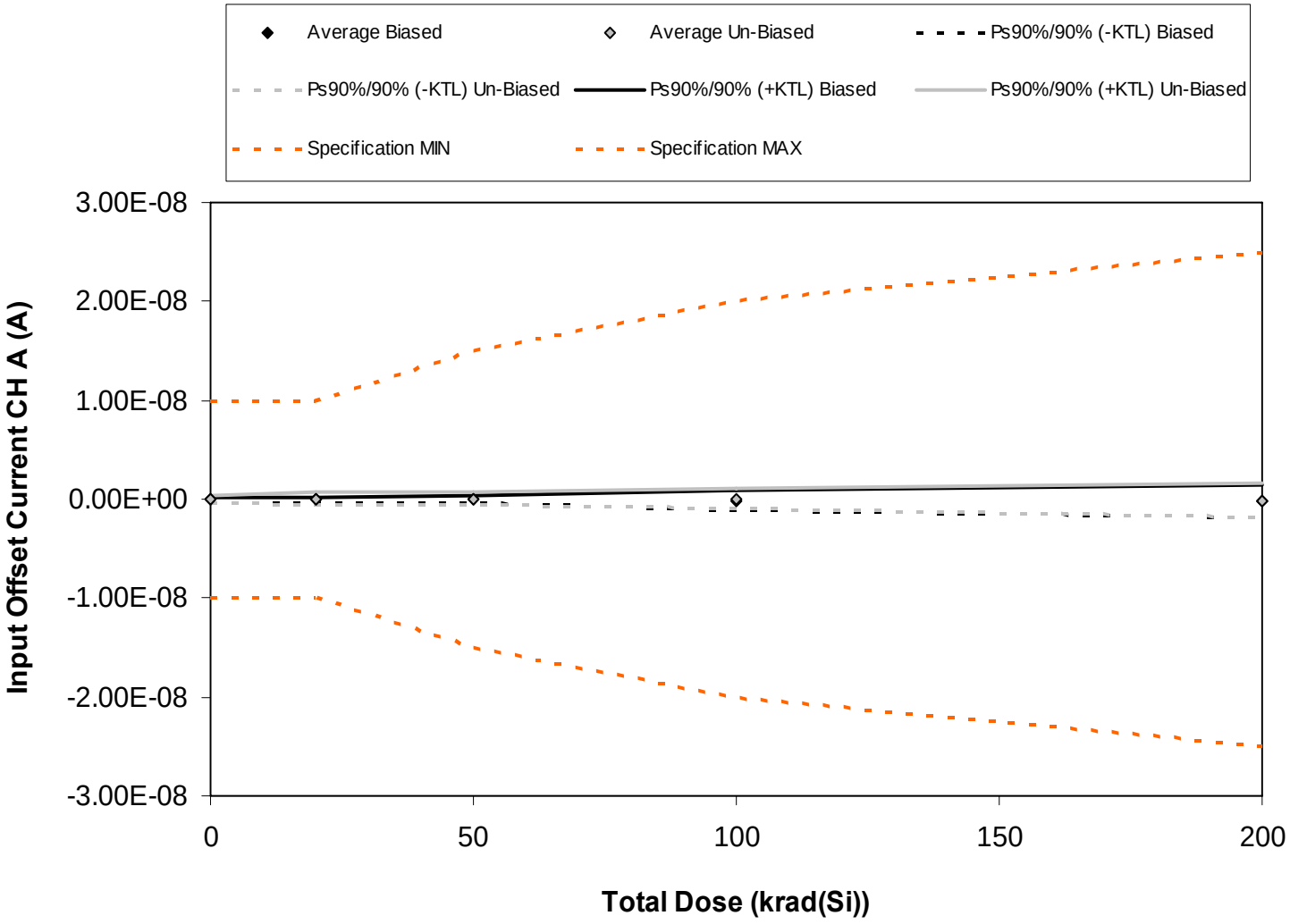

Figure 5.5. Plot of Input Offset Current CH A (A) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.5. Raw data for Input Offset Current CH A (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Current CH A (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.70E-10	-1.95E-10	-8.80E-11	-3.90E-11	1.22E-10
116	6.80E-11	5.40E-11	1.11E-10	3.87E-10	5.76E-10
182	4.90E-11	3.60E-11	1.26E-10	-3.06E-10	-7.39E-10
241	-2.40E-11	-6.70E-11	-1.76E-10	-5.98E-10	-8.15E-10
325	4.50E-11	2.30E-11	-8.30E-11	-8.10E-11	-2.70E-11
408	-8.40E-11	-1.87E-10	-1.14E-10	-1.63E-10	-4.91E-10
492	0.00E+00	-1.20E-11	-8.40E-11	-2.10E-10	-2.75E-10
724	8.60E-11	9.80E-11	1.50E-11	-1.60E-11	-1.12E-10
786	-4.00E-12	-3.30E-11	4.60E-11	-1.12E-10	-6.26E-10
868	2.81E-10	3.90E-10	4.98E-10	6.76E-10	1.02E-09
929	-7.20E-11	-7.80E-11	-4.90E-11	-4.50E-11	-4.90E-11
1012	-1.20E-11	-1.80E-11	-1.60E-11	-8.00E-12	-2.00E-12
Biased Statistics					
Average Biased	-6.40E-12	-2.98E-11	-2.20E-11	-1.27E-10	-1.77E-10
Std Dev Biased	9.79E-11	1.03E-10	1.34E-10	3.63E-10	5.92E-10
Ps90%/90% (+KTL) Biased	2.62E-10	2.54E-10	3.44E-10	8.69E-10	1.45E-09
Ps90%/90% (-KTL) Biased	-2.75E-10	-3.13E-10	-3.88E-10	-1.12E-09	-1.80E-09
Un-Biased Statistics					
Average Un-Biased	5.58E-11	5.12E-11	7.22E-11	3.50E-11	-9.64E-11
Std Dev Un-Biased	1.40E-10	2.15E-10	2.47E-10	3.65E-10	6.56E-10
Ps90%/90% (+KTL) Un-Biased	4.38E-10	6.41E-10	7.50E-10	1.04E-09	1.70E-09
Ps90%/90% (-KTL) Un-Biased	-3.27E-10	-5.38E-10	-6.05E-10	-9.67E-10	-1.89E-09
Specification MIN	-1.00E-08	-1.00E-08	-1.50E-08	-2.00E-08	-2.50E-08
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.00E-08	1.00E-08	1.50E-08	2.00E-08	2.50E-08
Status	PASS	PASS	PASS	PASS	PASS

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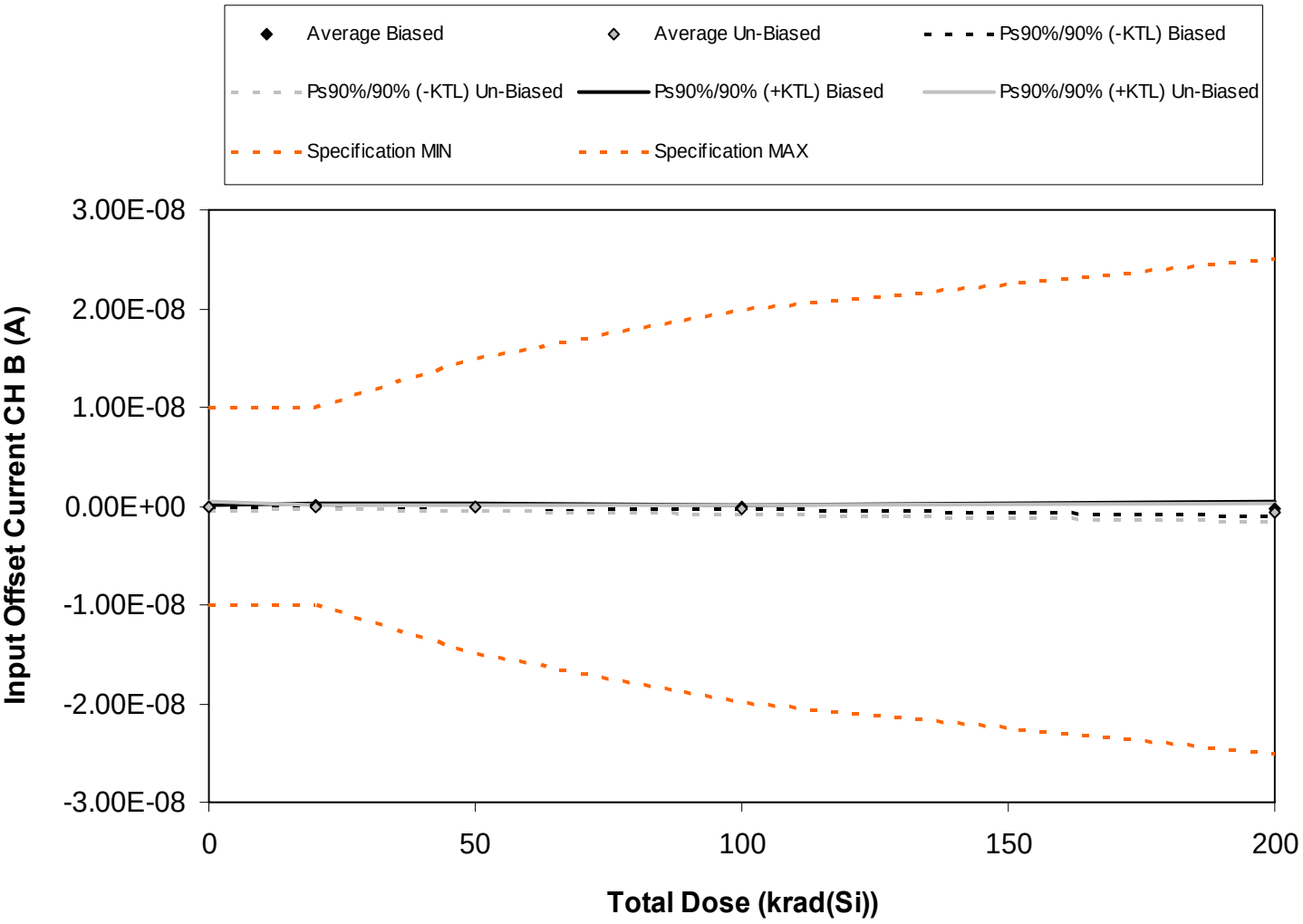

Figure 5.6. Plot of Input Offset Current CH B (A) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.6. Raw data for Input Offset Current CH B (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Current CH B (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.22E-10	-9.40E-11	-1.60E-10	-1.58E-10	-5.00E-11
116	0.00E+00	6.60E-11	-9.40E-11	-7.00E-12	-1.78E-10
182	1.40E-11	-2.00E-12	-6.30E-11	-4.70E-11	-5.11E-10
241	-4.20E-11	7.30E-11	-9.80E-11	-1.88E-10	-4.37E-10
325	-4.00E-12	3.00E-12	1.42E-10	-8.00E-12	9.90E-11
408	-1.25E-10	-6.20E-11	-1.68E-10	-3.56E-10	-9.87E-10
492	3.30E-11	-3.10E-11	-6.10E-11	-2.72E-10	-3.37E-10
724	2.06E-10	4.20E-11	-4.90E-11	-3.69E-10	-6.28E-10
786	-1.80E-11	-9.00E-11	-2.68E-10	-5.03E-10	-9.99E-10
868	-1.22E-10	-7.20E-11	-8.00E-11	-7.00E-11	-3.43E-10
929	-6.60E-11	-5.70E-11	-8.10E-11	-7.40E-11	-9.00E-11
1012	-1.00E-10	-9.90E-11	-1.19E-10	-9.20E-11	-1.25E-10
Biased Statistics					
Average Biased	-3.08E-11	9.20E-12	-5.46E-11	-8.16E-11	-2.15E-10
Std Dev Biased	5.50E-11	6.73E-11	1.15E-10	8.56E-11	2.57E-10
Ps90%/90% (+KTL) Biased	1.20E-10	1.94E-10	2.62E-10	1.53E-10	4.89E-10
Ps90%/90% (-KTL) Biased	-1.82E-10	-1.75E-10	-3.71E-10	-3.16E-10	-9.20E-10
Un-Biased Statistics					
Average Un-Biased	-5.20E-12	-4.26E-11	-1.25E-10	-3.14E-10	-6.59E-10
Std Dev Un-Biased	1.36E-10	5.19E-11	9.25E-11	1.60E-10	3.27E-10
Ps90%/90% (+KTL) Un-Biased	3.68E-10	9.97E-11	1.28E-10	1.23E-10	2.38E-10
Ps90%/90% (-KTL) Un-Biased	-3.79E-10	-1.85E-10	-3.79E-10	-7.51E-10	-1.56E-09
Specification MIN	-1.00E-08	-1.00E-08	-1.50E-08	-2.00E-08	-2.50E-08
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.00E-08	1.00E-08	1.50E-08	2.00E-08	2.50E-08
Status	PASS	PASS	PASS	PASS	PASS

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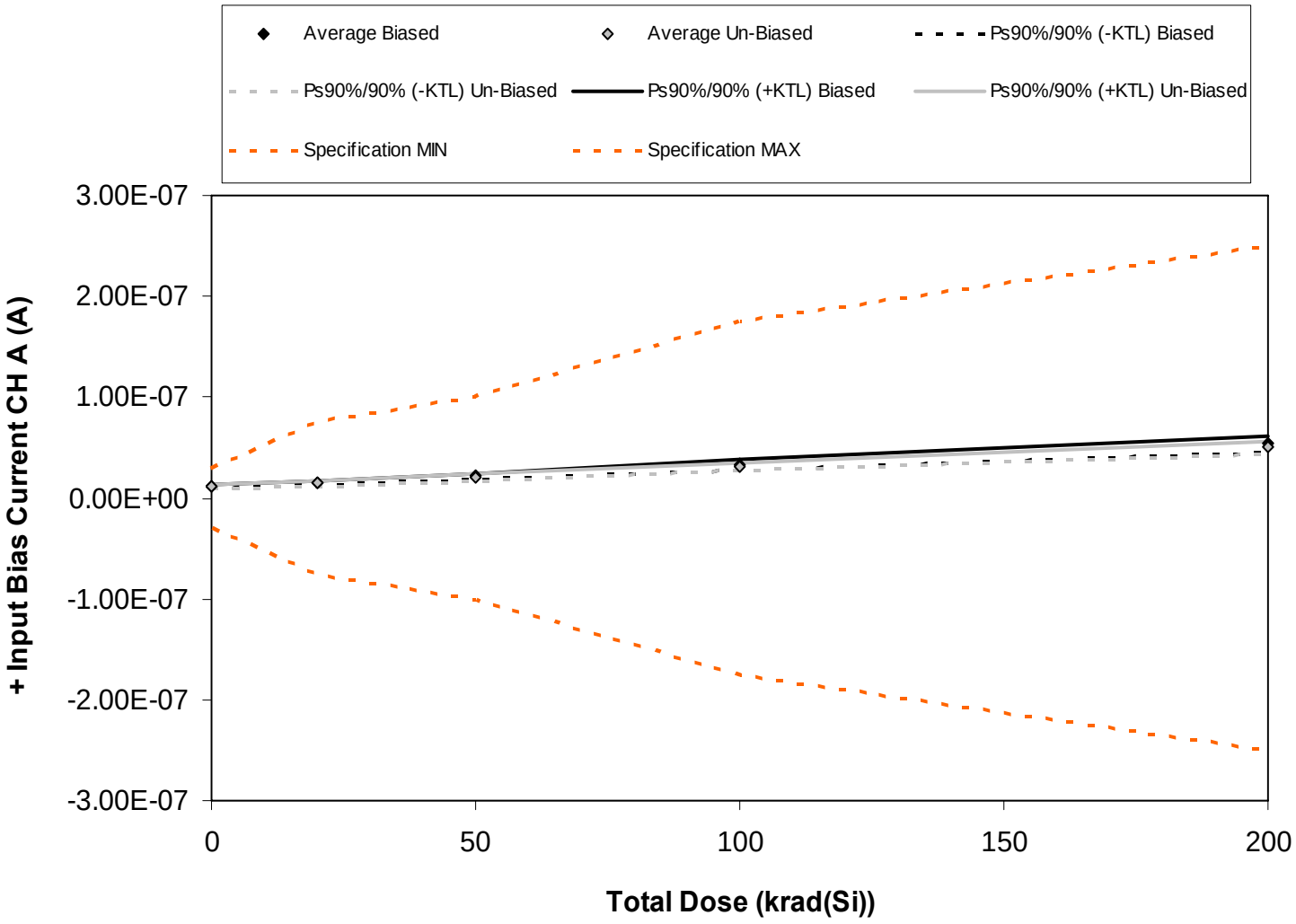

Figure 5.7. Plot of input bias current, non-inverting input @ +/-15V (A) for channel A versus total dose. The data show an increase with radiation, however it is not sufficient to cause the parameter to exceed the post-radiation specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and dashed lines). The red dashed lines are the minimum and maximum specification values as defined in the datasheet and/or test plan.

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Table 5.7. Raw data for + Input Bias Current CH A (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

+ Input Bias Current CH A (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.09E-08	1.42E-08	2.10E-08	3.22E-08	5.22E-08
116	1.17E-08	1.46E-08	2.09E-08	3.21E-08	5.35E-08
182	1.18E-08	1.51E-08	2.21E-08	3.41E-08	5.52E-08
241	1.24E-08	1.59E-08	2.35E-08	3.57E-08	5.81E-08
325	1.13E-08	1.43E-08	2.06E-08	3.15E-08	5.04E-08
408	1.14E-08	1.47E-08	2.10E-08	3.15E-08	5.04E-08
492	1.05E-08	1.35E-08	1.96E-08	2.95E-08	4.80E-08
724	1.17E-08	1.50E-08	2.15E-08	3.20E-08	5.14E-08
786	1.24E-08	1.60E-08	2.27E-08	3.35E-08	5.39E-08
868	1.06E-08	1.39E-08	2.01E-08	3.06E-08	4.92E-08
929	1.15E-08	1.16E-08	1.15E-08	1.16E-08	1.16E-08
1012	1.11E-08	1.11E-08	1.11E-08	1.11E-08	1.11E-08
Biased Statistics					
Average Biased	1.16E-08	1.48E-08	2.16E-08	3.31E-08	5.39E-08
Std Dev Biased	5.64E-10	7.27E-10	1.19E-09	1.75E-09	2.96E-09
Ps90%/90% (+KTL) Biased	1.32E-08	1.68E-08	2.49E-08	3.79E-08	6.20E-08
Ps90%/90% (-KTL) Biased	1.01E-08	1.28E-08	1.83E-08	2.83E-08	4.58E-08
Un-Biased Statistics					
Average Un-Biased	1.13E-08	1.46E-08	2.10E-08	3.14E-08	5.06E-08
Std Dev Un-Biased	7.74E-10	9.67E-10	1.19E-09	1.49E-09	2.28E-09
Ps90%/90% (+KTL) Un-Biased	1.34E-08	1.73E-08	2.42E-08	3.55E-08	5.68E-08
Ps90%/90% (-KTL) Un-Biased	9.19E-09	1.20E-08	1.77E-08	2.73E-08	4.43E-08
Specification MIN	-3.00E-08	-7.50E-08	-1.00E-07	-1.75E-07	-2.50E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-08	7.50E-08	1.00E-07	1.75E-07	2.50E-07
Status	PASS	PASS	PASS	PASS	PASS

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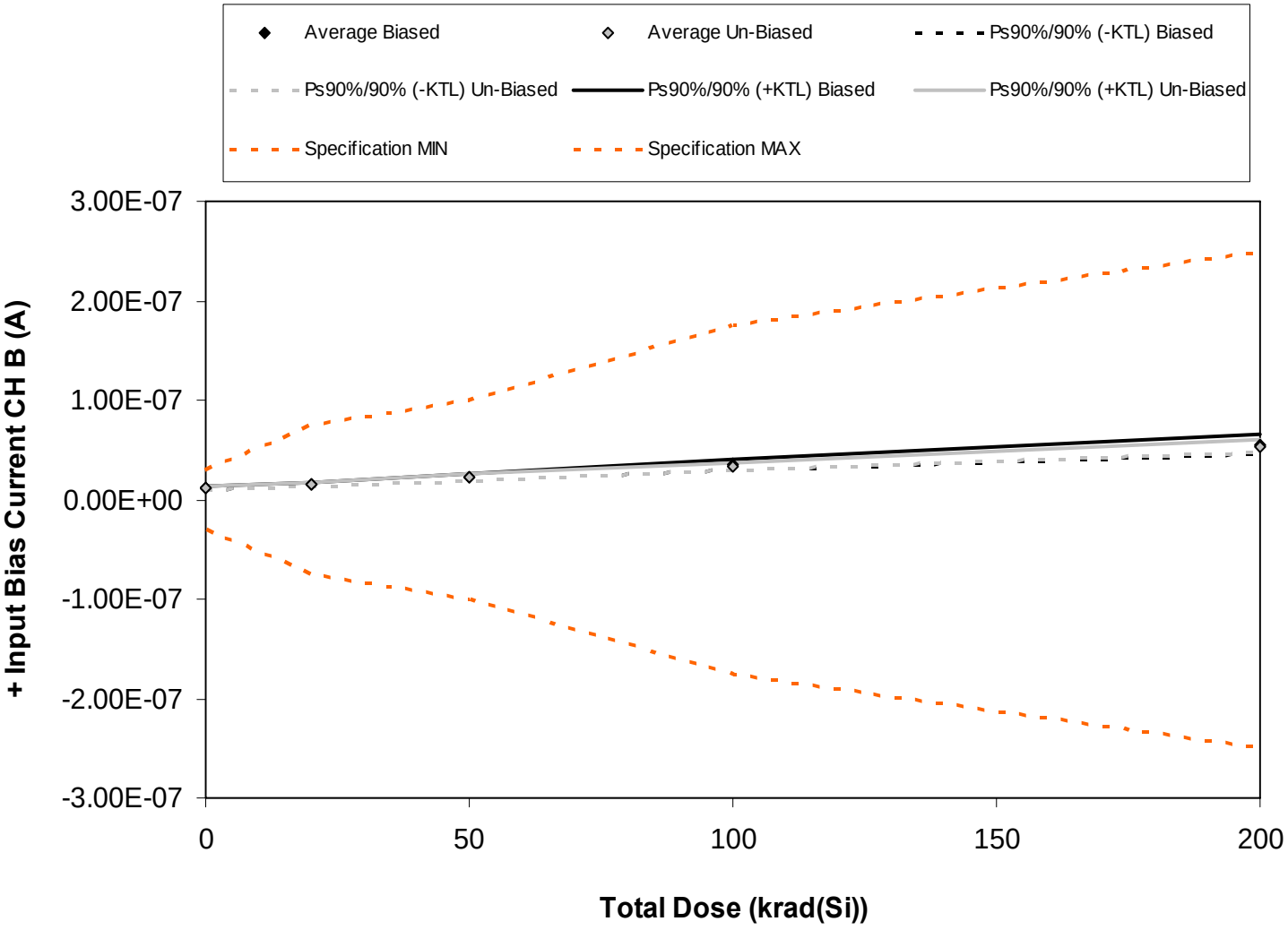

Figure 5.8. Plot of input bias current, non-inverting input @ +/-15V (A) for channel B versus total dose. The data show an increase with radiation, however it is not sufficient to cause the parameter to exceed the post-radiation specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and dashed lines). The red dashed lines are the minimum and maximum specification values as defined in the datasheet and/or test plan.

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Table 5.8. Raw data for + Input Bias Current CH B (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

+ Input Bias Current CH B (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.12E-08	1.47E-08	2.18E-08	3.34E-08	5.39E-08
116	1.21E-08	1.50E-08	2.17E-08	3.33E-08	5.52E-08
182	1.23E-08	1.57E-08	2.30E-08	3.51E-08	5.72E-08
241	1.30E-08	1.68E-08	2.47E-08	3.74E-08	6.09E-08
325	1.17E-08	1.49E-08	2.12E-08	3.24E-08	5.18E-08
408	1.24E-08	1.59E-08	2.28E-08	3.42E-08	5.48E-08
492	1.09E-08	1.40E-08	2.04E-08	3.09E-08	5.03E-08
724	1.27E-08	1.63E-08	2.33E-08	3.51E-08	5.59E-08
786	1.21E-08	1.57E-08	2.25E-08	3.35E-08	5.39E-08
868	1.16E-08	1.50E-08	2.16E-08	3.26E-08	5.24E-08
929	1.19E-08	1.19E-08	1.19E-08	1.19E-08	1.19E-08
1012	1.14E-08	1.14E-08	1.14E-08	1.14E-08	1.14E-08
Biased Statistics					
Average Biased	1.21E-08	1.54E-08	2.25E-08	3.43E-08	5.58E-08
Std Dev Biased	6.69E-10	8.37E-10	1.41E-09	1.98E-09	3.47E-09
Ps90%/90% (+KTL) Biased	1.39E-08	1.77E-08	2.64E-08	3.97E-08	6.53E-08
Ps90%/90% (-KTL) Biased	1.03E-08	1.31E-08	1.87E-08	2.89E-08	4.63E-08
Un-Biased Statistics					
Average Un-Biased	1.19E-08	1.54E-08	2.21E-08	3.33E-08	5.35E-08
Std Dev Un-Biased	7.28E-10	8.81E-10	1.16E-09	1.59E-09	2.21E-09
Ps90%/90% (+KTL) Un-Biased	1.39E-08	1.78E-08	2.53E-08	3.76E-08	5.95E-08
Ps90%/90% (-KTL) Un-Biased	9.93E-09	1.30E-08	1.89E-08	2.89E-08	4.74E-08
Specification MIN	-3.00E-08	-7.50E-08	-1.00E-07	-1.75E-07	-2.50E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-08	7.50E-08	1.00E-07	1.75E-07	2.50E-07
Status	PASS	PASS	PASS	PASS	PASS

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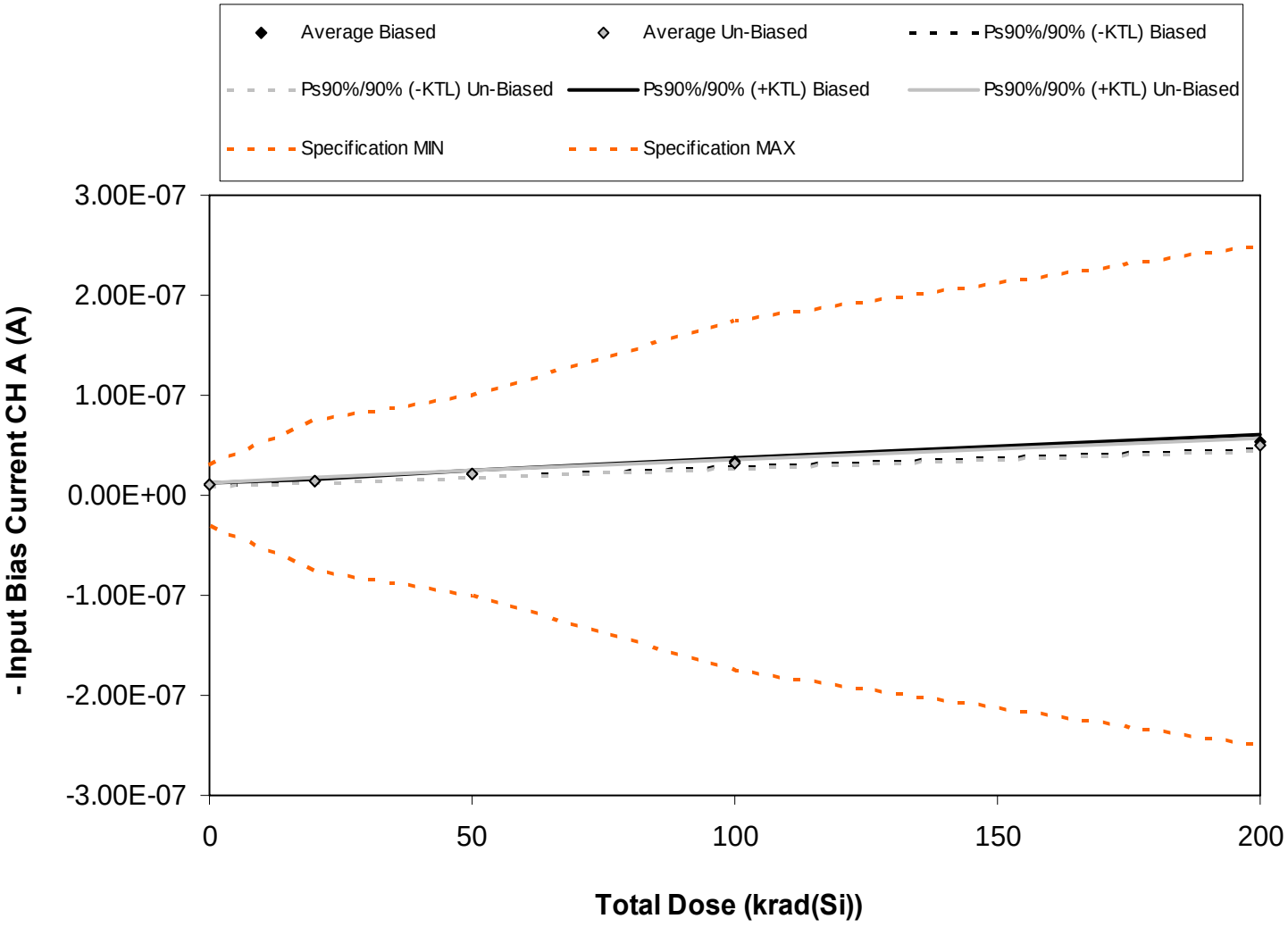

Figure 5.9. Plot of input bias current, inverting input @ +/-15V for channel A versus total dose. The data show an increase with radiation, however it is not sufficient to cause the parameter to exceed the post-radiation specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and dashed lines). The red dashed lines are the minimum and maximum specification values as defined in the datasheet and/or test plan.

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Table 5.9. Raw data for - Input Bias Current CH A (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

- Input Bias Current CH A (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.07E-08	1.40E-08	2.09E-08	3.22E-08	5.24E-08
116	1.18E-08	1.46E-08	2.11E-08	3.26E-08	5.42E-08
182	1.19E-08	1.52E-08	2.23E-08	3.39E-08	5.45E-08
241	1.23E-08	1.58E-08	2.33E-08	3.52E-08	5.75E-08
325	1.13E-08	1.44E-08	2.06E-08	3.15E-08	5.04E-08
408	1.12E-08	1.45E-08	2.08E-08	3.14E-08	5.02E-08
492	1.05E-08	1.35E-08	1.95E-08	2.94E-08	4.79E-08
724	1.18E-08	1.51E-08	2.15E-08	3.22E-08	5.14E-08
786	1.23E-08	1.59E-08	2.27E-08	3.35E-08	5.35E-08
868	1.09E-08	1.43E-08	2.07E-08	3.14E-08	5.03E-08
929	1.15E-08	1.15E-08	1.15E-08	1.15E-08	1.15E-08
1012	1.11E-08	1.11E-08	1.11E-08	1.11E-08	1.11E-08
Biased Statistics					
Average Biased	1.16E-08	1.48E-08	2.16E-08	3.31E-08	5.38E-08
Std Dev Biased	6.08E-10	7.34E-10	1.13E-09	1.48E-09	2.63E-09
Ps90%/90% (+KTL) Biased	1.33E-08	1.68E-08	2.47E-08	3.71E-08	6.10E-08
Ps90%/90% (-KTL) Biased	9.92E-09	1.28E-08	1.85E-08	2.90E-08	4.66E-08
Un-Biased Statistics					
Average Un-Biased	1.13E-08	1.47E-08	2.10E-08	3.16E-08	5.07E-08
Std Dev Un-Biased	7.28E-10	9.18E-10	1.17E-09	1.49E-09	2.06E-09
Ps90%/90% (+KTL) Un-Biased	1.33E-08	1.72E-08	2.43E-08	3.56E-08	5.63E-08
Ps90%/90% (-KTL) Un-Biased	9.34E-09	1.21E-08	1.78E-08	2.75E-08	4.50E-08
Specification MIN	-3.00E-08	-7.50E-08	-1.00E-07	-1.75E-07	-2.50E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-08	7.50E-08	1.00E-07	1.75E-07	2.50E-07
Status	PASS	PASS	PASS	PASS	PASS

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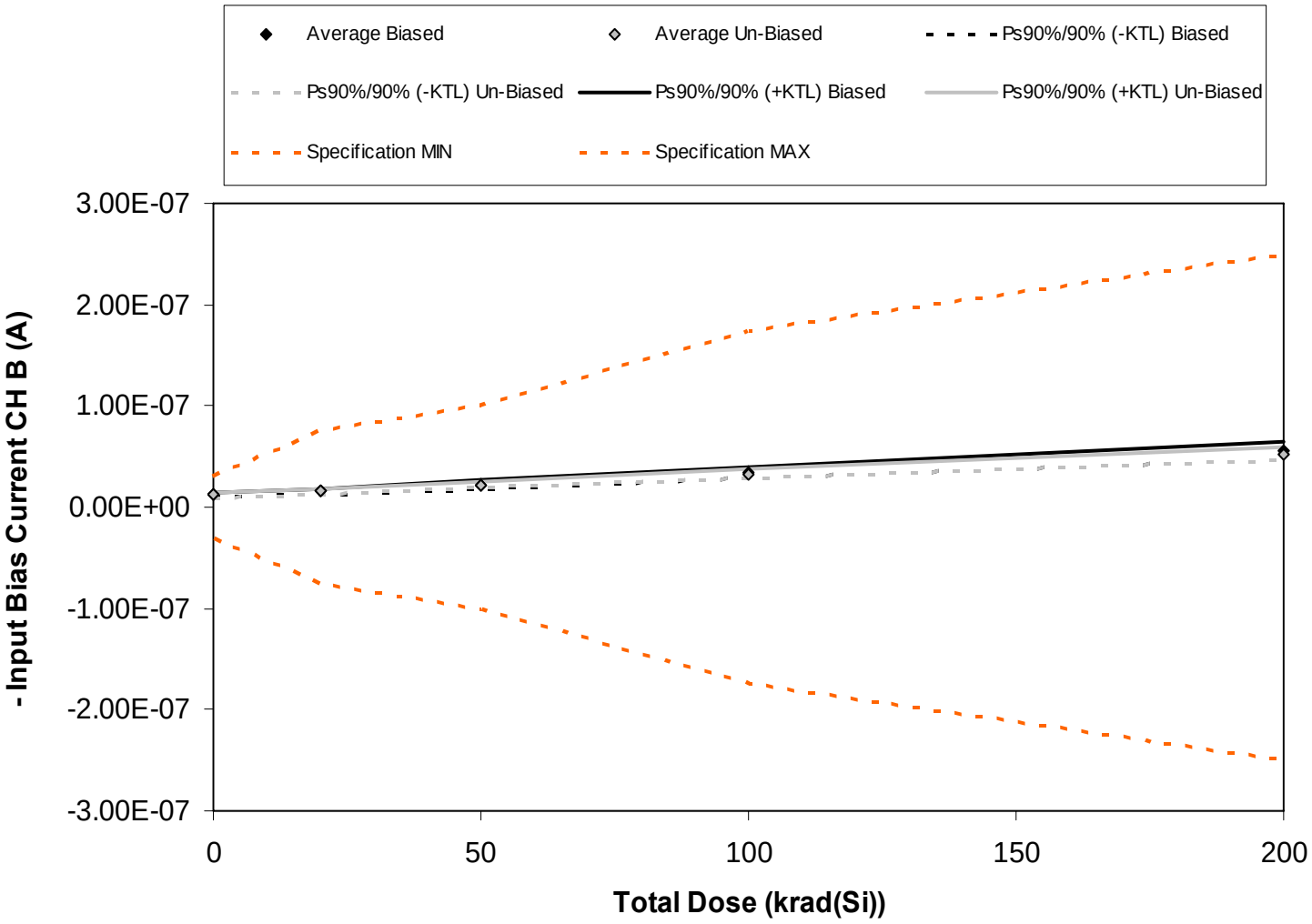

Figure 5.10. Plot of input bias current, inverting input @ +/-15V for channel B versus total dose. The data show an increase with radiation, however it is not sufficient to cause the parameter to exceed the post-radiation specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and dashed lines). The red dashed lines are the minimum and maximum specification values as defined in the datasheet and/or test plan.

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Table 5.10. Raw data for - Input Bias Current CH B (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

- Input Bias Current CH B (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.11E-08	1.46E-08	2.17E-08	3.33E-08	5.39E-08
116	1.21E-08	1.51E-08	2.16E-08	3.33E-08	5.52E-08
182	1.23E-08	1.57E-08	2.30E-08	3.52E-08	5.68E-08
241	1.30E-08	1.68E-08	2.46E-08	3.73E-08	6.07E-08
325	1.17E-08	1.49E-08	2.13E-08	3.25E-08	5.20E-08
408	1.22E-08	1.59E-08	2.28E-08	3.40E-08	5.40E-08
492	1.08E-08	1.40E-08	2.03E-08	3.07E-08	5.02E-08
724	1.27E-08	1.63E-08	2.33E-08	3.48E-08	5.54E-08
786	1.21E-08	1.57E-08	2.23E-08	3.30E-08	5.31E-08
868	1.14E-08	1.49E-08	2.16E-08	3.26E-08	5.22E-08
929	1.18E-08	1.18E-08	1.18E-08	1.18E-08	1.18E-08
1012	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08
Biased Statistics					
Average Biased	1.20E-08	1.54E-08	2.24E-08	3.43E-08	5.57E-08
Std Dev Biased	7.03E-10	8.89E-10	1.36E-09	1.93E-09	3.29E-09
Ps90%/90% (+KTL) Biased	1.39E-08	1.79E-08	2.62E-08	3.96E-08	6.48E-08
Ps90%/90% (-KTL) Biased	1.01E-08	1.30E-08	1.87E-08	2.90E-08	4.67E-08
Un-Biased Statistics					
Average Un-Biased	1.19E-08	1.54E-08	2.21E-08	3.30E-08	5.30E-08
Std Dev Un-Biased	7.32E-10	9.01E-10	1.15E-09	1.53E-09	1.97E-09
Ps90%/90% (+KTL) Un-Biased	1.39E-08	1.78E-08	2.52E-08	3.72E-08	5.84E-08
Ps90%/90% (-KTL) Un-Biased	9.85E-09	1.29E-08	1.89E-08	2.88E-08	4.76E-08
Specification MIN	-3.00E-08	-7.50E-08	-1.00E-07	-1.75E-07	-2.50E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	3.00E-08	7.50E-08	1.00E-07	1.75E-07	2.50E-07
Status	PASS	PASS	PASS	PASS	PASS

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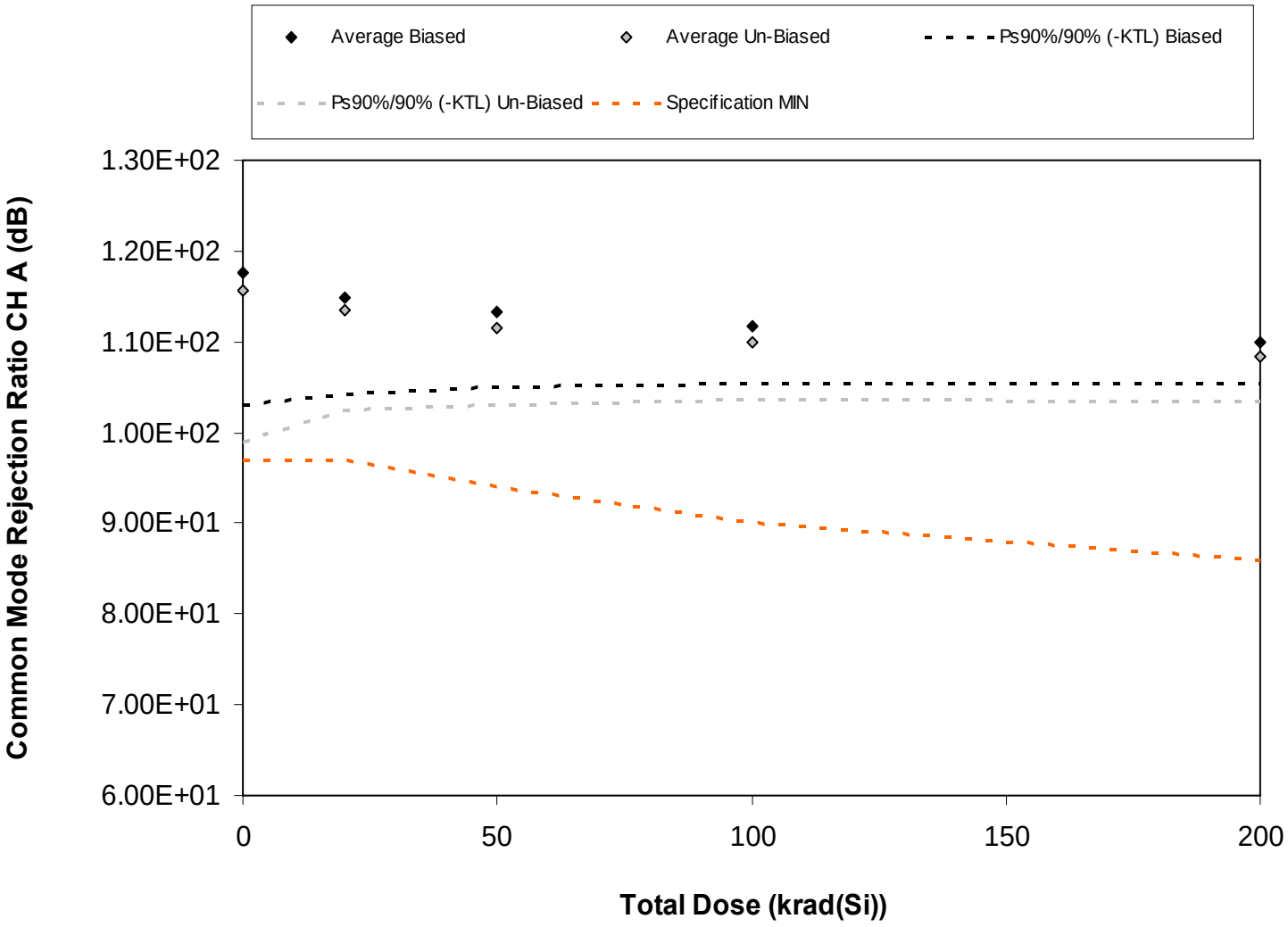

Figure 5.11. Plot of common mode rejection ratio for channel A versus total dose. Although the data show a significant decrease with total dose, the parameter does not fall below the specification value. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.11. Raw data for Common Mode Rejection Ratio CH A (dB) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Common Mode Rejection Ratio CH A (dB)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.23E+02	1.18E+02	1.16E+02	1.14E+02	1.12E+02
116	1.10E+02	1.09E+02	1.09E+02	1.08E+02	1.08E+02
182	1.20E+02	1.16E+02	1.15E+02	1.13E+02	1.11E+02
241	1.21E+02	1.18E+02	1.15E+02	1.13E+02	1.11E+02
325	1.14E+02	1.12E+02	1.11E+02	1.10E+02	1.09E+02
408	1.15E+02	1.14E+02	1.13E+02	1.11E+02	1.09E+02
492	1.26E+02	1.20E+02	1.16E+02	1.14E+02	1.11E+02
724	1.14E+02	1.12E+02	1.10E+02	1.09E+02	1.07E+02
786	1.15E+02	1.13E+02	1.11E+02	1.10E+02	1.08E+02
868	1.09E+02	1.09E+02	1.08E+02	1.07E+02	1.07E+02
929	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02
1012	1.18E+02	1.18E+02	1.18E+02	1.18E+02	1.18E+02
Biased Statistics					
Average Biased	1.18E+02	1.15E+02	1.13E+02	1.12E+02	1.10E+02
Std Dev Biased	5.33E+00	3.82E+00	3.05E+00	2.32E+00	1.67E+00
Ps90%/90% (+KTL) Biased	1.32E+02	1.25E+02	1.22E+02	1.18E+02	1.15E+02
Ps90%/90% (-KTL) Biased	1.03E+02	1.04E+02	1.05E+02	1.05E+02	1.05E+02
Un-Biased Statistics					
Average Un-Biased	1.16E+02	1.13E+02	1.12E+02	1.10E+02	1.08E+02
Std Dev Un-Biased	6.08E+00	4.02E+00	3.11E+00	2.35E+00	1.75E+00
Ps90%/90% (+KTL) Un-Biased	1.32E+02	1.24E+02	1.20E+02	1.16E+02	1.13E+02
Ps90%/90% (-KTL) Un-Biased	9.90E+01	1.02E+02	1.03E+02	1.04E+02	1.03E+02
Specification MIN	9.70E+01	9.70E+01	9.40E+01	9.00E+01	8.60E+01
Status	PASS	PASS	PASS	PASS	PASS

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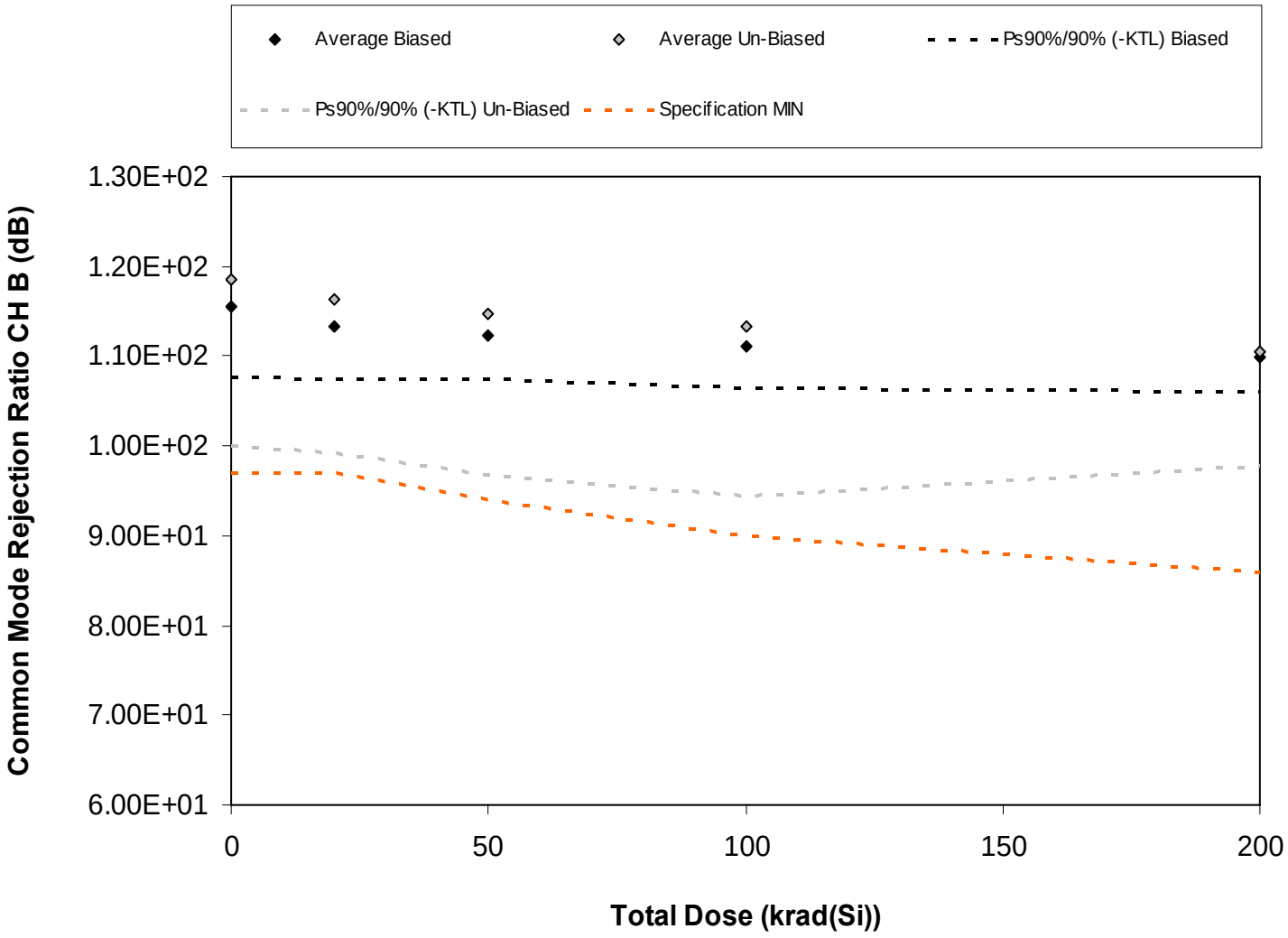

Figure 5.12. Plot of common mode rejection ratio for channel B versus total dose. Although the data show a significant decrease with total dose, the parameter does not fall below the specification value. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.12. Raw data for Common Mode Rejection Ratio CH B (dB) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Common Mode Rejection Ratio CH B (dB)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.13E+02	1.11E+02	1.11E+02	1.09E+02	1.08E+02
116	1.15E+02	1.14E+02	1.13E+02	1.12E+02	1.10E+02
182	1.14E+02	1.12E+02	1.11E+02	1.10E+02	1.09E+02
241	1.20E+02	1.17E+02	1.15E+02	1.14E+02	1.12E+02
325	1.14E+02	1.13E+02	1.12E+02	1.11E+02	1.10E+02
408	1.19E+02	1.16E+02	1.14E+02	1.12E+02	1.10E+02
492	1.21E+02	1.18E+02	1.15E+02	1.13E+02	1.10E+02
724	1.13E+02	1.12E+02	1.10E+02	1.09E+02	1.08E+02
786	1.11E+02	1.10E+02	1.09E+02	1.07E+02	1.06E+02
868	1.28E+02	1.26E+02	1.25E+02	1.25E+02	1.18E+02
929	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02
1012	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02
Biased Statistics					
Average Biased	1.15E+02	1.13E+02	1.12E+02	1.11E+02	1.10E+02
Std Dev Biased	2.80E+00	2.13E+00	1.77E+00	1.71E+00	1.37E+00
Ps90%/90% (+KTL) Biased	1.23E+02	1.19E+02	1.17E+02	1.16E+02	1.14E+02
Ps90%/90% (-KTL) Biased	1.08E+02	1.08E+02	1.07E+02	1.06E+02	1.06E+02
Un-Biased Statistics					
Average Un-Biased	1.19E+02	1.16E+02	1.15E+02	1.13E+02	1.10E+02
Std Dev Un-Biased	6.81E+00	6.25E+00	6.52E+00	6.89E+00	4.56E+00
Ps90%/90% (+KTL) Un-Biased	1.37E+02	1.33E+02	1.33E+02	1.32E+02	1.23E+02
Ps90%/90% (-KTL) Un-Biased	9.99E+01	9.92E+01	9.68E+01	9.44E+01	9.79E+01
Specification MIN	9.70E+01	9.70E+01	9.40E+01	9.00E+01	8.60E+01
Status	PASS	PASS	PASS	PASS	PASS

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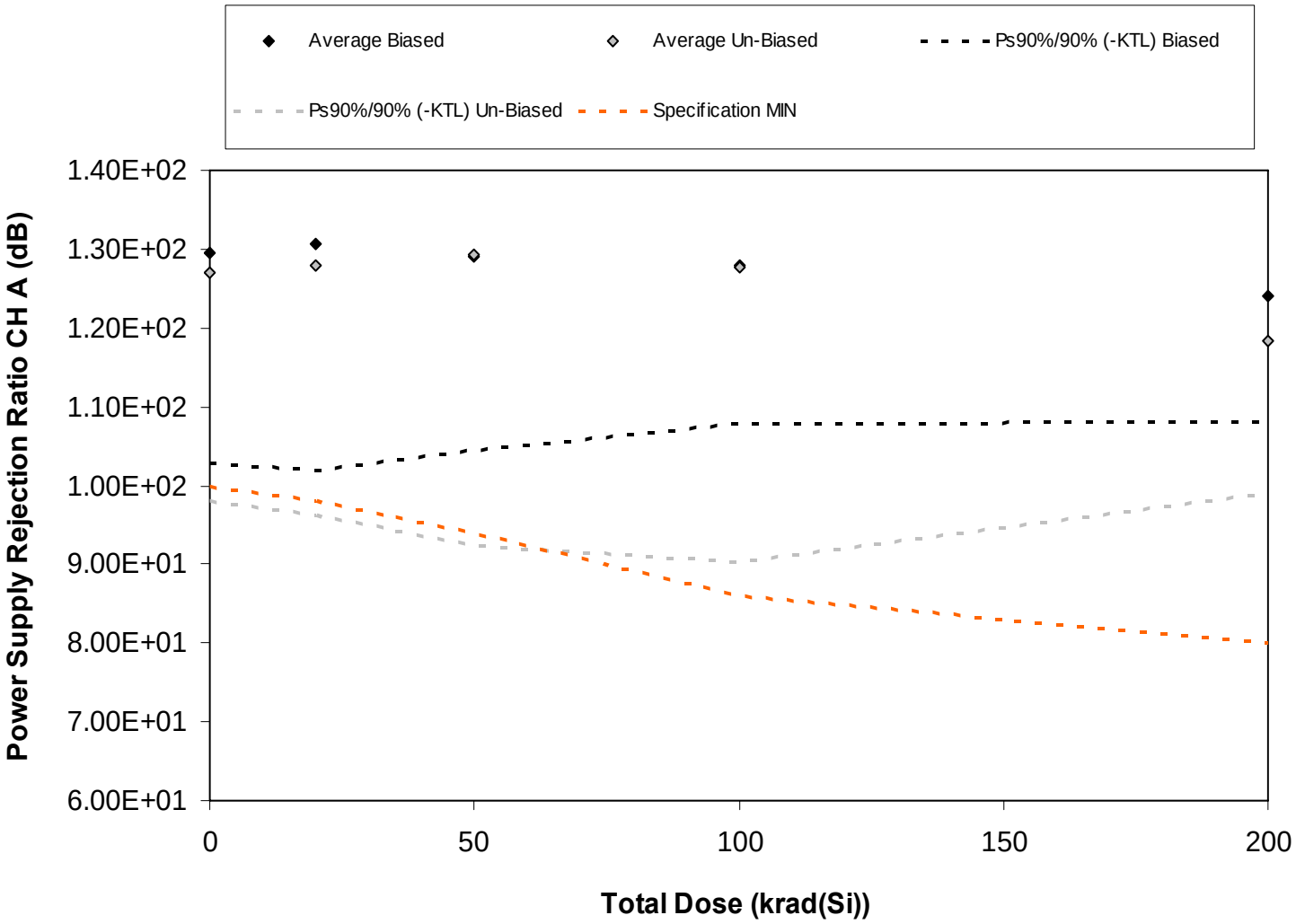

Figure 5.13. Plot of Power Supply Rejection Ratio CH A (dB) versus total dose. The data show no significant change with total dose (note that the KTL value is "out of specification pre-irradiation and at the 20krad(Si) and 50krad(Si) dose levels due to the distribution within the sample population). The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.13. Raw data for Power Supply Rejection Ratio CH A (dB) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Power Supply Rejection Ratio CH A (dB)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.41E+02	1.33E+02	1.30E+02	1.26E+02	1.21E+02
116	1.17E+02	1.17E+02	1.18E+02	1.17E+02	1.18E+02
182	1.35E+02	1.44E+02	1.42E+02	1.34E+02	1.24E+02
241	1.32E+02	1.36E+02	1.32E+02	1.36E+02	1.25E+02
325	1.23E+02	1.24E+02	1.25E+02	1.26E+02	1.33E+02
408	1.32E+02	1.33E+02	1.41E+02	1.34E+02	1.23E+02
492	1.28E+02	1.29E+02	1.31E+02	1.44E+02	1.24E+02
724	1.35E+02	1.39E+02	1.41E+02	1.31E+02	1.22E+02
786	1.33E+02	1.29E+02	1.25E+02	1.22E+02	1.17E+02
868	1.09E+02	1.09E+02	1.08E+02	1.08E+02	1.07E+02
929	1.42E+02	1.41E+02	1.43E+02	1.44E+02	1.44E+02
1012	1.34E+02	1.35E+02	1.34E+02	1.34E+02	1.34E+02
Biased Statistics					
Average Biased	1.29E+02	1.31E+02	1.29E+02	1.28E+02	1.24E+02
Std Dev Biased	9.70E+00	1.05E+01	8.94E+00	7.29E+00	5.82E+00
Ps90%/90% (+KTL) Biased	1.56E+02	1.60E+02	1.54E+02	1.48E+02	1.40E+02
Ps90%/90% (-KTL) Biased	1.03E+02	1.02E+02	1.04E+02	1.08E+02	1.08E+02
Un-Biased Statistics					
Average Un-Biased	1.27E+02	1.28E+02	1.29E+02	1.28E+02	1.18E+02
Std Dev Un-Biased	1.06E+01	1.15E+01	1.35E+01	1.36E+01	7.13E+00
Ps90%/90% (+KTL) Un-Biased	1.56E+02	1.60E+02	1.66E+02	1.65E+02	1.38E+02
Ps90%/90% (-KTL) Un-Biased	9.81E+01	9.63E+01	9.24E+01	9.04E+01	9.89E+01
Specification MIN	1.00E+02	9.80E+01	9.40E+01	8.60E+01	8.00E+01
Status	FAIL	FAIL	FAIL	PASS	PASS

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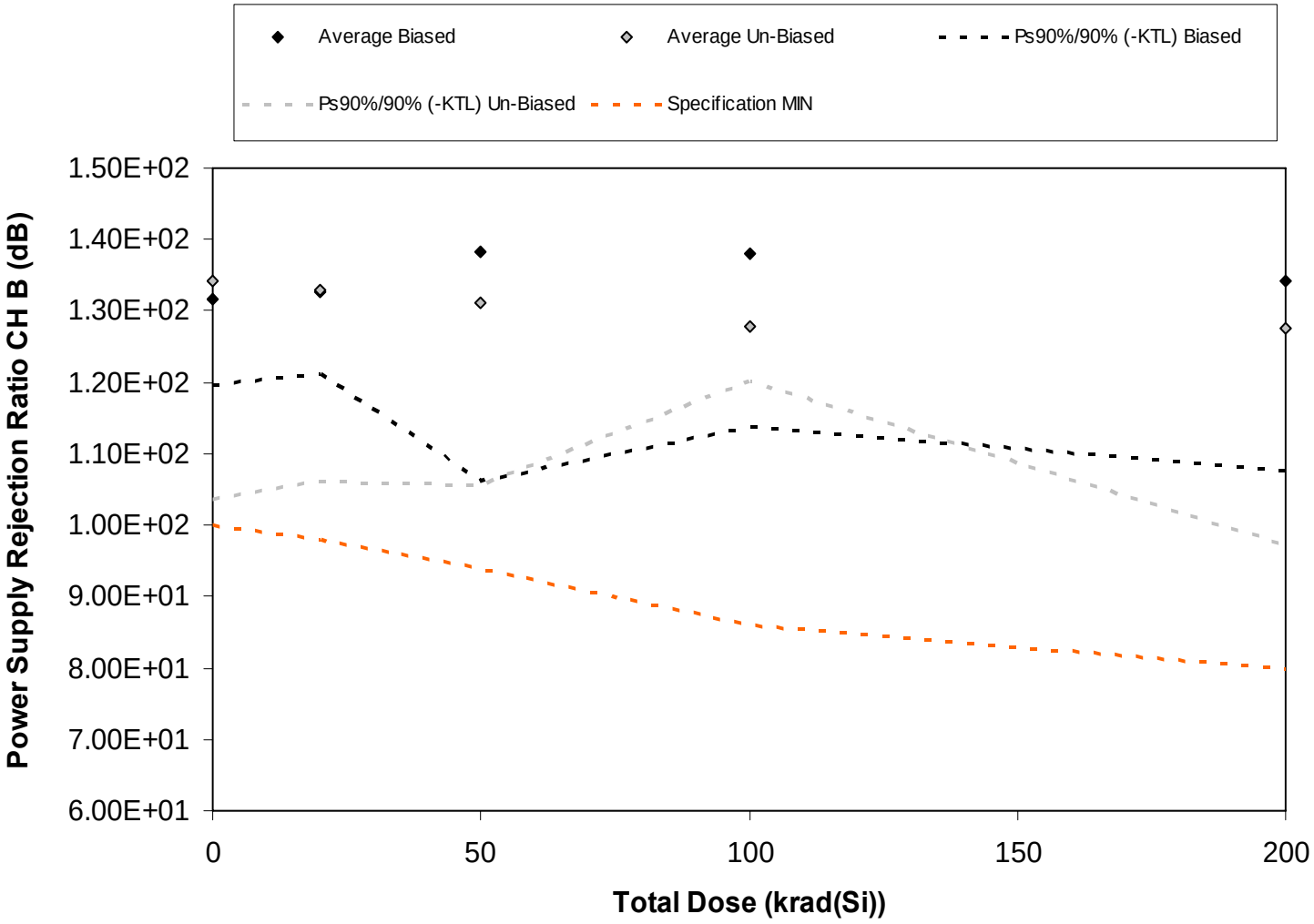

Figure 5.14. Plot of Power Supply Rejection Ratio CH B (dB) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.14. Raw data for Power Supply Rejection Ratio CH B (dB) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Power Supply Rejection Ratio CH B (dB)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.37E+02	1.33E+02	1.30E+02	1.25E+02	1.22E+02
116	1.30E+02	1.32E+02	1.36E+02	1.41E+02	1.49E+02
182	1.35E+02	1.39E+02	1.58E+02	1.43E+02	1.37E+02
241	1.26E+02	1.27E+02	1.29E+02	1.33E+02	1.31E+02
325	1.31E+02	1.33E+02	1.37E+02	1.48E+02	1.32E+02
408	1.49E+02	1.36E+02	1.29E+02	1.25E+02	1.19E+02
492	1.22E+02	1.22E+02	1.24E+02	1.28E+02	1.42E+02
724	1.40E+02	1.38E+02	1.31E+02	1.26E+02	1.19E+02
786	1.37E+02	1.45E+02	1.47E+02	1.32E+02	1.21E+02
868	1.24E+02	1.24E+02	1.25E+02	1.28E+02	1.37E+02
929	1.31E+02	1.31E+02	1.32E+02	1.31E+02	1.32E+02
1012	1.28E+02	1.29E+02	1.29E+02	1.29E+02	1.29E+02
Biased Statistics					
Average Biased	1.32E+02	1.33E+02	1.38E+02	1.38E+02	1.34E+02
Std Dev Biased	4.35E+00	4.17E+00	1.17E+01	8.88E+00	9.63E+00
Ps90%/90% (+KTL) Biased	1.44E+02	1.44E+02	1.70E+02	1.62E+02	1.61E+02
Ps90%/90% (-KTL) Biased	1.20E+02	1.21E+02	1.06E+02	1.14E+02	1.08E+02
Un-Biased Statistics					
Average Un-Biased	1.34E+02	1.33E+02	1.31E+02	1.28E+02	1.28E+02
Std Dev Un-Biased	1.12E+01	9.80E+00	9.32E+00	2.79E+00	1.11E+01
Ps90%/90% (+KTL) Un-Biased	1.65E+02	1.60E+02	1.57E+02	1.35E+02	1.58E+02
Ps90%/90% (-KTL) Un-Biased	1.03E+02	1.06E+02	1.06E+02	1.20E+02	9.73E+01
Specification MIN	1.00E+02	9.80E+01	9.40E+01	8.60E+01	8.00E+01
Status	PASS	PASS	PASS	PASS	PASS

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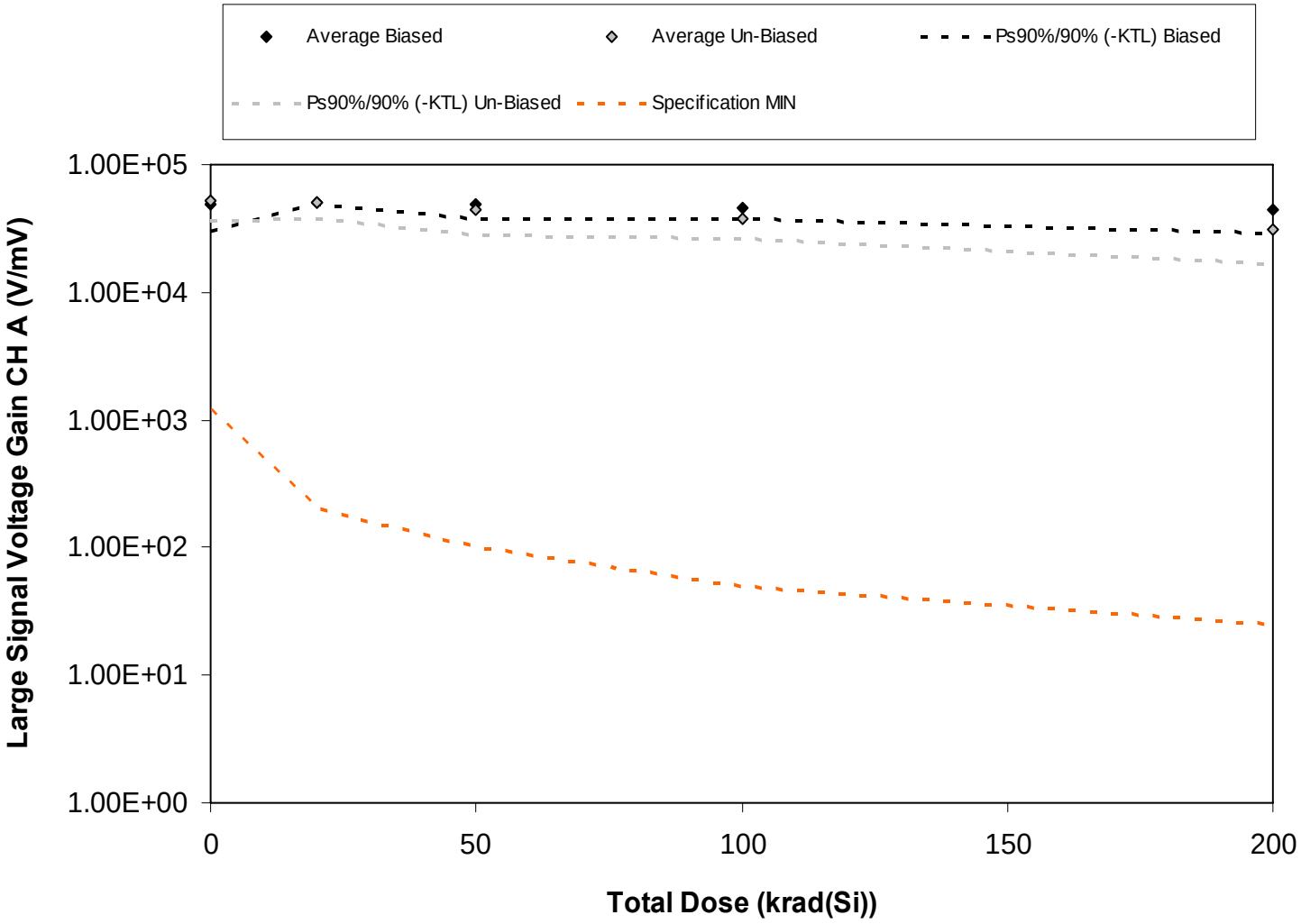

Figure 5.15. Plot of Large Signal Voltage Gain CH A (V/mV) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.15. Raw data for Large Signal Voltage Gain CH A (V/mV) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Large Signal Voltage Gain CH A (V/mV)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	5.35E+04	5.04E+04	5.07E+04	4.58E+04	4.40E+04
116	5.82E+04	5.03E+04	5.25E+04	4.78E+04	4.55E+04
182	4.06E+04	5.25E+04	4.31E+04	4.73E+04	4.62E+04
241	5.20E+04	5.12E+04	5.35E+04	4.27E+04	4.80E+04
325	4.35E+04	5.04E+04	4.67E+04	4.22E+04	3.45E+04
408	4.52E+04	4.49E+04	4.66E+04	4.08E+04	2.67E+04
492	5.93E+04	5.17E+04	4.17E+04	4.21E+04	3.13E+04
724	5.12E+04	5.58E+04	4.15E+04	3.25E+04	2.96E+04
786	5.46E+04	4.68E+04	3.69E+04	3.45E+04	2.76E+04
868	4.76E+04	5.33E+04	5.16E+04	4.08E+04	3.97E+04
929	5.50E+04	5.71E+04	5.98E+04	5.56E+04	5.55E+04
1012	5.81E+04	5.78E+04	5.23E+04	5.54E+04	5.68E+04
Biased Statistics					
Average Biased	4.95E+04	5.10E+04	4.93E+04	4.52E+04	4.36E+04
Std Dev Biased	7.29E+03	9.25E+02	4.32E+03	2.56E+03	5.29E+03
Ps90%/90% (+KTL) Biased	6.95E+04	5.35E+04	6.12E+04	5.22E+04	5.82E+04
Ps90%/90% (-KTL) Biased	2.95E+04	4.84E+04	3.74E+04	3.81E+04	2.91E+04
Un-Biased Statistics					
Average Un-Biased	5.16E+04	5.05E+04	4.37E+04	3.82E+04	3.10E+04
Std Dev Un-Biased	5.60E+03	4.54E+03	5.62E+03	4.34E+03	5.16E+03
Ps90%/90% (+KTL) Un-Biased	6.69E+04	6.30E+04	5.91E+04	5.01E+04	4.51E+04
Ps90%/90% (-KTL) Un-Biased	3.62E+04	3.81E+04	2.82E+04	2.62E+04	1.68E+04
Specification MIN	1.20E+03	2.00E+02	1.00E+02	5.00E+01	2.50E+01
Status	PASS	PASS	PASS	PASS	PASS

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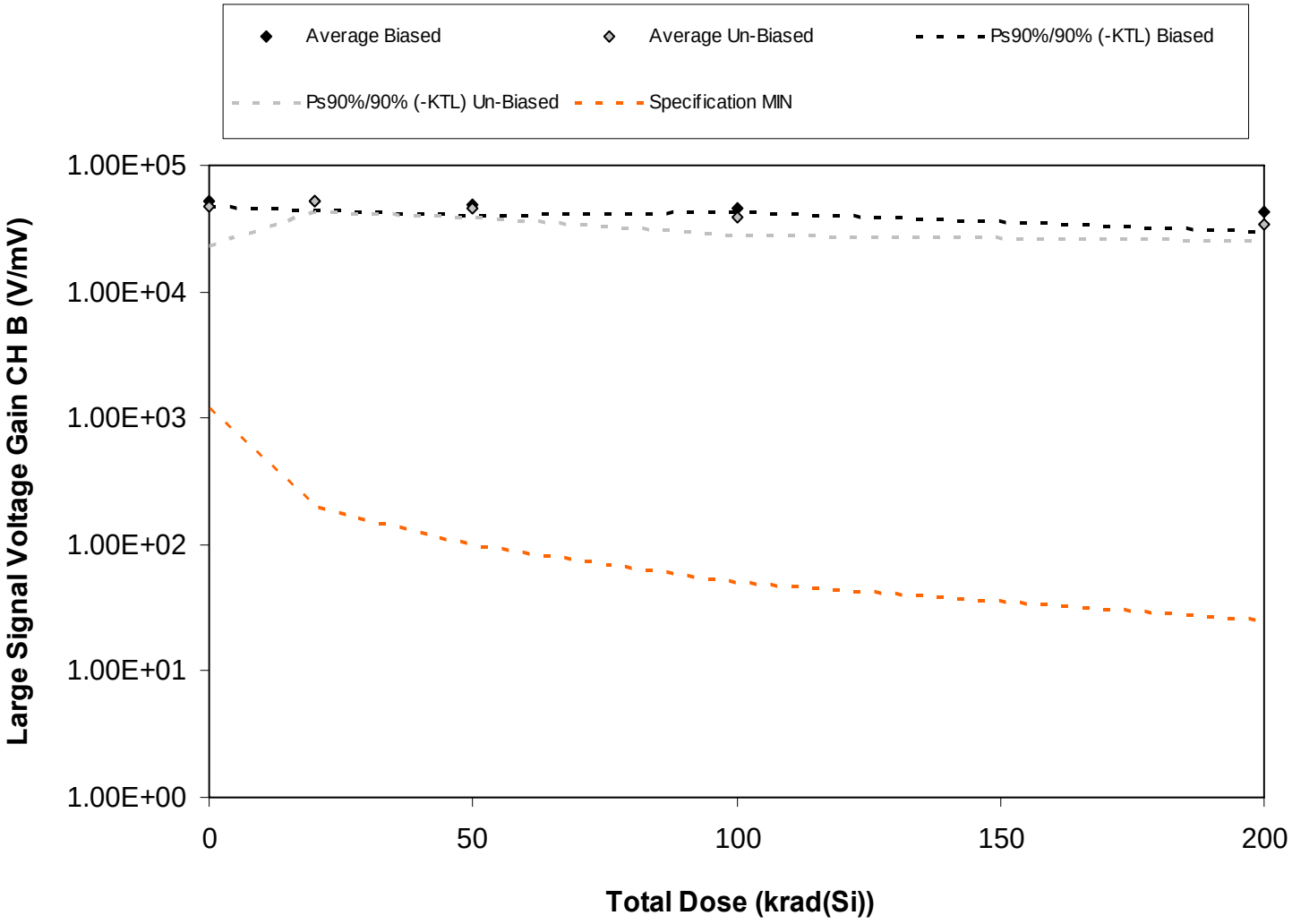

Figure 5.16. Plot of Large Signal Voltage Gain CH B (V/mV) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.16. Raw data for Large Signal Voltage Gain CH B (V/mV) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Large Signal Voltage Gain CH B (V/mV)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	5.22E+04	5.50E+04	4.90E+04	4.52E+04	3.66E+04
116	5.43E+04	5.40E+04	4.86E+04	4.73E+04	4.20E+04
182	5.01E+04	5.39E+04	4.59E+04	4.78E+04	4.96E+04
241	5.30E+04	4.84E+04	5.21E+04	4.53E+04	4.08E+04
325	5.13E+04	4.91E+04	4.49E+04	4.57E+04	4.27E+04
408	5.10E+04	5.28E+04	4.15E+04	3.43E+04	3.14E+04
492	4.94E+04	5.12E+04	4.72E+04	3.96E+04	3.21E+04
724	3.23E+04	5.44E+04	4.59E+04	3.50E+04	3.07E+04
786	4.76E+04	4.70E+04	4.39E+04	4.29E+04	3.66E+04
868	5.53E+04	5.46E+04	4.68E+04	4.17E+04	3.72E+04
929	5.22E+04	5.39E+04	5.60E+04	5.68E+04	5.51E+04
1012	5.50E+04	5.56E+04	5.35E+04	5.91E+04	5.77E+04
Biased Statistics					
Average Biased	5.22E+04	5.21E+04	4.81E+04	4.62E+04	4.23E+04
Std Dev Biased	1.62E+03	3.06E+03	2.83E+03	1.20E+03	4.69E+03
Ps90%/90% (+KTL) Biased	5.66E+04	6.05E+04	5.59E+04	4.95E+04	5.52E+04
Ps90%/90% (-KTL) Biased	4.78E+04	4.37E+04	4.04E+04	4.29E+04	2.95E+04
Un-Biased Statistics					
Average Un-Biased	4.71E+04	5.20E+04	4.51E+04	3.87E+04	3.36E+04
Std Dev Un-Biased	8.77E+03	3.11E+03	2.39E+03	3.88E+03	3.06E+03
Ps90%/90% (+KTL) Un-Biased	7.12E+04	6.05E+04	5.16E+04	4.93E+04	4.20E+04
Ps90%/90% (-KTL) Un-Biased	2.31E+04	4.35E+04	3.85E+04	2.80E+04	2.52E+04
Specification MIN	1.20E+03	2.00E+02	1.00E+02	5.00E+01	2.50E+01
Status	PASS	PASS	PASS	PASS	PASS

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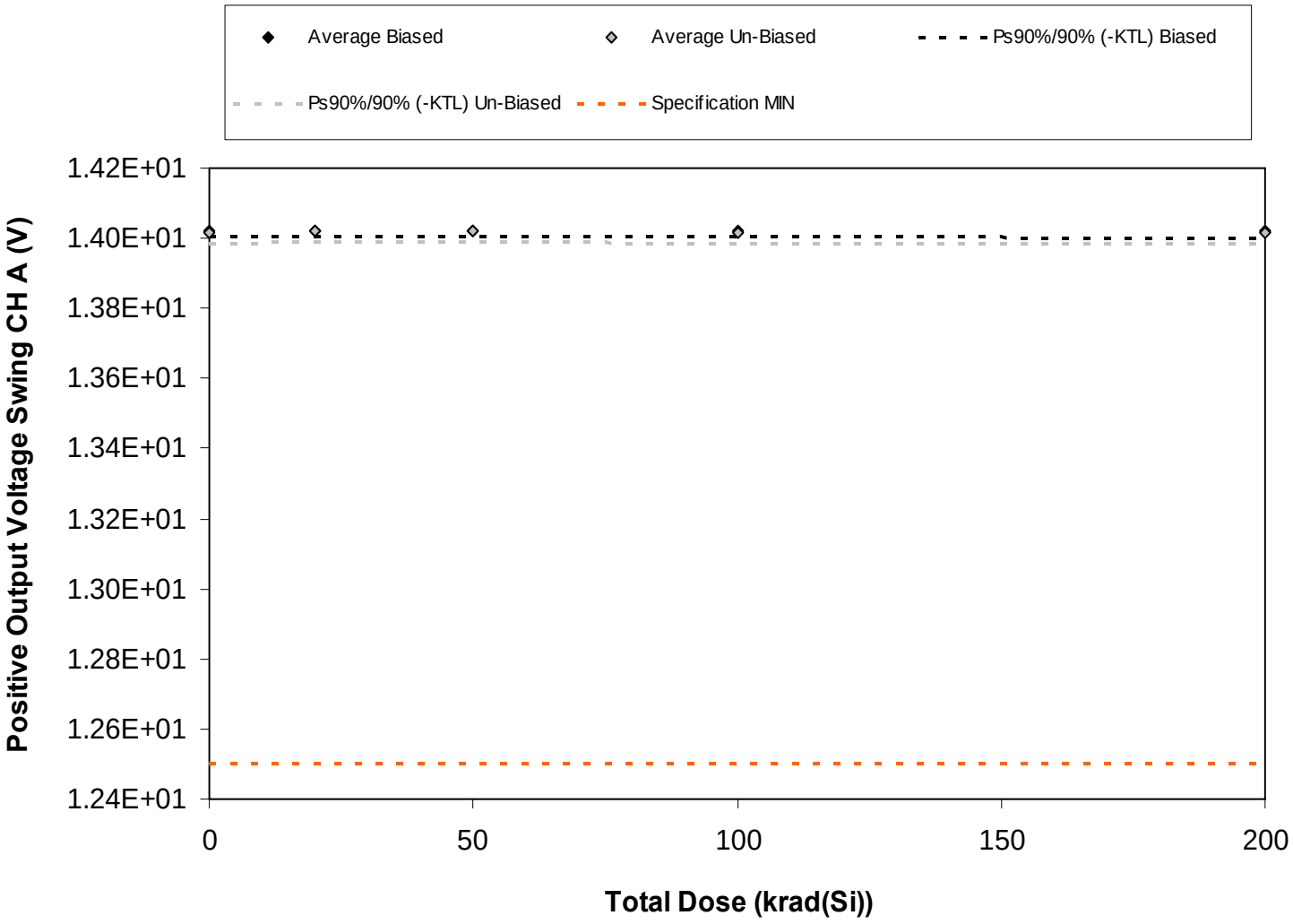

Figure 5.17. Plot of Positive Output Voltage Swing CH A (V) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.17. Raw data for Positive Output Voltage Swing CH A (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Output Voltage Swing CH A (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
116	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
182	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
241	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
325	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
408	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
492	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
724	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
786	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
868	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
929	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
1012	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Biased Statistics					
Average Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Std Dev Biased	5.50E-03	5.79E-03	6.02E-03	5.94E-03	6.26E-03
Ps90%/90% (+KTL) Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Ps90%/90% (-KTL) Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Un-Biased Statistics					
Average Un-Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Std Dev Un-Biased	1.13E-02	1.15E-02	1.09E-02	1.17E-02	1.19E-02
Ps90%/90% (+KTL) Un-Biased	1.40E+01	1.41E+01	1.40E+01	1.41E+01	1.40E+01
Ps90%/90% (-KTL) Un-Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Specification MIN	1.25E+01	1.25E+01	1.25E+01	1.25E+01	1.25E+01
Status	PASS	PASS	PASS	PASS	PASS

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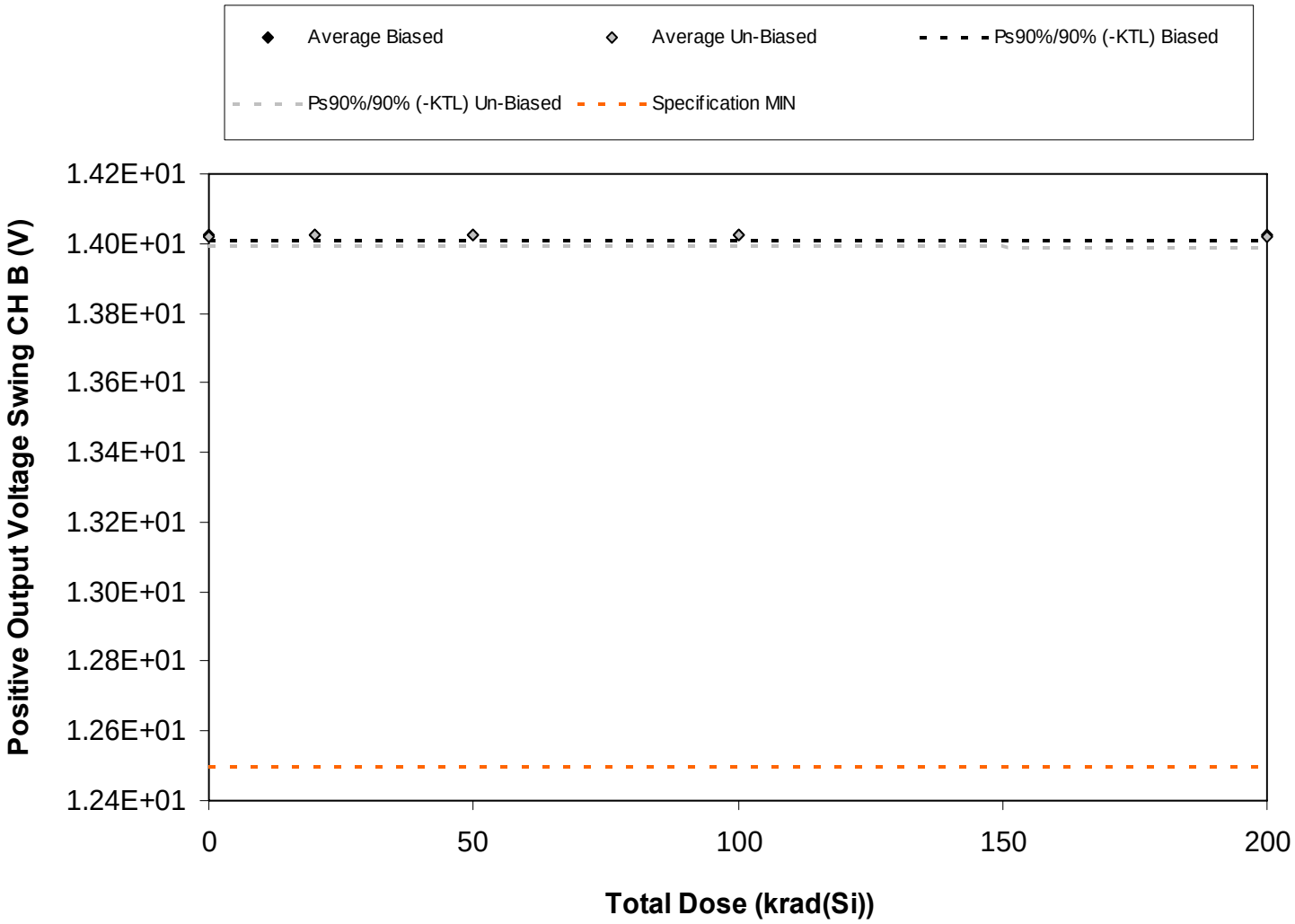

Figure 5.18. Plot of Positive Output Voltage Swing CH B (V) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.18. Raw data for Positive Output Voltage Swing CH B (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Output Voltage Swing CH B (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
116	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
182	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
241	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
325	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
408	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
492	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
724	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
786	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
868	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
929	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
1012	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Biased Statistics					
Average Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Std Dev Biased	5.54E-03	6.04E-03	6.04E-03	5.48E-03	6.20E-03
Ps90%/90% (+KTL) Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Ps90%/90% (-KTL) Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Un-Biased Statistics					
Average Un-Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Std Dev Un-Biased	1.04E-02	1.07E-02	1.09E-02	1.04E-02	1.13E-02
Ps90%/90% (+KTL) Un-Biased	1.40E+01	1.41E+01	1.41E+01	1.41E+01	1.41E+01
Ps90%/90% (-KTL) Un-Biased	1.40E+01	1.40E+01	1.40E+01	1.40E+01	1.40E+01
Specification MIN	1.25E+01	1.25E+01	1.25E+01	1.25E+01	1.25E+01
Status	PASS	PASS	PASS	PASS	PASS

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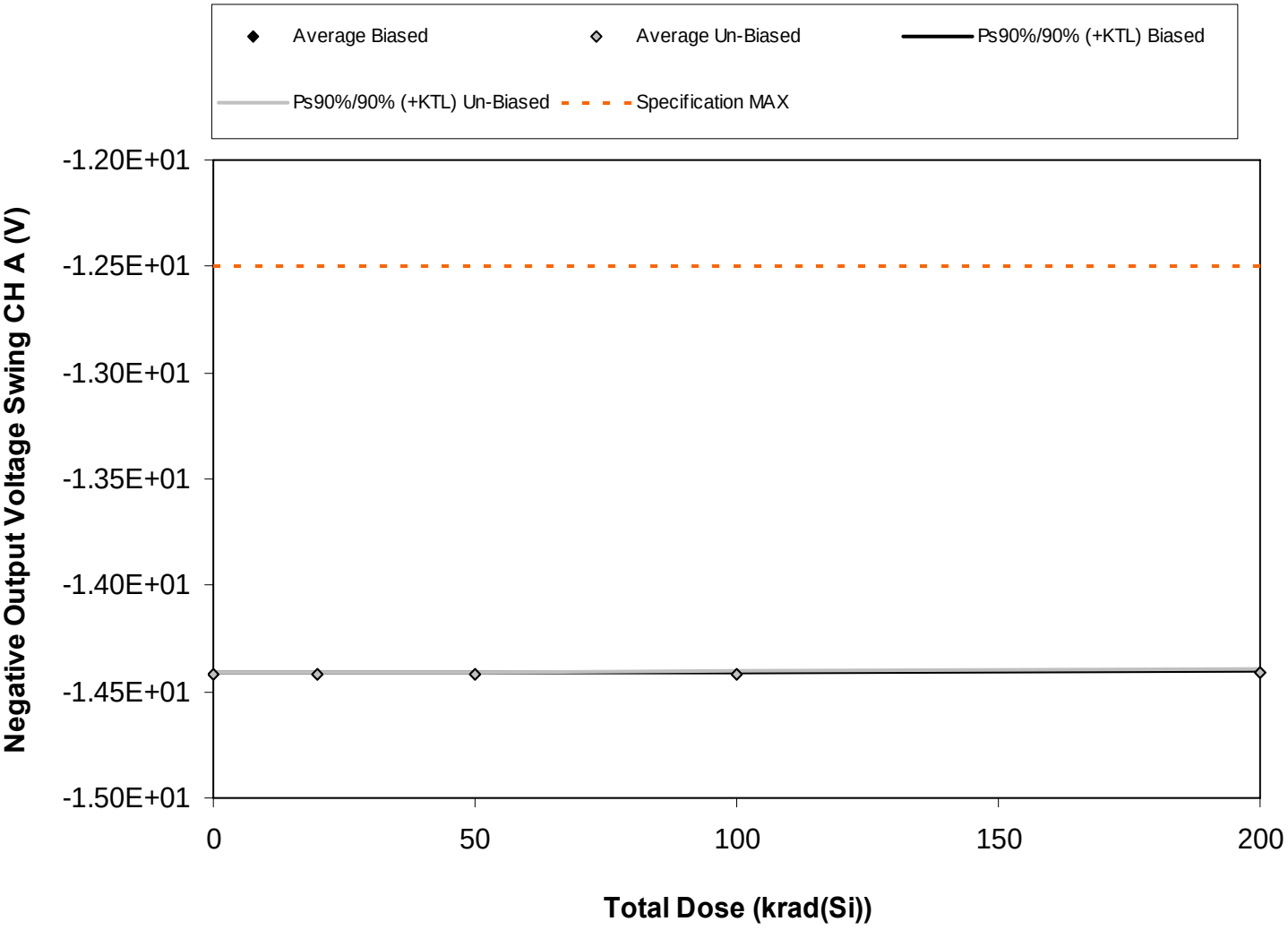

Figure 5.19. Plot of Negative Output Voltage Swing CH A (V) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.19. Raw data for Negative Output Voltage Swing CH A (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Output Voltage Swing CH A (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
116	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
182	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
241	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
325	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
408	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
492	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
724	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
786	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
868	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
929	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
1012	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Biased Statistics					
Average Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Std Dev Biased	2.28E-03	2.28E-03	2.35E-03	2.61E-03	2.61E-03
Ps90%/90% (+KTL) Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Ps90%/90% (-KTL) Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Un-Biased Statistics					
Average Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Std Dev Un-Biased	2.24E-03	2.61E-03	2.97E-03	3.65E-03	5.31E-03
Ps90%/90% (+KTL) Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Ps90%/90% (-KTL) Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Specification MAX	-1.25E+01	-1.25E+01	-1.25E+01	-1.25E+01	-1.25E+01
Status	PASS	PASS	PASS	PASS	PASS

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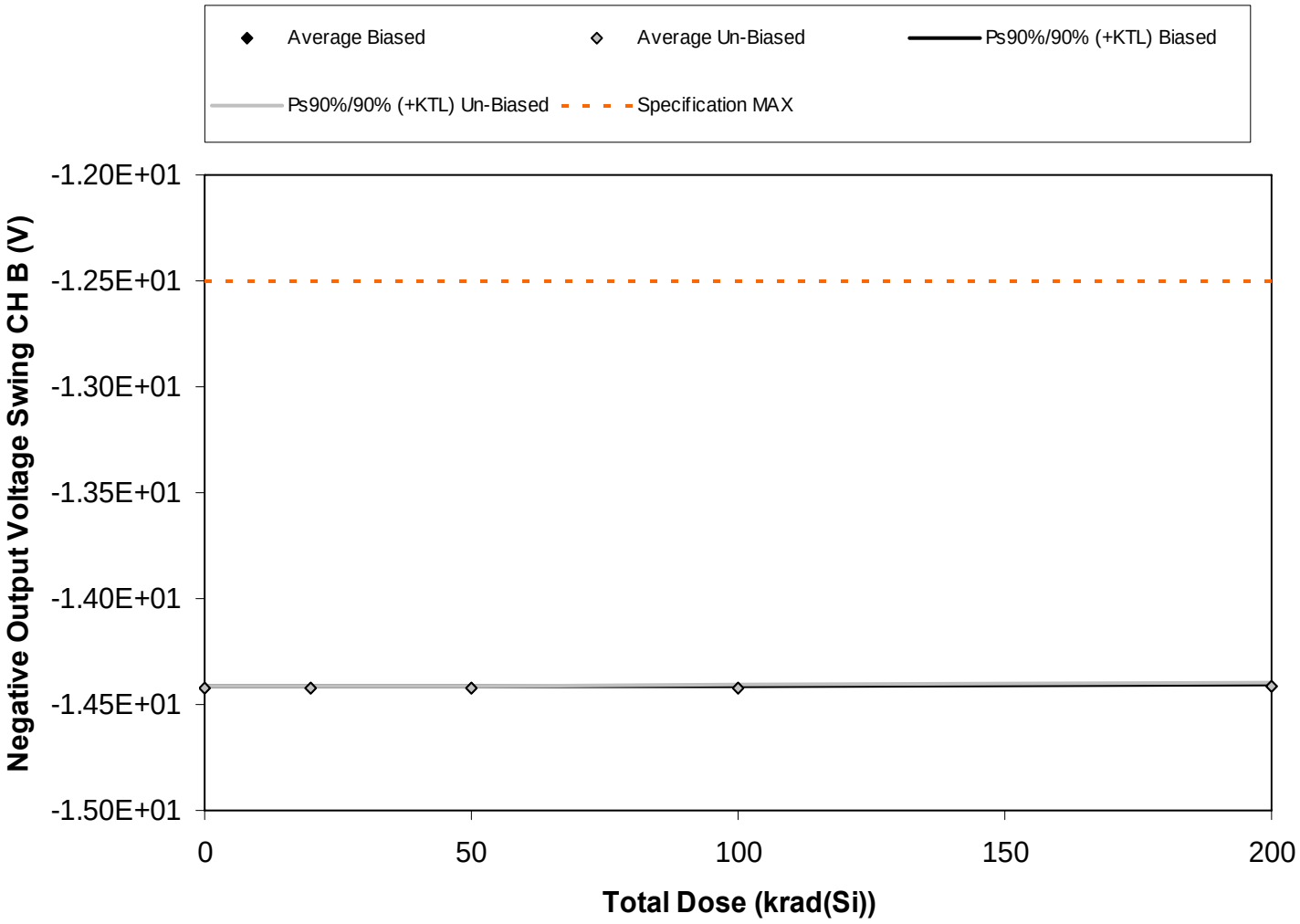

Figure 5.20. Plot of Negative Output Voltage Swing CH B (V) versus total dose. The data show no significant change with total dose. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.20. Raw data for Negative Output Voltage Swing CH B (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Output Voltage Swing CH B (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
116	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
182	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
241	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
325	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
408	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
492	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
724	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
786	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
868	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
929	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
1012	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Biased Statistics					
Average Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Std Dev Biased	2.65E-03	2.28E-03	2.17E-03	2.61E-03	2.49E-03
Ps90%/90% (+KTL) Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Ps90%/90% (-KTL) Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Un-Biased Statistics					
Average Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Std Dev Un-Biased	3.42E-03	3.77E-03	4.10E-03	4.69E-03	6.10E-03
Ps90%/90% (+KTL) Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Ps90%/90% (-KTL) Un-Biased	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01	-1.44E+01
Specification MAX	-1.25E+01	-1.25E+01	-1.25E+01	-1.25E+01	-1.25E+01
Status	PASS	PASS	PASS	PASS	PASS

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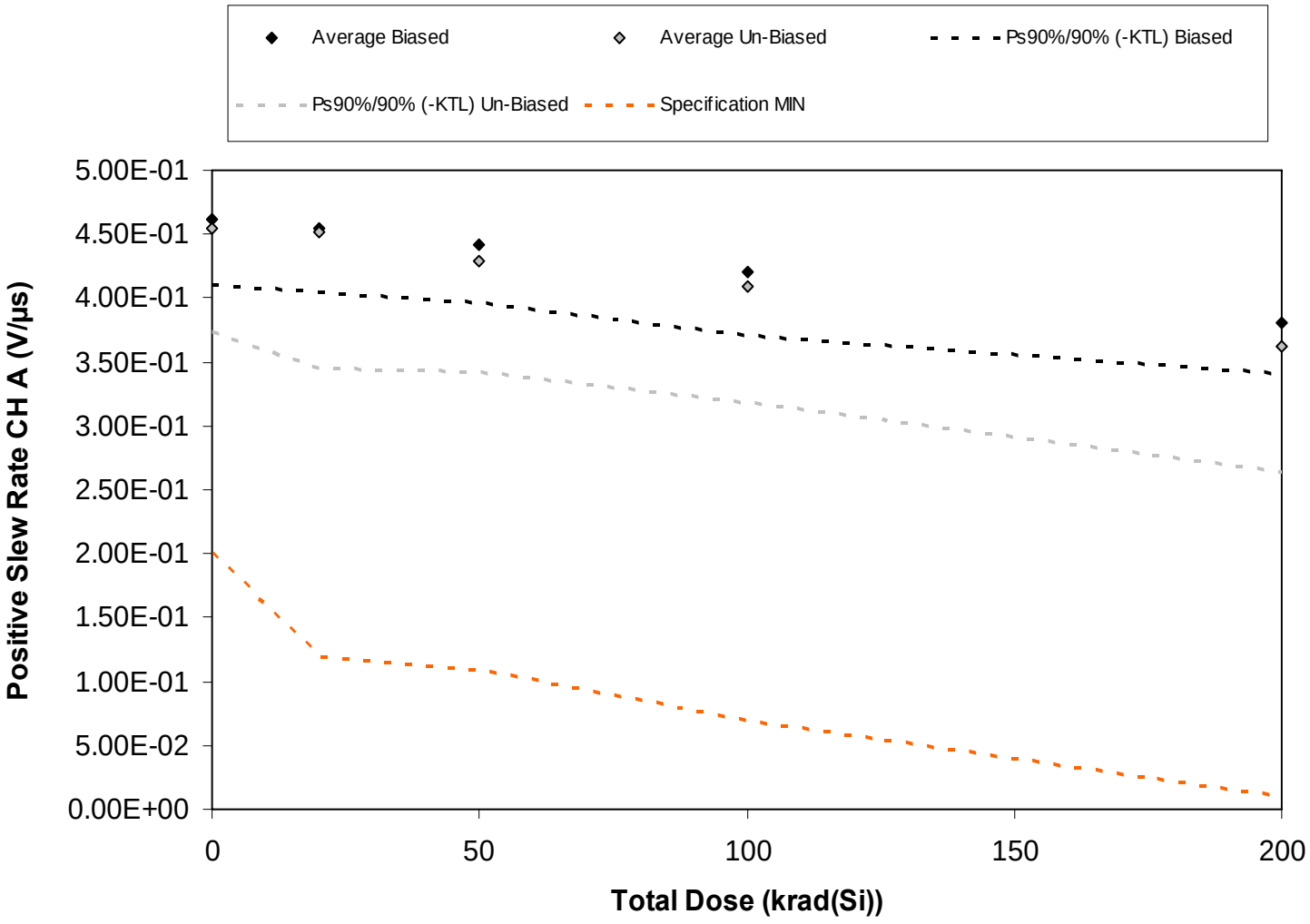

Figure 5.21. Plot of positive slew rate for channel A versus total dose. The data show a moderate decrease with total dose, however not sufficient to case the parameter to fall below the specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.21. Raw data for Positive Slew Rate CH A (V/µs) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Slew Rate CH A (V/µs)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	4.55E-01	4.40E-01	4.24E-01	4.04E-01	3.67E-01
116	4.59E-01	4.55E-01	4.51E-01	4.22E-01	3.77E-01
182	4.85E-01	4.71E-01	4.57E-01	4.34E-01	3.93E-01
241	4.75E-01	4.73E-01	4.56E-01	4.40E-01	3.97E-01
325	4.36E-01	4.32E-01	4.24E-01	4.00E-01	3.67E-01
408	4.37E-01	4.17E-01	4.03E-01	3.79E-01	3.26E-01
492	4.55E-01	4.54E-01	4.30E-01	4.08E-01	3.61E-01
724	4.42E-01	4.44E-01	4.24E-01	4.03E-01	3.54E-01
786	4.34E-01	4.26E-01	4.06E-01	3.89E-01	3.47E-01
868	5.06E-01	5.15E-01	4.81E-01	4.64E-01	4.21E-01
929	4.73E-01	4.76E-01	4.74E-01	4.79E-01	4.76E-01
1012	4.91E-01	4.84E-01	4.94E-01	4.86E-01	4.94E-01
Biased Statistics					
Average Biased	4.62E-01	4.54E-01	4.42E-01	4.20E-01	3.80E-01
Std Dev Biased	1.89E-02	1.82E-02	1.69E-02	1.77E-02	1.42E-02
Ps90%/90% (+KTL) Biased	5.14E-01	5.04E-01	4.89E-01	4.69E-01	4.19E-01
Ps90%/90% (-KTL) Biased	4.10E-01	4.04E-01	3.96E-01	3.71E-01	3.41E-01
Un-Biased Statistics					
Average Un-Biased	4.55E-01	4.51E-01	4.29E-01	4.09E-01	3.62E-01
Std Dev Un-Biased	2.97E-02	3.85E-02	3.14E-02	3.30E-02	3.56E-02
Ps90%/90% (+KTL) Un-Biased	5.36E-01	5.57E-01	5.15E-01	4.99E-01	4.59E-01
Ps90%/90% (-KTL) Un-Biased	3.73E-01	3.46E-01	3.43E-01	3.18E-01	2.64E-01
Specification MIN	2.00E-01	1.20E-01	1.10E-01	7.00E-02	1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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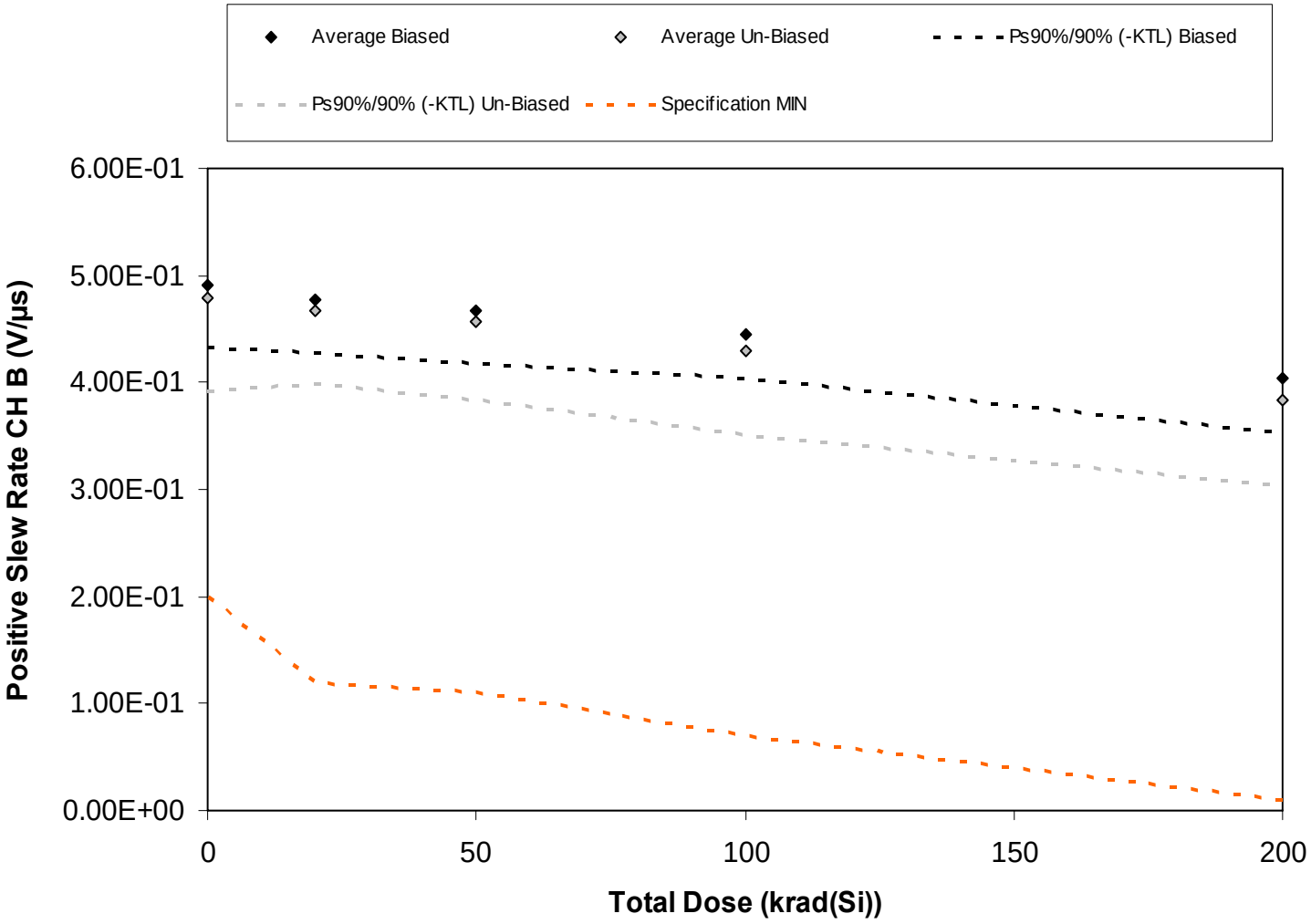

Figure 5.22. Plot of positive slew rate for channel B versus total dose. The data show a moderate decrease with total dose, however not sufficient to case the parameter to fall below the specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.22. Raw data for Positive Slew Rate CH B (V/µs) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Slew Rate CH B (V/µs)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	4.74E-01	4.69E-01	4.52E-01	4.31E-01	3.87E-01
116	4.86E-01	4.66E-01	4.71E-01	4.43E-01	3.95E-01
182	5.05E-01	4.87E-01	4.78E-01	4.58E-01	4.21E-01
241	5.18E-01	5.04E-01	4.90E-01	4.63E-01	4.27E-01
325	4.68E-01	4.60E-01	4.47E-01	4.30E-01	3.90E-01
408	4.63E-01	4.47E-01	4.30E-01	4.11E-01	3.58E-01
492	4.84E-01	4.74E-01	4.67E-01	4.29E-01	3.88E-01
724	4.66E-01	4.64E-01	4.53E-01	4.24E-01	3.78E-01
786	4.50E-01	4.44E-01	4.36E-01	4.07E-01	3.63E-01
868	5.31E-01	5.05E-01	4.96E-01	4.78E-01	4.31E-01
929	5.05E-01	5.08E-01	4.93E-01	5.00E-01	4.99E-01
1012	5.16E-01	5.22E-01	5.17E-01	5.18E-01	5.11E-01
Biased Statistics					
Average Biased	4.90E-01	4.77E-01	4.68E-01	4.45E-01	4.04E-01
Std Dev Biased	2.10E-02	1.80E-02	1.80E-02	1.51E-02	1.86E-02
Ps90%/90% (+KTL) Biased	5.48E-01	5.27E-01	5.17E-01	4.87E-01	4.55E-01
Ps90%/90% (-KTL) Biased	4.33E-01	4.28E-01	4.18E-01	4.03E-01	3.53E-01
Un-Biased Statistics					
Average Un-Biased	4.79E-01	4.67E-01	4.56E-01	4.30E-01	3.84E-01
Std Dev Un-Biased	3.16E-02	2.47E-02	2.65E-02	2.84E-02	2.91E-02
Ps90%/90% (+KTL) Un-Biased	5.65E-01	5.34E-01	5.29E-01	5.08E-01	4.63E-01
Ps90%/90% (-KTL) Un-Biased	3.92E-01	3.99E-01	3.84E-01	3.52E-01	3.04E-01
Specification MIN	2.00E-01	1.20E-01	1.10E-01	7.00E-02	1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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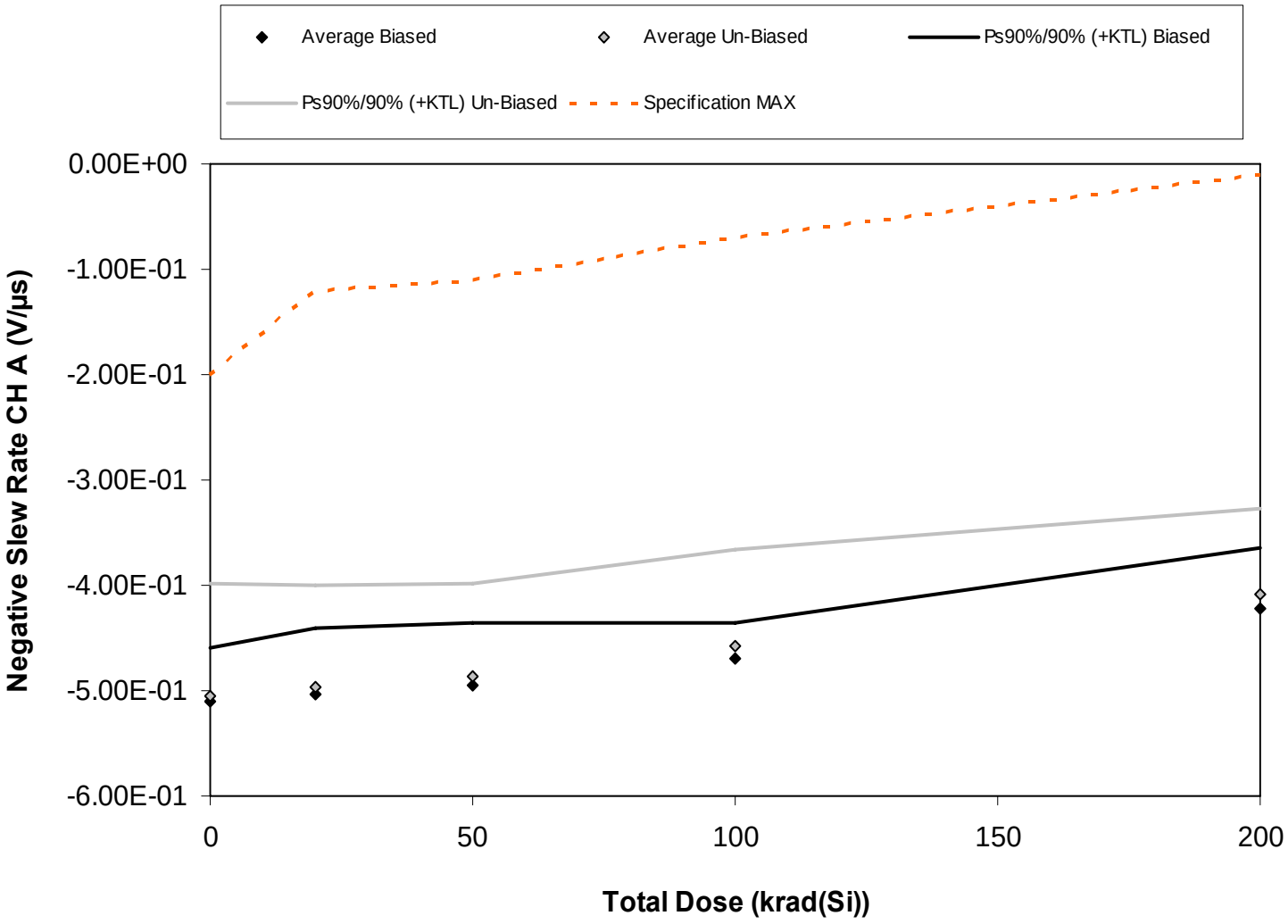

Figure 5.23. Plot of negative slew rate for channel A versus total dose. The data show a moderate increase with total dose, however not sufficient to exceed the specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.23. Raw data for Negative Slew Rate CH A (V/µs) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Slew Rate CH A (V/µs)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-4.98E-01	-4.96E-01	-4.80E-01	-4.66E-01	-4.04E-01
116	-5.12E-01	-4.87E-01	-4.97E-01	-4.66E-01	-4.19E-01
182	-5.34E-01	-5.36E-01	-5.09E-01	-4.76E-01	-4.46E-01
241	-5.22E-01	-5.16E-01	-5.20E-01	-4.84E-01	-4.42E-01
325	-4.87E-01	-4.80E-01	-4.67E-01	-4.52E-01	-4.00E-01
408	-4.77E-01	-4.69E-01	-4.66E-01	-4.31E-01	-3.93E-01
492	-5.11E-01	-4.95E-01	-4.96E-01	-4.63E-01	-4.03E-01
724	-4.82E-01	-4.92E-01	-4.75E-01	-4.48E-01	-3.93E-01
786	-4.83E-01	-4.69E-01	-4.56E-01	-4.32E-01	-3.94E-01
868	-5.70E-01	-5.54E-01	-5.36E-01	-5.12E-01	-4.62E-01
929	-5.21E-01	-5.39E-01	-5.32E-01	-5.22E-01	-5.37E-01
1012	-5.30E-01	-5.46E-01	-5.45E-01	-5.51E-01	-5.47E-01
Biased Statistics					
Average Biased	-5.11E-01	-5.03E-01	-4.95E-01	-4.69E-01	-4.22E-01
Std Dev Biased	1.87E-02	2.29E-02	2.14E-02	1.20E-02	2.12E-02
Ps90%/90% (+KTL) Biased	-4.59E-01	-4.40E-01	-4.36E-01	-4.36E-01	-3.64E-01
Ps90%/90% (-KTL) Biased	-5.62E-01	-5.66E-01	-5.53E-01	-5.02E-01	-4.80E-01
Un-Biased Statistics					
Average Un-Biased	-5.05E-01	-4.96E-01	-4.86E-01	-4.57E-01	-4.09E-01
Std Dev Un-Biased	3.89E-02	3.48E-02	3.17E-02	3.33E-02	2.99E-02
Ps90%/90% (+KTL) Un-Biased	-3.98E-01	-4.00E-01	-3.99E-01	-3.66E-01	-3.27E-01
Ps90%/90% (-KTL) Un-Biased	-6.11E-01	-5.91E-01	-5.73E-01	-5.49E-01	-4.91E-01
Specification MAX	-2.00E-01	-1.20E-01	-1.10E-01	-7.00E-02	-1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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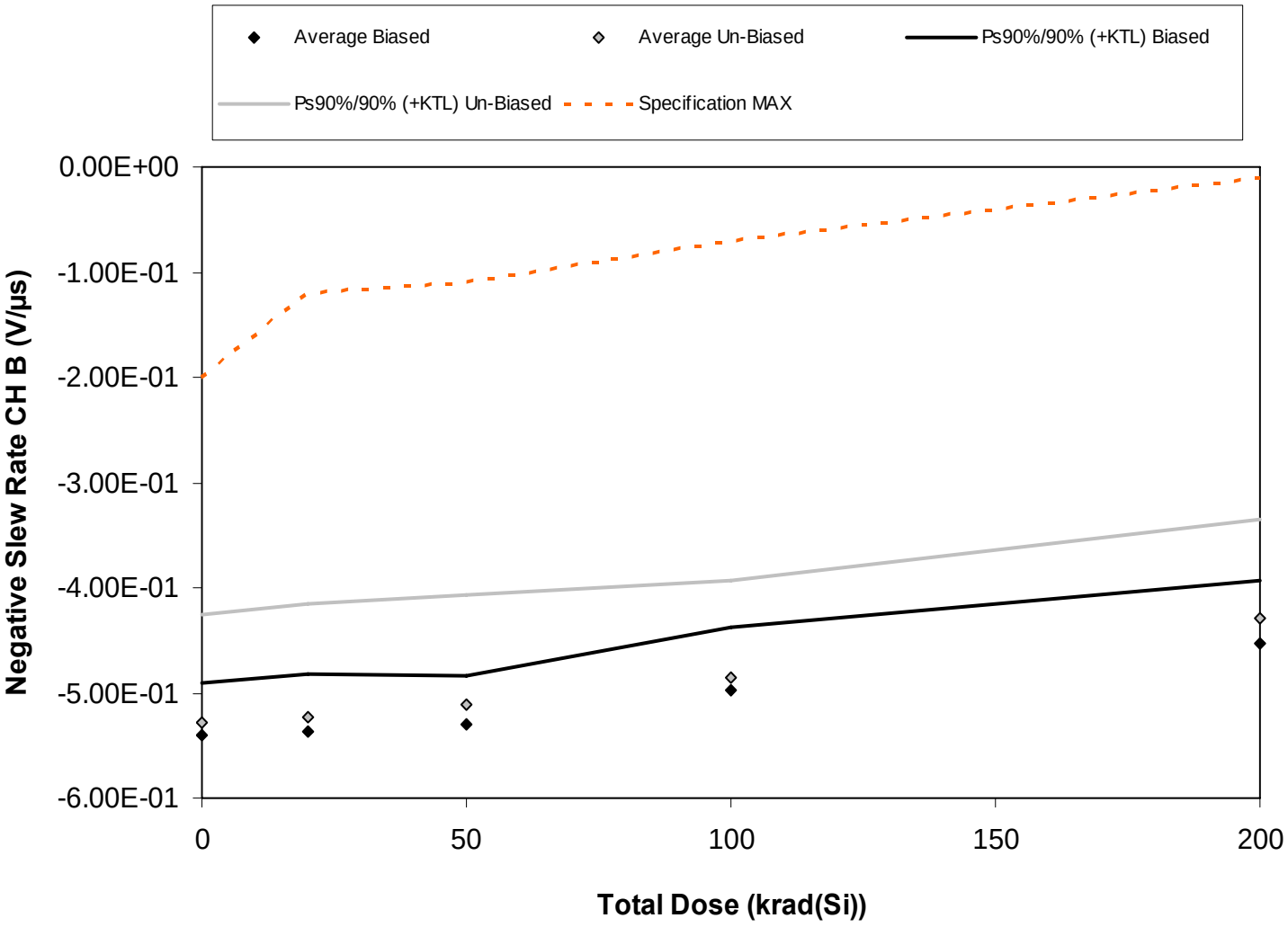

Figure 5.24. Plot of negative slew rate for channel B versus total dose. The data show a moderate increase with total dose, however not sufficient to exceed the specification, even after application of the KTL statistics. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black lines show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray lines show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed lines are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.24. Raw data for Negative Slew Rate CH B (V/µs) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Slew Rate CH B (V/µs)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-5.32E-01	-5.23E-01	-5.18E-01	-4.79E-01	-4.35E-01
116	-5.35E-01	-5.44E-01	-5.24E-01	-4.94E-01	-4.46E-01
182	-5.52E-01	-5.49E-01	-5.47E-01	-5.09E-01	-4.73E-01
241	-5.66E-01	-5.56E-01	-5.47E-01	-5.30E-01	-4.81E-01
325	-5.19E-01	-5.09E-01	-5.12E-01	-4.78E-01	-4.33E-01
408	-5.07E-01	-5.01E-01	-4.84E-01	-4.67E-01	-3.99E-01
492	-5.30E-01	-5.20E-01	-5.31E-01	-4.95E-01	-4.36E-01
724	-5.18E-01	-5.10E-01	-5.05E-01	-4.70E-01	-4.19E-01
786	-4.94E-01	-4.94E-01	-4.70E-01	-4.54E-01	-4.08E-01
868	-5.90E-01	-5.91E-01	-5.65E-01	-5.39E-01	-4.86E-01
929	-5.66E-01	-5.67E-01	-5.56E-01	-5.55E-01	-5.67E-01
1012	-5.87E-01	-5.68E-01	-5.70E-01	-5.82E-01	-5.78E-01
Biased Statistics					
Average Biased	-5.41E-01	-5.36E-01	-5.30E-01	-4.98E-01	-4.54E-01
Std Dev Biased	1.83E-02	1.96E-02	1.64E-02	2.19E-02	2.21E-02
Ps90%/90% (+KTL) Biased	-4.90E-01	-4.83E-01	-4.85E-01	-4.38E-01	-3.93E-01
Ps90%/90% (-KTL) Biased	-5.91E-01	-5.90E-01	-5.75E-01	-5.58E-01	-5.14E-01
Un-Biased Statistics					
Average Un-Biased	-5.28E-01	-5.23E-01	-5.11E-01	-4.85E-01	-4.30E-01
Std Dev Un-Biased	3.72E-02	3.91E-02	3.80E-02	3.36E-02	3.44E-02
Ps90%/90% (+KTL) Un-Biased	-4.26E-01	-4.16E-01	-4.07E-01	-3.93E-01	-3.35E-01
Ps90%/90% (-KTL) Un-Biased	-6.30E-01	-6.31E-01	-6.15E-01	-5.77E-01	-5.24E-01
Specification MAX	-2.00E-01	-1.20E-01	-1.10E-01	-7.00E-02	-1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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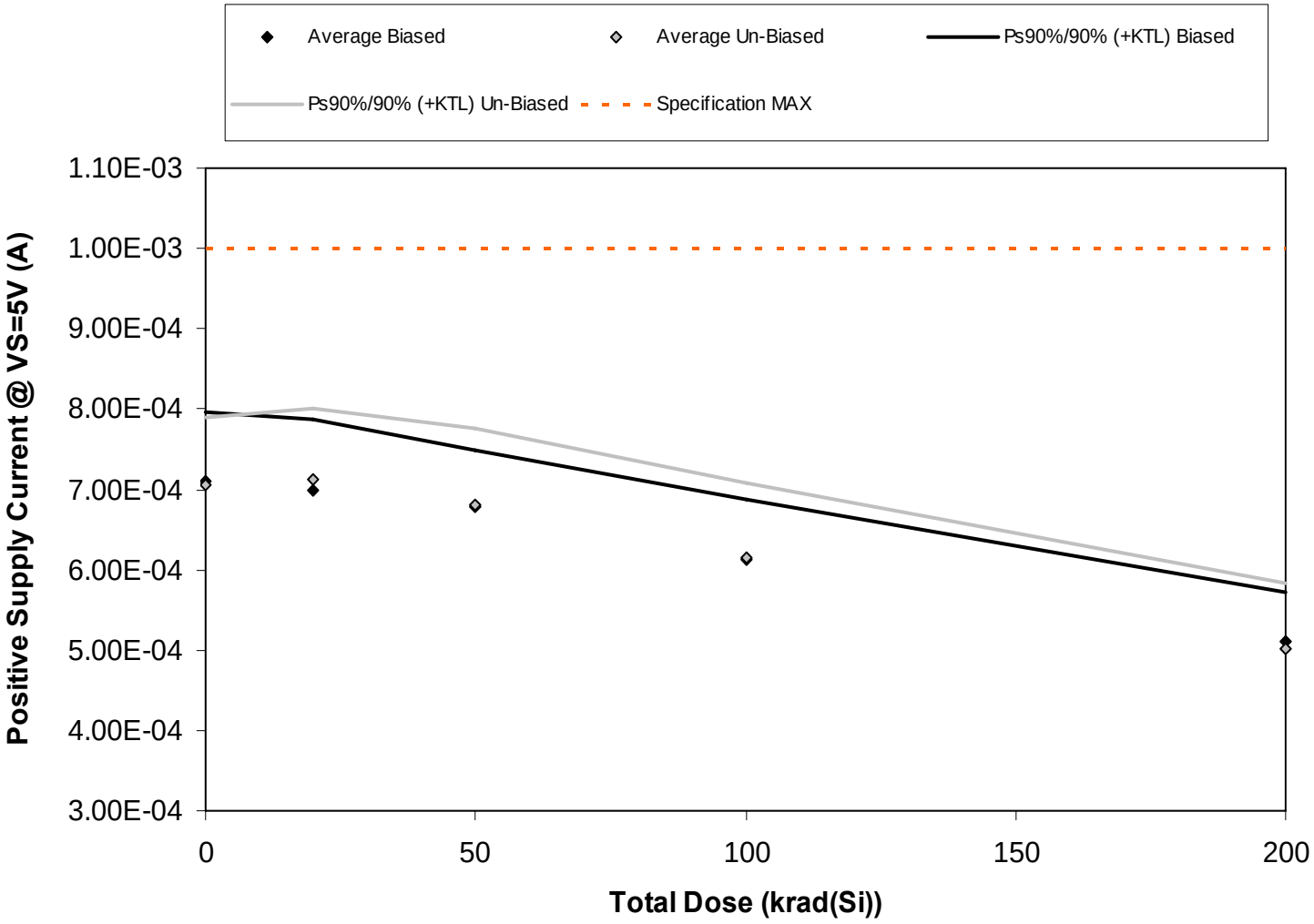

Figure 5.25. Plot of positive supply current at 5V versus total dose. The data show a slight decrease (improvement) with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.25. Raw data for Positive Supply Current @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Positive Supply Current @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	6.94E-04	6.83E-04	6.56E-04	5.90E-04	4.89E-04
116	6.89E-04	6.76E-04	6.65E-04	6.02E-04	4.98E-04
182	7.35E-04	7.24E-04	6.97E-04	6.30E-04	5.29E-04
241	7.53E-04	7.43E-04	7.14E-04	6.53E-04	5.39E-04
325	6.85E-04	6.74E-04	6.59E-04	5.94E-04	4.94E-04
408	6.76E-04	6.82E-04	6.53E-04	5.89E-04	4.75E-04
492	6.99E-04	7.01E-04	6.70E-04	6.03E-04	4.83E-04
724	7.02E-04	7.09E-04	6.75E-04	6.11E-04	5.06E-04
786	6.96E-04	7.00E-04	6.67E-04	6.02E-04	4.88E-04
868	7.58E-04	7.67E-04	7.41E-04	6.74E-04	5.51E-04
929	7.20E-04	7.24E-04	7.21E-04	7.24E-04	7.25E-04
1012	7.24E-04	7.29E-04	7.25E-04	7.27E-04	7.22E-04
Biased Statistics					
Average Biased	7.11E-04	7.00E-04	6.78E-04	6.14E-04	5.10E-04
Std Dev Biased	3.08E-05	3.15E-05	2.58E-05	2.69E-05	2.26E-05
Ps90%/90% (+KTL) Biased	7.96E-04	7.86E-04	7.49E-04	6.88E-04	5.72E-04
Ps90%/90% (-KTL) Biased	6.27E-04	6.14E-04	6.07E-04	5.40E-04	4.48E-04
Un-Biased Statistics					
Average Un-Biased	7.06E-04	7.12E-04	6.81E-04	6.16E-04	5.01E-04
Std Dev Un-Biased	3.07E-05	3.24E-05	3.44E-05	3.35E-05	3.04E-05
Ps90%/90% (+KTL) Un-Biased	7.90E-04	8.01E-04	7.76E-04	7.08E-04	5.84E-04
Ps90%/90% (-KTL) Un-Biased	6.22E-04	6.23E-04	5.87E-04	5.24E-04	4.17E-04
Specification MAX	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03
Status	PASS	PASS	PASS	PASS	PASS

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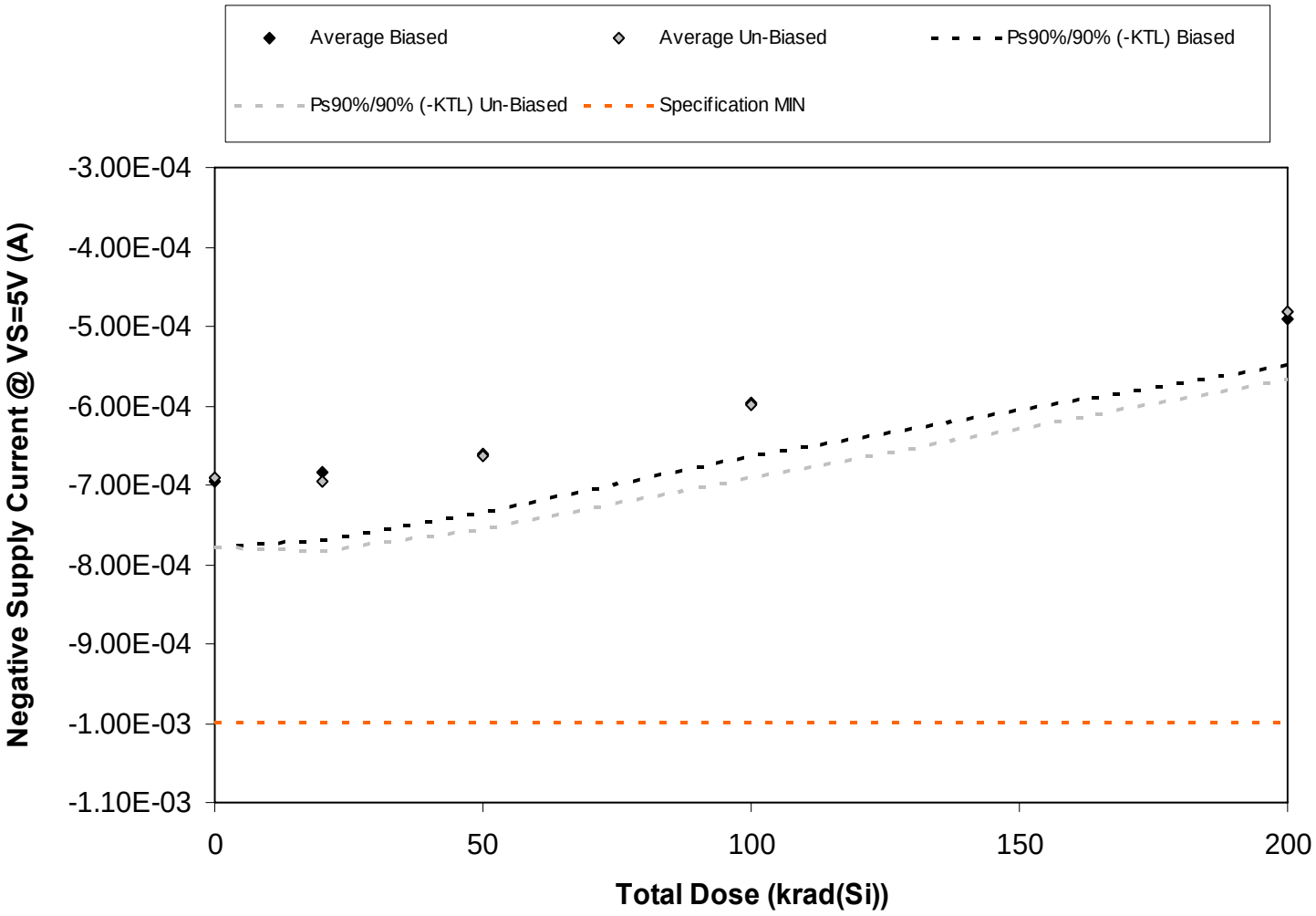

Figure 5.26. Plot of the negative supply current at 5V versus total dose. The data show an increase (improvement) with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.26. Raw data for Negative Supply Current @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Negative Supply Current @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-6.80E-04	-6.67E-04	-6.37E-04	-5.73E-04	-4.73E-04
116	-6.74E-04	-6.60E-04	-6.47E-04	-5.87E-04	-4.82E-04
182	-7.20E-04	-7.07E-04	-6.82E-04	-6.14E-04	-5.09E-04
241	-7.35E-04	-7.26E-04	-6.97E-04	-6.30E-04	-5.18E-04
325	-6.69E-04	-6.56E-04	-6.42E-04	-5.78E-04	-4.77E-04
408	-6.59E-04	-6.68E-04	-6.36E-04	-5.69E-04	-4.56E-04
492	-6.83E-04	-6.85E-04	-6.50E-04	-5.88E-04	-4.65E-04
724	-6.87E-04	-6.89E-04	-6.60E-04	-5.95E-04	-4.89E-04
786	-6.82E-04	-6.87E-04	-6.52E-04	-5.84E-04	-4.67E-04
868	-7.44E-04	-7.50E-04	-7.21E-04	-6.56E-04	-5.32E-04
929	-7.04E-04	-7.05E-04	-7.05E-04	-7.08E-04	-7.05E-04
1012	-7.07E-04	-7.10E-04	-7.12E-04	-7.12E-04	-7.09E-04
Biased Statistics					
Average Biased	-6.96E-04	-6.83E-04	-6.61E-04	-5.96E-04	-4.92E-04
Std Dev Biased	2.99E-05	3.14E-05	2.68E-05	2.46E-05	2.03E-05
Ps90%/90% (+KTL) Biased	-6.14E-04	-5.97E-04	-5.88E-04	-5.29E-04	-4.36E-04
Ps90%/90% (-KTL) Biased	-7.77E-04	-7.69E-04	-7.34E-04	-6.64E-04	-5.48E-04
Un-Biased Statistics					
Average Un-Biased	-6.91E-04	-6.96E-04	-6.64E-04	-5.98E-04	-4.82E-04
Std Dev Un-Biased	3.16E-05	3.14E-05	3.31E-05	3.36E-05	3.06E-05
Ps90%/90% (+KTL) Un-Biased	-6.04E-04	-6.10E-04	-5.73E-04	-5.06E-04	-3.98E-04
Ps90%/90% (-KTL) Un-Biased	-7.78E-04	-7.82E-04	-7.55E-04	-6.90E-04	-5.66E-04
Specification MIN	-1.00E-03	-1.00E-03	-1.00E-03	-1.00E-03	-1.00E-03
Status	PASS	PASS	PASS	PASS	PASS

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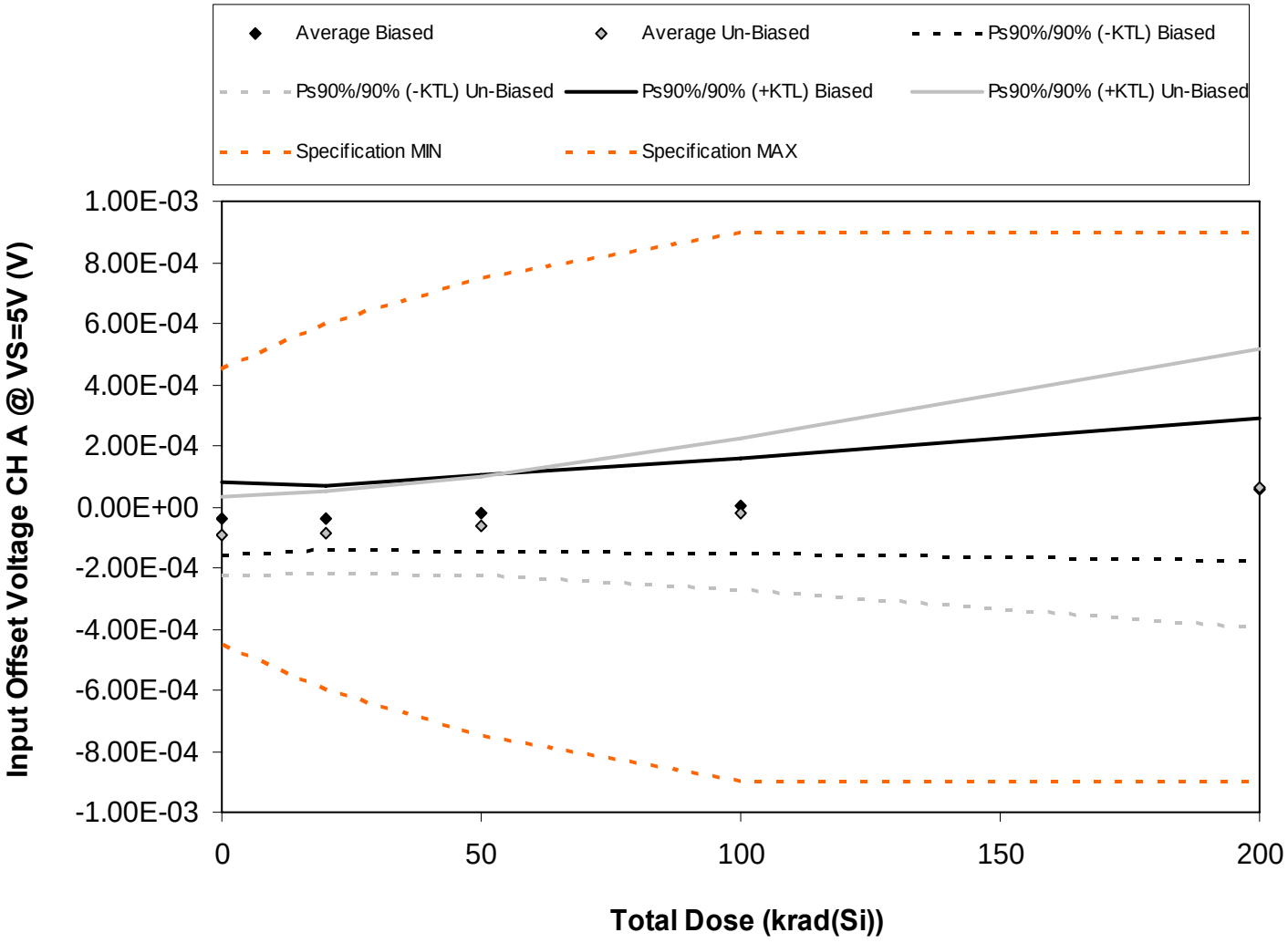

Figure 5.27. Plot of input offset voltage at 5V for channel A versus total dose. The data show a slight increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.27. Raw data for Input Offset Voltage CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Voltage CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	2.57E-05	1.21E-05	3.62E-05	7.03E-05	1.45E-04
116	-9.14E-05	-8.93E-05	-8.86E-05	-8.50E-05	-8.38E-05
182	-6.44E-05	-5.58E-05	-3.31E-05	4.59E-06	7.16E-05
241	-3.72E-05	-2.93E-05	-1.04E-05	2.06E-05	9.04E-05
325	-2.96E-05	-2.51E-05	-8.94E-06	1.22E-05	5.82E-05
408	-1.05E-04	-8.69E-05	-5.16E-05	4.83E-06	1.20E-04
492	-2.70E-05	-2.42E-05	-1.69E-06	4.39E-05	1.50E-04
724	-6.59E-05	-5.19E-05	-2.39E-05	3.44E-05	1.51E-04
786	-1.40E-04	-1.28E-04	-9.06E-05	-2.00E-05	1.23E-04
868	-1.32E-04	-1.38E-04	-1.51E-04	-1.78E-04	-2.35E-04
929	-3.79E-05	-3.71E-05	-3.77E-05	-3.79E-05	-3.78E-05
1012	1.52E-05	1.47E-05	1.46E-05	1.41E-05	1.44E-05
Biased Statistics					
Average Biased	-3.94E-05	-3.75E-05	-2.10E-05	4.54E-06	5.64E-05
Std Dev Biased	4.38E-05	3.77E-05	4.54E-05	5.62E-05	8.51E-05
Ps90%/90% (+KTL) Biased	8.07E-05	6.60E-05	1.04E-04	1.59E-04	2.90E-04
Ps90%/90% (-KTL) Biased	-1.59E-04	-1.41E-04	-1.45E-04	-1.50E-04	-1.77E-04
Un-Biased Statistics					
Average Un-Biased	-9.40E-05	-8.59E-05	-6.37E-05	-2.30E-05	6.17E-05
Std Dev Un-Biased	4.73E-05	4.88E-05	5.88E-05	9.02E-05	1.67E-04
Ps90%/90% (+KTL) Un-Biased	3.57E-05	4.78E-05	9.76E-05	2.24E-04	5.19E-04
Ps90%/90% (-KTL) Un-Biased	-2.24E-04	-2.20E-04	-2.25E-04	-2.70E-04	-3.95E-04
Specification MIN	-4.50E-04	-6.00E-04	-7.50E-04	-9.00E-04	-9.00E-04
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	4.50E-04	6.00E-04	7.50E-04	9.00E-04	9.00E-04
Status	PASS	PASS	PASS	PASS	PASS

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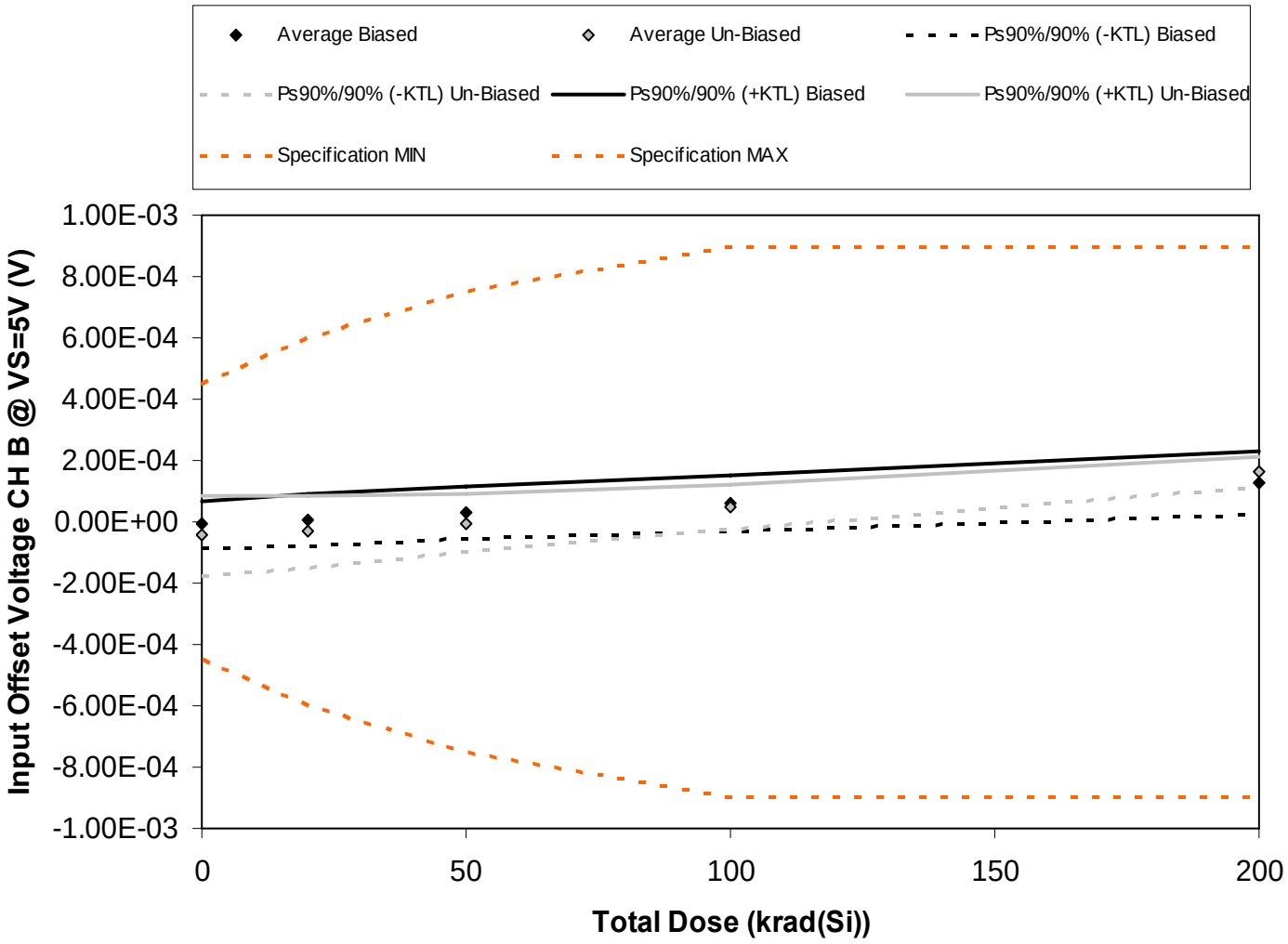

Figure 5.28. Plot of input offset voltage at 5V for channel B versus total dose. The data show a slight increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.28. Raw data for Input Offset Voltage CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Voltage CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-2.70E-05	-1.78E-05	7.48E-06	4.31E-05	1.12E-04
116	1.28E-05	2.96E-05	4.96E-05	7.26E-05	1.28E-04
182	-5.00E-05	-3.53E-05	-1.27E-05	1.77E-05	8.33E-05
241	1.28E-05	3.43E-05	6.25E-05	1.03E-04	1.84E-04
325	7.24E-06	2.25E-05	4.18E-05	7.52E-05	1.36E-04
408	-6.71E-05	-5.67E-05	-2.04E-05	3.53E-05	1.77E-04
492	1.24E-05	1.71E-05	3.83E-05	8.63E-05	1.81E-04
724	-7.26E-05	-5.46E-05	-1.63E-05	4.70E-05	1.70E-04
786	-9.54E-05	-7.84E-05	-4.61E-05	1.77E-05	1.55E-04
868	-4.47E-06	7.60E-06	2.61E-05	6.53E-05	1.40E-04
929	9.17E-06	9.78E-06	9.90E-06	1.00E-05	1.10E-05
1012	-2.99E-05	-3.05E-05	-3.01E-05	-2.99E-05	-2.97E-05
Biased Statistics					
Average Biased	-8.84E-06	6.66E-06	2.97E-05	6.23E-05	1.29E-04
Std Dev Biased	2.84E-05	3.12E-05	3.13E-05	3.28E-05	3.70E-05
Ps90%/90% (+KTL) Biased	6.89E-05	9.22E-05	1.15E-04	1.52E-04	2.30E-04
Ps90%/90% (-KTL) Biased	-8.66E-05	-7.89E-05	-5.60E-05	-2.75E-05	2.72E-05
Un-Biased Statistics					
Average Un-Biased	-4.54E-05	-3.30E-05	-3.70E-06	5.03E-05	1.65E-04
Std Dev Un-Biased	4.67E-05	4.26E-05	3.49E-05	2.66E-05	1.70E-05
Ps90%/90% (+KTL) Un-Biased	8.27E-05	8.37E-05	9.21E-05	1.23E-04	2.11E-04
Ps90%/90% (-KTL) Un-Biased	-1.74E-04	-1.50E-04	-9.95E-05	-2.25E-05	1.18E-04
Specification MIN	-4.50E-04	-6.00E-04	-7.50E-04	-9.00E-04	-9.00E-04
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	4.50E-04	6.00E-04	7.50E-04	9.00E-04	9.00E-04
Status	PASS	PASS	PASS	PASS	PASS

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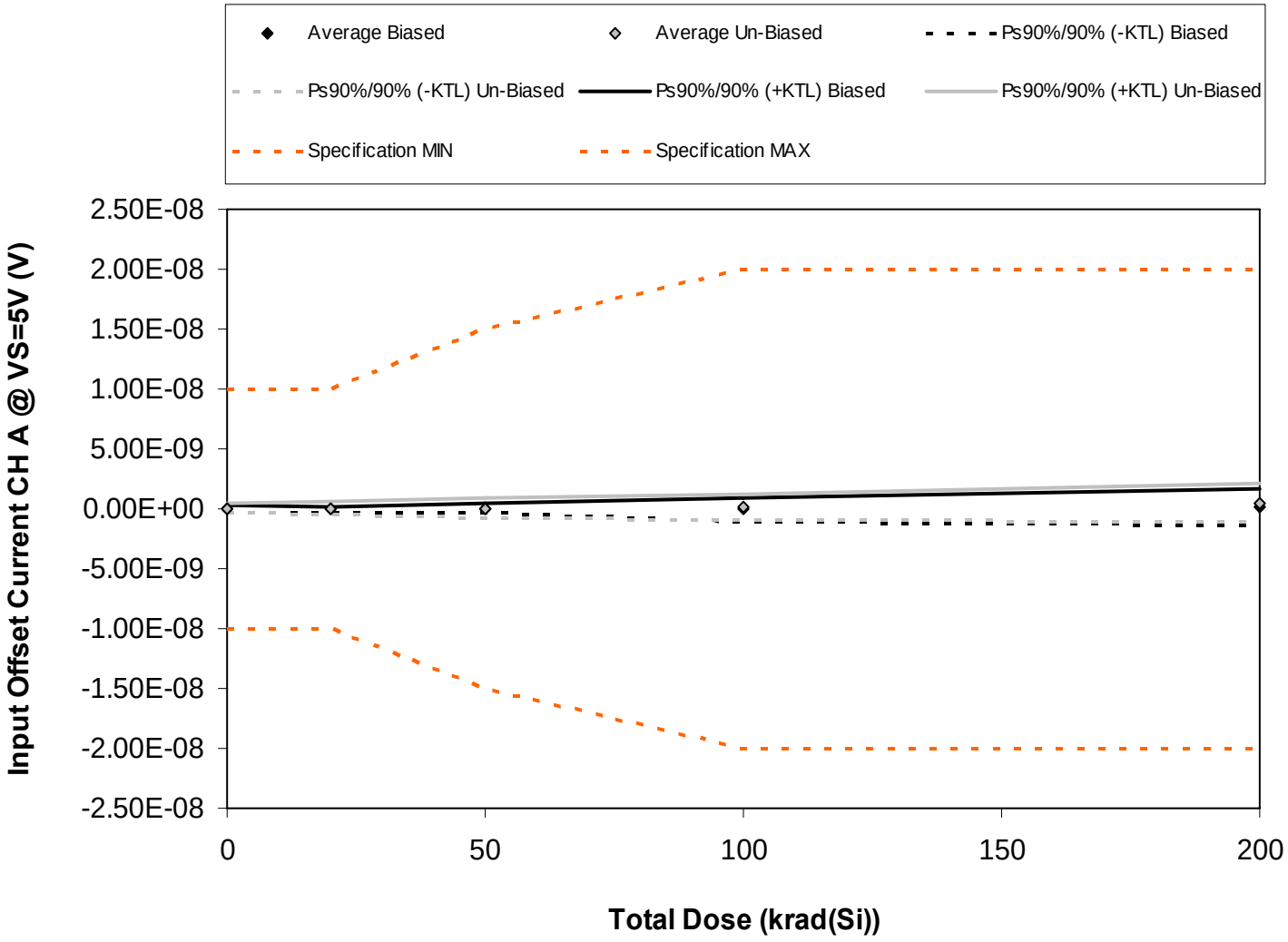

Figure 5.29. Plot of Input Offset Current CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.29. Raw data for Input Offset Current CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Current CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.63E-10	-1.84E-10	-2.00E-12	2.50E-11	5.68E-10
116	9.70E-11	3.00E-12	1.87E-10	5.09E-10	8.28E-10
182	8.90E-11	3.70E-11	1.68E-10	-2.66E-10	-3.94E-10
241	-5.10E-11	-4.60E-11	-1.49E-10	-4.28E-10	-3.33E-10
325	9.70E-11	3.90E-11	-5.70E-11	8.00E-12	3.14E-10
408	-4.60E-11	-1.95E-10	-1.30E-10	-3.70E-11	2.86E-10
492	-1.90E-11	-6.00E-12	-1.70E-11	-7.50E-11	5.30E-10
724	1.08E-10	9.30E-11	-6.90E-11	1.90E-11	2.23E-10
786	-9.00E-12	-1.40E-11	0.00E+00	5.60E-11	-3.00E-11
868	2.95E-10	3.61E-10	5.67E-10	8.57E-10	1.50E-09
929	-5.20E-11	-4.90E-11	-6.70E-11	-5.00E-11	-7.30E-11
1012	0.00E+00	-9.00E-12	7.00E-12	-8.00E-12	-1.70E-11
Biased Statistics					
Average Biased	1.38E-11	-3.02E-11	2.94E-11	-3.04E-11	1.97E-10
Std Dev Biased	1.17E-10	9.26E-11	1.45E-10	3.57E-10	5.43E-10
Ps90%/90% (+KTL) Biased	3.35E-10	2.24E-10	4.28E-10	9.48E-10	1.69E-09
Ps90%/90% (-KTL) Biased	-3.08E-10	-2.84E-10	-3.69E-10	-1.01E-09	-1.29E-09
Un-Biased Statistics					
Average Un-Biased	6.58E-11	4.78E-11	7.02E-11	1.64E-10	5.02E-10
Std Dev Un-Biased	1.41E-10	2.04E-10	2.82E-10	3.91E-10	5.93E-10
Ps90%/90% (+KTL) Un-Biased	4.53E-10	6.06E-10	8.44E-10	1.24E-09	2.13E-09
Ps90%/90% (-KTL) Un-Biased	-3.21E-10	-5.10E-10	-7.04E-10	-9.07E-10	-1.12E-09
Specification MIN	-1.00E-08	-1.00E-08	-1.50E-08	-2.00E-08	-2.00E-08
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.00E-08	1.00E-08	1.50E-08	2.00E-08	2.00E-08
Status	PASS	PASS	PASS	PASS	PASS

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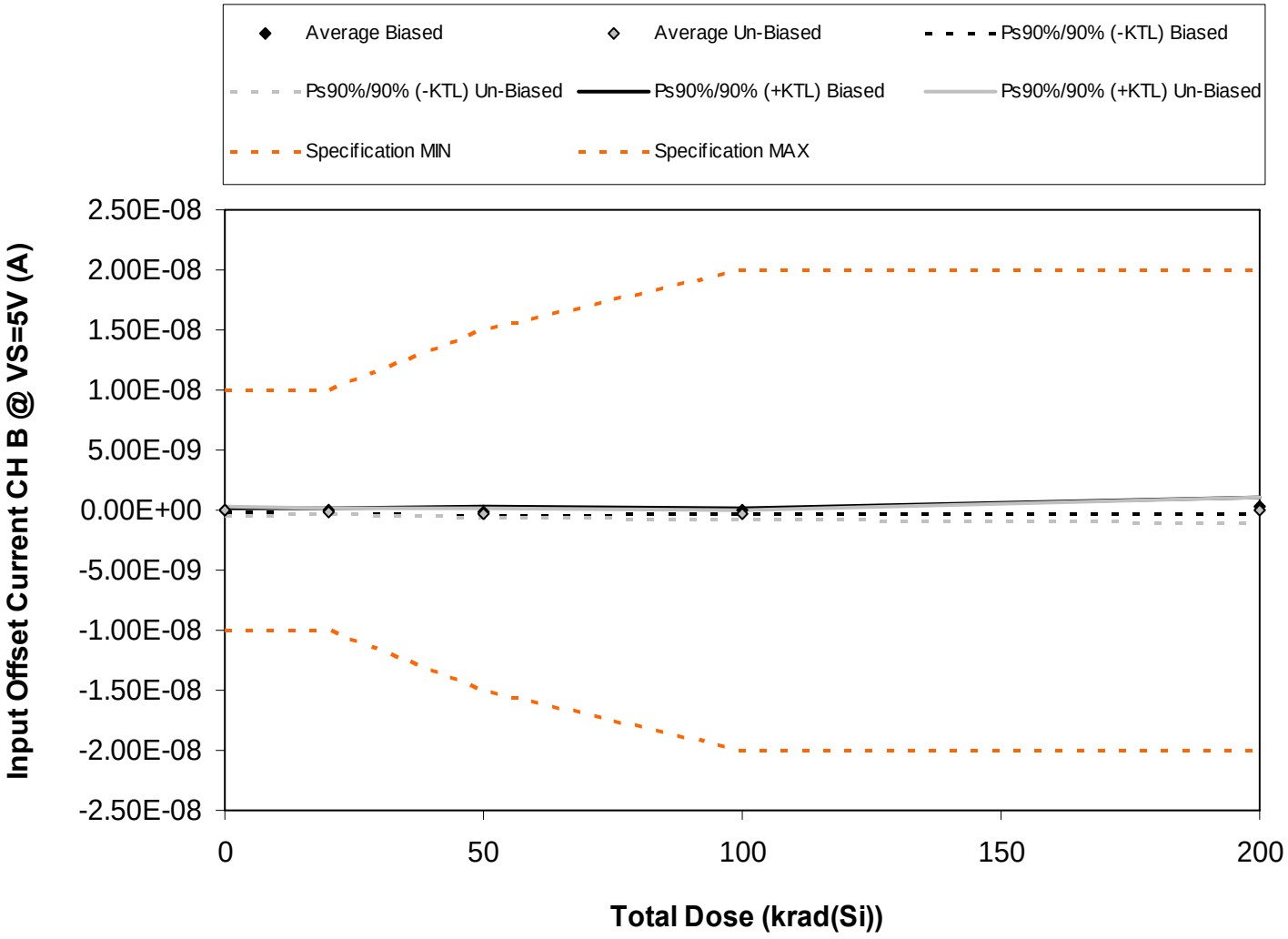

Figure 5.30. Plot of Input Offset Current CH B @ VS=5V (A) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.30. Raw data for Input Offset Current CH B @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Input Offset Current CH B @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	-1.20E-10	-1.98E-10	-2.40E-10	-9.00E-11	5.30E-10
116	3.00E-12	-1.60E-11	-1.47E-10	-3.30E-11	2.90E-10
182	8.00E-12	-5.90E-11	-1.58E-10	8.00E-12	3.10E-11
241	-7.30E-11	7.00E-12	-1.69E-10	-1.80E-10	3.26E-10
325	-2.00E-12	-2.50E-11	1.30E-10	7.10E-11	6.34E-10
408	-1.58E-10	-2.17E-10	-2.67E-10	-2.48E-10	-1.04E-10
492	-7.00E-12	-4.70E-11	-1.91E-10	-3.48E-10	4.05E-10
724	8.20E-11	-3.80E-11	-1.30E-10	-3.98E-10	-1.33E-10
786	-4.60E-11	-1.79E-10	-4.59E-10	-6.19E-10	-6.15E-10
868	-2.16E-10	-1.98E-10	-2.68E-10	-2.16E-10	1.98E-10
929	-7.80E-11	-1.07E-10	-9.00E-11	-7.30E-11	-8.20E-11
1012	-1.17E-10	-1.64E-10	-1.27E-10	-1.17E-10	-1.15E-10
Biased Statistics					
Average Biased	-3.68E-11	-5.82E-11	-1.17E-10	-4.48E-11	3.62E-10
Std Dev Biased	5.71E-11	8.17E-11	1.43E-10	9.57E-11	2.34E-10
Ps90%/90% (+KTL) Biased	1.20E-10	1.66E-10	2.74E-10	2.18E-10	1.00E-09
Ps90%/90% (-KTL) Biased	-1.93E-10	-2.82E-10	-5.08E-10	-3.07E-10	-2.78E-10
Un-Biased Statistics					
Average Un-Biased	-6.90E-11	-1.36E-10	-2.63E-10	-3.66E-10	-4.98E-11
Std Dev Un-Biased	1.19E-10	8.63E-11	1.24E-10	1.60E-10	3.87E-10
Ps90%/90% (+KTL) Un-Biased	2.57E-10	1.01E-10	7.65E-11	7.16E-11	1.01E-09
Ps90%/90% (-KTL) Un-Biased	-3.95E-10	-3.72E-10	-6.03E-10	-8.03E-10	-1.11E-09
Specification MIN	-1.00E-08	-1.00E-08	-1.50E-08	-2.00E-08	-2.00E-08
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	1.00E-08	1.00E-08	1.50E-08	2.00E-08	2.00E-08
Status	PASS	PASS	PASS	PASS	PASS

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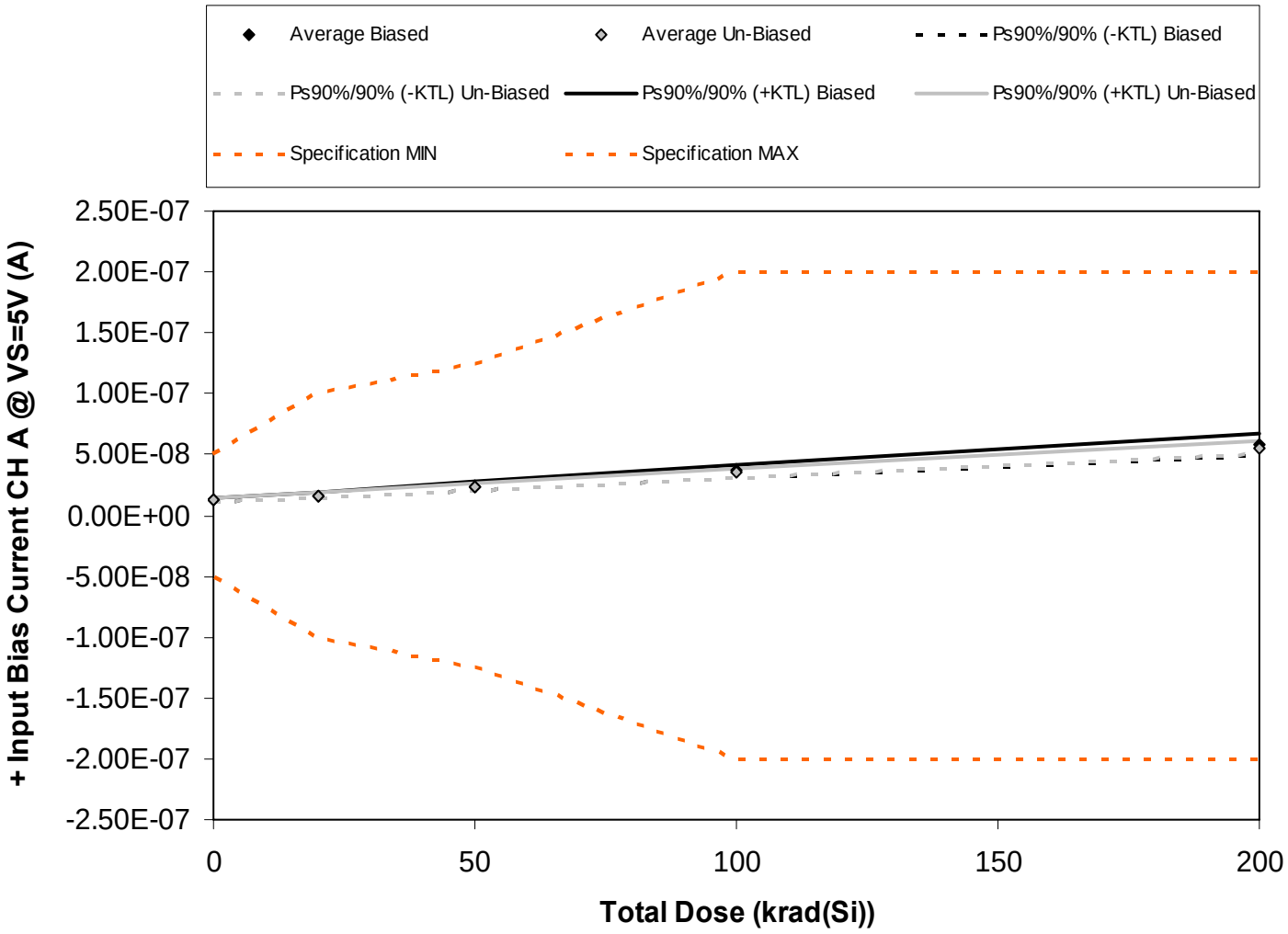

Figure 5.31. Plot of input bias current, non-inverting input at 5V for channel A versus total dose. The data show an increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.31. Raw data for + Input Bias Current CH A @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

+ Input Bias Current CH A @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.21E-08	1.57E-08	2.34E-08	3.57E-08	5.64E-08
116	1.29E-08	1.62E-08	2.33E-08	3.55E-08	5.80E-08
182	1.31E-08	1.68E-08	2.45E-08	3.75E-08	5.97E-08
241	1.35E-08	1.76E-08	2.60E-08	3.92E-08	6.27E-08
325	1.25E-08	1.60E-08	2.29E-08	3.47E-08	5.46E-08
408	1.25E-08	1.63E-08	2.35E-08	3.52E-08	5.53E-08
492	1.17E-08	1.53E-08	2.21E-08	3.33E-08	5.29E-08
724	1.28E-08	1.66E-08	2.39E-08	3.59E-08	5.63E-08
786	1.35E-08	1.76E-08	2.51E-08	3.71E-08	5.86E-08
868	1.19E-08	1.57E-08	2.28E-08	3.46E-08	5.50E-08
929	1.28E-08	1.28E-08	1.28E-08	1.29E-08	1.28E-08
1012	1.23E-08	1.24E-08	1.24E-08	1.24E-08	1.24E-08
Biased Statistics					
Average Biased	1.28E-08	1.65E-08	2.40E-08	3.65E-08	5.83E-08
Std Dev Biased	5.57E-10	7.47E-10	1.26E-09	1.82E-09	3.13E-09
Ps90%/90% (+KTL) Biased	1.44E-08	1.85E-08	2.75E-08	4.15E-08	6.69E-08
Ps90%/90% (-KTL) Biased	1.13E-08	1.44E-08	2.06E-08	3.15E-08	4.97E-08
Un-Biased Statistics					
Average Un-Biased	1.25E-08	1.63E-08	2.35E-08	3.52E-08	5.56E-08
Std Dev Un-Biased	6.97E-10	8.86E-10	1.14E-09	1.44E-09	2.08E-09
Ps90%/90% (+KTL) Un-Biased	1.44E-08	1.87E-08	2.66E-08	3.92E-08	6.13E-08
Ps90%/90% (-KTL) Un-Biased	1.06E-08	1.39E-08	2.03E-08	3.13E-08	4.99E-08
Specification MIN	-5.00E-08	-1.00E-07	-1.25E-07	-2.00E-07	-2.00E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-08	1.00E-07	1.25E-07	2.00E-07	2.00E-07
Status	PASS	PASS	PASS	PASS	PASS

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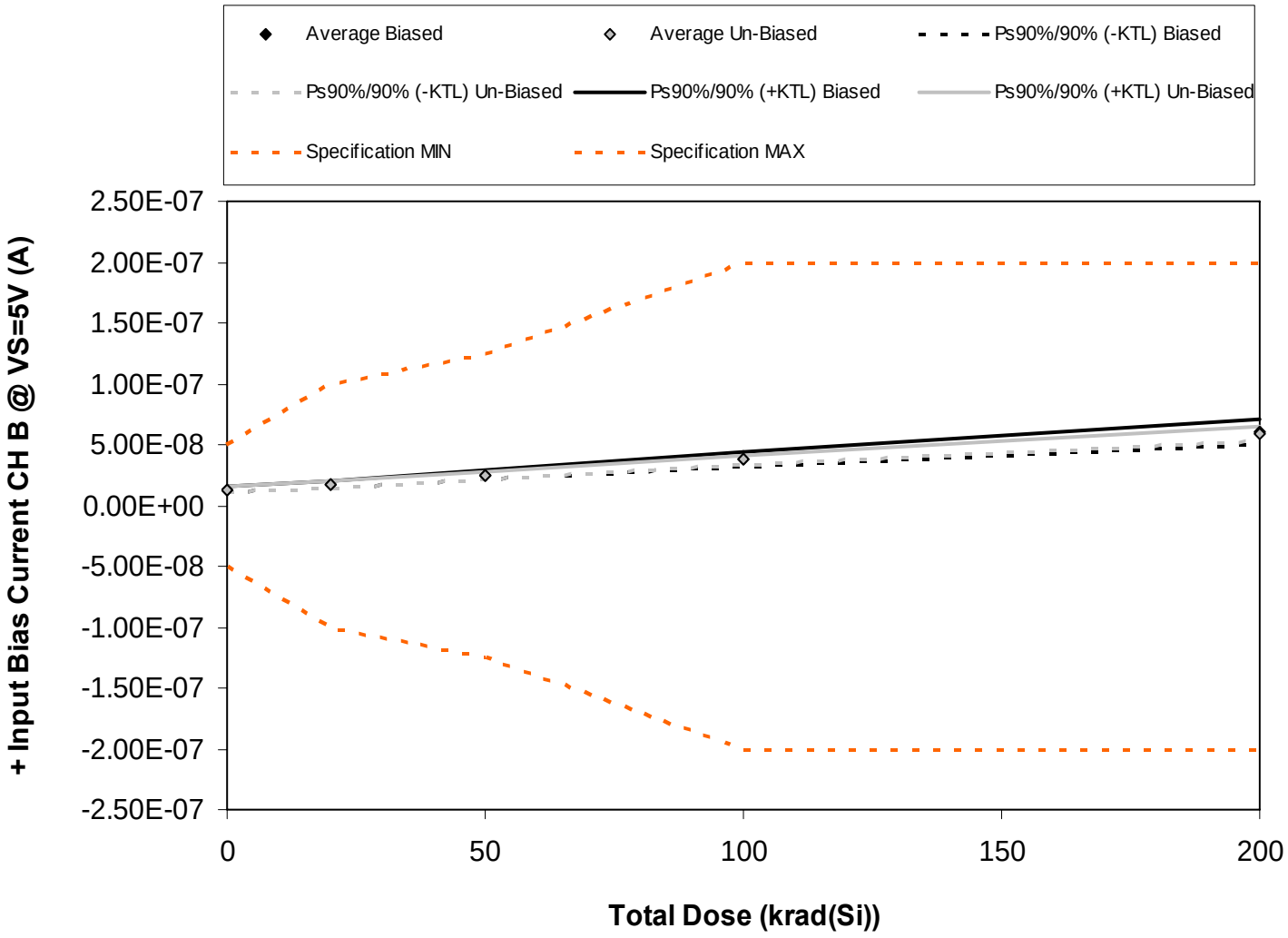

Figure 5.32. Plot of input bias current, non-inverting input at 5V for channel B versus total dose. The data show a slight increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.32. Raw data for + Input Bias Current CH B @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

+ Input Bias Current CH B @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.25E-08	1.65E-08	2.45E-08	3.69E-08	5.82E-08
116	1.34E-08	1.68E-08	2.43E-08	3.68E-08	5.97E-08
182	1.36E-08	1.75E-08	2.56E-08	3.87E-08	6.17E-08
241	1.43E-08	1.85E-08	2.74E-08	4.11E-08	6.55E-08
325	1.29E-08	1.66E-08	2.37E-08	3.58E-08	5.60E-08
408	1.37E-08	1.78E-08	2.56E-08	3.82E-08	5.97E-08
492	1.21E-08	1.59E-08	2.31E-08	3.50E-08	5.54E-08
724	1.40E-08	1.81E-08	2.61E-08	3.90E-08	6.10E-08
786	1.33E-08	1.75E-08	2.52E-08	3.73E-08	5.87E-08
868	1.30E-08	1.71E-08	2.46E-08	3.71E-08	5.85E-08
929	1.32E-08	1.32E-08	1.32E-08	1.32E-08	1.32E-08
1012	1.27E-08	1.28E-08	1.28E-08	1.28E-08	1.28E-08
Biased Statistics					
Average Biased	1.34E-08	1.72E-08	2.51E-08	3.79E-08	6.02E-08
Std Dev Biased	6.84E-10	8.50E-10	1.47E-09	2.08E-09	3.63E-09
Ps90%/90% (+KTL) Biased	1.52E-08	1.95E-08	2.91E-08	4.36E-08	7.02E-08
Ps90%/90% (-KTL) Biased	1.15E-08	1.48E-08	2.11E-08	3.22E-08	5.03E-08
Un-Biased Statistics					
Average Un-Biased	1.32E-08	1.73E-08	2.49E-08	3.73E-08	5.87E-08
Std Dev Un-Biased	7.06E-10	8.70E-10	1.13E-09	1.53E-09	2.07E-09
Ps90%/90% (+KTL) Un-Biased	1.51E-08	1.97E-08	2.80E-08	4.15E-08	6.44E-08
Ps90%/90% (-KTL) Un-Biased	1.13E-08	1.49E-08	2.18E-08	3.31E-08	5.30E-08
Specification MIN	-5.00E-08	-1.00E-07	-1.25E-07	-2.00E-07	-2.00E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-08	1.00E-07	1.25E-07	2.00E-07	2.00E-07
Status	PASS	PASS	PASS	PASS	PASS

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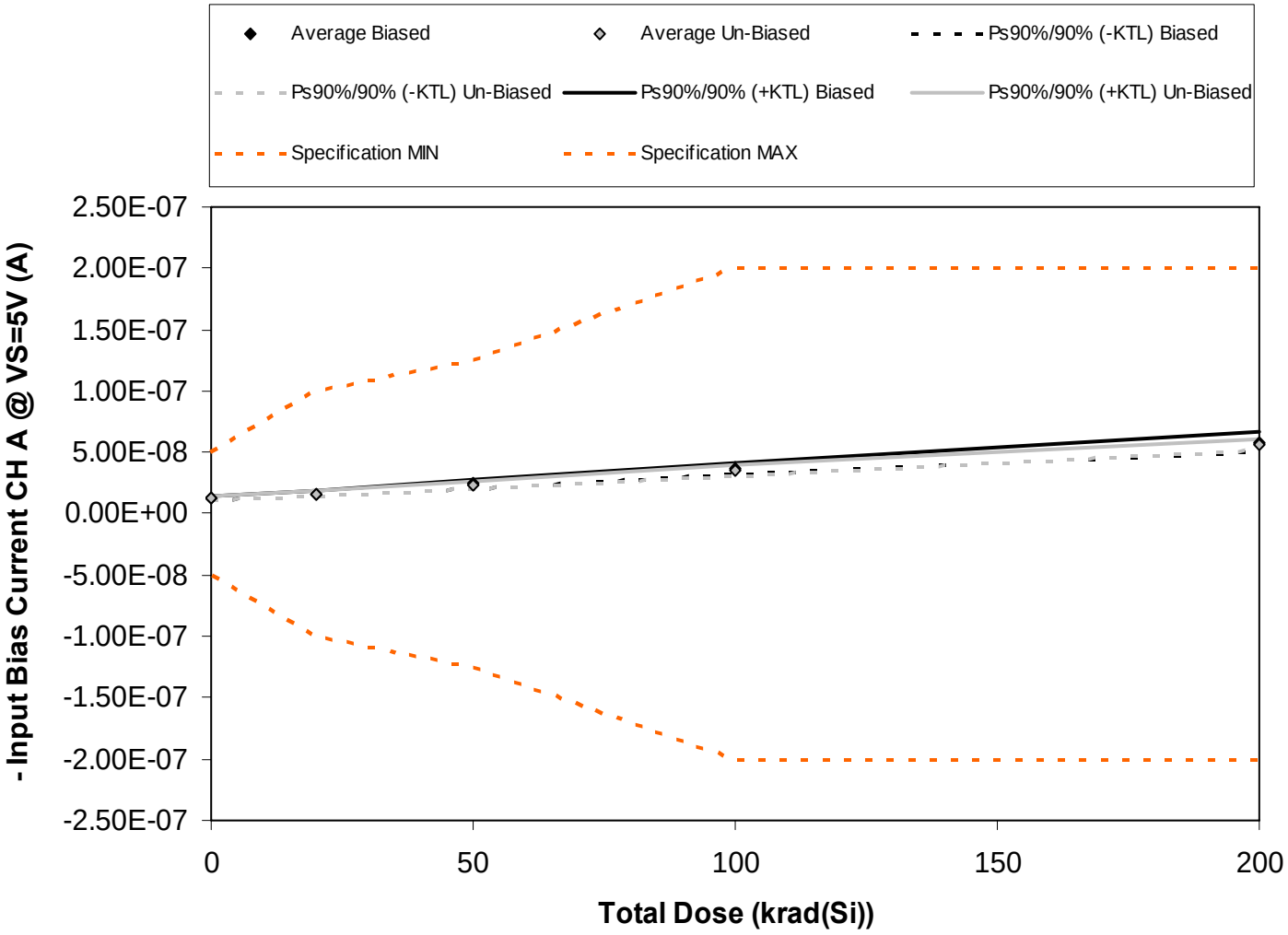

Figure 5.33. Plot of input bias current, inverting input at 5V for channel A versus total dose. The data show a slight increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.33. Raw data for - Input Bias Current CH A @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

- Input Bias Current CH A @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.19E-08	1.56E-08	2.34E-08	3.57E-08	5.71E-08
116	1.30E-08	1.63E-08	2.35E-08	3.60E-08	5.89E-08
182	1.31E-08	1.69E-08	2.47E-08	3.73E-08	5.93E-08
241	1.35E-08	1.76E-08	2.59E-08	3.88E-08	6.25E-08
325	1.26E-08	1.60E-08	2.30E-08	3.49E-08	5.49E-08
408	1.25E-08	1.61E-08	2.34E-08	3.53E-08	5.56E-08
492	1.18E-08	1.52E-08	2.20E-08	3.33E-08	5.35E-08
724	1.29E-08	1.67E-08	2.40E-08	3.59E-08	5.66E-08
786	1.35E-08	1.76E-08	2.52E-08	3.73E-08	5.86E-08
868	1.22E-08	1.60E-08	2.34E-08	3.55E-08	5.65E-08
929	1.27E-08	1.28E-08	1.28E-08	1.27E-08	1.28E-08
1012	1.23E-08	1.23E-08	1.24E-08	1.23E-08	1.23E-08
Biased Statistics					
Average Biased	1.28E-08	1.65E-08	2.41E-08	3.65E-08	5.85E-08
Std Dev Biased	6.11E-10	7.77E-10	1.20E-09	1.55E-09	2.83E-09
Ps90%/90% (+KTL) Biased	1.45E-08	1.86E-08	2.74E-08	4.08E-08	6.63E-08
Ps90%/90% (-KTL) Biased	1.11E-08	1.43E-08	2.08E-08	3.23E-08	5.08E-08
Un-Biased Statistics					
Average Un-Biased	1.26E-08	1.63E-08	2.36E-08	3.55E-08	5.62E-08
Std Dev Un-Biased	6.70E-10	8.78E-10	1.13E-09	1.46E-09	1.86E-09
Ps90%/90% (+KTL) Un-Biased	1.44E-08	1.87E-08	2.67E-08	3.94E-08	6.12E-08
Ps90%/90% (-KTL) Un-Biased	1.07E-08	1.39E-08	2.05E-08	3.15E-08	5.11E-08
Specification MIN	-5.00E-08	-1.00E-07	-1.25E-07	-2.00E-07	-2.00E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-08	1.00E-07	1.25E-07	2.00E-07	2.00E-07
Status	PASS	PASS	PASS	PASS	PASS

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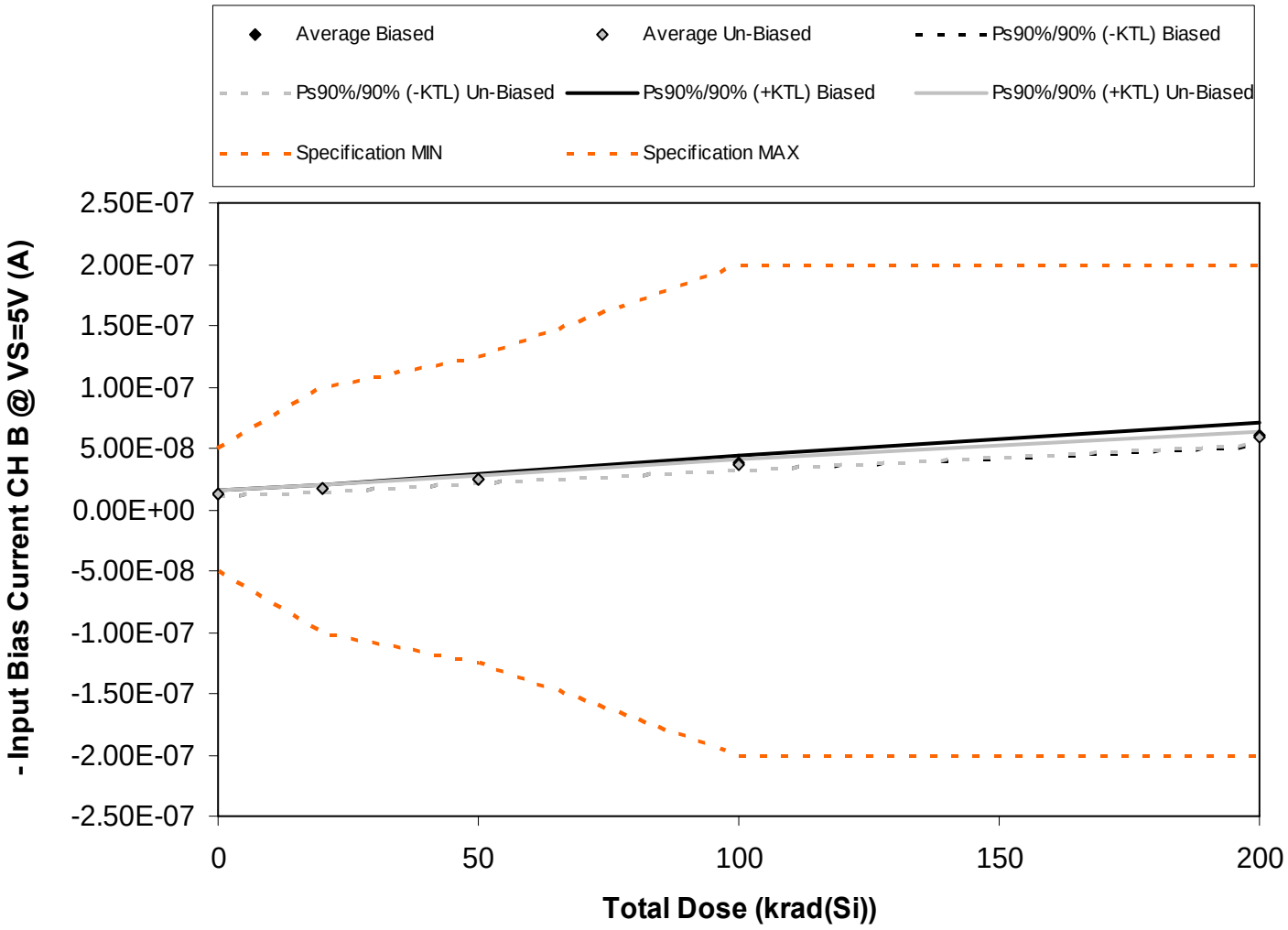

Figure 5.34. Plot of input bias current, inverting input at 5V for channel B versus total dose. The data show a slight increase with total dose, however not sufficient for the parameter to exceed specification, including after application of the KTL statistics. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of measured data points from the biased sample (devices irradiated with an electrical bias) while the shaded diamonds are the average from the un-biased sample. The black line(s) show the effects on the data after application of the biased KTL statistics (solid and/or dashed lines) while the gray line(s) show the effects on the data after application of the unbiased KTL statistics (solid and/or dashed lines). The red dashed line(s) are the minimum and/or maximum specification values as defined in the datasheet and/or test plan.

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Table 5.34. Raw data for - Input Bias Current CH B @ VS=5V (A) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

- Input Bias Current CH B @ VS=5V (A)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.24E-08	1.63E-08	2.42E-08	3.69E-08	5.88E-08
116	1.34E-08	1.68E-08	2.41E-08	3.68E-08	6.01E-08
182	1.36E-08	1.74E-08	2.55E-08	3.89E-08	6.19E-08
241	1.42E-08	1.86E-08	2.72E-08	4.10E-08	6.59E-08
325	1.30E-08	1.66E-08	2.38E-08	3.59E-08	5.66E-08
408	1.35E-08	1.76E-08	2.54E-08	3.80E-08	5.97E-08
492	1.22E-08	1.59E-08	2.30E-08	3.46E-08	5.58E-08
724	1.40E-08	1.81E-08	2.60E-08	3.87E-08	6.10E-08
786	1.33E-08	1.73E-08	2.48E-08	3.67E-08	5.82E-08
868	1.28E-08	1.68E-08	2.44E-08	3.70E-08	5.89E-08
929	1.31E-08	1.32E-08	1.32E-08	1.32E-08	1.31E-08
1012	1.26E-08	1.27E-08	1.27E-08	1.27E-08	1.27E-08
Biased Statistics					
Average Biased	1.33E-08	1.71E-08	2.50E-08	3.79E-08	6.07E-08
Std Dev Biased	7.04E-10	9.16E-10	1.41E-09	2.05E-09	3.50E-09
Ps90%/90% (+KTL) Biased	1.53E-08	1.97E-08	2.88E-08	4.35E-08	7.03E-08
Ps90%/90% (-KTL) Biased	1.14E-08	1.46E-08	2.11E-08	3.23E-08	5.11E-08
Un-Biased Statistics					
Average Un-Biased	1.32E-08	1.72E-08	2.47E-08	3.70E-08	5.87E-08
Std Dev Un-Biased	6.94E-10	8.41E-10	1.12E-09	1.55E-09	1.93E-09
Ps90%/90% (+KTL) Un-Biased	1.51E-08	1.95E-08	2.78E-08	4.13E-08	6.40E-08
Ps90%/90% (-KTL) Un-Biased	1.13E-08	1.49E-08	2.16E-08	3.28E-08	5.34E-08
Specification MIN	-5.00E-08	-1.00E-07	-1.25E-07	-2.00E-07	-2.00E-07
Status	PASS	PASS	PASS	PASS	PASS
Specification MAX	5.00E-08	1.00E-07	1.25E-07	2.00E-07	2.00E-07
Status	PASS	PASS	PASS	PASS	PASS

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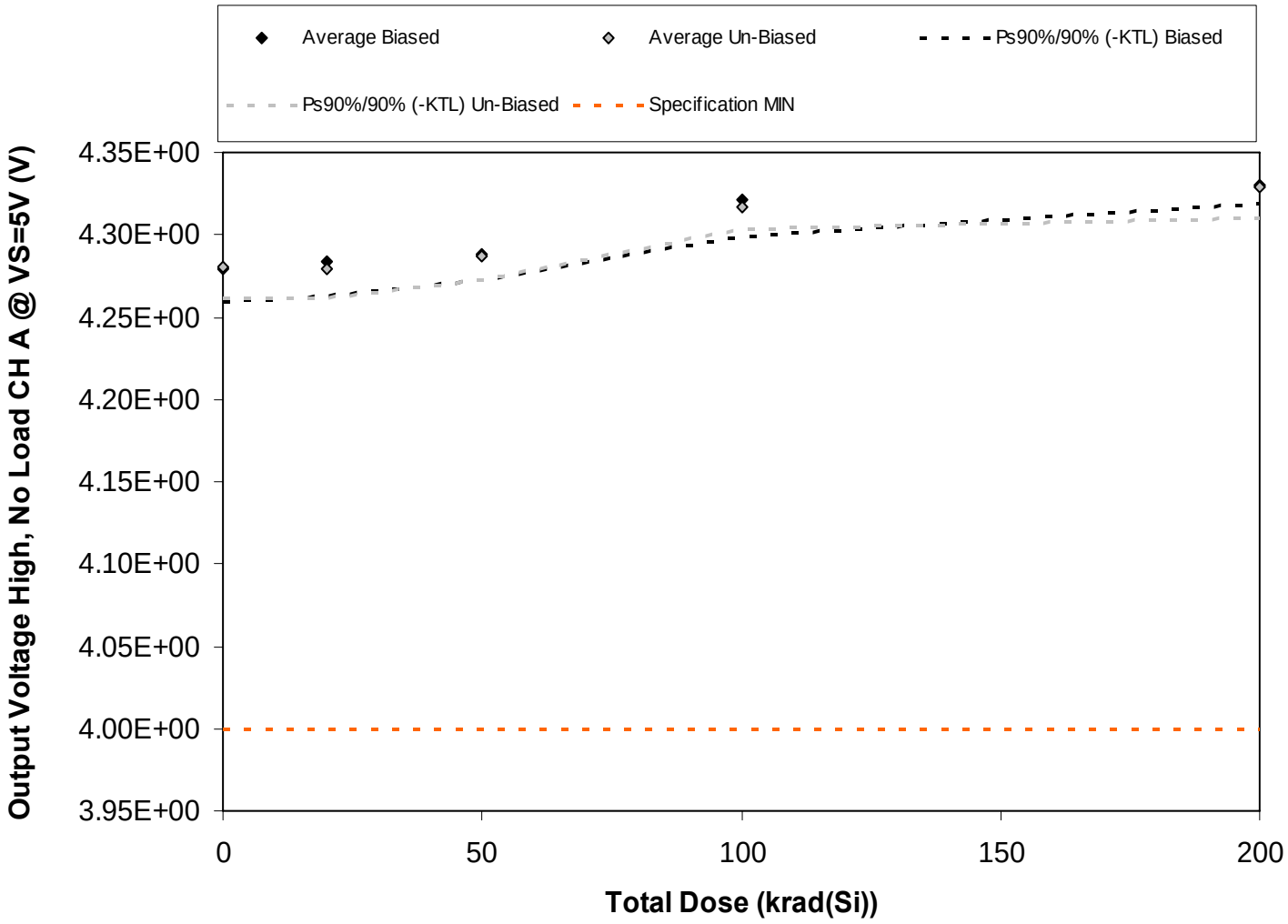

Figure 5.35. Plot of Output Voltage High, No Load CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.35. Raw data for Output Voltage High, No Load CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage High, No Load CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	4.28E+00	4.28E+00	4.29E+00	4.33E+00	4.33E+00
116	4.29E+00	4.30E+00	4.30E+00	4.33E+00	4.34E+00
182	4.27E+00	4.28E+00	4.28E+00	4.32E+00	4.33E+00
241	4.27E+00	4.28E+00	4.28E+00	4.31E+00	4.33E+00
325	4.28E+00	4.29E+00	4.29E+00	4.32E+00	4.33E+00
408	4.28E+00	4.28E+00	4.29E+00	4.31E+00	4.33E+00
492	4.28E+00	4.28E+00	4.29E+00	4.31E+00	4.33E+00
724	4.28E+00	4.28E+00	4.29E+00	4.32E+00	4.32E+00
786	4.27E+00	4.27E+00	4.28E+00	4.31E+00	4.33E+00
868	4.29E+00	4.29E+00	4.30E+00	4.32E+00	4.34E+00
929	4.28E+00	4.28E+00	4.28E+00	4.28E+00	4.28E+00
1012	4.28E+00	4.28E+00	4.28E+00	4.28E+00	4.28E+00
Biased Statistics					
Average Biased	4.28E+00	4.28E+00	4.29E+00	4.32E+00	4.33E+00
Std Dev Biased	7.21E-03	7.54E-03	5.94E-03	7.99E-03	4.22E-03
Ps90%/90% (+KTL) Biased	4.30E+00	4.30E+00	4.30E+00	4.34E+00	4.34E+00
Ps90%/90% (-KTL) Biased	4.26E+00	4.26E+00	4.27E+00	4.30E+00	4.32E+00
Un-Biased Statistics					
Average Un-Biased	4.28E+00	4.28E+00	4.29E+00	4.32E+00	4.33E+00
Std Dev Un-Biased	6.77E-03	6.50E-03	5.36E-03	4.51E-03	6.87E-03
Ps90%/90% (+KTL) Un-Biased	4.30E+00	4.30E+00	4.30E+00	4.33E+00	4.35E+00
Ps90%/90% (-KTL) Un-Biased	4.26E+00	4.26E+00	4.27E+00	4.30E+00	4.31E+00
Specification MIN	4.00E+00	4.00E+00	4.00E+00	4.00E+00	4.00E+00
Status	PASS	PASS	PASS	PASS	PASS

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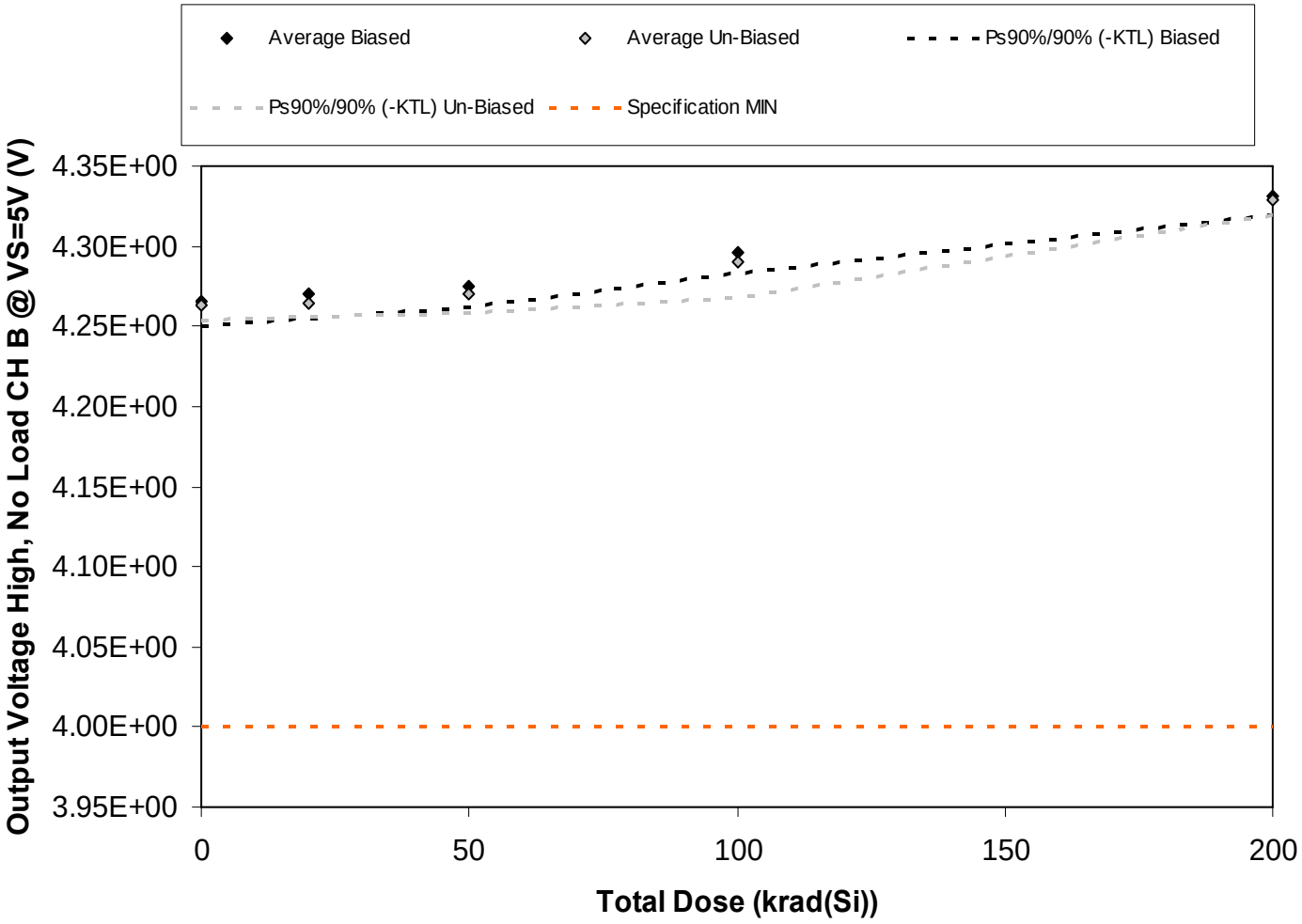

Figure 5.36. Plot of Output Voltage High, No Load CH B @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.36. Raw data for Output Voltage High, No Load CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage High, No Load CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	4.27E+00	4.27E+00	4.28E+00	4.30E+00	4.33E+00
116	4.27E+00	4.28E+00	4.28E+00	4.30E+00	4.34E+00
182	4.26E+00	4.27E+00	4.27E+00	4.29E+00	4.33E+00
241	4.26E+00	4.26E+00	4.27E+00	4.29E+00	4.33E+00
325	4.27E+00	4.27E+00	4.28E+00	4.30E+00	4.33E+00
408	4.27E+00	4.27E+00	4.27E+00	4.30E+00	4.33E+00
492	4.27E+00	4.27E+00	4.27E+00	4.29E+00	4.33E+00
724	4.26E+00	4.27E+00	4.27E+00	4.30E+00	4.33E+00
786	4.26E+00	4.26E+00	4.27E+00	4.29E+00	4.33E+00
868	4.26E+00	4.26E+00	4.26E+00	4.28E+00	4.34E+00
929	4.27E+00	4.27E+00	4.27E+00	4.27E+00	4.27E+00
1012	4.27E+00	4.27E+00	4.27E+00	4.27E+00	4.27E+00
Biased Statistics					
Average Biased	4.27E+00	4.27E+00	4.27E+00	4.30E+00	4.33E+00
Std Dev Biased	5.72E-03	5.68E-03	4.60E-03	4.67E-03	4.62E-03
Ps90%/90% (+KTL) Biased	4.28E+00	4.29E+00	4.29E+00	4.31E+00	4.34E+00
Ps90%/90% (-KTL) Biased	4.25E+00	4.26E+00	4.26E+00	4.28E+00	4.32E+00
Un-Biased Statistics					
Average Un-Biased	4.26E+00	4.26E+00	4.27E+00	4.29E+00	4.33E+00
Std Dev Un-Biased	3.44E-03	3.11E-03	4.32E-03	8.17E-03	3.78E-03
Ps90%/90% (+KTL) Un-Biased	4.27E+00	4.27E+00	4.28E+00	4.31E+00	4.34E+00
Ps90%/90% (-KTL) Un-Biased	4.25E+00	4.26E+00	4.26E+00	4.27E+00	4.32E+00
Specification MIN	4.00E+00	4.00E+00	4.00E+00	4.00E+00	4.00E+00
Status	PASS	PASS	PASS	PASS	PASS

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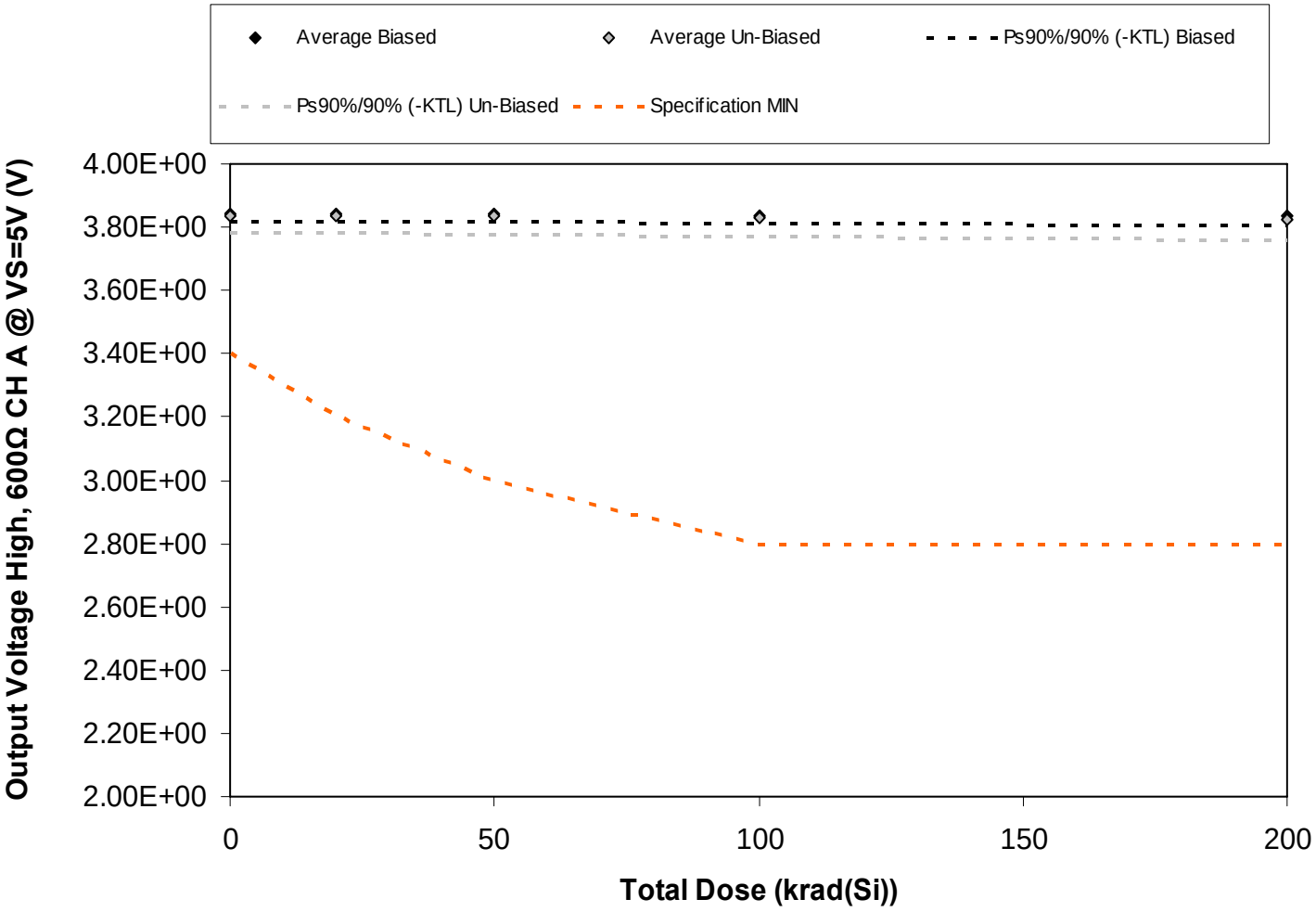

Figure 5.37. Plot of Output Voltage High, 600Ω CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.37. Raw data for Output Voltage High, 600Ω CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage High, 600Ω CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	3.84E+00	3.84E+00	3.83E+00	3.83E+00	3.83E+00
116	3.86E+00	3.86E+00	3.86E+00	3.85E+00	3.85E+00
182	3.84E+00	3.84E+00	3.84E+00	3.83E+00	3.83E+00
241	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.83E+00
325	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.83E+00
408	3.83E+00	3.83E+00	3.83E+00	3.83E+00	3.82E+00
492	3.84E+00	3.84E+00	3.83E+00	3.83E+00	3.82E+00
724	3.83E+00	3.83E+00	3.82E+00	3.82E+00	3.81E+00
786	3.82E+00	3.82E+00	3.82E+00	3.82E+00	3.81E+00
868	3.87E+00	3.87E+00	3.87E+00	3.87E+00	3.87E+00
929	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.84E+00
1012	3.84E+00	3.85E+00	3.85E+00	3.85E+00	3.85E+00
Biased Statistics					
Average Biased	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.83E+00
Std Dev Biased	8.58E-03	8.80E-03	9.13E-03	9.52E-03	9.71E-03
Ps90%/90% (+KTL) Biased	3.87E+00	3.87E+00	3.87E+00	3.86E+00	3.86E+00
Ps90%/90% (-KTL) Biased	3.82E+00	3.82E+00	3.82E+00	3.81E+00	3.81E+00
Un-Biased Statistics					
Average Un-Biased	3.84E+00	3.84E+00	3.84E+00	3.83E+00	3.83E+00
Std Dev Un-Biased	2.01E-02	2.08E-02	2.16E-02	2.15E-02	2.34E-02
Ps90%/90% (+KTL) Un-Biased	3.89E+00	3.89E+00	3.89E+00	3.89E+00	3.89E+00
Ps90%/90% (-KTL) Un-Biased	3.78E+00	3.78E+00	3.78E+00	3.77E+00	3.76E+00
Specification MIN	3.40E+00	3.20E+00	3.00E+00	2.80E+00	2.80E+00
Status	PASS	PASS	PASS	PASS	PASS

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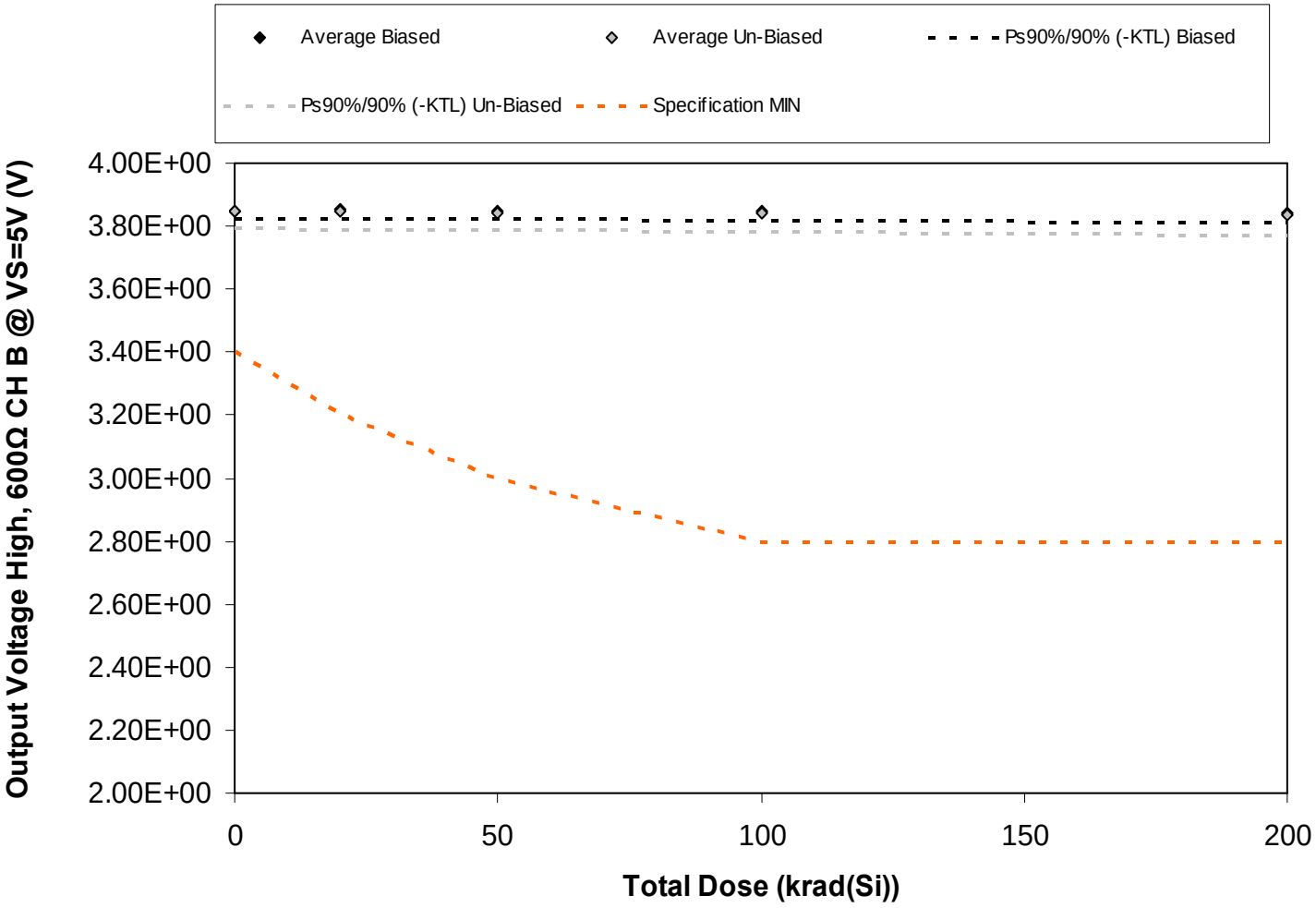

Figure 5.38. Plot of Output Voltage High, 600Ω CH B @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.38. Raw data for Output Voltage High, 600Ω CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage High, 600Ω CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.83E+00
116	3.86E+00	3.87E+00	3.86E+00	3.86E+00	3.86E+00
182	3.85E+00	3.85E+00	3.85E+00	3.84E+00	3.84E+00
241	3.85E+00	3.85E+00	3.85E+00	3.84E+00	3.84E+00
325	3.85E+00	3.85E+00	3.85E+00	3.85E+00	3.84E+00
408	3.84E+00	3.84E+00	3.84E+00	3.83E+00	3.83E+00
492	3.84E+00	3.84E+00	3.84E+00	3.84E+00	3.83E+00
724	3.83E+00	3.83E+00	3.83E+00	3.83E+00	3.82E+00
786	3.83E+00	3.83E+00	3.83E+00	3.82E+00	3.82E+00
868	3.88E+00	3.88E+00	3.88E+00	3.88E+00	3.87E+00
929	3.85E+00	3.85E+00	3.85E+00	3.85E+00	3.85E+00
1012	3.85E+00	3.85E+00	3.85E+00	3.85E+00	3.85E+00
Biased Statistics					
Average Biased	3.85E+00	3.85E+00	3.85E+00	3.85E+00	3.84E+00
Std Dev Biased	8.38E-03	9.10E-03	9.03E-03	9.86E-03	1.01E-02
Ps90%/90% (+KTL) Biased	3.87E+00	3.88E+00	3.87E+00	3.87E+00	3.87E+00
Ps90%/90% (-KTL) Biased	3.83E+00	3.83E+00	3.82E+00	3.82E+00	3.81E+00
Un-Biased Statistics					
Average Un-Biased	3.84E+00	3.85E+00	3.84E+00	3.84E+00	3.83E+00
Std Dev Un-Biased	1.91E-02	1.98E-02	2.02E-02	2.06E-02	2.23E-02
Ps90%/90% (+KTL) Un-Biased	3.90E+00	3.90E+00	3.90E+00	3.90E+00	3.89E+00
Ps90%/90% (-KTL) Un-Biased	3.79E+00	3.79E+00	3.79E+00	3.78E+00	3.77E+00
Specification MIN	3.40E+00	3.20E+00	3.00E+00	2.80E+00	2.80E+00
Status	PASS	PASS	PASS	PASS	PASS

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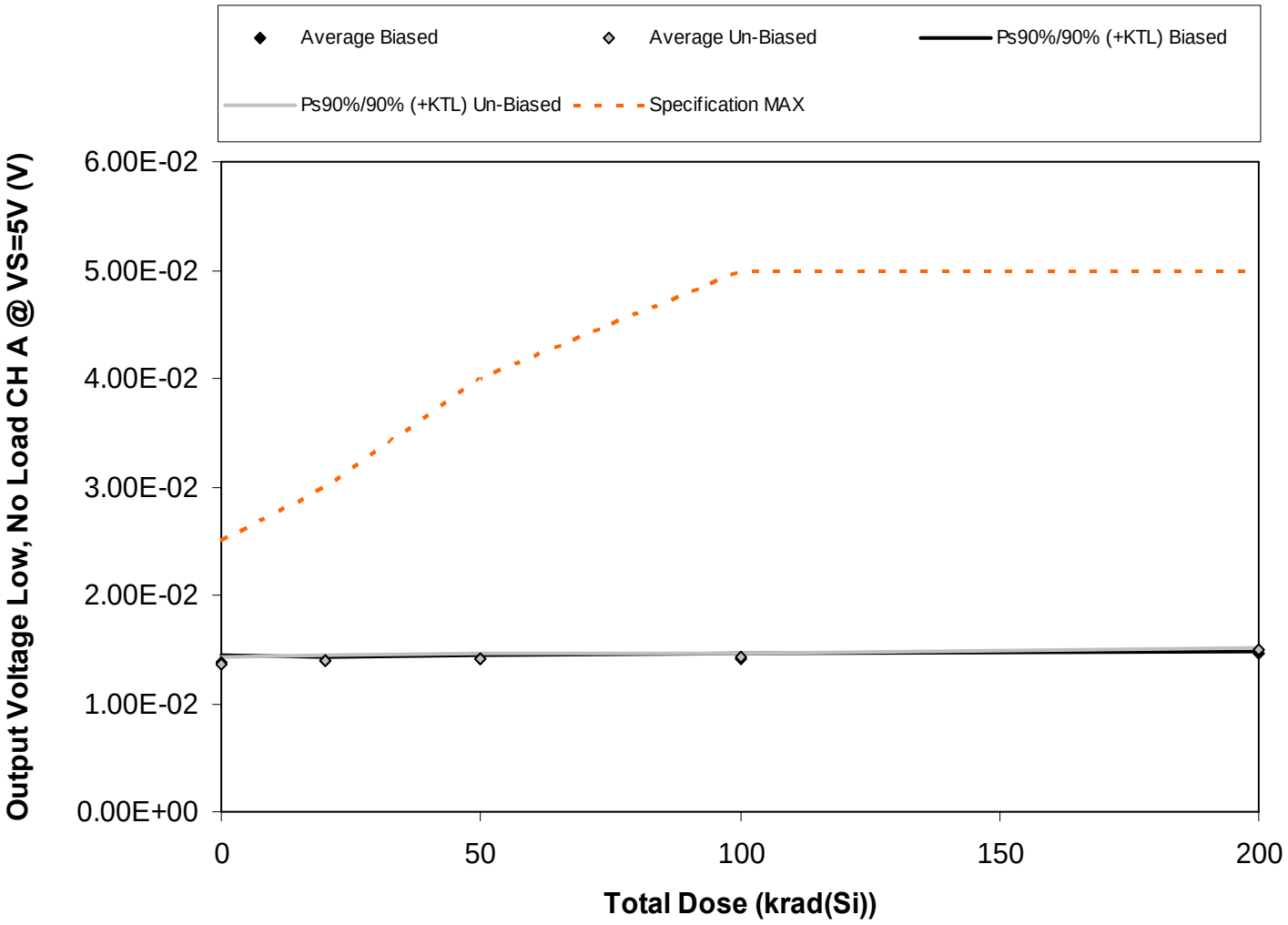

Figure 5.39. Plot of Output Voltage Low, No Load CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.39. Raw data for Output Voltage Low, No Load CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, No Load CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.37E-02	1.39E-02	1.41E-02	1.42E-02	1.45E-02
116	1.41E-02	1.41E-02	1.42E-02	1.44E-02	1.47E-02
182	1.35E-02	1.39E-02	1.38E-02	1.41E-02	1.44E-02
241	1.37E-02	1.38E-02	1.41E-02	1.40E-02	1.46E-02
325	1.39E-02	1.40E-02	1.41E-02	1.42E-02	1.45E-02
408	1.36E-02	1.37E-02	1.40E-02	1.41E-02	1.49E-02
492	1.36E-02	1.40E-02	1.41E-02	1.43E-02	1.49E-02
724	1.36E-02	1.37E-02	1.38E-02	1.43E-02	1.51E-02
786	1.35E-02	1.39E-02	1.40E-02	1.43E-02	1.50E-02
868	1.41E-02	1.42E-02	1.43E-02	1.45E-02	1.49E-02
929	1.37E-02	1.37E-02	1.36E-02	1.37E-02	1.38E-02
1012	1.38E-02	1.38E-02	1.38E-02	1.39E-02	1.39E-02
Biased Statistics					
Average Biased	1.38E-02	1.39E-02	1.41E-02	1.42E-02	1.45E-02
Std Dev Biased	2.28E-04	1.14E-04	1.52E-04	1.48E-04	1.14E-04
Ps90%/90% (+KTL) Biased	1.44E-02	1.43E-02	1.45E-02	1.46E-02	1.49E-02
Ps90%/90% (-KTL) Biased	1.32E-02	1.36E-02	1.36E-02	1.38E-02	1.42E-02
Un-Biased Statistics					
Average Un-Biased	1.37E-02	1.39E-02	1.40E-02	1.43E-02	1.50E-02
Std Dev Un-Biased	2.39E-04	2.12E-04	1.82E-04	1.41E-04	8.94E-05
Ps90%/90% (+KTL) Un-Biased	1.43E-02	1.45E-02	1.45E-02	1.47E-02	1.52E-02
Ps90%/90% (-KTL) Un-Biased	1.30E-02	1.33E-02	1.35E-02	1.39E-02	1.47E-02
Specification MAX	2.50E-02	3.00E-02	4.00E-02	5.00E-02	5.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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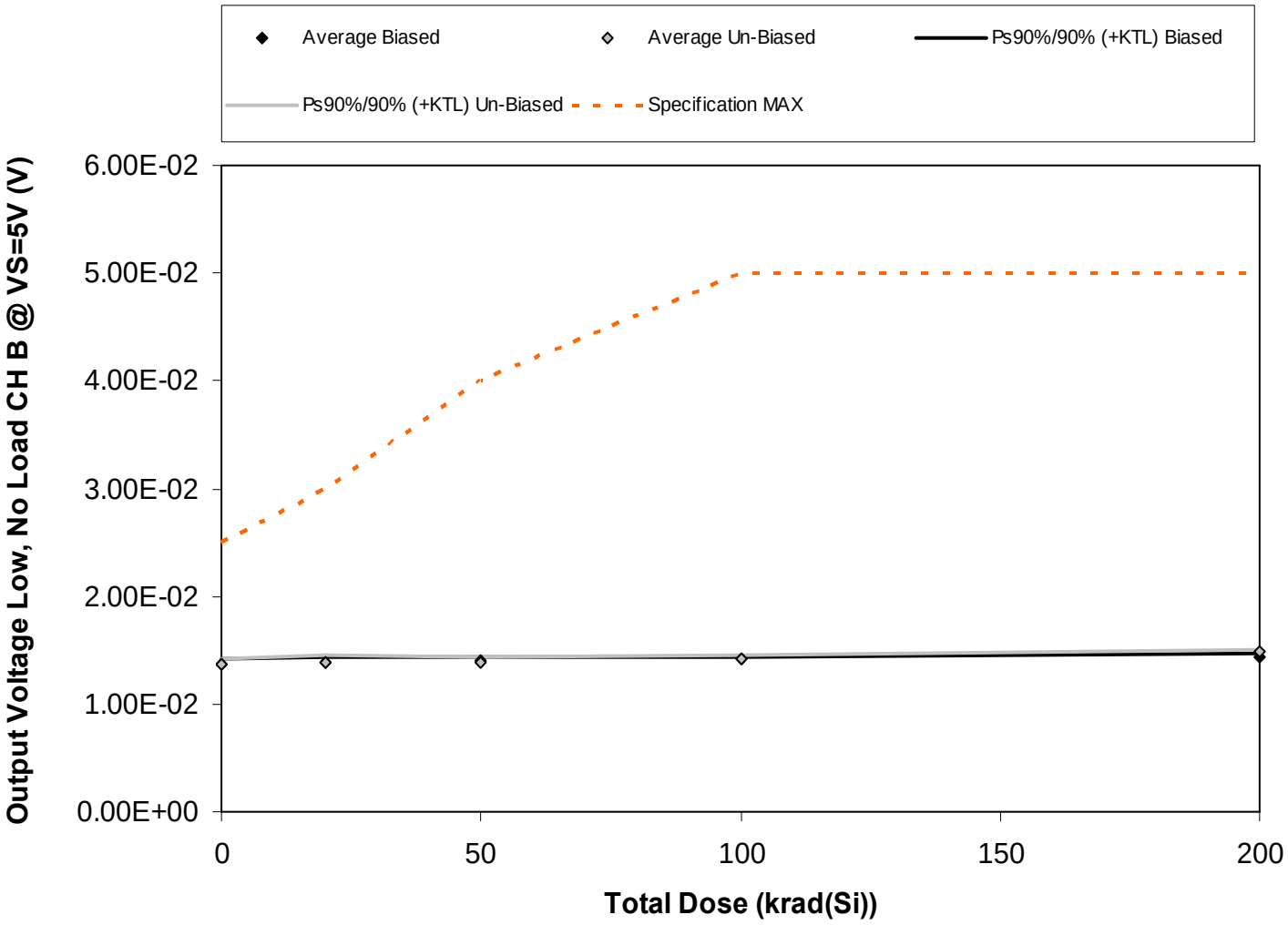

Figure 5.40. Plot of Output Voltage Low, No Load CH B @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.40. Raw data for Output Voltage Low, No Load CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, No Load CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.37E-02	1.37E-02	1.40E-02	1.41E-02	1.43E-02
116	1.40E-02	1.42E-02	1.43E-02	1.43E-02	1.45E-02
182	1.36E-02	1.38E-02	1.40E-02	1.40E-02	1.43E-02
241	1.36E-02	1.38E-02	1.40E-02	1.41E-02	1.44E-02
325	1.38E-02	1.39E-02	1.40E-02	1.41E-02	1.42E-02
408	1.37E-02	1.38E-02	1.38E-02	1.41E-02	1.50E-02
492	1.37E-02	1.39E-02	1.40E-02	1.42E-02	1.49E-02
724	1.35E-02	1.37E-02	1.38E-02	1.43E-02	1.48E-02
786	1.35E-02	1.35E-02	1.37E-02	1.42E-02	1.49E-02
868	1.40E-02	1.42E-02	1.42E-02	1.44E-02	1.49E-02
929	1.35E-02	1.37E-02	1.36E-02	1.35E-02	1.36E-02
1012	1.35E-02	1.37E-02	1.38E-02	1.37E-02	1.35E-02
Biased Statistics					
Average Biased	1.37E-02	1.39E-02	1.41E-02	1.41E-02	1.43E-02
Std Dev Biased	1.67E-04	1.92E-04	1.34E-04	1.10E-04	1.14E-04
Ps90%/90% (+KTL) Biased	1.42E-02	1.44E-02	1.44E-02	1.44E-02	1.47E-02
Ps90%/90% (-KTL) Biased	1.33E-02	1.34E-02	1.37E-02	1.38E-02	1.40E-02
Un-Biased Statistics					
Average Un-Biased	1.37E-02	1.38E-02	1.39E-02	1.42E-02	1.49E-02
Std Dev Un-Biased	2.05E-04	2.59E-04	2.00E-04	1.14E-04	7.07E-05
Ps90%/90% (+KTL) Un-Biased	1.42E-02	1.45E-02	1.44E-02	1.46E-02	1.51E-02
Ps90%/90% (-KTL) Un-Biased	1.31E-02	1.31E-02	1.34E-02	1.39E-02	1.47E-02
Specification MAX	2.50E-02	3.00E-02	4.00E-02	5.00E-02	5.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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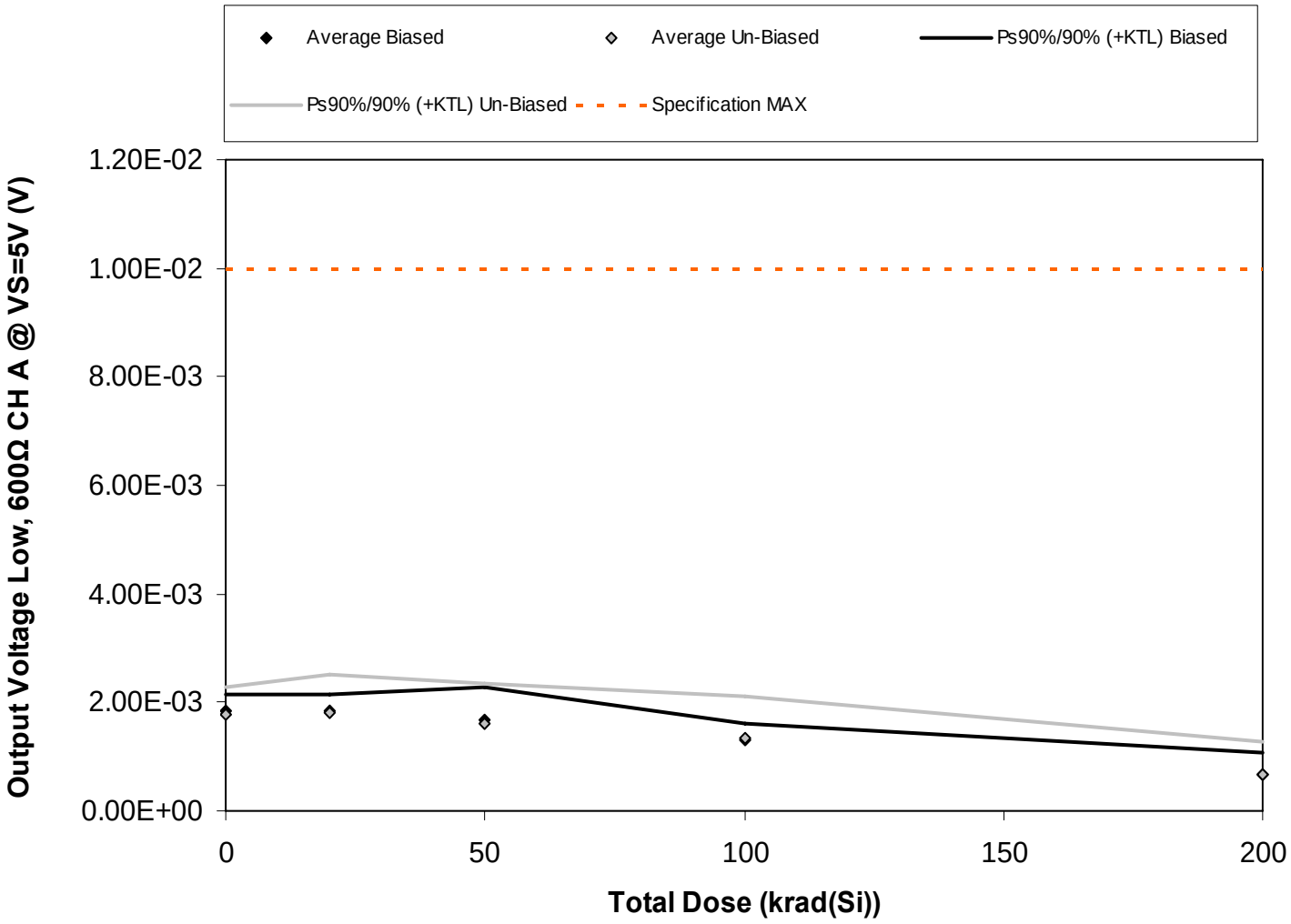

Figure 5.41. Plot of Output Voltage Low, 600Ω CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.41. Raw data for Output Voltage Low, 600Ω CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, 600Ω CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	1.80E-03	1.80E-03	1.50E-03	1.20E-03	5.00E-04
116	1.80E-03	1.80E-03	1.90E-03	1.40E-03	7.00E-04
182	2.00E-03	1.90E-03	1.80E-03	1.40E-03	8.00E-04
241	1.90E-03	2.00E-03	1.80E-03	1.40E-03	8.00E-04
325	1.70E-03	1.70E-03	1.40E-03	1.20E-03	5.00E-04
408	1.70E-03	1.60E-03	1.50E-03	1.10E-03	6.00E-04
492	1.70E-03	1.90E-03	1.70E-03	1.40E-03	7.00E-04
724	1.70E-03	1.80E-03	1.60E-03	1.20E-03	6.00E-04
786	1.60E-03	1.60E-03	1.30E-03	1.20E-03	4.00E-04
868	2.10E-03	2.20E-03	2.00E-03	1.80E-03	1.00E-03
929	1.90E-03	1.90E-03	1.90E-03	1.90E-03	1.80E-03
1012	1.90E-03	1.90E-03	1.90E-03	2.10E-03	2.00E-03
Biased Statistics					
Average Biased	1.84E-03	1.84E-03	1.68E-03	1.32E-03	6.60E-04
Std Dev Biased	1.14E-04	1.14E-04	2.17E-04	1.10E-04	1.52E-04
Ps90%/90% (+KTL) Biased	2.15E-03	2.15E-03	2.27E-03	1.62E-03	1.08E-03
Ps90%/90% (-KTL) Biased	1.53E-03	1.53E-03	1.09E-03	1.02E-03	2.44E-04
Un-Biased Statistics					
Average Un-Biased	1.76E-03	1.82E-03	1.62E-03	1.34E-03	6.60E-04
Std Dev Un-Biased	1.95E-04	2.49E-04	2.59E-04	2.79E-04	2.19E-04
Ps90%/90% (+KTL) Un-Biased	2.29E-03	2.50E-03	2.33E-03	2.11E-03	1.26E-03
Ps90%/90% (-KTL) Un-Biased	1.23E-03	1.14E-03	9.10E-04	5.74E-04	5.93E-05
Specification MAX	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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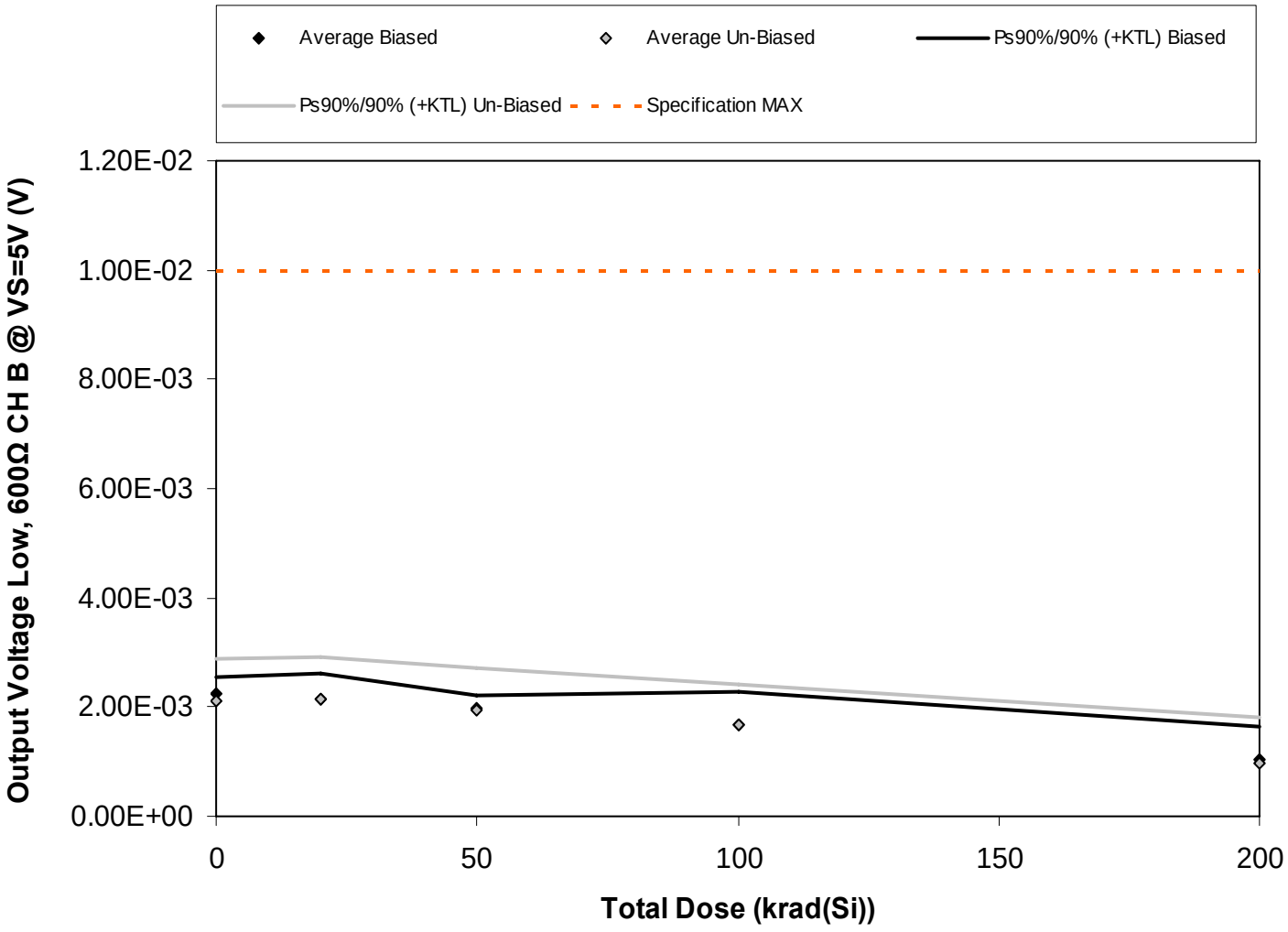

Figure 5.42. Plot of Output Voltage Low, 600Ω CH B @ VS=5V (V) versus total dose. The data show no significant change with total dose. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.42. Raw data for Output Voltage Low, 600Ω CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, 600Ω CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	2.20E-03	2.00E-03	1.90E-03	1.30E-03	8.00E-04
116	2.20E-03	2.20E-03	2.00E-03	1.60E-03	1.20E-03
182	2.30E-03	2.20E-03	2.00E-03	1.80E-03	1.20E-03
241	2.40E-03	2.40E-03	2.10E-03	1.90E-03	1.20E-03
325	2.10E-03	2.00E-03	1.90E-03	1.70E-03	8.00E-04
408	1.90E-03	1.90E-03	1.70E-03	1.40E-03	8.00E-04
492	2.10E-03	2.20E-03	2.00E-03	1.70E-03	8.00E-04
724	2.00E-03	2.10E-03	1.90E-03	1.70E-03	9.00E-04
786	2.00E-03	1.90E-03	1.80E-03	1.50E-03	8.00E-04
868	2.60E-03	2.60E-03	2.40E-03	2.10E-03	1.50E-03
929	2.20E-03	2.30E-03	2.10E-03	2.30E-03	2.30E-03
1012	2.30E-03	2.30E-03	2.20E-03	2.40E-03	2.30E-03
Biased Statistics					
Average Biased	2.24E-03	2.16E-03	1.98E-03	1.66E-03	1.04E-03
Std Dev Biased	1.14E-04	1.67E-04	8.37E-05	2.30E-04	2.19E-04
Ps90%/90% (+KTL) Biased	2.55E-03	2.62E-03	2.21E-03	2.29E-03	1.64E-03
Ps90%/90% (-KTL) Biased	1.93E-03	1.70E-03	1.75E-03	1.03E-03	4.39E-04
Un-Biased Statistics					
Average Un-Biased	2.12E-03	2.14E-03	1.96E-03	1.68E-03	9.60E-04
Std Dev Un-Biased	2.77E-04	2.88E-04	2.70E-04	2.68E-04	3.05E-04
Ps90%/90% (+KTL) Un-Biased	2.88E-03	2.93E-03	2.70E-03	2.42E-03	1.80E-03
Ps90%/90% (-KTL) Un-Biased	1.36E-03	1.35E-03	1.22E-03	9.44E-04	1.24E-04
Specification MAX	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E-02
Status	PASS	PASS	PASS	PASS	PASS

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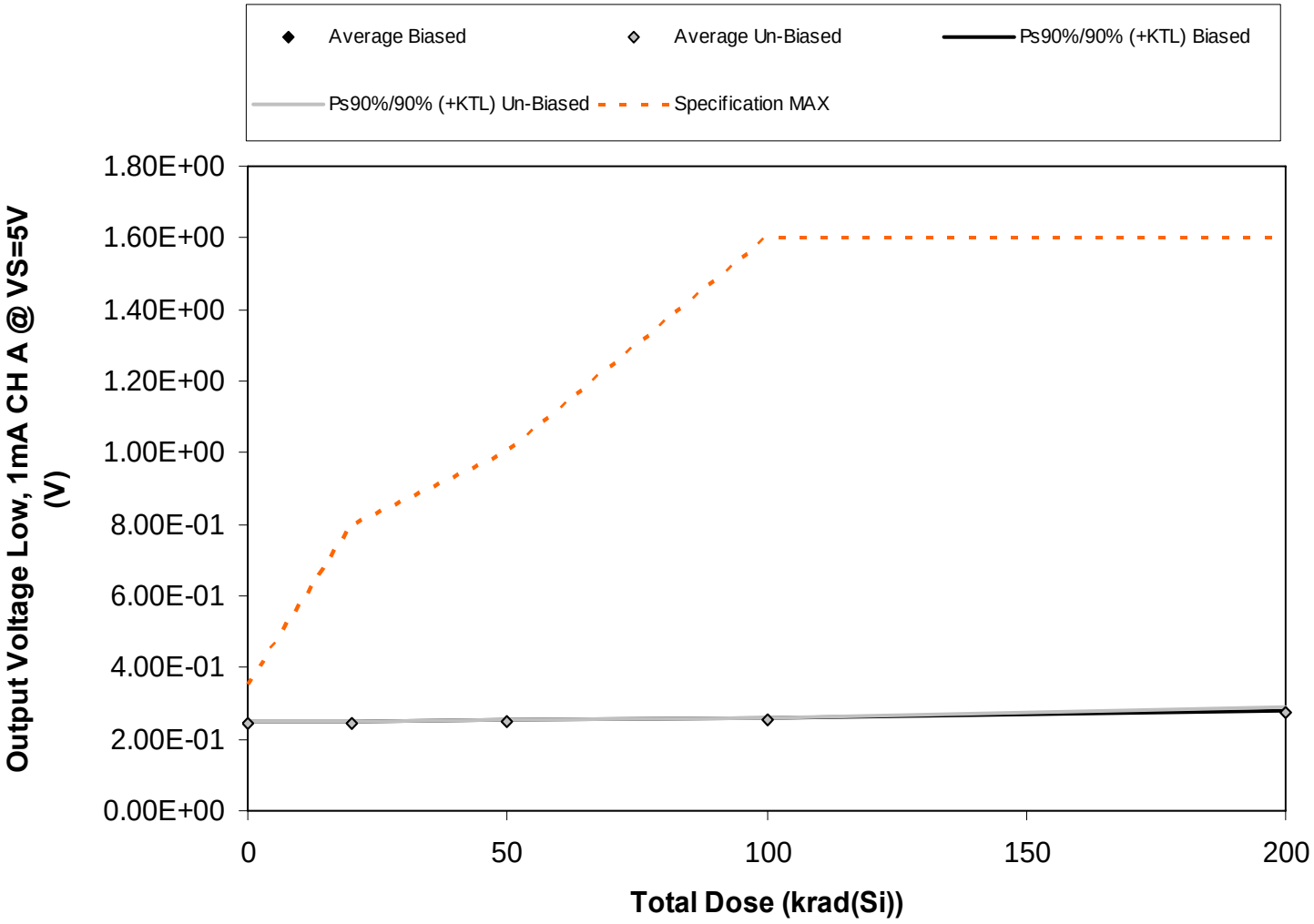

Figure 5.43. Plot of Output Voltage Low, 1mA CH A @ VS=5V (V) versus total dose. The data show no significant change with total dose to the 100krad(Si) dose level and substantial degradation at the 200krad(Si) dose level. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.43. Raw data for Output Voltage Low, 1mA CH A @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, 1mA CH A @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	2.46E-01	2.47E-01	2.50E-01	2.56E-01	2.76E-01
116	2.43E-01	2.46E-01	2.46E-01	2.51E-01	2.70E-01
182	2.42E-01	2.45E-01	2.47E-01	2.53E-01	2.73E-01
241	2.43E-01	2.46E-01	2.48E-01	2.54E-01	2.74E-01
325	2.42E-01	2.45E-01	2.46E-01	2.52E-01	2.69E-01
408	2.43E-01	2.45E-01	2.47E-01	2.53E-01	2.72E-01
492	2.42E-01	2.44E-01	2.46E-01	2.52E-01	2.72E-01
724	2.45E-01	2.46E-01	2.49E-01	2.55E-01	2.76E-01
786	2.46E-01	2.48E-01	2.50E-01	2.56E-01	2.78E-01
868	2.41E-01	2.43E-01	2.44E-01	2.48E-01	2.63E-01
929	2.43E-01	2.44E-01	2.44E-01	2.44E-01	2.43E-01
1012	2.43E-01	2.44E-01	2.44E-01	2.43E-01	2.43E-01
Biased Statistics					
Average Biased	2.43E-01	2.46E-01	2.47E-01	2.53E-01	2.72E-01
Std Dev Biased	1.64E-03	8.37E-04	1.67E-03	1.92E-03	2.88E-03
Ps90%/90% (+KTL) Biased	2.48E-01	2.48E-01	2.52E-01	2.58E-01	2.80E-01
Ps90%/90% (-KTL) Biased	2.39E-01	2.44E-01	2.43E-01	2.48E-01	2.65E-01
Un-Biased Statistics					
Average Un-Biased	2.43E-01	2.45E-01	2.47E-01	2.53E-01	2.72E-01
Std Dev Un-Biased	2.07E-03	1.92E-03	2.39E-03	3.11E-03	5.76E-03
Ps90%/90% (+KTL) Un-Biased	2.49E-01	2.50E-01	2.54E-01	2.61E-01	2.88E-01
Ps90%/90% (-KTL) Un-Biased	2.38E-01	2.40E-01	2.41E-01	2.44E-01	2.56E-01
Specification MAX	3.50E-01	8.00E-01	1.00E+00	1.60E+00	1.60E+00
Status	PASS	PASS	PASS	PASS	PASS

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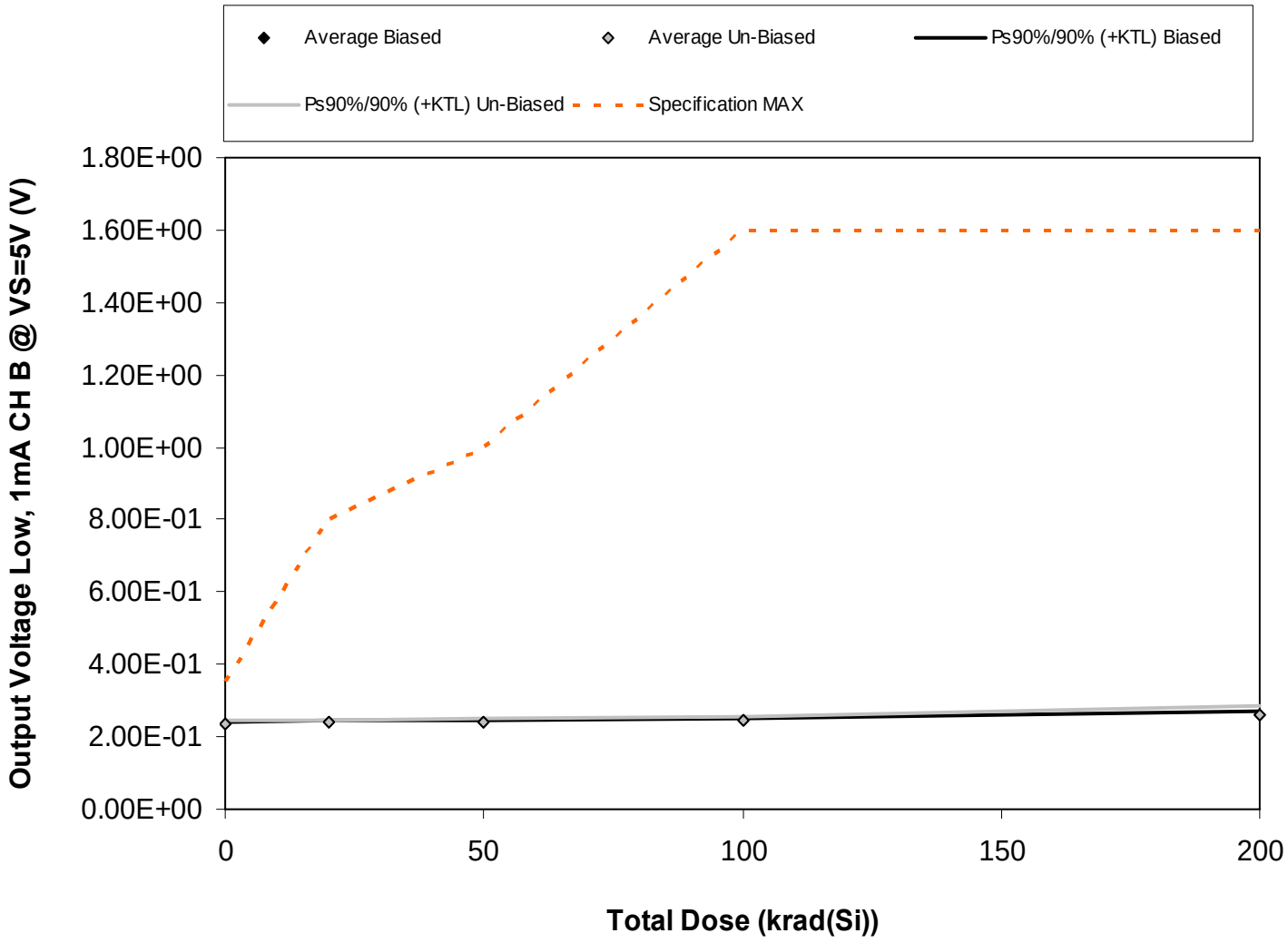

Figure 5.44. Plot of Output Voltage Low, 1mA CH B @ VS=5V (V) versus total dose. The data show no significant change with total dose to the 100krad(Si) dose level and substantial degradation at the 200krad(Si) dose level. Note that this parameter is only specified to 100krad(Si) and the 200krad(Si) dose data is for reference only. The solid diamonds are the average of the measured data points for the samples irradiated under electrical bias while the shaded diamonds are the average of the measured data points for the samples irradiated with all pins tied to ground. The black lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated under electrical bias while the gray lines (solid and/or dashed) are the average of the data points after application of the KTL statistics on the samples irradiated in the unbiased condition. The red dotted line(s) are the pre- and/or post-irradiation minimum and/or maximum specification value as defined in the datasheet and/or test plan.

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Table 5.44. Raw data for Output Voltage Low, 1mA CH B @ VS=5V (V) versus total dose, including the statistical analysis, specification and the status of the testing (pass/fail).

Output Voltage Low, 1mA CH B @ VS=5V (V)	Total Dose (krad(Si))				
Device	0	20	50	100	200
41	2.41E-01	2.43E-01	2.45E-01	2.50E-01	2.66E-01
116	2.37E-01	2.40E-01	2.41E-01	2.45E-01	2.60E-01
182	2.37E-01	2.40E-01	2.42E-01	2.47E-01	2.62E-01
241	2.38E-01	2.41E-01	2.43E-01	2.48E-01	2.62E-01
325	2.37E-01	2.40E-01	2.41E-01	2.46E-01	2.59E-01
408	2.39E-01	2.41E-01	2.43E-01	2.48E-01	2.66E-01
492	2.38E-01	2.39E-01	2.42E-01	2.47E-01	2.64E-01
724	2.39E-01	2.40E-01	2.43E-01	2.49E-01	2.67E-01
786	2.40E-01	2.42E-01	2.44E-01	2.49E-01	2.68E-01
868	2.32E-01	2.34E-01	2.36E-01	2.39E-01	2.49E-01
929	2.38E-01	2.40E-01	2.39E-01	2.40E-01	2.39E-01
1012	2.37E-01	2.39E-01	2.40E-01	2.39E-01	2.38E-01
Biased Statistics					
Average Biased	2.38E-01	2.41E-01	2.42E-01	2.47E-01	2.62E-01
Std Dev Biased	1.73E-03	1.30E-03	1.67E-03	1.92E-03	2.68E-03
Ps90%/90% (+KTL) Biased	2.43E-01	2.44E-01	2.47E-01	2.52E-01	2.69E-01
Ps90%/90% (-KTL) Biased	2.33E-01	2.37E-01	2.38E-01	2.42E-01	2.54E-01
Un-Biased Statistics					
Average Un-Biased	2.38E-01	2.39E-01	2.42E-01	2.46E-01	2.63E-01
Std Dev Un-Biased	3.21E-03	3.11E-03	3.21E-03	4.22E-03	7.85E-03
Ps90%/90% (+KTL) Un-Biased	2.46E-01	2.48E-01	2.50E-01	2.58E-01	2.84E-01
Ps90%/90% (-KTL) Un-Biased	2.29E-01	2.31E-01	2.33E-01	2.35E-01	2.41E-01
Specification MAX	3.50E-01	8.00E-01	1.00E+00	1.60E+00	1.60E+00
Status	PASS	PASS	PASS	PASS	PASS

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6.0. Summary / Conclusions

The total ionizing dose testing described in this final report was performed using the facilities at Radiation Assured Devices' Longmire Laboratories in Colorado Springs, CO. The high dose rate total ionizing dose (TID) source is a JLSA 84-21 irradiator modified to provide a panoramic exposure. The Co-60 rods are held in the base of the irradiator heavily shielded by lead, during the radiation exposures the rod is raised by an electronic timer/controller and the exposure is performed in air. The dose rate for this irradiator in this configuration ranges from <1rad(Si)/s to a maximum of approximately 120rad(Si)/s, determined by the distance from the source.

The parametric data was obtained as "read and record" and all the raw data plus an attributes summary were presented in this report. The attributes data contains the average, standard deviation and the average with the KTL values applied. The KTL value used was 2.742 per MIL HDBK 814 using one-sided tolerance limits of 90/90 and a 5-piece sample size. Note that the following criteria was used to determine the outcome of the testing: following the radiation exposure each parameter had to pass the specification value and the average value for the five-piece sample must pass the specification value when the KTL limits are applied. If these conditions were not both satisfied following the radiation exposure, then the lot could be logged as an RLAT failure.

Based on these criteria, the RH1013M operational amplifiers from the lot of material described on the first page of this report passed the RLAT to the maximum tested level of 100krad(Si) and 200krad(Si) without significant degradation to most of the measured parameters. As seen in the data plots, several parameters suffered measurable radiation-induced degradation, however in no case was the degradation sufficient to cause the parameters to go out of specification even after application of the KTL statistics. Note that PSSR for Channel A was out of specification pre-irradiation and at the first two dose levels. In our opinion this is due to the distribution within the sample population and is not reflective of radiation-induced degradation of the parameter. Further note that RH1013 is specified to 100krad(Si) in the +VS=5V, -VS=0 supply conditions and the 200krad(Si) data shown in this report for those parameters should be used for reference only.

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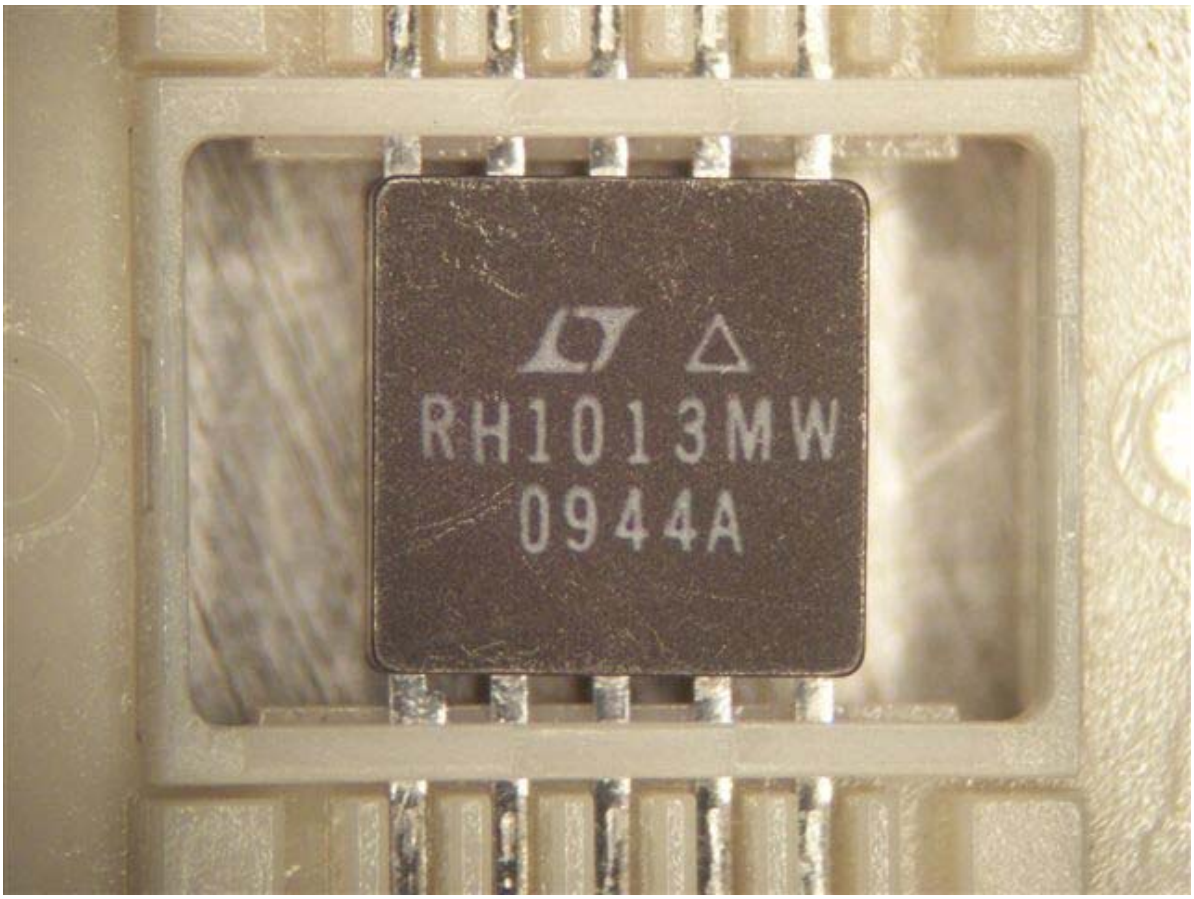
Appendix A: Photograph of device-under-test to show part markings



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Appendix B: TID Bias Connections

(Extracted from LINEAR TECHNOLOGY CORPORATION RH1013M Dual Precision Operational Amplifier Datasheet)

Biased Samples:

Pin	Function	Bias
1	OUT A	To Pin 2 Via 10kΩ Resistor
2	-IN A	To Pin 1 Via 10kΩ Resistor
3	+IN A	8V Via 10kΩ Resistor
4	NC	NC
5	V-	-15V Decoupled to GND w/ 0.1µF
6	NC	NC
7	+IN B	8V Via 10kΩ Resistor
8	-IN B	To Pin 9 Via 10kΩ Resistor
9	OUT B	To Pin 8 Via 10kΩ Resistor
10	V+	+15V Decoupled to GND w/ 0.1µF

Unbiased Samples (All Pins Tied to Ground):

Pin	Function	Bias
1	OUT A	GND
2	-IN A	GND
3	+IN A	GND
4	NC	GND
5	V-	GND
6	NC	GND
7	+IN B	GND
8	-IN B	GND
9	OUT B	GND
10	V+	GND

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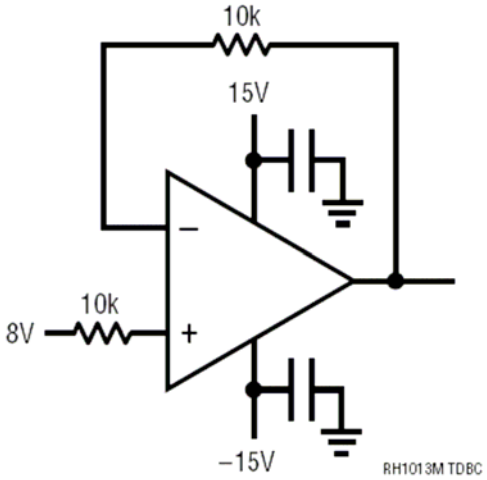

Figure B.1. Irradiation bias drawing for the units to be irradiated under electrical bias. This figure was extracted from the LINEAR TECHNOLOGY CORPORATION RH1013M Dual Precision Operational Amplifier Datasheet.

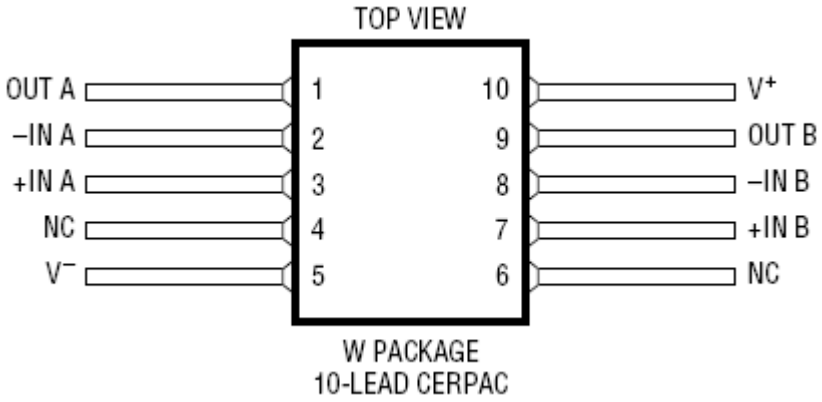

Figure B.2. W package drawing (for reference only). This figure was extracted from the LINEAR TECHNOLOGY CORPORATION RH1013M Dual Precision Operational Amplifier Datasheet.

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Appendix C: Electrical Test Parameters and Conditions

All electrical tests for this device are performed on Radiation Assured Device's LTS2020 Test System. The LTS2020 Test System is a programmable parametric tester that provides parameter measurements for a variety of digital, analog and mixed signal products including voltage regulators, voltage comparators, D to A and A to D converters. The LTS2020 Test System achieves accuracy and sensitivity through the use of software self-calibration and an internal relay matrix with separate family boards and custom personality adapter boards. The tester uses this relay matrix to connect the required test circuits, select the appropriate voltage / current sources and establish the needed measurement loops for all the tests performed. The measured parameters and test conditions are shown in Table C.1.

A listing of the measurement precision/resolution for each parameter is shown in Table C.2. The precision/resolution values were obtained either from test data or from the DAC resolution of the LTS-2020. To generate the precision/resolution shown in Table C.2, one of the units-under-test was tested repetitively (a total of 10-times with re-insertion between tests) to obtain the average test value and standard deviation. Using this test data MIL-HDBK-814 90/90 KTL statistics were applied to the measured standard deviation to generate the final measurement range. This value encompasses the precision/resolution of all aspects of the test system, including the LTS2020 mainframe, family board, socket assembly and DUT board as well as insertion error. In some cases, the measurement resolution is limited by the internal DACs, which results in a measured standard deviation of zero. In these instances the precision/resolution will be reported back as the LSB of the DAC.

Note that the testing and statistics used in this document are based on an "analysis of variables" technique, which relies on small sample sizes to qualify much larger lot sizes (see MIL-HDBK-814, p. 91 for a discussion of statistical treatments). Unfortunately, not all measured parameters are well suited to this approach due to inherent large variations in measurement accuracy or the sample population. One such parameter for this device is pre-irradiation power supply rejection ratio, where the device exhibits sensitivity to input conditions and has a relatively large distribution within the sample population, resulting in a pre-irradiation "failure" after application of the KTL statistics. If necessary, larger samples sizes could be used to qualify these parameters using an "attributes" approach.

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Table C.1. Measured parameters and test conditions for the RH1013MW. Unless otherwise noted the conditions were selected to match the post-irradiation specifications. See LINEAR TECHNOLOGY CORPORATION RH1013M Dual Precision Operational Amplifier Datasheet for the post irradiation test conditions and specifications.

Test Description	Test Conditions
Positive Supply Current	V_S=±15V
Negative Supply Current	V_S=±15V
Input Offset Voltage	V_S=±15V
Input Offset Current	V_S=±15V
+ Input Bias Current	V_S=±15V
- Input Bias Current	V_S=±15V
Common Mode Rejection Ratio	V_{CM} = 13V, –15V
Power Supply Rejection Ratio	V_S = ±10V to ±18V
Large Signal Voltage Gain	V_S=±15V, V_O = ±10V, R_L = 10kΩ
Positive Output Voltage Swing	V_S=±15V, R_L= 10kΩ
Negative Output Voltage Swing	V_S=±15V, R_L= 10kΩ
Positive Slew Rate	V_S=±15V, R_L= 10kΩ
Negative Slew Rate	V_S=±15V, R_L= 10kΩ
Positive Supply Current @ VS=5V	V_S=+5V
Negative Supply Current @ VS=5V	V_S=+5V
Input Offset Voltage @ VS=5V	V_S=+5V
Input Offset Current @ VS=5V	V_S=+5V
+ Input Bias Current @ VS=5V	V_S=+5V
- Input Bias Current @ VS=5V	V_S=+5V
Output Voltage High, No Load @ VS=5V	V_S=+5V, No Load
Output Voltage High, 600Ω @ VS=5V	V_S=+5V, R_L = 600Ω
Output Voltage Low, No Load @ VS=5V	V_S=+5V, No Load
Output Voltage Low, 600Ω @ VS=5V	V_S=+5V, R_L = 600Ω
Output Voltage Low, 1mA @ VS=5V	V_S=+5V, I_{SINK} = 1mA

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Table C.2. Measured parameters, pre-irradiation specifications and measurement resolution for the RH1013MW.

Measured Parameter	Pre-Irradiation Specification	Measurement Precision/Resolution
Positive Supply Current	1.1mA MAX	±1.2E-6A
Negative Supply Current	-1.1mA MIN	±1.2E-6A
Input Offset Voltage	±300µV MAX	±1.0E-6V
Input Offset Current	±10nA MAX	±2.0E-11A
+ Input Bias Current	±30nA MAX	±4.0E-11A
- Input Bias Current	±30nA MAX	±4.0E-11A
Common Mode Rejection Ratio	97dB MIN	±0.5dB
Power Supply Rejection Ratio	100dB MIN	±1.0dB
Large Signal Voltage Gain	1200V/mV MIN	±7.38E3V/mV
Positive Output Voltage Swing	12.5V MIN	±1.0E-3V
Negative Output Voltage Swing	-12.5V MAX	±1.0E-3V
Positive Slew Rate	0.2V/ µs MIN	±1.08E-2V/ µs
Negative Slew Rate	-0.2V/ µs MAX	±1.14E-2V/ µs
Positive Supply Current @ VS=5V	1.0mA MAX	±3.05E-6A
Negative Supply Current @ VS=5V	-1.0mA MIN	±2.56E-6A
Input Offset Voltage @ VS=5V	±450µV MAX	±5.8E-7V
Input Offset Current @ VS=5V	±10nA MAX	±3.8E-11A
+ Input Bias Current @ VS=5V	±50nA MAX	±4.23E-11A
- Input Bias Current @ VS=5V	±50nA MAX	±5.2E-11
Output Voltage High, No Load @ VS=5V	4V MIN	±1.0E-3V
Output Voltage High, 600Ω @ VS=5V	3.4V MIN	±1.0E-3V
Output Voltage Low, No Load @ VS=5V	25mV MAX	±1.0E-3V
Output Voltage Low, 600Ω @ VS=5V	10mV MAX	±1.0E-3V
Output Voltage Low, 1mA @ VS=5V	350mV MAX	±1.0E-3V

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Appendix D: List of Figures in the Results Section (Section 5)

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5.40 Output Voltage Low, No Load CH B @ VS=5V (V)
5.41 Output Voltage Low, 600Ω CH A @ VS=5V (V)
5.42 Output Voltage Low, 600Ω CH B @ VS=5V (V)
5.43 Output Voltage Low, 1mA CH A @ VS=5V (V)
5.44 Output Voltage Low, 1mA CH B @ VS=5V (V)