



TOTAL DOSE RADIATION TEST REPORT

Protons Test

Part Type : 3C91C

Package: modified TO-72

Opto-Couplers

ABB HAFO (MITEL)

Report Reference : ESA_QCA0105T_C

Issue : 02



Date : February 22, 2001

ESA Contract No 13528/99/NL/MV CCN No. 04 dated 22/02/2001, COO-05

ESTEC Technical Officer: R. Harboe Sorensen

European Space Agency Contract Report

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| Authorized by: | F.X. GUERRE | Study Manager | |  |

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| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

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TOTAL DOSE RADIATION TEST REPORT
on
3C91C
Opto-Couplers

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1 Introduction

This report details the work carried out in response to European Space Agency contract reference: 13528/99/NL/MV CCN No. 04 dated 22/02/2001, COO-05 covering "Proton Testing of 3C91C Opto-Couplers for ENVISAT-1".

Displacement damage effects in ABB HAFO 3C91C Opto-Couplers devices from various flight lots was investigated using 60 MeV proton. Unbiased, 2 mA and 10 mA biased devices were irradiated at the Centre de Protonthérapie d'Orsay (CPO) up to a total fluence of about $1,5 \text{ E}+11 \text{ p/cm}^2$ with the Current Transfer Ratio (CTR) degradation being the main parameter monitored.

The main purpose of these tests were to characterizing these Opto-Coupler CTR degradation due to proton displacement damage so a further mission analysis could determine their suitability for flight. All tests were conducted on hirel samples delivered to Hirex by ESA.

A complete set of electrical measurements together with graphical representation of measured parameters with respect to the proton fluence received, are provided for all samples.

2 Applicable and Reference Documents

2.1 Applicable Documents

- AD-1 ESA-SCC Detail Specification No 5401/001 Issue 4
- AD-2 Proton Testing of 3C91C Optocouplers For ENVISAT-1, 01ENV_SOW_3C91C.doc-RHS/TOS-QCA, January 2001, Issue 0, dated 18 January 2001
- AD-3 Proton test of Optocouplers at CPO, HRX/MOM/0029, dated 08 February 2001
- AD-4 ESA/SCC Basic specification N° 22900 issue 4.

2.2 Reference Documents

- RD-1. MIL-STD-750: test methods and procedures for discrete semiconductors.
- RD-2. The 200MeV proton beam of the Centre de Protonthérapie d'Orsay, Radecs 99
- RD-3. ABB HAFO datasheet 3C91: Art.No.12065, June1990

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|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
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3 Test Samples

A total of 41 3C91C Opto-Coupler devices were available for tested.

However, having 8 different lot/date codes the number of devices allocated per biasing conditions and as reference (control samples) can be seen in Table 1a.

| CPO – 60 MeV Proton Test | Reference Devices | Bias Conditions During Test | | |
|-----------------------------|----------------------|-----------------------------|-----------|----------|
| | | 10 mA/5 V | 2 mA/ 5 V | Unbiased |
| 3C91C d/c 9508 | 1 | 2 | 1 | 1 |
| 3C91C d/c 9601 | 1 | 2 | 1 | 1 |
| 3C91C d/c 9519 | 1 | 2 | 1 | 1 |
| 3C91C d/c 9344 | 1 | 2 | 1 | 1 |
| 3C91C d/c 9426 | | 3 | 3 | 3 |
| 3C91C d/c 9309 | | 1 | | |
| ENVISAT-1 30 pc | 4 | 12 | 7 | 7 |
| 3C91C L234 | 1 | 2 | 2 | 2 |
| 3C91C d/c 9806 | 1 | 1 | 1 | 1 |
| CNES 11 pc | 2 | 3 | 3 | 3 |

Table 1a - 3C91 devices tested

| Device | Lot No | Device Marking | datecode | Quality level |
|--------|-----------|----------------------|----------|---------------|
| 3C91C | | HAFO 540100102B 9519 | 9519 | SCC B |
| 3C91C | GR054130 | | 9426 | SCC B |
| 3C91C | RA38417 | | 9309 | SCC B |
| 3C91C | GR044020 | HAFO 540100102B 9344 | 9344 | SCC B |
| 3C91C | 55034 | HAFO 540100102B 9508 | 9508 | SCC B |
| 3C91C | 55975 | HAFO 540100102B 9601 | 9601 | SCC B |
| 3C91C | 19980666A | MITEL MAAJQ02B 9806 | 9806 | Matra B |
| 3C91C | L234 | 3C91CSCCC234 | | SCC C |

Table 1b - 3C91 lot information

Table 1 – 3C91C test samples

Further device information and procurement references can be found in Table 1b. Table 2 provides the different serial number/date codes in respect to allocated exposure conditions.

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

| Serial Number | Date Code | Allocation |
|---------------|-----------|----------------------------|
| 029 | DC9344 | Control sample |
| 179 | DC9508 | Control sample |
| 015 | DC9519 | Control sample |
| 192 | DC9601 | Control sample |
| 743 | DC9806 | Control sample |
| 1 | L234 | Control sample |
| 046 | DC9344 | Irradiated unbiased |
| 29 | DC9426 | Irradiated unbiased |
| 38 | DC9426 | Irradiated unbiased |
| 55 | DC9426 | Irradiated unbiased |
| 362 | DC9508 | Irradiated unbiased |
| 180 | DC9519 | Irradiated unbiased |
| 270 | DC9601 | Irradiated unbiased |
| 627 | DC9806 | Irradiated unbiased |
| 2 | L234 | Irradiated unbiased |
| 3 | L234 | Irradiated unbiased |
| 074 | DC9344 | Irradiated with 2 mA bias |
| 15 | DC9426 | Irradiated with 2 mA bias |
| 22 | DC9426 | Irradiated with 2 mA bias |
| 39 | DC9426 | Irradiated with 2 mA bias |
| 280 | DC9508 | Irradiated with 2 mA bias |
| 167 | DC9519 | Irradiated with 2 mA bias |
| 282 | DC9601 | Irradiated with 2 mA bias |
| 739 | DC9806 | Irradiated with 2 mA bias |
| 4 | L234 | Irradiated with 2 mA bias |
| 5 | L234 | Irradiated with 2 mA bias |
| 097 | DC9309 | Irradiated with 10 mA bias |
| 020 | DC9344 | Irradiated with 10 mA bias |
| 034 | DC9344 | Irradiated with 10 mA bias |
| 19 | DC9426 | Irradiated with 10 mA bias |
| 24 | DC9426 | Irradiated with 10 mA bias |
| 48 | DC9426 | Irradiated with 10 mA bias |
| 361 | DC9508 | Irradiated with 10 mA bias |
| 363 | DC9508 | Irradiated with 10 mA bias |
| 107 | DC9519 | Irradiated with 10 mA bias |
| 241 | DC9519 | Irradiated with 10 mA bias |
| 73 | DC9601 | Irradiated with 10 mA bias |
| 232 | DC9601 | Irradiated with 10 mA bias |
| 694 | DC9806 | Irradiated with 10 mA bias |
| 6 | L234 | Irradiated with 10 mA bias |
| 7 | L234 | Irradiated with 10 mA bias |

Table 2 – 3C91 Test Sample allocation

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

4 Experimental Conditions

4.1 Radiation Source Dose Rate

The dose exposures were performed at Centre de Prorionthérapie d'Orsay (CPO). In this irradiation facility, a synchro-cyclotron SC200 is used with the possibility to vary the proton beam energy by the adjunction of degraders. (See RD-2 for details).

A mono-energetic 60MeV proton beam was used for this test with a beam diameter of 10 cm. The fluence rate was set to 2.7 E+7 p/cm².s.

The irradiation conditions used for this test are provided in the following table:

| Irr. Steps | Fluence | Irr. Time | Temp. |
|----------------------------------|----------------|------------------|--------------|
| p/cm2 | p/cm2 | Seconds | °C |
| 0 | | | 22 |
| 7.26E09 | 7.26E09 | 269 | 22 |
| 1.10E10 | 1.82E10 | 407 | 22 |
| 1.82E10 | 3.63E10 | 674 | 22 |
| 3.63E10 | 7.26E10 | 1344 | 22 |
| 7.26E10 | 1.50E11 | 2688 | 22 |
| Flux : 2.70E07 p/cm2/sec. | | | |

Table 3 : Experimental Conditions

Information on beam dosimetry and beam uniformity is provided in APPENDIX 2.

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

4.2 Bias condition during Dose Exposures

During exposures a dedicated test board was used mounted on a special board-holder made for irradiation. The test board allowed to bias the devices in accordance with the electrical circuit provided in Figure 1. Figure 2 shows a photo of the test board which allows the exposure of all devices with three different biasing conditions at the same time. The constant current source was supplied by Hirex internal BILT system. For unbiased devices all device terminals were connected to ground.

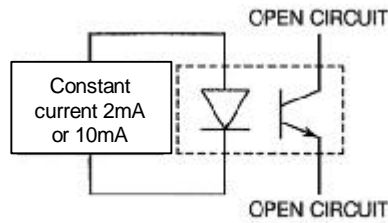


Figure 1 : Bias Conditions during Irradiation Exposures and Annealing

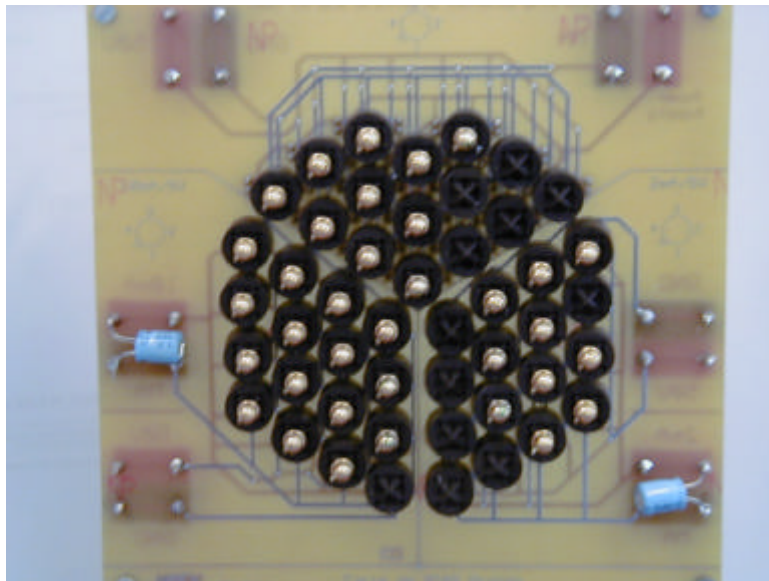


Figure 2 : Photo of the Irradiation Test Board

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

4.3 Electrical parameters test conditions and limits

Electrical parameters test conditions and limits used for performing this test are given in the following table. There are extracted from ESA/SCC specification: 5401/001 Issue 04.

Table 4 : Test conditions

| Symbol | Description | Conditions | Min | Max | Unit |
|------------|--------------------------------------|------------------------------------|-------|----------|------|
| VF1 | Forward Voltage 1 | IF=2.0mA | | 1.3 | V |
| VF2 | Forward Voltage 2 | IF=50mA | | 1.8 | V |
| VBR | Breakdown Voltage | IR=0.1mA | 7 | | V |
| VBRCE0 | Collector-Emitter Breakdown Voltage | IC=10mA | 50 | | V |
| ICE0 | Dark Current | VCE=5.0V. IF=0mA | | 5.00E-08 | A |
| IC1 | Output Current1 | VCE=5.0V. IF=1mA | | Note 1 | A |
| IC2 | Output Current2 | VCE=5.0V. IF=2mA | | Note 1 | A |
| IC5 | Output Current5 | VCE=5.0V. IF=5mA | | Note 1 | A |
| IC10 | Output Current10 | VCE=5.0V. IF=10mA | 0.004 | | A |
| VCESAT | Collector Emitter Saturation Voltage | IC=2mA. IF=50mA | | 0.4 | V |
| trise | Rise Time | RL=100 Ohms. IC=2.0mA. VCE=5.0V | | 5.00E-06 | s |
| tfall | Fall Time | RL=100 Ohms. IC=2.0mA. VCE=5.0V | | 5.00E-06 | s |
| CTR1 degr | Current Transfer Ratio | CTR1=Iout/IF(1ma) | | Note 1 | % |
| CTR2 degr | Current Transfer Ratio | CTR1=Iout/IF(2ma) | | Note 1 | % |
| CTR5 degr | Current Transfer Ratio | CTR1=Iout/IF(5ma) | | Note 1 | % |
| CTR10 degr | Current Transfer Ratio | CTR1=Iout/IF(10ma) | | Note 1 | % |

Note 1: No limit specified in component specification: ESA/SCC 5401/001. These parameters have been added to cover a wider range of potential application conditions.

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
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| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

4.4 Electrical Measurements

Opto-coupler test program principle is provided in Figure 2.

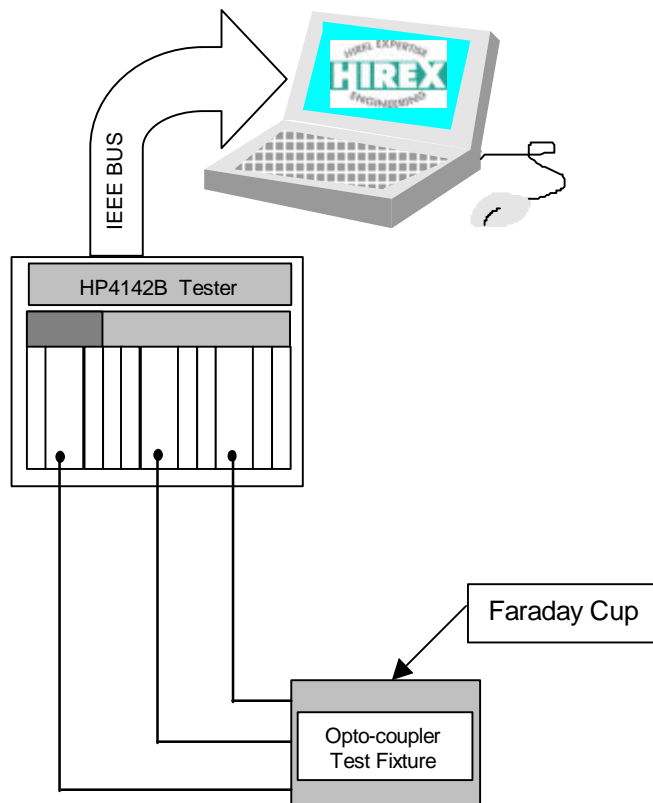
One instrument (DC tester HP4142B) was used to perform required measurements.

A dedicated test fixture was designed to ensure proper measurement conditions. In addition a faraday cup was used to ensure optimum conditions for low level measurements.

Test results were automatically loaded in an Excel worksheet and compared in real time to specification limits. This allowed for real time data analysis in particular when failures were recorded.

For dynamic parameters measurements, a sampling scope Tektronix TH720 and a pulse signal generator HP33120A were used.

Figure 3 : Opto-coupler test program principle



| | | | | | |
|--------------------------|-------------------------------|----------------|------------------|--|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | | |

5 Test Results

The complete set of test results including the raw data and the different degradation curves versus the exposure bias conditions and for the different lot date codes are presented in APPENDIX 1.

A general trend which can be observed is that CTR degradation is more important when no bias is applied to the device during the beam exposures.

The following table gives the page number for each parameter versus datecode and bias condition. In addition the drift trend is indicated in the last column

| Symbol | Page No | | | | | | | | | | | Drift Trend |
|------------|---------|-----|----------|--------|--------|--------|--------|--------|--------|------|--------|-------------|
| | 10mA | 2mA | Unbiased | DC9309 | DC9519 | DC9806 | DC9601 | DC9508 | DC9344 | L234 | DC9426 | |
| VF1 | 29 | 45 | 61 | 77 | 91 | 105 | 119 | 133 | 147 | 161 | 175 | — |
| VF2 | 30 | 46 | 62 | 78 | 92 | 106 | 120 | 134 | 148 | 162 | 176 | — |
| VBR | 31 | 47 | 63 | 79 | 93 | 107 | 121 | 135 | 149 | 163 | 177 | — |
| VBRCE0 | 32 | 48 | 64 | 80 | 94 | 108 | 122 | 136 | 150 | 164 | 178 | — |
| ICE0 | 33 | 49 | 65 | 81 | 95 | 109 | 123 | 137 | 151 | 165 | 179 | — |
| IC1 | 34 | 50 | 66 | 82 | 96 | 110 | 124 | 138 | 152 | 166 | 180 | ↓ |
| IC2 | 35 | 51 | 67 | 83 | 97 | 111 | 125 | 139 | 153 | 167 | 181 | ↓ |
| IC5 | 36 | 52 | 68 | 84 | 98 | 112 | 126 | 140 | 154 | 168 | 182 | ↓ |
| IC10 | 37 | 53 | 69 | 85 | 99 | 113 | 127 | 141 | 155 | 169 | 183 | ↓ |
| VCESAT | 38 | 54 | 70 | 86 | 100 | 114 | 128 | 142 | 156 | 170 | 184 | ↗ |
| trise | 39 | 55 | 71 | | | | | | | | 185 | ↗ |
| tfall | 40 | 56 | 72 | | | | | | | | 186 | ↗ |
| CTR1 degr | 41 | 57 | 73 | 87 | 101 | 115 | 129 | 143 | 157 | 171 | 187 | ↓ |
| CTR2 degr | 42 | 58 | 74 | 88 | 102 | 116 | 130 | 144 | 158 | 172 | 188 | ↓ |
| CTR5 degr | 43 | 59 | 75 | 89 | 103 | 117 | 131 | 145 | 159 | 173 | 189 | ↓ |
| CTR10 degr | 44 | 60 | 76 | 90 | 104 | 118 | 132 | 146 | 160 | 174 | 190 | ↓ |

6 Conclusion

A proton test was carried out by Hirex Engineering under ESA contract on the 3C91C Opto-Couplers.

35 samples plus 6 control samples were used during testing. Each device was exposed to radiation up to a total fluence of about $1.5 \text{ E}+11 \text{ p/cm}^2$ using a flux of $2.7 \text{ E}+07 \text{ p/cm}^2.\text{s}$ at room temperature.

CTR degradation at 4 different diode current levels versus proton fluence has been characterised for 3 different bias conditions on 8 different 3C91C lots.

It can be observed that the degradation is generally more severe when the device is not biased during beam exposure.

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
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| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

APPENDIX 1 - TEST RESULTS

| | | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|--|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 | |
| | | | | Issue : 02 | |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | | |

Parameter : VF1

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 1.07216 | 1.07552 | 1.07252 | 1.07704 | 1.077 | 1.076 |
| 179_Ref | 1.075 | 1.07592 | 1.07392 | 1.0728 | 1.07512 | 1.074 |
| 015_Ref | 1.06524 | 1.07104 | 1.06936 | 1.06692 | 1.07112 | 1.071 |
| 192_Ref | 1.06872 | 1.07488 | 1.07268 | 1.07176 | 1.07396 | 1.074 |
| 743_Ref | 1.0652 | 1.0746 | 1.07248 | 1.07168 | 1.07404 | 1.075 |
| 1_Ref | 1.06744 | 1.0728 | 1.07084 | 1.06916 | 1.07164 | 1.072 |
| 046 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 29 | 1.07E+00 | 1.08E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 38 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 55 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 362 | 1.07E+00 | 1.08E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 180 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 | 1.04E+00 |
| 270 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 627 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 2 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 | 1.04E+00 |
| 3 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 | 1.04E+00 |
| 074 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 15 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 22 | 1.07E+00 | 1.08E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 |
| 39 | 1.06E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 280 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 167 | 1.06E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 282 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 739 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 4 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 5 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 097 | 1.06E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 020 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 034 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 19 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 |
| 24 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 |
| 48 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 |
| 361 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 363 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 |
| 107 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 241 | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 73 | 1.06E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 | 1.04E+00 |
| 232 | 1.06E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 694 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| 6 | 1.06E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 | 1.04E+00 |
| 7 | 1.06E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| Max | 1.07E+00 | 1.08E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 |
| Mean | 1.07E+00 | 1.07E+00 | 1.07E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 |
| Mean3Sig- | 1.05E+00 | 1.06E+00 | 1.05E+00 | 1.05E+00 | 1.04E+00 | 1.03E+00 |
| Mean3Sig+ | 1.08E+00 | 1.08E+00 | 1.08E+00 | 1.07E+00 | 1.06E+00 | 1.06E+00 |
| Min | 1.06E+00 | 1.06E+00 | 1.06E+00 | 1.05E+00 | 1.04E+00 | 1.04E+00 |
| Sigma | 5.02E-03 | 3.82E-03 | 5.02E-03 | 4.04E-03 | 4.16E-03 | 5.58E-03 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : VF2

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 1.3088 | 1.312 | 1.3088 | 1.3136 | 1.314 | 1.313 |
| 179_Ref | 1.2484 | 1.2492 | 1.2476 | 1.2464 | 1.2484 | 1.248 |
| 015_Ref | 1.2448 | 1.25 | 1.2484 | 1.2464 | 1.2504 | 1.25 |
| 192_Ref | 1.2536 | 1.2596 | 1.2572 | 1.2568 | 1.2584 | 1.259 |
| 743_Ref | 1.2464 | 1.2556 | 1.2536 | 1.2528 | 1.2552 | 1.256 |
| 1_Ref | 1.2272 | 1.232 | 1.23 | 1.2292 | 1.2312 | 1.232 |
| 046 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 |
| 29 | 1.30E+00 | 1.31E+00 | 1.31E+00 | 1.31E+00 | 1.30E+00 | 1.31E+00 |
| 38 | 1.26E+00 | 1.27E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 |
| 55 | 1.29E+00 | 1.30E+00 | 1.29E+00 | 1.29E+00 | 1.29E+00 | 1.30E+00 |
| 362 | 1.34E+00 | 1.35E+00 | 1.34E+00 | 1.34E+00 | 1.34E+00 | 1.35E+00 |
| 180 | 1.24E+00 | 1.25E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 270 | 1.26E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.26E+00 | 1.27E+00 |
| 627 | 1.26E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.26E+00 | 1.27E+00 |
| 2 | 1.24E+00 | 1.25E+00 | 1.25E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 3 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.24E+00 | 1.25E+00 |
| 074 | 1.26E+00 | 1.27E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 |
| 15 | 1.29E+00 | 1.30E+00 | 1.29E+00 | 1.29E+00 | 1.29E+00 | 1.30E+00 |
| 22 | 1.40E+00 | 1.41E+00 | 1.40E+00 | 1.40E+00 | 1.40E+00 | 1.41E+00 |
| 39 | 1.30E+00 | 1.31E+00 | 1.31E+00 | 1.31E+00 | 1.30E+00 | 1.31E+00 |
| 280 | 1.27E+00 | 1.28E+00 | 1.28E+00 | 1.27E+00 | 1.27E+00 | 1.28E+00 |
| 167 | 1.24E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.24E+00 | 1.25E+00 |
| 282 | 1.26E+00 | 1.27E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.27E+00 |
| 739 | 1.24E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 |
| 4 | 1.22E+00 | 1.23E+00 | 1.22E+00 | 1.22E+00 | 1.22E+00 | 1.22E+00 |
| 5 | 1.24E+00 | 1.25E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 097 | 1.27E+00 | 1.28E+00 | 1.28E+00 | 1.28E+00 | 1.28E+00 | 1.28E+00 |
| 020 | 1.26E+00 | 1.27E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 |
| 034 | 1.25E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 | 1.26E+00 |
| 19 | 1.26E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 |
| 24 | 1.30E+00 | 1.31E+00 | 1.31E+00 | 1.31E+00 | 1.31E+00 | 1.31E+00 |
| 48 | 1.29E+00 | 1.30E+00 | 1.30E+00 | 1.30E+00 | 1.30E+00 | 1.30E+00 |
| 361 | 1.24E+00 | 1.25E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 363 | 1.24E+00 | 1.25E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 107 | 1.25E+00 | 1.26E+00 | 1.26E+00 | 1.25E+00 | 1.25E+00 | 1.26E+00 |
| 241 | 1.26E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.28E+00 |
| 73 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 232 | 1.24E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 | 1.25E+00 |
| 694 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 | 1.24E+00 |
| 6 | 1.22E+00 | 1.23E+00 | 1.23E+00 | 1.22E+00 | 1.22E+00 | 1.22E+00 |
| 7 | 1.23E+00 | 1.23E+00 | 1.23E+00 | 1.23E+00 | 1.22E+00 | 1.22E+00 |
| Max | 1.40E+00 | 1.41E+00 | 1.40E+00 | 1.40E+00 | 1.40E+00 | 1.41E+00 |
| Mean | 1.26E+00 | 1.27E+00 | 1.27E+00 | 1.27E+00 | 1.26E+00 | 1.27E+00 |
| Mean3Sig- | 1.16E+00 | 1.16E+00 | 1.16E+00 | 1.16E+00 | 1.16E+00 | 1.15E+00 |
| Mean3Sig+ | 1.37E+00 | 1.38E+00 | 1.37E+00 | 1.37E+00 | 1.37E+00 | 1.38E+00 |
| Min | 1.22E+00 | 1.23E+00 | 1.22E+00 | 1.22E+00 | 1.22E+00 | 1.22E+00 |
| Sigma | 3.51E-02 | 3.61E-02 | 3.53E-02 | 3.59E-02 | 3.59E-02 | 3.84E-02 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : VBR

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 27.008 | 26.912 | 26.966 | 26.884 | 26.88 | 26.904 |
| 179_Ref | 25.106 | 25.094 | 25.126 | 25.146 | 25.102 | 25.122 |
| 015_Ref | 42.234 | 42.02 | 42.082 | 42.164 | 42.042 | 42.05 |
| 192_Ref | 19.684 | 19.602 | 19.63 | 19.644 | 19.612 | 19.606 |
| 743_Ref | 31.396 | 31.168 | 31.224 | 31.246 | 31.204 | 31.198 |
| 1_Ref | 26.11 | 26.014 | 26.048 | 26.076 | 26.036 | 26.026 |
| 046 | 3.15E+01 | 3.13E+01 | 3.13E+01 | 3.13E+01 | 3.14E+01 | 3.13E+01 |
| 29 | 3.03E+01 | 3.01E+01 | 3.02E+01 | 3.02E+01 | 3.02E+01 | 3.01E+01 |
| 38 | 2.34E+01 | 2.33E+01 | 2.33E+01 | 2.33E+01 | 2.33E+01 | 2.32E+01 |
| 55 | 2.05E+01 | 2.04E+01 | 2.04E+01 | 2.04E+01 | 2.04E+01 | 2.04E+01 |
| 362 | 2.97E+01 | 2.95E+01 | 2.96E+01 | 2.96E+01 | 2.97E+01 | 2.95E+01 |
| 180 | 3.49E+01 | 3.47E+01 | 3.48E+01 | 3.48E+01 | 3.48E+01 | 3.47E+01 |
| 270 | 2.18E+01 | 2.16E+01 | 2.16E+01 | 2.18E+01 | 2.18E+01 | 2.16E+01 |
| 627 | 3.00E+01 | 2.97E+01 | 2.98E+01 | 2.99E+01 | 2.98E+01 | 2.98E+01 |
| 2 | 3.21E+01 | 3.19E+01 | 3.20E+01 | 3.20E+01 | 3.20E+01 | 3.19E+01 |
| 3 | 4.15E+01 | 4.13E+01 | 4.14E+01 | 4.14E+01 | 4.13E+01 | 4.12E+01 |
| 074 | 3.50E+01 | 3.53E+01 | 3.55E+01 | 3.48E+01 | 3.49E+01 | 3.51E+01 |
| 15 | 3.58E+01 | 3.56E+01 | 3.56E+01 | 3.57E+01 | 3.57E+01 | 3.56E+01 |
| 22 | 3.60E+01 | 3.58E+01 | 3.59E+01 | 3.59E+01 | 3.59E+01 | 3.58E+01 |
| 39 | 2.94E+01 | 2.92E+01 | 2.92E+01 | 2.93E+01 | 2.93E+01 | 2.92E+01 |
| 280 | 2.23E+01 | 2.21E+01 | 2.21E+01 | 2.22E+01 | 2.22E+01 | 2.21E+01 |
| 167 | 3.03E+01 | 3.01E+01 | 3.01E+01 | 3.02E+01 | 3.02E+01 | 3.00E+01 |
| 282 | 2.68E+01 | 2.66E+01 | 2.67E+01 | 2.67E+01 | 2.67E+01 | 2.66E+01 |
| 739 | 2.95E+01 | 2.92E+01 | 2.94E+01 | 2.93E+01 | 2.93E+01 | 2.92E+01 |
| 4 | 3.11E+01 | 3.08E+01 | 3.09E+01 | 3.09E+01 | 3.09E+01 | 3.08E+01 |
| 5 | 4.30E+01 | 4.28E+01 | 4.27E+01 | 4.27E+01 | 4.28E+01 | 4.25E+01 |
| 097 | 3.15E+01 | 3.13E+01 | 3.13E+01 | 3.14E+01 | 3.14E+01 | 3.13E+01 |
| 020 | 2.81E+01 | 2.79E+01 | 2.80E+01 | 2.80E+01 | 2.80E+01 | 2.79E+01 |
| 034 | 4.17E+01 | 4.13E+01 | 4.15E+01 | 4.15E+01 | 4.15E+01 | 4.13E+01 |
| 19 | 2.39E+01 | 2.38E+01 | 2.38E+01 | 2.38E+01 | 2.38E+01 | 2.37E+01 |
| 24 | 3.22E+01 | 3.20E+01 | 3.21E+01 | 3.21E+01 | 3.21E+01 | 3.20E+01 |
| 48 | 2.52E+01 | 2.50E+01 | 2.51E+01 | 2.51E+01 | 2.50E+01 | 2.50E+01 |
| 361 | 3.99E+01 | 3.97E+01 | 3.98E+01 | 3.99E+01 | 3.98E+01 | 3.97E+01 |
| 363 | 2.48E+01 | 2.44E+01 | 2.48E+01 | 2.45E+01 | 2.45E+01 | 2.45E+01 |
| 107 | 2.50E+01 | 2.48E+01 | 2.48E+01 | 2.48E+01 | 2.48E+01 | 2.48E+01 |
| 241 | 3.42E+01 | 3.46E+01 | 3.41E+01 | 3.41E+01 | 3.41E+01 | 3.40E+01 |
| 73 | 2.77E+01 | 2.77E+01 | 2.77E+01 | 2.76E+01 | 2.77E+01 | 2.77E+01 |
| 232 | 2.72E+01 | 2.71E+01 | 2.71E+01 | 2.71E+01 | 2.71E+01 | 2.71E+01 |
| 694 | 1.96E+01 | 1.95E+01 | 1.95E+01 | 1.96E+01 | 1.95E+01 | 1.95E+01 |
| 6 | 3.42E+01 | 3.39E+01 | 3.40E+01 | 3.41E+01 | 3.40E+01 | 3.40E+01 |
| 7 | 3.07E+01 | 3.06E+01 | 3.06E+01 | 3.06E+01 | 3.06E+01 | 3.06E+01 |
| Max | 4.30E+01 | 4.28E+01 | 4.27E+01 | 4.27E+01 | 4.28E+01 | 4.25E+01 |
| Mean | 3.03E+01 | 3.01E+01 | 3.02E+01 | 3.02E+01 | 3.02E+01 | 3.01E+01 |
| Mean3Sig- | 1.24E+01 | 1.22E+01 | 1.23E+01 | 1.23E+01 | 1.23E+01 | 1.23E+01 |
| Mean3Sig+ | 4.82E+01 | 4.80E+01 | 4.81E+01 | 4.80E+01 | 4.80E+01 | 4.79E+01 |
| Min | 1.96E+01 | 1.95E+01 | 1.95E+01 | 1.96E+01 | 1.95E+01 | 1.95E+01 |
| Sigma | 5.97E+00 | 5.96E+00 | 5.97E+00 | 5.95E+00 | 5.95E+00 | 5.93E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : VBRCEO

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 57.446 | 57.418 | 57.434 | 57.376 | 57.38 | 57.386 |
| 179_Ref | 59.688 | 59.67 | 59.7 | 59.718 | 59.684 | 59.694 |
| 015_Ref | 59.15 | 59.052 | 59.078 | 59.11 | 59.05 | 59.058 |
| 192_Ref | 56.1 | 56.046 | 56.064 | 56.074 | 56.056 | 56.052 |
| 743_Ref | 54.678 | 54.618 | 54.632 | 54.642 | 54.624 | 54.614 |
| 1_Ref | 76.212 | 76.05 | 76.098 | 76.136 | 76.068 | 76.076 |
| 046 | 5.78E+01 | 5.79E+01 | 5.82E+01 | 5.88E+01 | 5.94E+01 | 6.00E+01 |
| 29 | 5.88E+01 | 5.89E+01 | 5.93E+01 | 5.98E+01 | 6.06E+01 | 6.12E+01 |
| 38 | 5.93E+01 | 5.94E+01 | 5.98E+01 | 6.03E+01 | 6.13E+01 | 6.21E+01 |
| 55 | 5.82E+01 | 5.83E+01 | 5.87E+01 | 5.91E+01 | 5.98E+01 | 6.04E+01 |
| 362 | 5.55E+01 | 5.56E+01 | 5.59E+01 | 5.63E+01 | 5.66E+01 | 5.70E+01 |
| 180 | 6.06E+01 | 6.07E+01 | 6.10E+01 | 6.15E+01 | 6.21E+01 | 6.27E+01 |
| 270 | 5.49E+01 | 5.49E+01 | 5.50E+01 | 5.51E+01 | 5.53E+01 | 5.58E+01 |
| 627 | 5.63E+01 | 5.63E+01 | 5.64E+01 | 5.66E+01 | 5.68E+01 | 5.72E+01 |
| 2 | 7.62E+01 | 7.60E+01 | 7.62E+01 | 7.63E+01 | 7.65E+01 | 7.69E+01 |
| 3 | 6.80E+01 | 6.78E+01 | 6.80E+01 | 6.81E+01 | 6.84E+01 | 6.87E+01 |
| 074 | 5.80E+01 | 5.81E+01 | 5.83E+01 | 5.87E+01 | 5.92E+01 | 5.98E+01 |
| 15 | 5.68E+01 | 5.70E+01 | 5.73E+01 | 5.79E+01 | 5.86E+01 | 5.92E+01 |
| 22 | 5.93E+01 | 5.94E+01 | 5.98E+01 | 6.03E+01 | 6.11E+01 | 6.20E+01 |
| 39 | 5.73E+01 | 5.74E+01 | 5.78E+01 | 5.84E+01 | 5.94E+01 | 6.04E+01 |
| 280 | 5.90E+01 | 5.91E+01 | 5.95E+01 | 6.01E+01 | 6.09E+01 | 6.16E+01 |
| 167 | 5.96E+01 | 5.96E+01 | 5.98E+01 | 6.01E+01 | 6.05E+01 | 6.09E+01 |
| 282 | 5.62E+01 | 5.63E+01 | 5.64E+01 | 5.66E+01 | 5.69E+01 | 5.74E+01 |
| 739 | 5.35E+01 | 5.35E+01 | 5.36E+01 | 5.37E+01 | 5.39E+01 | 5.43E+01 |
| 4 | 7.58E+01 | 7.56E+01 | 7.57E+01 | 7.59E+01 | 7.61E+01 | 7.64E+01 |
| 5 | 6.90E+01 | 6.89E+01 | 6.90E+01 | 6.91E+01 | 6.93E+01 | 6.95E+01 |
| 097 | 5.81E+01 | 5.81E+01 | 5.84E+01 | 5.86E+01 | 5.88E+01 | 5.93E+01 |
| 020 | 5.83E+01 | 5.84E+01 | 5.88E+01 | 5.94E+01 | 6.04E+01 | 6.11E+01 |
| 034 | 5.87E+01 | 5.88E+01 | 5.91E+01 | 5.96E+01 | 6.04E+01 | 6.10E+01 |
| 19 | 5.92E+01 | 5.93E+01 | 5.96E+01 | 6.01E+01 | 6.10E+01 | 6.20E+01 |
| 24 | 5.93E+01 | 5.94E+01 | 5.99E+01 | 6.05E+01 | 6.15E+01 | 6.25E+01 |
| 48 | 5.88E+01 | 5.89E+01 | 5.94E+01 | 6.00E+01 | 6.10E+01 | 6.19E+01 |
| 361 | 5.55E+01 | 5.56E+01 | 5.59E+01 | 5.62E+01 | 5.65E+01 | 5.70E+01 |
| 363 | 5.92E+01 | 5.93E+01 | 5.97E+01 | 6.01E+01 | 6.05E+01 | 6.10E+01 |
| 107 | 6.05E+01 | 6.05E+01 | 6.09E+01 | 6.12E+01 | 6.15E+01 | 6.20E+01 |
| 241 | 6.01E+01 | 6.02E+01 | 6.04E+01 | 6.06E+01 | 6.08E+01 | 6.12E+01 |
| 73 | 5.48E+01 | 5.49E+01 | 5.50E+01 | 5.51E+01 | 5.54E+01 | 5.58E+01 |
| 232 | 5.74E+01 | 5.74E+01 | 5.75E+01 | 5.76E+01 | 5.78E+01 | 5.82E+01 |
| 694 | 5.33E+01 | 5.34E+01 | 5.36E+01 | 5.40E+01 | 5.45E+01 | 5.51E+01 |
| 6 | 7.03E+01 | 7.00E+01 | 7.01E+01 | 7.03E+01 | 7.04E+01 | 7.07E+01 |
| 7 | 7.47E+01 | 7.45E+01 | 7.47E+01 | 7.48E+01 | 7.50E+01 | 7.54E+01 |
| | | | | | | |
| Max | 7.62E+01 | 7.60E+01 | 7.62E+01 | 7.63E+01 | 7.65E+01 | 7.69E+01 |
| Mean | 6.02E+01 | 6.03E+01 | 6.05E+01 | 6.09E+01 | 6.14E+01 | 6.19E+01 |
| Mean3Sig- | 4.21E+01 | 4.25E+01 | 4.28E+01 | 4.33E+01 | 4.40E+01 | 4.48E+01 |
| Mean3Sig+ | 7.83E+01 | 7.81E+01 | 7.83E+01 | 7.84E+01 | 7.87E+01 | 7.91E+01 |
| Min | 5.33E+01 | 5.34E+01 | 5.36E+01 | 5.37E+01 | 5.39E+01 | 5.43E+01 |
| Sigma | 6.03E+00 | 5.94E+00 | 5.91E+00 | 5.85E+00 | 5.78E+00 | 5.72E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : ICE0

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|
| 029_Ref | 4.3254E-10 | 3.6986E-10 | 4.4826E-10 | 3.5034E-10 | 3.4082E-10 | 3.6372E-10 |
| 179_Ref | 1.4204E-10 | 1.3774E-10 | 1.6324E-10 | 1.7316E-10 | 1.4486E-10 | 1.4866E-10 |
| 015_Ref | 6.0902E-10 | 4.3234E-10 | 4.8134E-10 | 5.7752E-10 | 4.1692E-10 | 4.5524E-10 |
| 192_Ref | 4.843E-10 | 3.3998E-10 | 3.7974E-10 | 4.1308E-10 | 3.6006E-10 | 3.5306E-10 |
| 743_Ref | 1.36E-10 | 8.766E-11 | 9.826E-11 | 1.0658E-10 | 9.362E-11 | 9.292E-11 |
| 1_Ref | 4.1364E-10 | 3.8622E-10 | 4.6976E-10 | 5.5186E-10 | 4.8626E-10 | 4.8558E-10 |
| 046 | 3.21E-10 | 2.07E-10 | 2.41E-10 | 2.51E-10 | 3.27E-10 | 2.20E-10 |
| 29 | 2.02E-10 | 1.35E-10 | 1.69E-10 | 1.79E-10 | 2.21E-10 | 1.74E-10 |
| 38 | 2.67E-10 | 1.62E-10 | 2.03E-10 | 2.27E-10 | 2.76E-10 | 1.91E-10 |
| 55 | 2.50E-10 | 1.66E-10 | 2.08E-10 | 2.11E-10 | 2.40E-10 | 2.09E-10 |
| 362 | 2.65E-10 | 1.45E-10 | 1.97E-10 | 2.16E-10 | 2.63E-10 | 1.74E-10 |
| 180 | 2.47E-10 | 1.53E-10 | 2.05E-10 | 2.17E-10 | 2.68E-10 | 1.86E-10 |
| 270 | 2.55E-10 | 1.83E-10 | 2.35E-10 | 2.58E-10 | 2.81E-10 | 2.08E-10 |
| 627 | 6.14E-11 | 5.06E-11 | 5.98E-11 | 7.26E-11 | 9.61E-11 | 1.09E-10 |
| 2 | 6.28E-10 | 4.55E-10 | 4.75E-10 | 5.10E-10 | 3.71E-10 | 2.25E-10 |
| 3 | 4.38E-10 | 3.67E-10 | 5.42E-10 | 5.50E-10 | 4.23E-10 | 2.02E-10 |
| 074 | 4.44E-10 | 2.52E-10 | 3.46E-10 | 2.95E-10 | 2.91E-10 | 2.37E-10 |
| 15 | 3.57E-10 | 2.27E-10 | 2.30E-10 | 2.47E-10 | 2.67E-10 | 2.54E-10 |
| 22 | 3.59E-10 | 2.22E-10 | 2.53E-10 | 2.66E-10 | 2.37E-10 | 2.13E-10 |
| 39 | 3.60E-10 | 1.93E-10 | 2.15E-10 | 2.29E-10 | 2.58E-10 | 1.93E-10 |
| 280 | 1.70E-10 | 1.11E-10 | 1.23E-10 | 1.50E-10 | 1.93E-10 | 2.01E-10 |
| 167 | 9.23E-10 | 4.68E-10 | 5.43E-10 | 5.32E-10 | 4.57E-10 | 2.93E-10 |
| 282 | 4.66E-10 | 2.35E-10 | 3.09E-10 | 2.70E-10 | 2.78E-10 | 1.88E-10 |
| 739 | 1.48E-10 | 9.61E-11 | 1.37E-10 | 1.22E-10 | 1.34E-10 | 1.16E-10 |
| 4 | 8.15E-10 | 4.64E-10 | 5.47E-10 | 4.63E-10 | 4.06E-10 | 2.01E-10 |
| 5 | 4.92E-10 | 3.80E-10 | 4.92E-10 | 6.17E-10 | 5.76E-10 | 4.10E-10 |
| 097 | 2.71E-10 | 1.43E-10 | 1.83E-10 | 2.23E-10 | 2.04E-10 | 1.74E-10 |
| 020 | 1.82E-10 | 1.10E-10 | 1.39E-10 | 1.75E-10 | 1.98E-10 | 2.10E-10 |
| 034 | 5.20E-10 | 2.67E-10 | 3.70E-10 | 3.60E-10 | 3.65E-10 | 3.26E-10 |
| 19 | 3.15E-10 | 1.91E-10 | 2.38E-10 | 2.37E-10 | 2.33E-10 | 2.18E-10 |
| 24 | 2.81E-10 | 1.57E-10 | 1.81E-10 | 2.14E-10 | 2.03E-10 | 2.05E-10 |
| 48 | 3.16E-10 | 1.56E-10 | 2.09E-10 | 2.43E-10 | 2.28E-10 | 2.92E-10 |
| 361 | 3.27E-10 | 2.01E-10 | 2.63E-10 | 3.40E-10 | 3.53E-10 | 3.05E-10 |
| 363 | 3.10E-10 | 2.08E-10 | 2.61E-10 | 2.77E-10 | 2.91E-10 | 3.43E-10 |
| 107 | 3.76E-10 | 2.16E-10 | 2.51E-10 | 3.11E-10 | 2.84E-10 | 3.43E-10 |
| 241 | 1.80E-10 | 1.21E-10 | 1.51E-10 | 1.66E-10 | 1.56E-10 | 1.31E-10 |
| 73 | 4.82E-10 | 3.89E-10 | 4.05E-10 | 4.46E-10 | 3.71E-10 | 3.76E-10 |
| 232 | 2.06E-10 | 1.42E-10 | 1.50E-10 | 1.87E-10 | 1.84E-10 | 1.75E-10 |
| 694 | 1.08E-10 | 8.56E-11 | 1.07E-10 | 1.51E-10 | 2.01E-10 | 3.33E-10 |
| 6 | 7.39E-10 | 4.32E-10 | 4.57E-10 | 4.80E-10 | 2.94E-10 | 2.16E-10 |
| 7 | 6.46E-10 | 4.15E-10 | 3.55E-10 | 3.63E-10 | 2.95E-10 | 1.97E-10 |
| | | | | | | |
| Max | 9.23E-10 | 4.68E-10 | 5.47E-10 | 6.17E-10 | 5.76E-10 | 4.10E-10 |
| Mean | 3.64E-10 | 2.26E-10 | 2.70E-10 | 2.87E-10 | 2.78E-10 | 2.30E-10 |
| Mean3Sig- | -2.29E-10 | -1.31E-10 | -1.30E-10 | -1.10E-10 | -9.59E-12 | 1.42E-11 |
| Mean3Sig+ | 9.56E-10 | 5.83E-10 | 6.70E-10 | 6.85E-10 | 5.65E-10 | 4.46E-10 |
| Min | 6.14E-11 | 5.06E-11 | 5.98E-11 | 7.26E-11 | 9.61E-11 | 1.09E-10 |
| Sigma | 1.98E-10 | 1.19E-10 | 1.33E-10 | 1.32E-10 | 9.58E-11 | 7.19E-11 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : IC1

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 0.0005886 | 0.00059214 | 0.0005879 | 0.00059314 | 0.00059286 | 0.0005932 |
| 179_Ref | 0.00046776 | 0.00047022 | 0.00046926 | 0.00046796 | 0.00046974 | 0.00046974 |
| 015_Ref | 0.00040198 | 0.00040708 | 0.00040542 | 0.00040286 | 0.00040678 | 0.0004069 |
| 192_Ref | 0.00050552 | 0.00050598 | 0.00050512 | 0.00050444 | 0.00050494 | 0.00050536 |
| 743_Ref | 0.00039626 | 0.00039832 | 0.00039824 | 0.00039806 | 0.00039872 | 0.00039886 |
| 1_Ref | 0.00031464 | 0.00032466 | 0.00032274 | 0.00032128 | 0.00032438 | 0.00032554 |
| 046 | 6.43E-04 | 5.06E-04 | 3.55E-04 | 2.11E-04 | 9.46E-05 | 2.81E-05 |
| 29 | 4.86E-04 | 3.75E-04 | 2.61E-04 | 1.56E-04 | 6.70E-05 | 1.96E-05 |
| 38 | 5.02E-04 | 3.92E-04 | 2.74E-04 | 1.64E-04 | 6.96E-05 | 1.95E-05 |
| 55 | 4.65E-04 | 3.65E-04 | 2.59E-04 | 1.59E-04 | 7.17E-05 | 2.19E-05 |
| 362 | 4.87E-04 | 3.71E-04 | 2.51E-04 | 1.47E-04 | 6.61E-05 | 1.89E-05 |
| 180 | 2.39E-04 | 1.95E-04 | 1.42E-04 | 9.03E-05 | 4.43E-05 | 1.36E-05 |
| 270 | 4.42E-04 | 3.56E-04 | 2.64E-04 | 1.73E-04 | 8.71E-05 | 2.92E-05 |
| 627 | 3.17E-04 | 2.50E-04 | 1.82E-04 | 1.16E-04 | 5.47E-05 | 1.79E-05 |
| 2 | 3.09E-04 | 2.57E-04 | 1.92E-04 | 1.26E-04 | 6.34E-05 | 2.27E-05 |
| 3 | 4.05E-04 | 3.33E-04 | 2.43E-04 | 1.58E-04 | 7.73E-05 | 2.75E-05 |
| 074 | 5.81E-04 | 4.63E-04 | 3.40E-04 | 2.15E-04 | 1.03E-04 | 3.48E-05 |
| 15 | 5.06E-04 | 4.09E-04 | 2.97E-04 | 1.85E-04 | 8.55E-05 | 2.89E-05 |
| 22 | 5.31E-04 | 4.23E-04 | 3.07E-04 | 1.91E-04 | 8.65E-05 | 2.84E-05 |
| 39 | 4.69E-04 | 3.66E-04 | 2.57E-04 | 1.52E-04 | 6.36E-05 | 1.83E-05 |
| 280 | 5.14E-04 | 4.09E-04 | 2.93E-04 | 1.79E-04 | 8.04E-05 | 2.66E-05 |
| 167 | 3.73E-04 | 3.06E-04 | 2.26E-04 | 1.47E-04 | 7.26E-05 | 2.44E-05 |
| 282 | 5.69E-04 | 4.63E-04 | 3.46E-04 | 2.29E-04 | 1.17E-04 | 4.22E-05 |
| 739 | 4.42E-04 | 3.59E-04 | 2.74E-04 | 1.84E-04 | 9.51E-05 | 3.50E-05 |
| 4 | 3.74E-04 | 3.31E-04 | 2.61E-04 | 1.85E-04 | 1.04E-04 | 4.25E-05 |
| 5 | 3.22E-04 | 2.83E-04 | 2.20E-04 | 1.55E-04 | 8.40E-05 | 3.38E-05 |
| 097 | 5.66E-04 | 4.62E-04 | 3.47E-04 | 2.28E-04 | 1.16E-04 | 4.15E-05 |
| 020 | 5.80E-04 | 4.79E-04 | 3.55E-04 | 2.23E-04 | 1.03E-04 | 3.59E-05 |
| 034 | 4.65E-04 | 3.87E-04 | 2.92E-04 | 1.89E-04 | 9.18E-05 | 3.33E-05 |
| 19 | 4.21E-04 | 3.56E-04 | 2.68E-04 | 1.73E-04 | 8.25E-05 | 2.85E-05 |
| 24 | 3.34E-04 | 2.72E-04 | 1.99E-04 | 1.24E-04 | 5.48E-05 | 1.77E-05 |
| 48 | 4.64E-04 | 3.79E-04 | 2.75E-04 | 1.68E-04 | 7.52E-05 | 2.55E-05 |
| 361 | 5.62E-04 | 4.60E-04 | 3.46E-04 | 2.22E-04 | 1.15E-04 | 4.06E-05 |
| 363 | 5.17E-04 | 4.23E-04 | 3.18E-04 | 2.08E-04 | 1.09E-04 | 4.05E-05 |
| 107 | 2.80E-04 | 2.23E-04 | 1.64E-04 | 1.04E-04 | 5.08E-05 | 1.67E-05 |
| 241 | 3.97E-04 | 3.23E-04 | 2.43E-04 | 1.62E-04 | 8.33E-05 | 3.00E-05 |
| 73 | 6.28E-04 | 5.25E-04 | 4.21E-04 | 2.94E-04 | 1.65E-04 | 6.64E-05 |
| 232 | 5.02E-04 | 4.29E-04 | 3.46E-04 | 2.45E-04 | 1.41E-04 | 5.81E-05 |
| 694 | 3.11E-04 | 2.49E-04 | 1.88E-04 | 1.21E-04 | 5.89E-05 | 2.08E-05 |
| 6 | 3.81E-04 | 3.40E-04 | 2.75E-04 | 1.97E-04 | 1.14E-04 | 4.86E-05 |
| 7 | 2.53E-04 | 2.24E-04 | 1.81E-04 | 1.32E-04 | 7.51E-05 | 3.07E-05 |
| Max | 6.43E-04 | 5.25E-04 | 4.21E-04 | 2.94E-04 | 1.65E-04 | 6.64E-05 |
| Mean | 4.47E-04 | 3.64E-04 | 2.70E-04 | 1.75E-04 | 8.64E-05 | 3.05E-05 |
| Mean3Sig- | 1.25E-04 | 1.10E-04 | 7.87E-05 | 4.48E-05 | 8.64E-06 | -4.83E-06 |
| Mean3Sig+ | 7.69E-04 | 6.18E-04 | 4.62E-04 | 3.05E-04 | 1.64E-04 | 6.59E-05 |
| Min | 2.39E-04 | 1.95E-04 | 1.42E-04 | 9.03E-05 | 4.43E-05 | 1.36E-05 |
| Sigma | 1.07E-04 | 8.46E-05 | 6.39E-05 | 4.33E-05 | 2.59E-05 | 1.18E-05 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : IC2

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 0.0017378 | 0.0017428 | 0.0017378 | 0.0017432 | 0.0017418 | 0.0017444 |
| 179_Ref | 0.0014102 | 0.0014146 | 0.0014134 | 0.001413 | 0.0014142 | 0.0014134 |
| 015_Ref | 0.0012394 | 0.0012462 | 0.0012458 | 0.001241 | 0.0012482 | 0.0012482 |
| 192_Ref | 0.0015114 | 0.0015018 | 0.0015026 | 0.0015042 | 0.0015026 | 0.001501 |
| 743_Ref | 0.0011804 | 0.001174 | 0.0011764 | 0.0011768 | 0.0011756 | 0.001176 |
| 1_Ref | 0.00094322 | 0.00095834 | 0.00095424 | 0.00095104 | 0.00095738 | 0.00095944 |
| 046 | 1.89E-03 | 1.51E-03 | 1.08E-03 | 6.69E-04 | 3.13E-04 | 9.96E-05 |
| 29 | 1.49E-03 | 1.16E-03 | 8.29E-04 | 5.10E-04 | 2.31E-04 | 7.20E-05 |
| 38 | 1.57E-03 | 1.24E-03 | 8.88E-04 | 5.46E-04 | 2.43E-04 | 7.30E-05 |
| 55 | 1.45E-03 | 1.15E-03 | 8.32E-04 | 5.24E-04 | 2.46E-04 | 8.00E-05 |
| 362 | 1.51E-03 | 1.17E-03 | 8.17E-04 | 4.98E-04 | 2.33E-04 | 7.12E-05 |
| 180 | 7.53E-04 | 6.19E-04 | 4.61E-04 | 2.99E-04 | 1.52E-04 | 5.01E-05 |
| 270 | 1.39E-03 | 1.12E-03 | 8.55E-04 | 5.72E-04 | 2.96E-04 | 1.04E-04 |
| 627 | 9.49E-04 | 7.58E-04 | 5.66E-04 | 3.69E-04 | 1.82E-04 | 6.19E-05 |
| 2 | 9.17E-04 | 7.74E-04 | 5.94E-04 | 4.03E-04 | 2.11E-04 | 7.86E-05 |
| 3 | 1.23E-03 | 1.02E-03 | 7.64E-04 | 5.11E-04 | 2.60E-04 | 9.60E-05 |
| 074 | 1.76E-03 | 1.42E-03 | 1.07E-03 | 6.88E-04 | 3.40E-04 | 1.20E-04 |
| 15 | 1.54E-03 | 1.25E-03 | 9.32E-04 | 5.99E-04 | 2.87E-04 | 1.01E-04 |
| 22 | 1.59E-03 | 1.28E-03 | 9.55E-04 | 6.13E-04 | 2.89E-04 | 9.87E-05 |
| 39 | 1.46E-03 | 1.15E-03 | 8.26E-04 | 5.02E-04 | 2.19E-04 | 6.69E-05 |
| 280 | 1.57E-03 | 1.26E-03 | 9.22E-04 | 5.80E-04 | 2.71E-04 | 9.37E-05 |
| 167 | 1.12E-03 | 9.21E-04 | 6.96E-04 | 4.62E-04 | 2.38E-04 | 8.41E-05 |
| 282 | 1.73E-03 | 1.41E-03 | 1.08E-03 | 7.31E-04 | 3.84E-04 | 1.44E-04 |
| 739 | 1.28E-03 | 1.05E-03 | 8.21E-04 | 5.63E-04 | 3.00E-04 | 1.14E-04 |
| 4 | 1.12E-03 | 9.96E-04 | 8.04E-04 | 5.85E-04 | 3.38E-04 | 1.43E-04 |
| 5 | 9.75E-04 | 8.61E-04 | 6.87E-04 | 4.96E-04 | 2.77E-04 | 1.14E-04 |
| 097 | 1.75E-03 | 1.44E-03 | 1.11E-03 | 7.46E-04 | 3.90E-04 | 1.47E-04 |
| 020 | 1.78E-03 | 1.47E-03 | 1.12E-03 | 7.27E-04 | 3.50E-04 | 1.28E-04 |
| 034 | 1.46E-03 | 1.21E-03 | 9.39E-04 | 6.23E-04 | 3.12E-04 | 1.18E-04 |
| 19 | 1.32E-03 | 1.12E-03 | 8.69E-04 | 5.76E-04 | 2.87E-04 | 1.04E-04 |
| 24 | 1.05E-03 | 8.62E-04 | 6.46E-04 | 4.16E-04 | 1.93E-04 | 6.54E-05 |
| 48 | 1.45E-03 | 1.19E-03 | 8.83E-04 | 5.59E-04 | 2.59E-04 | 9.17E-05 |
| 361 | 1.71E-03 | 1.42E-03 | 1.09E-03 | 7.23E-04 | 3.84E-04 | 1.44E-04 |
| 363 | 1.54E-03 | 1.27E-03 | 9.80E-04 | 6.59E-04 | 3.56E-04 | 1.39E-04 |
| 107 | 8.64E-04 | 7.00E-04 | 5.25E-04 | 3.42E-04 | 1.73E-04 | 5.99E-05 |
| 241 | 1.23E-03 | 1.01E-03 | 7.79E-04 | 5.34E-04 | 2.84E-04 | 1.07E-04 |
| 73 | 1.91E-03 | 1.62E-03 | 1.32E-03 | 9.40E-04 | 5.38E-04 | 2.24E-04 |
| 232 | 1.52E-03 | 1.30E-03 | 1.07E-03 | 7.75E-04 | 4.56E-04 | 1.94E-04 |
| 694 | 9.62E-04 | 7.80E-04 | 6.01E-04 | 3.97E-04 | 1.98E-04 | 7.19E-05 |
| 6 | 1.16E-03 | 1.04E-03 | 8.62E-04 | 6.35E-04 | 3.78E-04 | 1.65E-04 |
| 7 | 7.48E-04 | 6.68E-04 | 5.54E-04 | 4.15E-04 | 2.45E-04 | 1.04E-04 |
| | | | | | | |
| Max | 1.91E-03 | 1.62E-03 | 1.32E-03 | 9.40E-04 | 5.38E-04 | 2.24E-04 |
| Mean | 1.36E-03 | 1.12E-03 | 8.52E-04 | 5.65E-04 | 2.89E-04 | 1.07E-04 |
| Mean3Sig- | 3.89E-04 | 3.47E-04 | 2.58E-04 | 1.56E-04 | 4.22E-05 | -9.20E-06 |
| Mean3Sig+ | 2.34E-03 | 1.89E-03 | 1.45E-03 | 9.75E-04 | 5.36E-04 | 2.22E-04 |
| Min | 7.48E-04 | 6.19E-04 | 4.61E-04 | 2.99E-04 | 1.52E-04 | 5.01E-05 |
| Sigma | 3.25E-04 | 2.58E-04 | 1.98E-04 | 1.37E-04 | 8.22E-05 | 3.86E-05 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : IC5

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 0.0060694 | 0.0060662 | 0.0060722 | 0.006061 | 0.0060642 | 0.0060668 |
| 179_Ref | 0.0050358 | 0.0050352 | 0.005039 | 0.0050416 | 0.0050354 | 0.005035 |
| 015_Ref | 0.0045488 | 0.0045512 | 0.0045548 | 0.0045516 | 0.0045512 | 0.0045528 |
| 192_Ref | 0.005304 | 0.0052494 | 0.0052648 | 0.0052712 | 0.0052532 | 0.0052526 |
| 743_Ref | 0.0041754 | 0.0041232 | 0.0041396 | 0.0041448 | 0.0041304 | 0.004129 |
| 1_Ref | 0.0034174 | 0.0034276 | 0.0034182 | 0.0034134 | 0.0034238 | 0.0034286 |
| 046 | 6.53E-03 | 5.37E-03 | 4.06E-03 | 2.67E-03 | 1.36E-03 | 4.83E-04 |
| 29 | 5.34E-03 | 4.31E-03 | 3.23E-03 | 2.11E-03 | 1.04E-03 | 3.62E-04 |
| 38 | 5.74E-03 | 4.67E-03 | 3.52E-03 | 2.30E-03 | 1.12E-03 | 3.75E-04 |
| 55 | 5.36E-03 | 4.35E-03 | 3.31E-03 | 2.20E-03 | 1.12E-03 | 4.01E-04 |
| 362 | 5.51E-03 | 4.44E-03 | 3.28E-03 | 2.13E-03 | 1.08E-03 | 3.71E-04 |
| 180 | 2.95E-03 | 2.46E-03 | 1.90E-03 | 1.29E-03 | 6.96E-04 | 2.55E-04 |
| 270 | 5.13E-03 | 4.27E-03 | 3.38E-03 | 2.38E-03 | 1.31E-03 | 4.98E-04 |
| 627 | 3.36E-03 | 2.77E-03 | 2.16E-03 | 1.49E-03 | 7.89E-04 | 2.93E-04 |
| 2 | 3.33E-03 | 2.88E-03 | 2.30E-03 | 1.65E-03 | 9.34E-04 | 3.80E-04 |
| 3 | 4.43E-03 | 3.78E-03 | 2.97E-03 | 2.10E-03 | 1.16E-03 | 4.64E-04 |
| 074 | 6.28E-03 | 5.21E-03 | 4.07E-03 | 2.77E-03 | 1.46E-03 | 5.62E-04 |
| 15 | 5.46E-03 | 4.56E-03 | 3.53E-03 | 2.40E-03 | 1.24E-03 | 4.80E-04 |
| 22 | 5.60E-03 | 4.65E-03 | 3.62E-03 | 2.47E-03 | 1.26E-03 | 4.66E-04 |
| 39 | 5.35E-03 | 4.33E-03 | 3.26E-03 | 2.11E-03 | 9.93E-04 | 3.35E-04 |
| 280 | 5.66E-03 | 4.67E-03 | 3.56E-03 | 2.37E-03 | 1.20E-03 | 4.50E-04 |
| 167 | 3.98E-03 | 3.34E-03 | 2.63E-03 | 1.83E-03 | 1.01E-03 | 3.92E-04 |
| 282 | 6.18E-03 | 5.17E-03 | 4.13E-03 | 2.93E-03 | 1.63E-03 | 6.59E-04 |
| 739 | 4.39E-03 | 3.68E-03 | 3.00E-03 | 2.16E-03 | 1.23E-03 | 5.03E-04 |
| 4 | 4.09E-03 | 3.69E-03 | 3.08E-03 | 2.35E-03 | 1.45E-03 | 6.59E-04 |
| 5 | 3.56E-03 | 3.19E-03 | 2.66E-03 | 2.01E-03 | 1.21E-03 | 5.33E-04 |
| 097 | 6.38E-03 | 5.36E-03 | 4.29E-03 | 3.05E-03 | 1.70E-03 | 7.00E-04 |
| 020 | 6.33E-03 | 5.38E-03 | 4.27E-03 | 2.94E-03 | 1.54E-03 | 6.15E-04 |
| 034 | 5.33E-03 | 4.52E-03 | 3.64E-03 | 2.54E-03 | 1.37E-03 | 5.62E-04 |
| 19 | 4.84E-03 | 4.18E-03 | 3.37E-03 | 2.37E-03 | 1.27E-03 | 5.06E-04 |
| 24 | 3.89E-03 | 3.26E-03 | 2.56E-03 | 1.75E-03 | 8.79E-04 | 3.29E-04 |
| 48 | 5.29E-03 | 4.42E-03 | 3.43E-03 | 2.31E-03 | 1.16E-03 | 4.43E-04 |
| 361 | 6.12E-03 | 5.20E-03 | 4.16E-03 | 2.92E-03 | 1.66E-03 | 6.84E-04 |
| 363 | 5.42E-03 | 4.60E-03 | 3.69E-03 | 2.61E-03 | 1.50E-03 | 6.39E-04 |
| 107 | 3.18E-03 | 2.64E-03 | 2.07E-03 | 1.42E-03 | 7.70E-04 | 6.39E-04 |
| 241 | 4.44E-03 | 3.73E-03 | 3.00E-03 | 2.15E-03 | 1.22E-03 | 5.08E-04 |
| 73 | 6.84E-03 | 5.92E-03 | 4.96E-03 | 3.71E-03 | 2.24E-03 | 1.00E-03 |
| 232 | 5.38E-03 | 4.71E-03 | 3.99E-03 | 3.03E-03 | 1.88E-03 | 8.64E-04 |
| 694 | 3.50E-03 | 2.92E-03 | 2.34E-03 | 1.63E-03 | 8.69E-04 | 3.38E-04 |
| 6 | 4.37E-03 | 3.97E-03 | 3.39E-03 | 2.61E-03 | 1.65E-03 | 7.76E-04 |
| 7 | 2.68E-03 | 2.43E-03 | 2.08E-03 | 1.64E-03 | 1.04E-03 | 4.81E-04 |
| Max | 6.84E-03 | 5.92E-03 | 4.96E-03 | 3.71E-03 | 2.24E-03 | 1.00E-03 |
| Mean | 4.92E-03 | 4.14E-03 | 3.28E-03 | 2.30E-03 | 1.26E-03 | 5.14E-04 |
| Mean3Sig- | 1.53E-03 | 1.37E-03 | 1.08E-03 | 7.12E-04 | 2.63E-04 | 2.13E-05 |
| Mean3Sig+ | 8.31E-03 | 6.92E-03 | 5.48E-03 | 3.88E-03 | 2.25E-03 | 1.01E-03 |
| Min | 2.68E-03 | 2.43E-03 | 1.90E-03 | 1.29E-03 | 6.96E-04 | 2.55E-04 |
| Sigma | 1.13E-03 | 9.24E-04 | 7.33E-04 | 5.29E-04 | 3.32E-04 | 1.64E-04 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : IC10

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 0.013936 | 0.013926 | 0.01395 | 0.013918 | 0.01391 | 0.013926 |
| 179_Ref | 0.011772 | 0.01176 | 0.011772 | 0.011782 | 0.011768 | 0.011772 |
| 015_Ref | 0.010798 | 0.010774 | 0.010788 | 0.01079 | 0.010782 | 0.010782 |
| 192_Ref | 0.012226 | 0.012108 | 0.012156 | 0.012174 | 0.012124 | 0.01212 |
| 743_Ref | 0.0097734 | 0.0096416 | 0.009678 | 0.0096916 | 0.009653 | 0.0096454 |
| 1_Ref | 0.0081466 | 0.0081476 | 0.0081354 | 0.0081248 | 0.0081412 | 0.0081552 |
| 046 | 1.49E-02 | 1.26E-02 | 9.95E-03 | 6.92E-03 | 3.80E-03 | 1.49E-03 |
| 29 | 1.24E-02 | 1.03E-02 | 8.10E-03 | 5.59E-03 | 2.98E-03 | 1.14E-03 |
| 38 | 1.35E-02 | 1.13E-02 | 8.94E-03 | 6.16E-03 | 3.24E-03 | 1.20E-03 |
| 55 | 1.27E-02 | 1.06E-02 | 8.44E-03 | 5.91E-03 | 3.22E-03 | 1.27E-03 |
| 362 | 1.30E-02 | 1.08E-02 | 8.36E-03 | 5.74E-03 | 3.14E-03 | 1.19E-03 |
| 180 | 7.42E-03 | 6.33E-03 | 5.04E-03 | 3.61E-03 | 2.04E-03 | 8.14E-04 |
| 270 | 1.22E-02 | 1.04E-02 | 8.56E-03 | 6.30E-03 | 3.69E-03 | 1.52E-03 |
| 627 | 7.87E-03 | 6.65E-03 | 5.40E-03 | 3.90E-03 | 2.21E-03 | 8.92E-04 |
| 2 | 8.05E-03 | 7.11E-03 | 5.89E-03 | 4.41E-03 | 2.66E-03 | 1.18E-03 |
| 3 | 1.05E-02 | 9.18E-03 | 7.49E-03 | 5.56E-03 | 3.29E-03 | 1.44E-03 |
| 074 | 1.45E-02 | 1.23E-02 | 1.00E-02 | 7.15E-03 | 4.04E-03 | 1.68E-03 |
| 15 | 1.26E-02 | 1.08E-02 | 8.67E-03 | 6.18E-03 | 3.44E-03 | 1.44E-03 |
| 22 | 1.29E-02 | 1.10E-02 | 8.90E-03 | 6.39E-03 | 3.53E-03 | 1.42E-03 |
| 39 | 1.26E-02 | 1.05E-02 | 8.24E-03 | 5.62E-03 | 2.86E-03 | 1.06E-03 |
| 280 | 1.32E-02 | 1.12E-02 | 8.89E-03 | 6.24E-03 | 3.38E-03 | 1.38E-03 |
| 167 | 9.29E-03 | 7.98E-03 | 6.48E-03 | 4.72E-03 | 2.77E-03 | 1.17E-03 |
| 282 | 1.43E-02 | 1.23E-02 | 1.02E-02 | 7.56E-03 | 4.49E-03 | 1.95E-03 |
| 739 | 1.01E-02 | 8.66E-03 | 7.29E-03 | 5.46E-03 | 3.29E-03 | 1.45E-03 |
| 4 | 9.80E-03 | 8.96E-03 | 7.71E-03 | 6.10E-03 | 3.99E-03 | 1.97E-03 |
| 5 | 8.54E-03 | 7.79E-03 | 6.68E-03 | 5.26E-03 | 3.37E-03 | 1.62E-03 |
| 097 | 1.49E-02 | 1.29E-02 | 1.07E-02 | 7.93E-03 | 4.73E-03 | 2.11E-03 |
| 020 | 1.46E-02 | 1.27E-02 | 1.04E-02 | 7.54E-03 | 4.27E-03 | 1.86E-03 |
| 034 | 1.25E-02 | 1.08E-02 | 9.01E-03 | 6.59E-03 | 3.81E-03 | 1.69E-03 |
| 19 | 1.14E-02 | 1.00E-02 | 8.35E-03 | 6.13E-03 | 3.55E-03 | 1.53E-03 |
| 24 | 9.27E-03 | 7.96E-03 | 6.47E-03 | 4.63E-03 | 2.51E-03 | 1.03E-03 |
| 48 | 1.24E-02 | 1.06E-02 | 8.54E-03 | 6.05E-03 | 3.28E-03 | 1.35E-03 |
| 361 | 1.41E-02 | 1.23E-02 | 1.02E-02 | 7.53E-03 | 4.54E-03 | 2.05E-03 |
| 363 | 1.26E-02 | 1.09E-02 | 9.04E-03 | 6.69E-03 | 4.08E-03 | 1.88E-03 |
| 107 | 7.58E-03 | 6.45E-03 | 5.23E-03 | 3.77E-03 | 2.17E-03 | 1.88E-03 |
| 241 | 1.04E-02 | 8.91E-03 | 7.39E-03 | 5.53E-03 | 3.34E-03 | 1.51E-03 |
| 73 | 1.58E-02 | 1.41E-02 | 1.21E-02 | 9.42E-03 | 6.00E-03 | 2.89E-03 |
| 232 | 1.25E-02 | 1.11E-02 | 9.70E-03 | 7.64E-03 | 5.02E-03 | 2.48E-03 |
| 694 | 8.31E-03 | 7.09E-03 | 5.87E-03 | 4.28E-03 | 2.43E-03 | 1.02E-03 |
| 6 | 1.07E-02 | 9.88E-03 | 8.64E-03 | 6.91E-03 | 4.62E-03 | 2.34E-03 |
| 7 | 6.34E-03 | 5.84E-03 | 5.14E-03 | 4.18E-03 | 2.83E-03 | 1.43E-03 |
| Max | 1.58E-02 | 1.41E-02 | 1.21E-02 | 9.42E-03 | 6.00E-03 | 2.89E-03 |
| Mean | 1.15E-02 | 9.95E-03 | 8.17E-03 | 5.99E-03 | 3.50E-03 | 1.55E-03 |
| Mean3Sig- | 3.99E-03 | 3.57E-03 | 2.93E-03 | 2.05E-03 | 9.00E-04 | 1.69E-04 |
| Mean3Sig+ | 1.91E-02 | 1.63E-02 | 1.34E-02 | 9.92E-03 | 6.11E-03 | 2.94E-03 |
| Min | 6.34E-03 | 5.84E-03 | 5.04E-03 | 3.61E-03 | 2.04E-03 | 8.14E-04 |
| Sigma | 2.52E-03 | 2.13E-03 | 1.75E-03 | 1.31E-03 | 8.68E-04 | 4.61E-04 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter :VCESAT

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 0.03204 | 0.03256 | 0.03276 | 0.0324 | 0.03224 | 0.03212 |
| 179_Ref | 0.032 | 0.03244 | 0.03256 | 0.03268 | 0.03248 | 0.03256 |
| 015_Ref | 0.03856 | 0.03844 | 0.03852 | 0.03876 | 0.03844 | 0.03844 |
| 192_Ref | 0.02852 | 0.0288 | 0.02904 | 0.02904 | 0.02908 | 0.02888 |
| 743_Ref | 0.0296 | 0.02952 | 0.02952 | 0.0296 | 0.02916 | 0.02932 |
| 1_Ref | 0.08136 | 0.0802 | 0.08056 | 0.081 | 0.08044 | 0.08008 |
| 046 | 3.14E-02 | 3.46E-02 | 4.11E-02 | 5.15E-02 | 7.09E-02 | 1.01E-01 |
| 29 | 3.29E-02 | 3.66E-02 | 4.42E-02 | 5.55E-02 | 7.64E-02 | 1.09E-01 |
| 38 | 3.36E-02 | 3.68E-02 | 4.36E-02 | 5.43E-02 | 7.44E-02 | 1.07E-01 |
| 55 | 3.73E-02 | 4.08E-02 | 4.70E-02 | 5.71E-02 | 7.58E-02 | 1.07E-01 |
| 362 | 3.51E-02 | 3.82E-02 | 4.53E-02 | 5.56E-02 | 7.41E-02 | 1.05E-01 |
| 180 | 4.38E-02 | 4.74E-02 | 5.48E-02 | 6.61E-02 | 8.63E-02 | 1.21E-01 |
| 270 | 3.08E-02 | 3.26E-02 | 3.67E-02 | 4.30E-02 | 5.70E-02 | 8.63E-02 |
| 627 | 3.52E-02 | 3.76E-02 | 4.28E-02 | 5.15E-02 | 7.00E-02 | 1.05E-01 |
| 2 | 8.33E-02 | 8.38E-02 | 8.88E-02 | 9.65E-02 | 1.11E-01 | 1.37E-01 |
| 3 | 7.35E-02 | 7.48E-02 | 8.00E-02 | 8.74E-02 | 1.02E-01 | 1.27E-01 |
| 074 | 3.50E-02 | 3.78E-02 | 4.34E-02 | 5.23E-02 | 6.94E-02 | 9.86E-02 |
| 15 | 3.56E-02 | 3.90E-02 | 4.56E-02 | 5.62E-02 | 7.53E-02 | 1.05E-01 |
| 22 | 3.40E-02 | 3.70E-02 | 4.31E-02 | 5.30E-02 | 7.15E-02 | 1.01E-01 |
| 39 | 3.54E-02 | 3.92E-02 | 4.62E-02 | 5.79E-02 | 7.92E-02 | 1.12E-01 |
| 280 | 3.11E-02 | 3.45E-02 | 4.14E-02 | 5.26E-02 | 7.25E-02 | 1.03E-01 |
| 167 | 4.21E-02 | 4.56E-02 | 5.15E-02 | 6.12E-02 | 7.88E-02 | 1.09E-01 |
| 282 | 2.83E-02 | 3.03E-02 | 3.48E-02 | 4.19E-02 | 5.67E-02 | 8.40E-02 |
| 739 | 2.74E-02 | 2.95E-02 | 3.38E-02 | 4.03E-02 | 5.45E-02 | 8.30E-02 |
| 4 | 7.59E-02 | 7.57E-02 | 8.01E-02 | 8.60E-02 | 9.79E-02 | 1.19E-01 |
| 5 | 8.87E-02 | 8.81E-02 | 9.24E-02 | 9.82E-02 | 1.10E-01 | 1.31E-01 |
| 097 | 3.15E-02 | 3.42E-02 | 3.94E-02 | 4.71E-02 | 6.11E-02 | 8.63E-02 |
| 020 | 3.20E-02 | 3.46E-02 | 4.07E-02 | 5.07E-02 | 6.90E-02 | 9.69E-02 |
| 034 | 3.43E-02 | 3.70E-02 | 4.30E-02 | 5.29E-02 | 7.08E-02 | 9.84E-02 |
| 19 | 3.45E-02 | 3.67E-02 | 4.25E-02 | 5.22E-02 | 7.00E-02 | 9.88E-02 |
| 24 | 3.78E-02 | 4.12E-02 | 4.83E-02 | 6.01E-02 | 8.04E-02 | 1.12E-01 |
| 48 | 3.27E-02 | 3.60E-02 | 4.28E-02 | 5.45E-02 | 7.44E-02 | 1.06E-01 |
| 361 | 3.35E-02 | 3.63E-02 | 4.20E-02 | 5.14E-02 | 6.66E-02 | 9.25E-02 |
| 363 | 3.20E-02 | 3.57E-02 | 4.20E-02 | 5.20E-02 | 6.85E-02 | 9.53E-02 |
| 107 | 4.40E-02 | 4.75E-02 | 5.43E-02 | 6.55E-02 | 8.42E-02 | 9.53E-02 |
| 241 | 3.77E-02 | 4.08E-02 | 4.64E-02 | 5.48E-02 | 6.97E-02 | 9.78E-02 |
| 73 | 2.76E-02 | 2.96E-02 | 3.29E-02 | 3.89E-02 | 5.01E-02 | 7.36E-02 |
| 232 | 2.85E-02 | 2.99E-02 | 3.26E-02 | 3.78E-02 | 4.84E-02 | 7.09E-02 |
| 694 | 3.05E-02 | 3.40E-02 | 4.01E-02 | 5.11E-02 | 7.18E-02 | 1.07E-01 |
| 6 | 6.82E-02 | 6.87E-02 | 7.22E-02 | 7.80E-02 | 8.84E-02 | 1.09E-01 |
| 7 | 8.61E-02 | 8.57E-02 | 8.93E-02 | 9.51E-02 | 1.06E-01 | 1.27E-01 |
| Max | 8.87E-02 | 8.81E-02 | 9.24E-02 | 9.82E-02 | 1.11E-01 | 1.37E-01 |
| Mean | 4.18E-02 | 4.42E-02 | 4.99E-02 | 5.89E-02 | 7.55E-02 | 1.03E-01 |
| Mean3Sig- | -1.23E-02 | -6.95E-03 | -2.57E-04 | 1.06E-02 | 2.92E-02 | 5.86E-02 |
| Mean3Sig+ | 9.58E-02 | 9.54E-02 | 1.00E-01 | 1.07E-01 | 1.22E-01 | 1.48E-01 |
| Min | 2.74E-02 | 2.95E-02 | 3.26E-02 | 3.78E-02 | 4.84E-02 | 7.09E-02 |
| Sigma | 1.80E-02 | 1.71E-02 | 1.67E-02 | 1.61E-02 | 1.54E-02 | 1.49E-02 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : trise

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 1.9426E-06 | 1.91E-06 | 1.789E-06 | 1.9152E-06 | 1.808E-06 | 1.7912E-06 |
| 179_Ref | | | | | | |
| 015_Ref | | | | | | |
| 192_Ref | | | | | | |
| 743_Ref | | | | | | |
| 1_Ref | | | | | | |
| 046 | | | | | | |
| 29 | 1.96E-06 | 1.77E-06 | 1.70E-06 | 1.56E-06 | 1.88E-06 | 2.49E-06 |
| 38 | 1.68E-06 | 1.58E-06 | 1.59E-06 | 1.56E-06 | 1.63E-06 | 2.05E-06 |
| 55 | 1.67E-06 | 1.53E-06 | 1.60E-06 | 1.42E-06 | 1.60E-06 | 2.11E-06 |
| 362 | | | | | | |
| 180 | | | | | | |
| 270 | | | | | | |
| 627 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 074 | | | | | | |
| 15 | 1.78E-06 | 1.81E-06 | 1.69E-06 | 1.72E-06 | 1.89E-06 | 2.31E-06 |
| 22 | 1.89E-06 | 1.73E-06 | 1.77E-06 | 1.64E-06 | 1.67E-06 | 1.93E-06 |
| 39 | 2.04E-06 | 1.63E-06 | 1.69E-06 | 1.59E-06 | 1.80E-06 | 2.40E-06 |
| 280 | | | | | | |
| 167 | | | | | | |
| 282 | | | | | | |
| 739 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 097 | | | | | | |
| 020 | | | | | | |
| 034 | | | | | | |
| 19 | 1.62E-06 | 1.67E-06 | 1.61E-06 | 1.54E-06 | 1.56E-06 | 2.10E-06 |
| 24 | 1.63E-06 | 1.52E-06 | 1.60E-06 | 1.58E-06 | 1.58E-06 | 1.87E-06 |
| 48 | 1.91E-06 | 1.74E-06 | 1.80E-06 | 1.60E-06 | 1.72E-06 | 2.19E-06 |
| 361 | | | | | | |
| 363 | | | | | | |
| 107 | | | | | | |
| 241 | | | | | | |
| 73 | | | | | | |
| 232 | | | | | | |
| 694 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| Max | 2.04E-06 | 1.81E-06 | 1.80E-06 | 1.72E-06 | 1.89E-06 | 2.49E-06 |
| Mean | 1.80E-06 | 1.66E-06 | 1.67E-06 | 1.58E-06 | 1.70E-06 | 2.16E-06 |
| Mean3Sig- | 1.33E-06 | 1.35E-06 | 1.44E-06 | 1.34E-06 | 1.32E-06 | 1.54E-06 |
| Mean3Sig+ | 2.27E-06 | 1.98E-06 | 1.91E-06 | 1.82E-06 | 2.08E-06 | 2.78E-06 |
| Min | 1.62E-06 | 1.52E-06 | 1.59E-06 | 1.42E-06 | 1.56E-06 | 1.87E-06 |
| Sigma | 1.57E-07 | 1.06E-07 | 7.77E-08 | 8.04E-08 | 1.27E-07 | 2.08E-07 |

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|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Parameter : tfall

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 2.1416E-06 | 2.004E-06 | 1.9883E-06 | 2.0204E-06 | 1.964E-06 | 1.888E-06 |
| 179_Ref | | | | | | |
| 015_Ref | | | | | | |
| 192_Ref | | | | | | |
| 743_Ref | | | | | | |
| 1_Ref | | | | | | |
| 046 | | | | | | |
| 29 | 1.98E-06 | 2.07E-06 | 1.93E-06 | 1.81E-06 | 1.63E-06 | 1.53E-06 |
| 38 | 1.85E-06 | 1.88E-06 | 1.81E-06 | 1.56E-06 | 1.59E-06 | 1.45E-06 |
| 55 | 1.64E-06 | 1.69E-06 | 1.61E-06 | 1.55E-06 | 1.61E-06 | 1.80E-06 |
| 362 | | | | | | |
| 180 | | | | | | |
| 270 | | | | | | |
| 627 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 074 | | | | | | |
| 15 | 2.01E-06 | 1.84E-06 | 2.05E-06 | 1.68E-06 | 1.79E-06 | 2.07E-06 |
| 22 | 1.93E-06 | 1.75E-06 | 1.78E-06 | 1.60E-06 | 1.66E-06 | 1.82E-06 |
| 39 | 1.90E-06 | 1.79E-06 | 1.88E-06 | 1.74E-06 | 1.61E-06 | 2.20E-06 |
| 280 | | | | | | |
| 167 | | | | | | |
| 282 | | | | | | |
| 739 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 097 | | | | | | |
| 020 | | | | | | |
| 034 | | | | | | |
| 19 | 1.84E-06 | 1.77E-06 | 1.88E-06 | 1.49E-06 | 1.72E-06 | 1.54E-06 |
| 24 | 1.68E-06 | 1.53E-06 | 1.78E-06 | 1.70E-06 | 1.38E-06 | 1.66E-06 |
| 48 | 2.02E-06 | 1.89E-06 | 2.04E-06 | 1.67E-06 | 1.75E-06 | 1.65E-06 |
| 361 | | | | | | |
| 363 | | | | | | |
| 107 | | | | | | |
| 241 | | | | | | |
| 73 | | | | | | |
| 232 | | | | | | |
| 694 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| Max | 2.02E-06 | 2.07E-06 | 2.05E-06 | 1.81E-06 | 1.79E-06 | 2.20E-06 |
| Mean | 1.87E-06 | 1.80E-06 | 1.86E-06 | 1.64E-06 | 1.64E-06 | 1.75E-06 |
| Mean3Sig- | 1.46E-06 | 1.35E-06 | 1.45E-06 | 1.34E-06 | 1.28E-06 | 9.87E-07 |
| Mean3Sig+ | 2.28E-06 | 2.25E-06 | 2.28E-06 | 1.95E-06 | 1.99E-06 | 2.51E-06 |
| Min | 1.64E-06 | 1.53E-06 | 1.61E-06 | 1.49E-06 | 1.38E-06 | 1.45E-06 |
| Sigma | 1.36E-07 | 1.49E-07 | 1.38E-07 | 1.02E-07 | 1.19E-07 | 2.53E-07 |

| | | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|--|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 | |
| | | | | Issue : 02 | |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | | |

Parameter : CTR1 degr

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|
| 029_Ref | 100 | 100.601427 | 99.8810737 | 100.771322 | 100.723751 | 100.781515 |
| 179_Ref | 100 | 100.525911 | 100.320677 | 100.042757 | 100.423294 | 100.423294 |
| 015_Ref | 100 | 101.26872 | 100.855764 | 100.218916 | 101.194089 | 101.223941 |
| 192_Ref | 100 | 100.090995 | 99.9208736 | 99.7863586 | 99.8852667 | 99.9683494 |
| 743_Ref | 100 | 100.519861 | 100.499672 | 100.454247 | 100.620805 | 100.656135 |
| 1_Ref | 100 | 103.184592 | 102.574371 | 102.110348 | 103.095601 | 103.464277 |
| 046 | 1.00E+02 | 7.87E+01 | 5.52E+01 | 3.28E+01 | 1.47E+01 | 4.37E+00 |
| 29 | 1.00E+02 | 7.72E+01 | 5.37E+01 | 3.20E+01 | 1.38E+01 | 4.02E+00 |
| 38 | 1.00E+02 | 7.82E+01 | 5.47E+01 | 3.26E+01 | 1.39E+01 | 3.88E+00 |
| 55 | 1.00E+02 | 7.83E+01 | 5.56E+01 | 3.41E+01 | 1.54E+01 | 4.71E+00 |
| 362 | 1.00E+02 | 7.62E+01 | 5.16E+01 | 3.03E+01 | 1.36E+01 | 3.88E+00 |
| 180 | 1.00E+02 | 8.15E+01 | 5.97E+01 | 3.79E+01 | 1.86E+01 | 5.72E+00 |
| 270 | 1.00E+02 | 8.04E+01 | 5.98E+01 | 3.91E+01 | 1.97E+01 | 6.60E+00 |
| 627 | 1.00E+02 | 7.90E+01 | 5.74E+01 | 3.65E+01 | 1.73E+01 | 5.65E+00 |
| 2 | 1.00E+02 | 8.32E+01 | 6.20E+01 | 4.07E+01 | 2.05E+01 | 7.35E+00 |
| 3 | 1.00E+02 | 8.22E+01 | 6.00E+01 | 3.90E+01 | 1.91E+01 | 6.79E+00 |
| 074 | 1.00E+02 | 7.98E+01 | 5.86E+01 | 3.69E+01 | 1.77E+01 | 6.00E+00 |
| 15 | 1.00E+02 | 8.08E+01 | 5.88E+01 | 3.66E+01 | 1.69E+01 | 5.72E+00 |
| 22 | 1.00E+02 | 7.96E+01 | 5.79E+01 | 3.60E+01 | 1.63E+01 | 5.35E+00 |
| 39 | 1.00E+02 | 7.80E+01 | 5.49E+01 | 3.24E+01 | 1.35E+01 | 3.91E+00 |
| 280 | 1.00E+02 | 7.96E+01 | 5.70E+01 | 3.48E+01 | 1.56E+01 | 5.17E+00 |
| 167 | 1.00E+02 | 8.18E+01 | 6.06E+01 | 3.93E+01 | 1.94E+01 | 6.53E+00 |
| 282 | 1.00E+02 | 8.14E+01 | 6.09E+01 | 4.03E+01 | 2.05E+01 | 7.42E+00 |
| 739 | 1.00E+02 | 8.12E+01 | 6.20E+01 | 4.16E+01 | 2.15E+01 | 7.92E+00 |
| 4 | 1.00E+02 | 8.84E+01 | 6.97E+01 | 4.94E+01 | 2.78E+01 | 1.13E+01 |
| 5 | 1.00E+02 | 8.79E+01 | 6.84E+01 | 4.83E+01 | 2.61E+01 | 1.05E+01 |
| 097 | 1.00E+02 | 8.16E+01 | 6.13E+01 | 4.03E+01 | 2.04E+01 | 7.32E+00 |
| 020 | 1.00E+02 | 8.25E+01 | 6.12E+01 | 3.85E+01 | 1.78E+01 | 6.20E+00 |
| 034 | 1.00E+02 | 8.32E+01 | 6.28E+01 | 4.08E+01 | 1.98E+01 | 7.17E+00 |
| 19 | 1.00E+02 | 8.45E+01 | 6.38E+01 | 4.10E+01 | 1.96E+01 | 6.76E+00 |
| 24 | 1.00E+02 | 8.15E+01 | 5.95E+01 | 3.70E+01 | 1.64E+01 | 5.30E+00 |
| 48 | 1.00E+02 | 8.17E+01 | 5.92E+01 | 3.63E+01 | 1.62E+01 | 5.51E+00 |
| 361 | 1.00E+02 | 8.19E+01 | 6.15E+01 | 3.96E+01 | 2.04E+01 | 7.22E+00 |
| 363 | 1.00E+02 | 8.20E+01 | 6.15E+01 | 4.03E+01 | 2.11E+01 | 7.83E+00 |
| 107 | 1.00E+02 | 7.98E+01 | 5.85E+01 | 3.71E+01 | 1.82E+01 | 5.97E+00 |
| 241 | 1.00E+02 | 8.12E+01 | 6.12E+01 | 4.08E+01 | 2.10E+01 | 7.55E+00 |
| 73 | 1.00E+02 | 8.36E+01 | 6.71E+01 | 4.69E+01 | 2.64E+01 | 1.06E+01 |
| 232 | 1.00E+02 | 8.54E+01 | 6.88E+01 | 4.89E+01 | 2.82E+01 | 1.16E+01 |
| 694 | 1.00E+02 | 8.02E+01 | 6.04E+01 | 3.89E+01 | 1.89E+01 | 6.68E+00 |
| 6 | 1.00E+02 | 8.91E+01 | 7.23E+01 | 5.18E+01 | 3.00E+01 | 1.28E+01 |
| 7 | 1.00E+02 | 8.87E+01 | 7.17E+01 | 5.23E+01 | 2.97E+01 | 1.21E+01 |
| | | | | | | |
| Max | 1.00E+02 | 8.91E+01 | 7.23E+01 | 5.23E+01 | 3.00E+01 | 1.28E+01 |
| Mean | 1.00E+02 | 8.17E+01 | 6.08E+01 | 3.95E+01 | 1.96E+01 | 6.95E+00 |
| Mean3Sig- | 1.00E+02 | 7.22E+01 | 4.60E+01 | 2.28E+01 | 5.95E+00 | -2.56E-01 |
| Mean3Sig+ | 1.00E+02 | 9.13E+01 | 7.57E+01 | 5.61E+01 | 3.32E+01 | 1.42E+01 |
| Min | 1.00E+02 | 7.62E+01 | 5.16E+01 | 3.03E+01 | 1.35E+01 | 3.88E+00 |
| Sigma | 0.00E+00 | 3.18E+00 | 4.94E+00 | 5.54E+00 | 4.55E+00 | 2.40E+00 |

| | | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|--|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 | |
| | | | | Issue : 02 | |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | | |

Parameter : CTR2 degr

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 100 | 100.28772 | 100 | 100.310738 | 100.230176 | 100.379791 |
| 179_Ref | 100 | 100.312012 | 100.226918 | 100.198553 | 100.283648 | 100.226918 |
| 015_Ref | 100 | 100.548653 | 100.516379 | 100.129095 | 100.710021 | 100.710021 |
| 192_Ref | 100 | 99.3648273 | 99.4177584 | 99.5236205 | 99.4177584 | 99.3118963 |
| 743_Ref | 100 | 99.4578109 | 99.6611318 | 99.6950186 | 99.5933582 | 99.627245 |
| 1_Ref | 100 | 101.603019 | 101.168338 | 100.829075 | 101.50124 | 101.719641 |
| 046 | 1.00E+02 | 7.97E+01 | 5.74E+01 | 3.54E+01 | 1.66E+01 | 5.27E+00 |
| 29 | 1.00E+02 | 7.81E+01 | 5.58E+01 | 3.43E+01 | 1.55E+01 | 4.85E+00 |
| 38 | 1.00E+02 | 7.89E+01 | 5.67E+01 | 3.48E+01 | 1.55E+01 | 4.66E+00 |
| 55 | 1.00E+02 | 7.90E+01 | 5.73E+01 | 3.61E+01 | 1.69E+01 | 5.50E+00 |
| 362 | 1.00E+02 | 7.76E+01 | 5.42E+01 | 3.30E+01 | 1.55E+01 | 4.73E+00 |
| 180 | 1.00E+02 | 8.21E+01 | 6.12E+01 | 3.97E+01 | 2.01E+01 | 6.66E+00 |
| 270 | 1.00E+02 | 8.10E+01 | 6.16E+01 | 4.12E+01 | 2.13E+01 | 7.46E+00 |
| 627 | 1.00E+02 | 7.99E+01 | 5.97E+01 | 3.89E+01 | 1.91E+01 | 6.53E+00 |
| 2 | 1.00E+02 | 8.44E+01 | 6.47E+01 | 4.39E+01 | 2.30E+01 | 8.57E+00 |
| 3 | 1.00E+02 | 8.31E+01 | 6.23E+01 | 4.17E+01 | 2.12E+01 | 7.83E+00 |
| 074 | 1.00E+02 | 8.07E+01 | 6.05E+01 | 3.90E+01 | 1.93E+01 | 6.81E+00 |
| 15 | 1.00E+02 | 8.15E+01 | 6.06E+01 | 3.89E+01 | 1.86E+01 | 6.59E+00 |
| 22 | 1.00E+02 | 8.06E+01 | 5.99E+01 | 3.85E+01 | 1.81E+01 | 6.20E+00 |
| 39 | 1.00E+02 | 7.87E+01 | 5.66E+01 | 3.44E+01 | 1.50E+01 | 4.59E+00 |
| 280 | 1.00E+02 | 8.04E+01 | 5.87E+01 | 3.69E+01 | 1.73E+01 | 5.96E+00 |
| 167 | 1.00E+02 | 8.23E+01 | 6.22E+01 | 4.13E+01 | 2.12E+01 | 7.51E+00 |
| 282 | 1.00E+02 | 8.18E+01 | 6.26E+01 | 4.23E+01 | 2.22E+01 | 8.33E+00 |
| 739 | 1.00E+02 | 8.18E+01 | 6.41E+01 | 4.40E+01 | 2.34E+01 | 8.93E+00 |
| 4 | 1.00E+02 | 8.89E+01 | 7.17E+01 | 5.22E+01 | 3.02E+01 | 1.27E+01 |
| 5 | 1.00E+02 | 8.83E+01 | 7.05E+01 | 5.08E+01 | 2.84E+01 | 1.17E+01 |
| 097 | 1.00E+02 | 8.20E+01 | 6.31E+01 | 4.25E+01 | 2.23E+01 | 8.37E+00 |
| 020 | 1.00E+02 | 8.30E+01 | 6.33E+01 | 4.09E+01 | 1.97E+01 | 7.20E+00 |
| 034 | 1.00E+02 | 8.32E+01 | 6.44E+01 | 4.27E+01 | 2.14E+01 | 8.06E+00 |
| 19 | 1.00E+02 | 8.49E+01 | 6.58E+01 | 4.36E+01 | 2.17E+01 | 7.86E+00 |
| 24 | 1.00E+02 | 8.21E+01 | 6.15E+01 | 3.96E+01 | 1.83E+01 | 6.23E+00 |
| 48 | 1.00E+02 | 8.20E+01 | 6.09E+01 | 3.86E+01 | 1.79E+01 | 6.33E+00 |
| 361 | 1.00E+02 | 8.27E+01 | 6.35E+01 | 4.22E+01 | 2.24E+01 | 8.38E+00 |
| 363 | 1.00E+02 | 8.28E+01 | 6.37E+01 | 4.28E+01 | 2.31E+01 | 9.01E+00 |
| 107 | 1.00E+02 | 8.10E+01 | 6.07E+01 | 3.96E+01 | 2.00E+01 | 6.94E+00 |
| 241 | 1.00E+02 | 8.20E+01 | 6.32E+01 | 4.33E+01 | 2.30E+01 | 8.69E+00 |
| 73 | 1.00E+02 | 8.46E+01 | 6.88E+01 | 4.92E+01 | 2.82E+01 | 1.17E+01 |
| 232 | 1.00E+02 | 8.59E+01 | 7.05E+01 | 5.11E+01 | 3.01E+01 | 1.28E+01 |
| 694 | 1.00E+02 | 8.11E+01 | 6.24E+01 | 4.12E+01 | 2.06E+01 | 7.47E+00 |
| 6 | 1.00E+02 | 8.96E+01 | 7.42E+01 | 5.46E+01 | 3.25E+01 | 1.42E+01 |
| 7 | 1.00E+02 | 8.93E+01 | 7.40E+01 | 5.55E+01 | 3.27E+01 | 1.38E+01 |
| Max | 1.00E+02 | 8.96E+01 | 7.42E+01 | 5.55E+01 | 3.27E+01 | 1.42E+01 |
| Mean | 1.00E+02 | 8.24E+01 | 6.28E+01 | 4.18E+01 | 2.15E+01 | 7.95E+00 |
| Mean3Sig- | 1.00E+02 | 7.33E+01 | 4.80E+01 | 2.48E+01 | 7.16E+00 | 1.86E-01 |
| Mean3Sig+ | 1.00E+02 | 9.16E+01 | 7.76E+01 | 5.89E+01 | 3.58E+01 | 1.57E+01 |
| Min | 1.00E+02 | 7.76E+01 | 5.42E+01 | 3.30E+01 | 1.50E+01 | 4.59E+00 |
| Sigma | 0.00E+00 | 3.05E+00 | 4.93E+00 | 5.68E+00 | 4.78E+00 | 2.59E+00 |

| | | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|--|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 | |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | | |

Parameter : CTR5 degr

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 100 | 99.9472765 | 100.046133 | 99.8616008 | 99.9143243 | 99.9571622 |
| 179_Ref | 100 | 99.9880853 | 100.063545 | 100.115175 | 99.9920569 | 99.9841137 |
| 015_Ref | 100 | 100.052761 | 100.131903 | 100.061555 | 100.052761 | 100.087935 |
| 192_Ref | 100 | 98.9705882 | 99.2609351 | 99.3815988 | 99.0422323 | 99.0309201 |
| 743_Ref | 100 | 98.7498204 | 99.1425971 | 99.2671361 | 98.9222589 | 98.8887292 |
| 1_Ref | 100 | 100.298473 | 100.02341 | 99.882952 | 100.187277 | 100.327735 |
| 046 | 1.00E+02 | 8.22E+01 | 6.22E+01 | 4.09E+01 | 2.08E+01 | 7.40E+00 |
| 29 | 1.00E+02 | 8.06E+01 | 6.05E+01 | 3.95E+01 | 1.95E+01 | 6.77E+00 |
| 38 | 1.00E+02 | 8.14E+01 | 6.14E+01 | 4.00E+01 | 1.95E+01 | 6.53E+00 |
| 55 | 1.00E+02 | 8.12E+01 | 6.18E+01 | 4.11E+01 | 2.09E+01 | 7.48E+00 |
| 362 | 1.00E+02 | 8.05E+01 | 5.94E+01 | 3.86E+01 | 1.96E+01 | 6.73E+00 |
| 180 | 1.00E+02 | 8.36E+01 | 6.45E+01 | 4.37E+01 | 2.36E+01 | 8.66E+00 |
| 270 | 1.00E+02 | 8.31E+01 | 6.58E+01 | 4.63E+01 | 2.55E+01 | 9.70E+00 |
| 627 | 1.00E+02 | 8.22E+01 | 6.43E+01 | 4.43E+01 | 2.34E+01 | 8.71E+00 |
| 2 | 1.00E+02 | 8.64E+01 | 6.92E+01 | 4.96E+01 | 2.81E+01 | 1.14E+01 |
| 3 | 1.00E+02 | 8.53E+01 | 6.71E+01 | 4.75E+01 | 2.62E+01 | 1.05E+01 |
| 074 | 1.00E+02 | 8.30E+01 | 6.49E+01 | 4.41E+01 | 2.33E+01 | 8.95E+00 |
| 15 | 1.00E+02 | 8.35E+01 | 6.48E+01 | 4.40E+01 | 2.28E+01 | 8.79E+00 |
| 22 | 1.00E+02 | 8.30E+01 | 6.47E+01 | 4.41E+01 | 2.25E+01 | 8.33E+00 |
| 39 | 1.00E+02 | 8.09E+01 | 6.09E+01 | 3.93E+01 | 1.86E+01 | 6.26E+00 |
| 280 | 1.00E+02 | 8.24E+01 | 6.29E+01 | 4.19E+01 | 2.11E+01 | 7.95E+00 |
| 167 | 1.00E+02 | 8.40E+01 | 6.60E+01 | 4.60E+01 | 2.53E+01 | 9.85E+00 |
| 282 | 1.00E+02 | 8.37E+01 | 6.68E+01 | 4.73E+01 | 2.64E+01 | 1.07E+01 |
| 739 | 1.00E+02 | 8.38E+01 | 6.84E+01 | 4.91E+01 | 2.79E+01 | 1.15E+01 |
| 4 | 1.00E+02 | 9.01E+01 | 7.53E+01 | 5.74E+01 | 3.54E+01 | 1.61E+01 |
| 5 | 1.00E+02 | 8.97E+01 | 7.47E+01 | 5.66E+01 | 3.39E+01 | 1.50E+01 |
| 097 | 1.00E+02 | 8.40E+01 | 6.72E+01 | 4.77E+01 | 2.67E+01 | 1.10E+01 |
| 020 | 1.00E+02 | 8.49E+01 | 6.75E+01 | 4.63E+01 | 2.43E+01 | 9.71E+00 |
| 034 | 1.00E+02 | 8.48E+01 | 6.83E+01 | 4.77E+01 | 2.57E+01 | 1.05E+01 |
| 19 | 1.00E+02 | 8.64E+01 | 6.97E+01 | 4.89E+01 | 2.63E+01 | 1.05E+01 |
| 24 | 1.00E+02 | 8.39E+01 | 6.59E+01 | 4.49E+01 | 2.26E+01 | 8.47E+00 |
| 48 | 1.00E+02 | 8.36E+01 | 6.49E+01 | 4.36E+01 | 2.19E+01 | 8.38E+00 |
| 361 | 1.00E+02 | 8.49E+01 | 6.79E+01 | 4.78E+01 | 2.71E+01 | 1.12E+01 |
| 363 | 1.00E+02 | 8.48E+01 | 6.81E+01 | 4.81E+01 | 2.77E+01 | 1.18E+01 |
| 107 | 1.00E+02 | 8.32E+01 | 6.51E+01 | 4.48E+01 | 2.42E+01 | 2.01E+01 |
| 241 | 1.00E+02 | 8.39E+01 | 6.74E+01 | 4.85E+01 | 2.75E+01 | 1.14E+01 |
| 73 | 1.00E+02 | 8.66E+01 | 7.26E+01 | 5.42E+01 | 3.27E+01 | 1.47E+01 |
| 232 | 1.00E+02 | 8.75E+01 | 7.41E+01 | 5.62E+01 | 3.50E+01 | 1.60E+01 |
| 694 | 1.00E+02 | 8.33E+01 | 6.68E+01 | 4.65E+01 | 2.48E+01 | 9.65E+00 |
| 6 | 1.00E+02 | 9.09E+01 | 7.75E+01 | 5.97E+01 | 3.78E+01 | 1.77E+01 |
| 7 | 1.00E+02 | 9.09E+01 | 7.79E+01 | 6.11E+01 | 3.87E+01 | 1.80E+01 |
| Max | 1.00E+02 | 9.09E+01 | 7.79E+01 | 6.11E+01 | 3.87E+01 | 2.01E+01 |
| Mean | 1.00E+02 | 8.44E+01 | 6.70E+01 | 4.71E+01 | 2.59E+01 | 1.08E+01 |
| Mean3Sig- | 1.00E+02 | 7.62E+01 | 5.31E+01 | 2.99E+01 | 1.02E+01 | 2.45E-01 |
| Mean3Sig+ | 1.00E+02 | 9.26E+01 | 8.10E+01 | 6.43E+01 | 4.16E+01 | 2.13E+01 |
| Min | 1.00E+02 | 8.05E+01 | 5.94E+01 | 3.86E+01 | 1.86E+01 | 6.26E+00 |
| Sigma | 0.00E+00 | 2.74E+00 | 4.64E+00 | 5.73E+00 | 5.23E+00 | 3.50E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

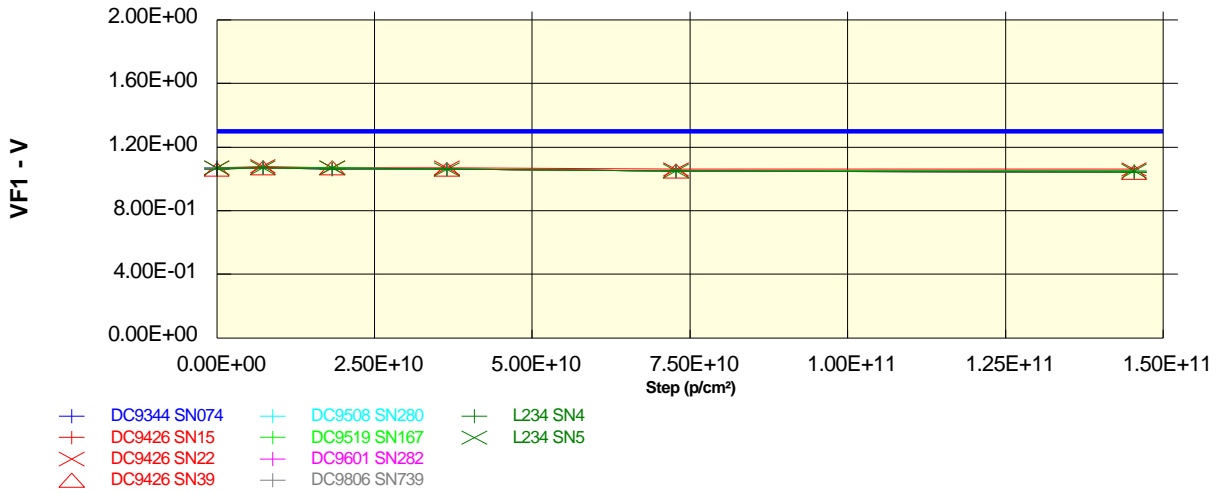
Parameter : CTR10 degr

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 029_Ref | 100 | 99.9282434 | 100.100459 | 99.8708381 | 99.8134328 | 99.9282434 |
| 179_Ref | 100 | 99.8980632 | 100 | 100.084947 | 99.9660211 | 100 |
| 015_Ref | 100 | 99.7777366 | 99.9073903 | 99.9259122 | 99.8518244 | 99.8518244 |
| 192_Ref | 100 | 99.0348438 | 99.4274497 | 99.5746769 | 99.1657124 | 99.1329953 |
| 743_Ref | 100 | 98.6514417 | 99.0238811 | 99.1630344 | 98.7680848 | 98.6903227 |
| 1_Ref | 100 | 100.012275 | 99.8625193 | 99.7324037 | 99.9337147 | 100.105566 |
| 046 | 1.00E+02 | 8.47E+01 | 6.69E+01 | 4.66E+01 | 2.55E+01 | 1.00E+01 |
| 29 | 1.00E+02 | 8.32E+01 | 6.52E+01 | 4.50E+01 | 2.40E+01 | 9.16E+00 |
| 38 | 1.00E+02 | 8.38E+01 | 6.60E+01 | 4.55E+01 | 2.40E+01 | 8.88E+00 |
| 55 | 1.00E+02 | 8.35E+01 | 6.62E+01 | 4.64E+01 | 2.53E+01 | 9.93E+00 |
| 362 | 1.00E+02 | 8.34E+01 | 6.46E+01 | 4.43E+01 | 2.42E+01 | 9.19E+00 |
| 180 | 1.00E+02 | 8.53E+01 | 6.80E+01 | 4.86E+01 | 2.74E+01 | 1.10E+01 |
| 270 | 1.00E+02 | 8.56E+01 | 7.02E+01 | 5.17E+01 | 3.03E+01 | 1.25E+01 |
| 627 | 1.00E+02 | 8.46E+01 | 6.86E+01 | 4.96E+01 | 2.81E+01 | 1.13E+01 |
| 2 | 1.00E+02 | 8.84E+01 | 7.31E+01 | 5.48E+01 | 3.31E+01 | 1.47E+01 |
| 3 | 1.00E+02 | 8.75E+01 | 7.15E+01 | 5.30E+01 | 3.14E+01 | 1.37E+01 |
| 074 | 1.00E+02 | 8.53E+01 | 6.92E+01 | 4.94E+01 | 2.79E+01 | 1.16E+01 |
| 15 | 1.00E+02 | 8.56E+01 | 6.89E+01 | 4.91E+01 | 2.73E+01 | 1.14E+01 |
| 22 | 1.00E+02 | 8.53E+01 | 6.92E+01 | 4.97E+01 | 2.74E+01 | 1.10E+01 |
| 39 | 1.00E+02 | 8.33E+01 | 6.53E+01 | 4.45E+01 | 2.27E+01 | 8.38E+00 |
| 280 | 1.00E+02 | 8.46E+01 | 6.71E+01 | 4.71E+01 | 2.55E+01 | 1.04E+01 |
| 167 | 1.00E+02 | 8.59E+01 | 6.97E+01 | 5.09E+01 | 2.98E+01 | 1.26E+01 |
| 282 | 1.00E+02 | 8.60E+01 | 7.11E+01 | 5.27E+01 | 3.13E+01 | 1.36E+01 |
| 739 | 1.00E+02 | 8.60E+01 | 7.24E+01 | 5.42E+01 | 3.27E+01 | 1.44E+01 |
| 4 | 1.00E+02 | 9.15E+01 | 7.86E+01 | 6.23E+01 | 4.07E+01 | 2.01E+01 |
| 5 | 1.00E+02 | 9.12E+01 | 7.82E+01 | 6.16E+01 | 3.94E+01 | 1.89E+01 |
| 097 | 1.00E+02 | 8.62E+01 | 7.13E+01 | 5.31E+01 | 3.16E+01 | 1.41E+01 |
| 020 | 1.00E+02 | 8.70E+01 | 7.15E+01 | 5.18E+01 | 2.93E+01 | 1.27E+01 |
| 034 | 1.00E+02 | 8.66E+01 | 7.21E+01 | 5.28E+01 | 3.05E+01 | 1.36E+01 |
| 19 | 1.00E+02 | 8.81E+01 | 7.35E+01 | 5.40E+01 | 3.12E+01 | 1.35E+01 |
| 24 | 1.00E+02 | 8.59E+01 | 6.98E+01 | 5.00E+01 | 2.71E+01 | 1.11E+01 |
| 48 | 1.00E+02 | 8.56E+01 | 6.90E+01 | 4.89E+01 | 2.65E+01 | 1.09E+01 |
| 361 | 1.00E+02 | 8.69E+01 | 7.19E+01 | 5.32E+01 | 3.21E+01 | 1.45E+01 |
| 363 | 1.00E+02 | 8.68E+01 | 7.20E+01 | 5.33E+01 | 3.25E+01 | 1.50E+01 |
| 107 | 1.00E+02 | 8.51E+01 | 6.90E+01 | 4.98E+01 | 2.87E+01 | 2.48E+01 |
| 241 | 1.00E+02 | 8.60E+01 | 7.14E+01 | 5.34E+01 | 3.22E+01 | 1.45E+01 |
| 73 | 1.00E+02 | 8.88E+01 | 7.63E+01 | 5.95E+01 | 3.79E+01 | 1.83E+01 |
| 232 | 1.00E+02 | 8.92E+01 | 7.77E+01 | 6.12E+01 | 4.02E+01 | 1.98E+01 |
| 694 | 1.00E+02 | 8.54E+01 | 7.06E+01 | 5.15E+01 | 2.93E+01 | 1.23E+01 |
| 6 | 1.00E+02 | 9.22E+01 | 8.06E+01 | 6.45E+01 | 4.31E+01 | 2.18E+01 |
| 7 | 1.00E+02 | 9.22E+01 | 8.11E+01 | 6.60E+01 | 4.46E+01 | 2.26E+01 |
| Max | 1.00E+02 | 9.22E+01 | 8.11E+01 | 6.60E+01 | 4.46E+01 | 2.48E+01 |
| Mean | 1.00E+02 | 8.65E+01 | 7.11E+01 | 5.23E+01 | 3.07E+01 | 1.38E+01 |
| Mean3Sig- | 1.00E+02 | 7.92E+01 | 5.83E+01 | 3.55E+01 | 1.40E+01 | 1.38E+00 |
| Mean3Sig+ | 1.00E+02 | 9.38E+01 | 8.39E+01 | 6.91E+01 | 4.74E+01 | 2.62E+01 |
| Min | 1.00E+02 | 8.32E+01 | 6.46E+01 | 4.43E+01 | 2.27E+01 | 8.38E+00 |
| Sigma | 0.00E+00 | 2.43E+00 | 4.26E+00 | 5.59E+00 | 5.56E+00 | 4.13E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Forward Voltage 1 : VF1
IF=2.0mA

Unit : V
Spec Limit Max : 1.30 E+00
Spec limits are represented in bold lines on the graphic.



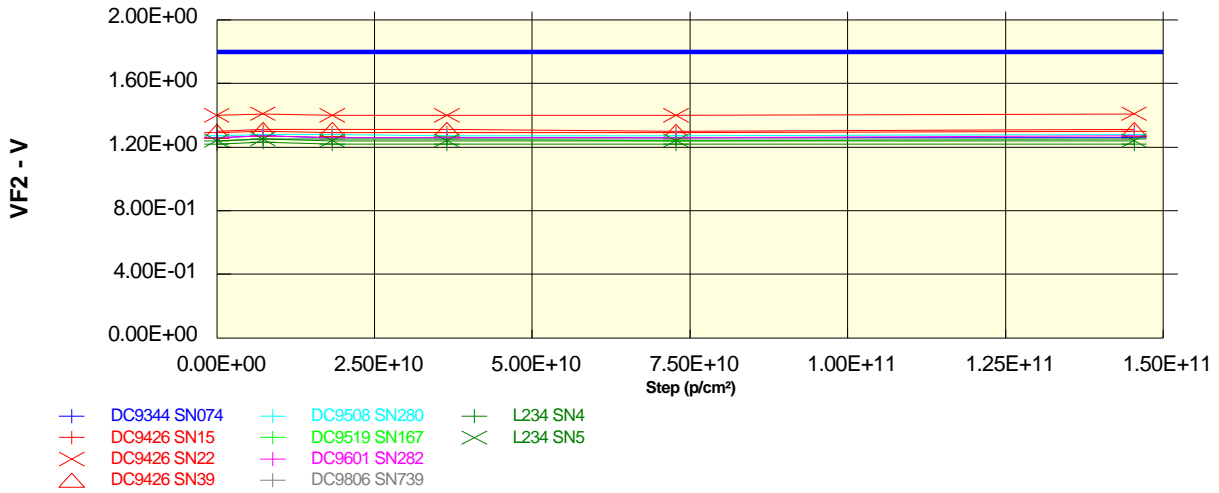
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 15 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 22 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 |
| 39 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 280 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 167 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 282 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 739 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 4 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 5 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Forward Voltage 2 : VF2
IF=50mA

Unit : V
Spec Limit Max : 1.80 E+00
Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 15 | 1.29 E+00 | 1.30 E+00 | 1.29 E+00 | 1.29 E+00 | 1.29 E+00 | 1.30 E+00 |
| 22 | 1.40 E+00 | 1.41 E+00 | 1.40 E+00 | 1.40 E+00 | 1.40 E+00 | 1.41 E+00 |
| 39 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.30 E+00 | 1.31 E+00 |
| 280 | 1.27 E+00 | 1.28 E+00 | 1.28 E+00 | 1.27 E+00 | 1.27 E+00 | 1.28 E+00 |
| 167 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.25 E+00 |
| 282 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.27 E+00 |
| 739 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |
| 4 | 1.22 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 |
| 5 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |

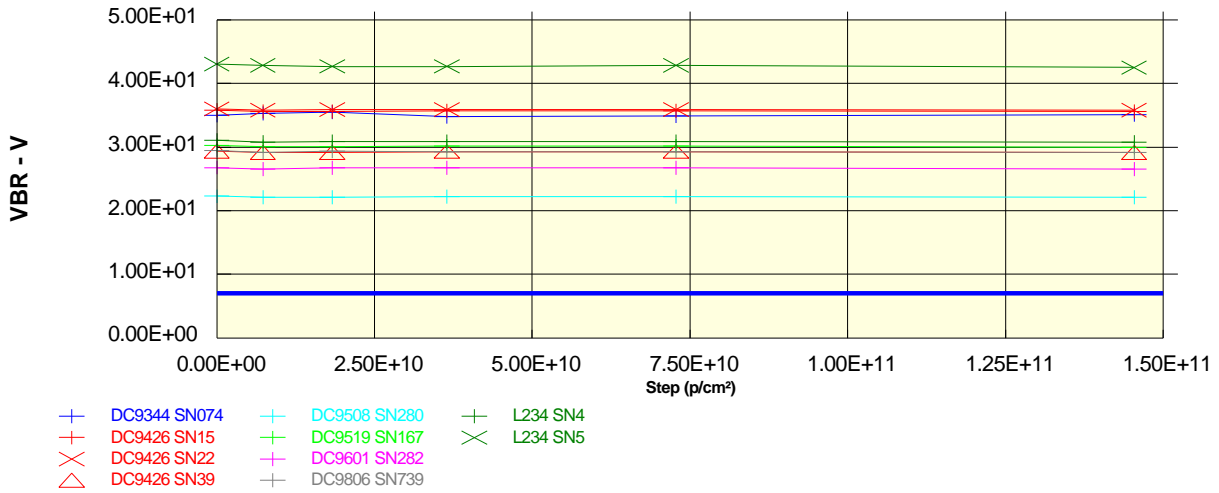
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Breakdown Voltage : VBR
IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

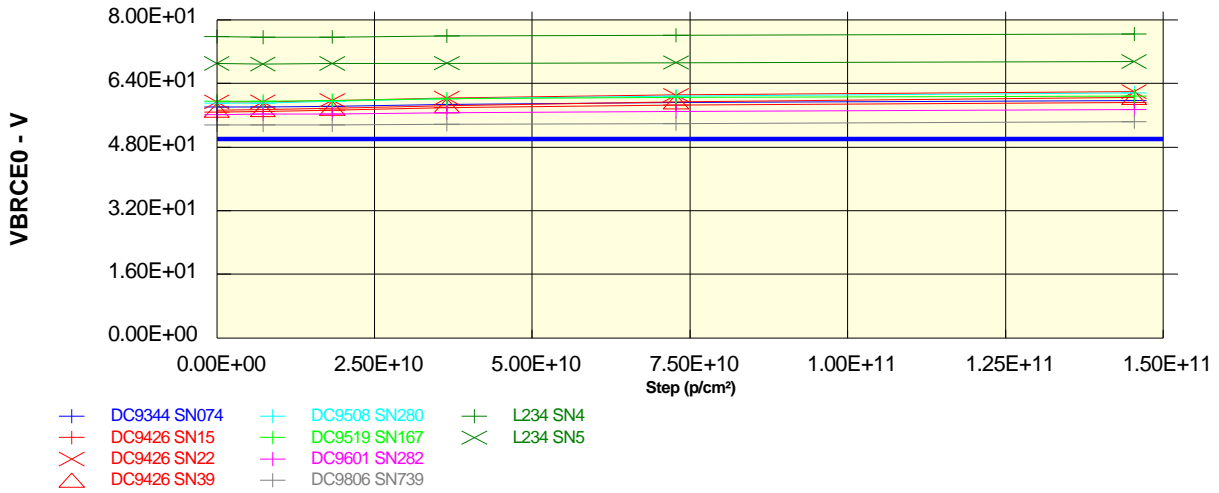


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 3.50 E+01 | 3.53 E+01 | 3.55 E+01 | 3.48 E+01 | 3.49 E+01 | 3.51 E+01 |
| 15 | 3.58 E+01 | 3.56 E+01 | 3.56 E+01 | 3.57 E+01 | 3.57 E+01 | 3.56 E+01 |
| 22 | 3.60 E+01 | 3.58 E+01 | 3.59 E+01 | 3.59 E+01 | 3.59 E+01 | 3.58 E+01 |
| 39 | 2.94 E+01 | 2.92 E+01 | 2.92 E+01 | 2.93 E+01 | 2.93 E+01 | 2.92 E+01 |
| 280 | 2.23 E+01 | 2.21 E+01 | 2.21 E+01 | 2.22 E+01 | 2.22 E+01 | 2.21 E+01 |
| 167 | 3.03 E+01 | 3.01 E+01 | 3.01 E+01 | 3.02 E+01 | 3.02 E+01 | 3.00 E+01 |
| 282 | 2.68 E+01 | 2.66 E+01 | 2.67 E+01 | 2.67 E+01 | 2.67 E+01 | 2.66 E+01 |
| 739 | 2.95 E+01 | 2.92 E+01 | 2.94 E+01 | 2.93 E+01 | 2.93 E+01 | 2.92 E+01 |
| 4 | 3.11 E+01 | 3.08 E+01 | 3.09 E+01 | 3.09 E+01 | 3.09 E+01 | 3.08 E+01 |
| 5 | 4.30 E+01 | 4.28 E+01 | 4.27 E+01 | 4.27 E+01 | 4.28 E+01 | 4.25 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 5.80 E+01 | 5.81 E+01 | 5.83 E+01 | 5.87 E+01 | 5.92 E+01 | 5.98 E+01 |
| 15 | 5.68 E+01 | 5.70 E+01 | 5.73 E+01 | 5.79 E+01 | 5.86 E+01 | 5.92 E+01 |
| 22 | 5.93 E+01 | 5.94 E+01 | 5.98 E+01 | 6.03 E+01 | 6.11 E+01 | 6.20 E+01 |
| 39 | 5.73 E+01 | 5.74 E+01 | 5.78 E+01 | 5.84 E+01 | 5.94 E+01 | 6.04 E+01 |
| 280 | 5.90 E+01 | 5.91 E+01 | 5.95 E+01 | 6.01 E+01 | 6.09 E+01 | 6.16 E+01 |
| 167 | 5.96 E+01 | 5.96 E+01 | 5.98 E+01 | 6.01 E+01 | 6.05 E+01 | 6.09 E+01 |
| 282 | 5.62 E+01 | 5.63 E+01 | 5.64 E+01 | 5.66 E+01 | 5.69 E+01 | 5.74 E+01 |
| 739 | 5.35 E+01 | 5.35 E+01 | 5.36 E+01 | 5.37 E+01 | 5.39 E+01 | 5.43 E+01 |
| 4 | 7.58 E+01 | 7.56 E+01 | 7.57 E+01 | 7.59 E+01 | 7.61 E+01 | 7.64 E+01 |
| 5 | 6.90 E+01 | 6.89 E+01 | 6.90 E+01 | 6.91 E+01 | 6.93 E+01 | 6.95 E+01 |

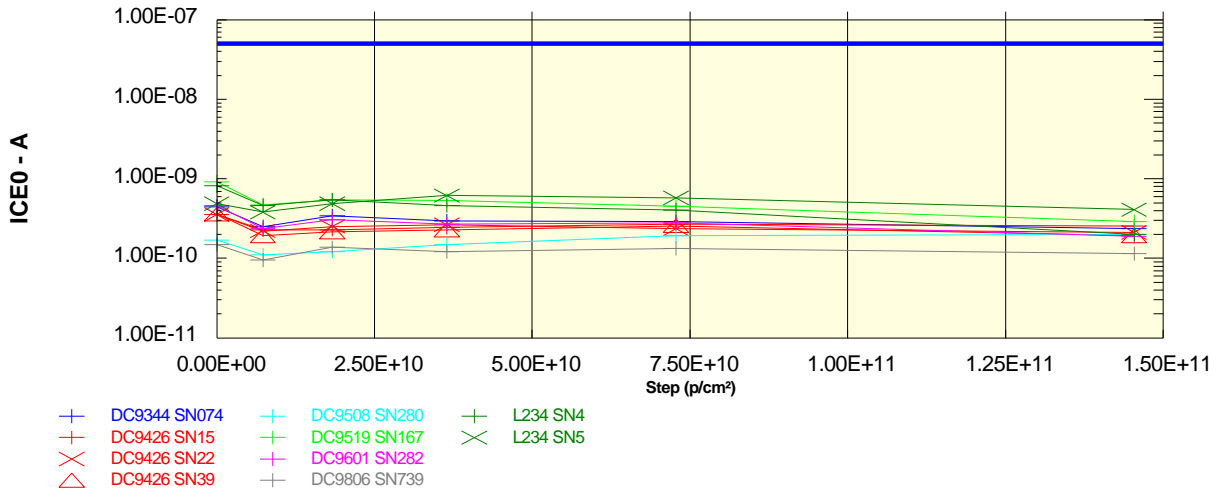
| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A

Spec Limit Max : 5.00 E-08

Spec limits are represented in bold lines on the graphic.

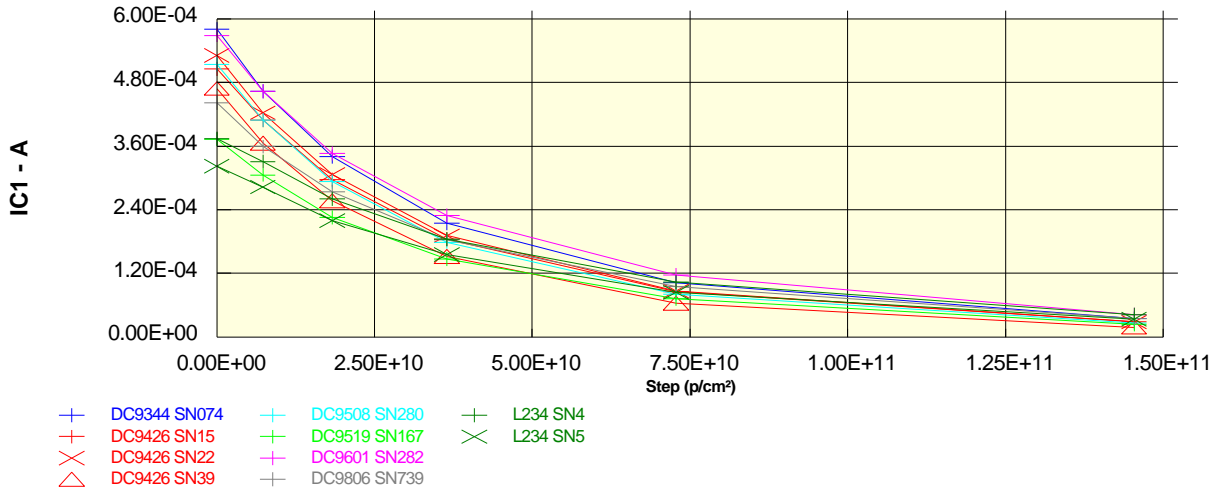


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 4.44 E-10 | 2.52 E-10 | 3.46 E-10 | 2.95 E-10 | 2.91 E-10 | 2.37 E-10 |
| 15 | 3.57 E-10 | 2.27 E-10 | 2.30 E-10 | 2.47 E-10 | 2.67 E-10 | 2.54 E-10 |
| 22 | 3.59 E-10 | 2.22 E-10 | 2.53 E-10 | 2.66 E-10 | 2.37 E-10 | 2.13 E-10 |
| 39 | 3.60 E-10 | 1.93 E-10 | 2.15 E-10 | 2.29 E-10 | 2.58 E-10 | 1.93 E-10 |
| 280 | 1.70 E-10 | 1.11 E-10 | 1.23 E-10 | 1.50 E-10 | 1.93 E-10 | 2.01 E-10 |
| 167 | 9.23 E-10 | 4.68 E-10 | 5.43 E-10 | 5.32 E-10 | 4.57 E-10 | 2.93 E-10 |
| 282 | 4.66 E-10 | 2.35 E-10 | 3.09 E-10 | 2.70 E-10 | 2.78 E-10 | 1.88 E-10 |
| 739 | 1.48 E-10 | 9.61 E-11 | 1.37 E-10 | 1.22 E-10 | 1.34 E-10 | 1.16 E-10 |
| 4 | 8.15 E-10 | 4.64 E-10 | 5.47 E-10 | 4.63 E-10 | 4.06 E-10 | 2.01 E-10 |
| 5 | 4.92 E-10 | 3.80 E-10 | 4.92 E-10 | 6.17 E-10 | 5.76 E-10 | 4.10 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
 Parameter : Output Current1 : IC1
 VCE=5.0V. IF=1mA
 Unit : A
 No spec limit specified.

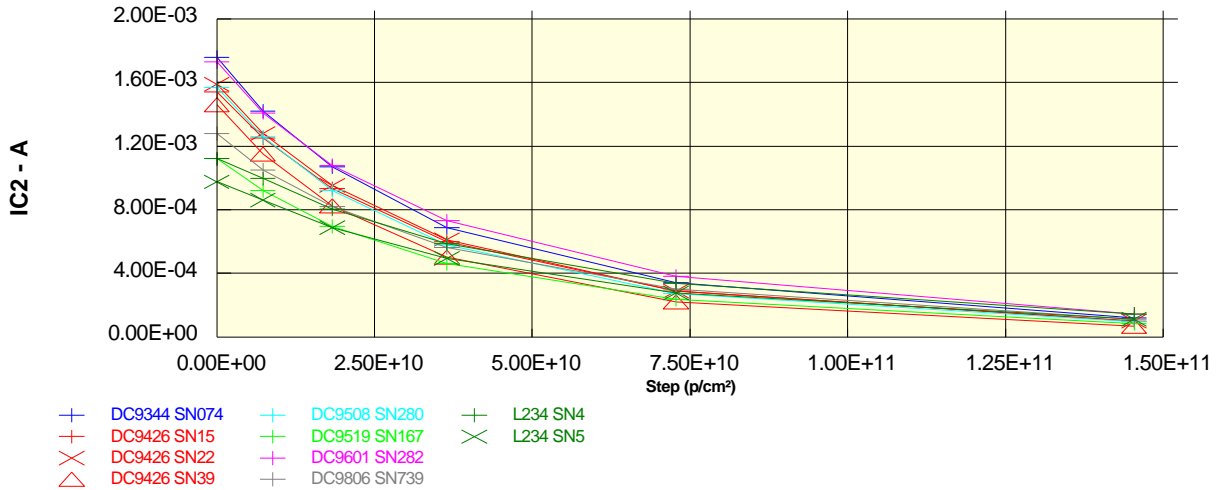


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 5.81 E-04 | 4.63 E-04 | 3.40 E-04 | 2.15 E-04 | 1.03 E-04 | 3.48 E-05 |
| 15 | 5.06 E-04 | 4.09 E-04 | 2.97 E-04 | 1.85 E-04 | 8.55 E-05 | 2.89 E-05 |
| 22 | 5.31 E-04 | 4.23 E-04 | 3.07 E-04 | 1.91 E-04 | 8.65 E-05 | 2.84 E-05 |
| 39 | 4.69 E-04 | 3.66 E-04 | 2.57 E-04 | 1.52 E-04 | 6.36 E-05 | 1.83 E-05 |
| 280 | 5.14 E-04 | 4.09 E-04 | 2.93 E-04 | 1.79 E-04 | 8.04 E-05 | 2.66 E-05 |
| 167 | 3.73 E-04 | 3.06 E-04 | 2.26 E-04 | 1.47 E-04 | 7.26 E-05 | 2.44 E-05 |
| 282 | 5.69 E-04 | 4.63 E-04 | 3.46 E-04 | 2.29 E-04 | 1.17 E-04 | 4.22 E-05 |
| 739 | 4.42 E-04 | 3.59 E-04 | 2.74 E-04 | 1.84 E-04 | 9.51 E-05 | 3.50 E-05 |
| 4 | 3.74 E-04 | 3.31 E-04 | 2.61 E-04 | 1.85 E-04 | 1.04 E-04 | 4.25 E-05 |
| 5 | 3.22 E-04 | 2.83 E-04 | 2.20 E-04 | 1.55 E-04 | 8.40 E-05 | 3.38 E-05 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

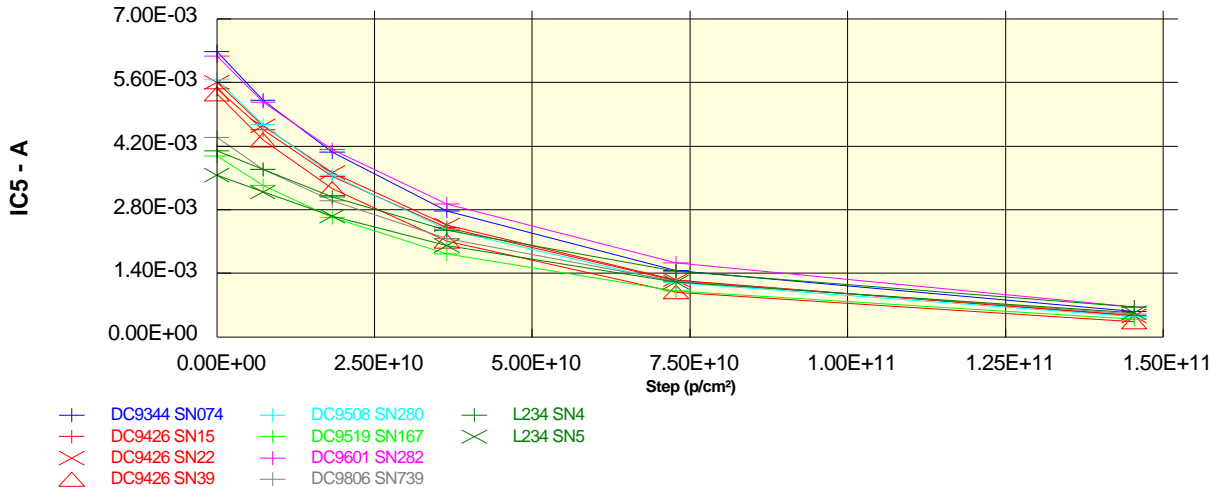


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 1.76 E-03 | 1.42 E-03 | 1.07 E-03 | 6.88 E-04 | 3.40 E-04 | 1.20 E-04 |
| 15 | 1.54 E-03 | 1.25 E-03 | 9.32 E-04 | 5.99 E-04 | 2.87 E-04 | 1.01 E-04 |
| 22 | 1.59 E-03 | 1.28 E-03 | 9.55 E-04 | 6.13 E-04 | 2.89 E-04 | 9.87 E-05 |
| 39 | 1.46 E-03 | 1.15 E-03 | 8.26 E-04 | 5.02 E-04 | 2.19 E-04 | 6.69 E-05 |
| 280 | 1.57 E-03 | 1.26 E-03 | 9.22 E-04 | 5.80 E-04 | 2.71 E-04 | 9.37 E-05 |
| 167 | 1.12 E-03 | 9.21 E-04 | 6.96 E-04 | 4.62 E-04 | 2.38 E-04 | 8.41 E-05 |
| 282 | 1.73 E-03 | 1.41 E-03 | 1.08 E-03 | 7.31 E-04 | 3.84 E-04 | 1.44 E-04 |
| 739 | 1.28 E-03 | 1.05 E-03 | 8.21 E-04 | 5.63 E-04 | 3.00 E-04 | 1.14 E-04 |
| 4 | 1.12 E-03 | 9.96 E-04 | 8.04 E-04 | 5.85 E-04 | 3.38 E-04 | 1.43 E-04 |
| 5 | 9.75 E-04 | 8.61 E-04 | 6.87 E-04 | 4.96 E-04 | 2.77 E-04 | 1.14 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
 Parameter : Output Current5 : IC5
 VCE=5.0V. IF=5mA
 Unit : A
 No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 6.28 E-03 | 5.21 E-03 | 4.07 E-03 | 2.77 E-03 | 1.46 E-03 | 5.62 E-04 |
| 15 | 5.46 E-03 | 4.56 E-03 | 3.53 E-03 | 2.40 E-03 | 1.24 E-03 | 4.80 E-04 |
| 22 | 5.60 E-03 | 4.65 E-03 | 3.62 E-03 | 2.47 E-03 | 1.26 E-03 | 4.66 E-04 |
| 39 | 5.35 E-03 | 4.33 E-03 | 3.26 E-03 | 2.11 E-03 | 9.93 E-04 | 3.35 E-04 |
| 280 | 5.66 E-03 | 4.67 E-03 | 3.56 E-03 | 2.37 E-03 | 1.20 E-03 | 4.50 E-04 |
| 167 | 3.98 E-03 | 3.34 E-03 | 2.63 E-03 | 1.83 E-03 | 1.01 E-03 | 3.92 E-04 |
| 282 | 6.18 E-03 | 5.17 E-03 | 4.13 E-03 | 2.93 E-03 | 1.63 E-03 | 6.59 E-04 |
| 739 | 4.39 E-03 | 3.68 E-03 | 3.00 E-03 | 2.16 E-03 | 1.23 E-03 | 5.03 E-04 |
| 4 | 4.09 E-03 | 3.69 E-03 | 3.08 E-03 | 2.35 E-03 | 1.45 E-03 | 6.59 E-04 |
| 5 | 3.56 E-03 | 3.19 E-03 | 2.66 E-03 | 2.01 E-03 | 1.21 E-03 | 5.33 E-04 |

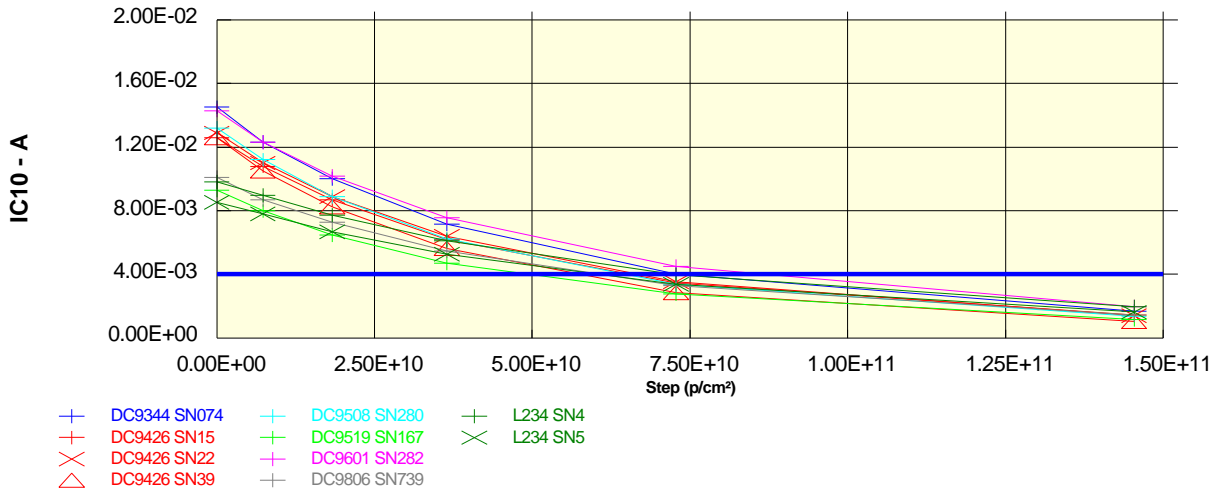
| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Output Current10 : IC10
VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 1.45 E-02 | 1.23 E-02 | 1.00 E-02 | 7.15 E-03 | 4.04 E-03 | 1.68 E-03 |
| 15 | 1.26 E-02 | 1.08 E-02 | 8.67 E-03 | 6.18 E-03 | 3.44 E-03 | 1.44 E-03 |
| 22 | 1.29 E-02 | 1.10 E-02 | 8.90 E-03 | 6.39 E-03 | 3.53 E-03 | 1.42 E-03 |
| 39 | 1.26 E-02 | 1.05 E-02 | 8.24 E-03 | 5.62 E-03 | 2.86 E-03 | 1.06 E-03 |
| 280 | 1.32 E-02 | 1.12 E-02 | 8.89 E-03 | 6.24 E-03 | 3.38 E-03 | 1.38 E-03 |
| 167 | 9.29 E-03 | 7.98 E-03 | 6.48 E-03 | 4.72 E-03 | 2.77 E-03 | 1.17 E-03 |
| 282 | 1.43 E-02 | 1.23 E-02 | 1.02 E-02 | 7.56 E-03 | 4.49 E-03 | 1.95 E-03 |
| 739 | 1.01 E-02 | 8.66 E-03 | 7.29 E-03 | 5.46 E-03 | 3.29 E-03 | 1.45 E-03 |
| 4 | 9.80 E-03 | 8.96 E-03 | 7.71 E-03 | 6.10 E-03 | 3.99 E-03 | 1.97 E-03 |
| 5 | 8.54 E-03 | 7.79 E-03 | 6.68 E-03 | 5.26 E-03 | 3.37 E-03 | 1.62 E-03 |

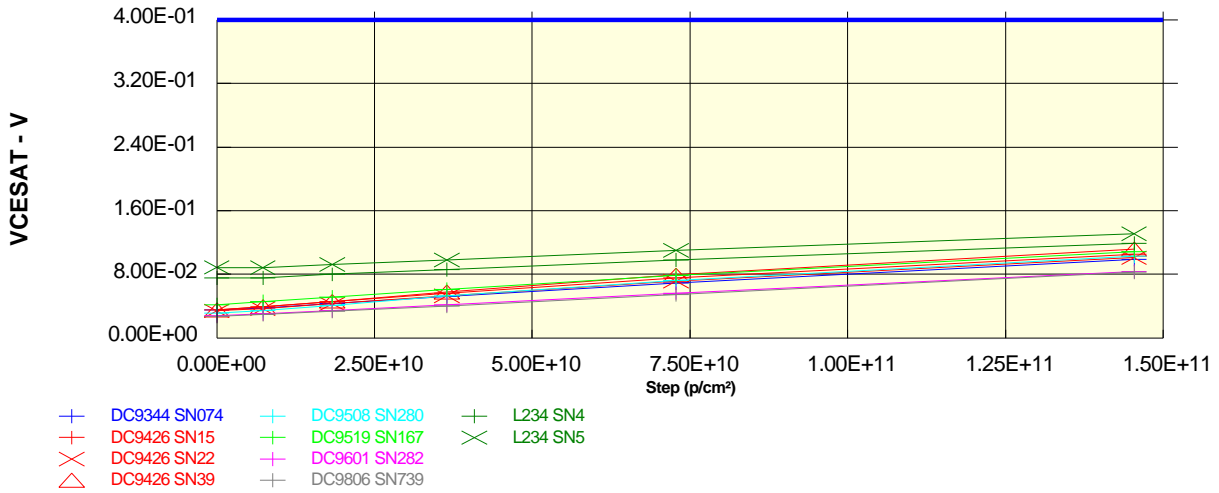
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Collector Emitter Saturation Voltage : VCESAT
IC=2mA. IF=50mA

Unit : V

Spec Limit Max : 4.00 E-01

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 3.50 E-02 | 3.78 E-02 | 4.34 E-02 | 5.23 E-02 | 6.94 E-02 | 9.86 E-02 |
| 15 | 3.56 E-02 | 3.90 E-02 | 4.56 E-02 | 5.62 E-02 | 7.53 E-02 | 1.05 E-01 |
| 22 | 3.40 E-02 | 3.70 E-02 | 4.31 E-02 | 5.30 E-02 | 7.15 E-02 | 1.01 E-01 |
| 39 | 3.54 E-02 | 3.92 E-02 | 4.62 E-02 | 5.79 E-02 | 7.92 E-02 | 1.12 E-01 |
| 280 | 3.11 E-02 | 3.45 E-02 | 4.14 E-02 | 5.26 E-02 | 7.25 E-02 | 1.03 E-01 |
| 167 | 4.21 E-02 | 4.56 E-02 | 5.15 E-02 | 6.12 E-02 | 7.88 E-02 | 1.09 E-01 |
| 282 | 2.83 E-02 | 3.03 E-02 | 3.48 E-02 | 4.19 E-02 | 5.67 E-02 | 8.40 E-02 |
| 739 | 2.74 E-02 | 2.95 E-02 | 3.38 E-02 | 4.03 E-02 | 5.45 E-02 | 8.30 E-02 |
| 4 | 7.59 E-02 | 7.57 E-02 | 8.01 E-02 | 8.60 E-02 | 9.79 E-02 | 1.19 E-01 |
| 5 | 8.87 E-02 | 8.81 E-02 | 9.24 E-02 | 9.82 E-02 | 1.10 E-01 | 1.31 E-01 |

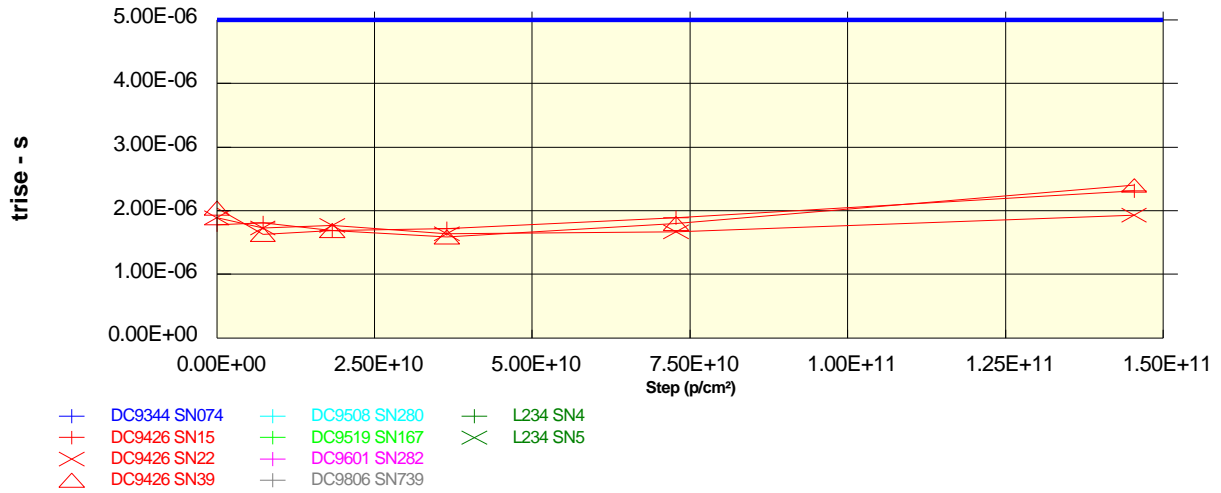
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Rise Time : trise
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

Spec limits are represented in bold lines on the graphic.



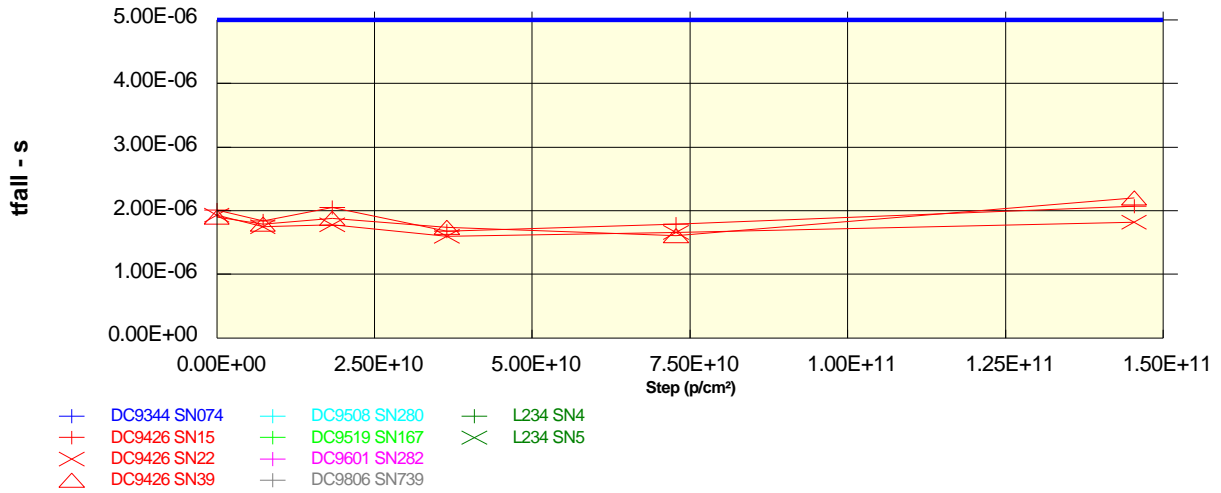
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : Fall Time : t_{fall}
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

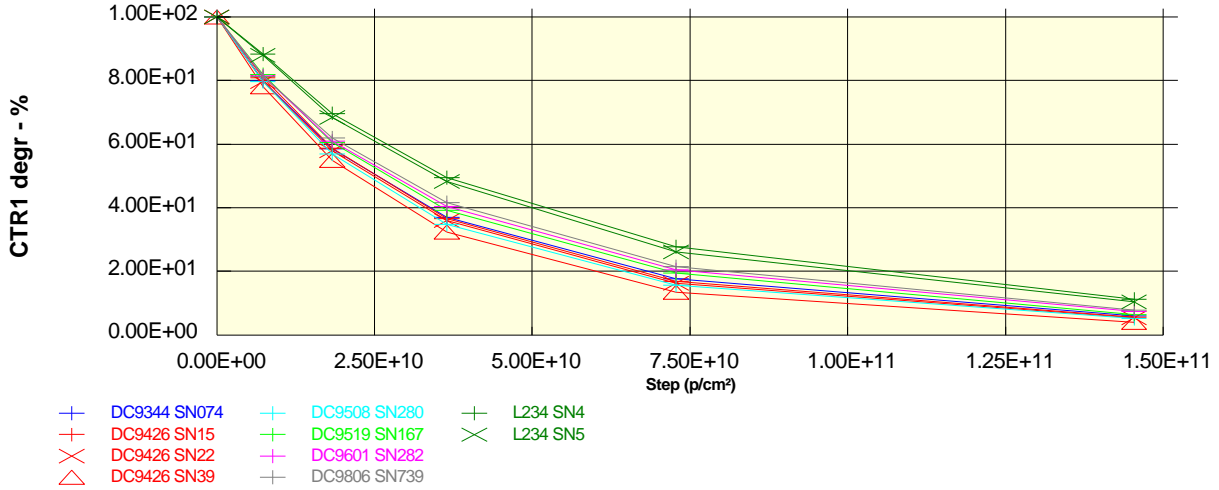
Spec limits are represented in bold lines on the graphic.



| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : CTR1 degr

Unit : %
No spec limit specified.



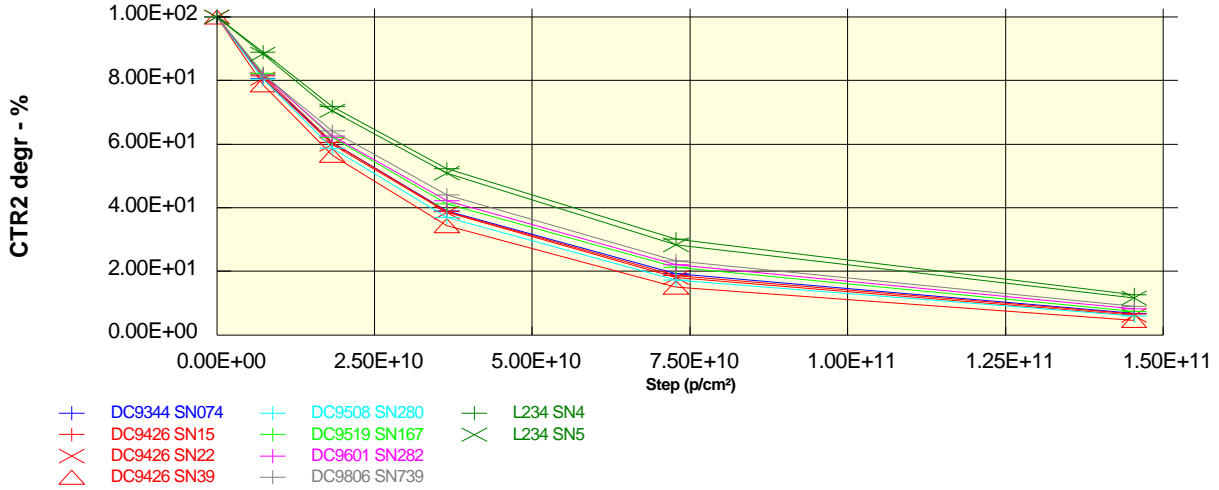
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 1.00 E+02 | 7.98 E+01 | 5.86 E+01 | 3.69 E+01 | 1.77 E+01 | 6.00 E+00 |
| 15 | 1.00 E+02 | 8.08 E+01 | 5.88 E+01 | 3.66 E+01 | 1.69 E+01 | 5.72 E+00 |
| 22 | 1.00 E+02 | 7.96 E+01 | 5.79 E+01 | 3.60 E+01 | 1.63 E+01 | 5.35 E+00 |
| 39 | 1.00 E+02 | 7.80 E+01 | 5.49 E+01 | 3.24 E+01 | 1.35 E+01 | 3.91 E+00 |
| 280 | 1.00 E+02 | 7.96 E+01 | 5.70 E+01 | 3.48 E+01 | 1.56 E+01 | 5.17 E+00 |
| 167 | 1.00 E+02 | 8.18 E+01 | 6.06 E+01 | 3.93 E+01 | 1.94 E+01 | 6.53 E+00 |
| 282 | 1.00 E+02 | 8.14 E+01 | 6.09 E+01 | 4.03 E+01 | 2.05 E+01 | 7.42 E+00 |
| 739 | 1.00 E+02 | 8.12 E+01 | 6.20 E+01 | 4.16 E+01 | 2.15 E+01 | 7.92 E+00 |
| 4 | 1.00 E+02 | 8.84 E+01 | 6.97 E+01 | 4.94 E+01 | 2.78 E+01 | 1.13 E+01 |
| 5 | 1.00 E+02 | 8.79 E+01 | 6.84 E+01 | 4.83 E+01 | 2.61 E+01 | 1.05 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : CTR2 degr

Unit : %
No spec limit specified.



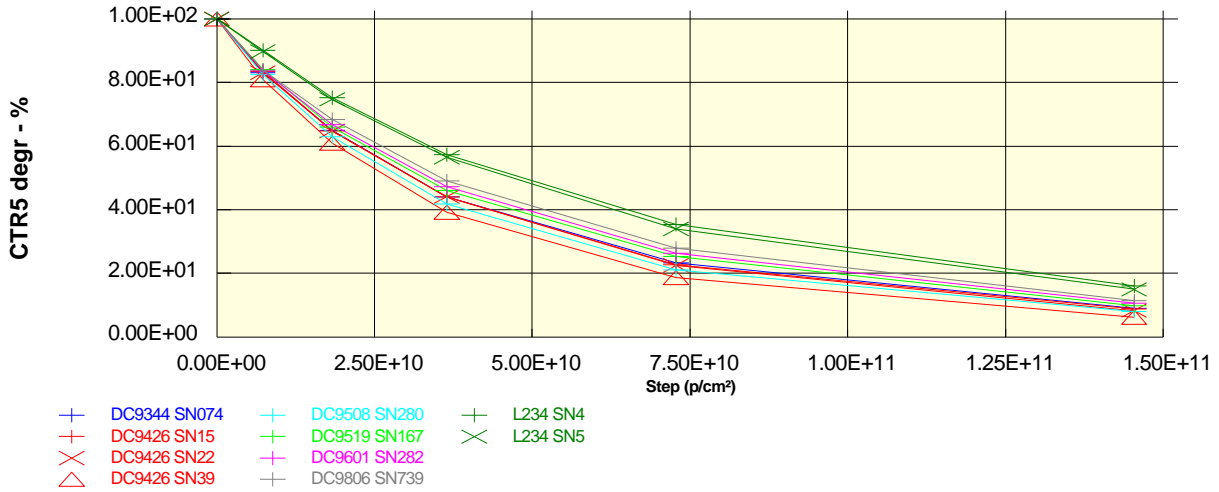
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 1.00 E+02 | 8.07 E+01 | 6.05 E+01 | 3.90 E+01 | 1.93 E+01 | 6.81 E+00 |
| 15 | 1.00 E+02 | 8.15 E+01 | 6.06 E+01 | 3.89 E+01 | 1.86 E+01 | 6.59 E+00 |
| 22 | 1.00 E+02 | 8.06 E+01 | 5.99 E+01 | 3.85 E+01 | 1.81 E+01 | 6.20 E+00 |
| 39 | 1.00 E+02 | 7.87 E+01 | 5.66 E+01 | 3.44 E+01 | 1.50 E+01 | 4.59 E+00 |
| 280 | 1.00 E+02 | 8.04 E+01 | 5.87 E+01 | 3.69 E+01 | 1.73 E+01 | 5.96 E+00 |
| 167 | 1.00 E+02 | 8.23 E+01 | 6.22 E+01 | 4.13 E+01 | 2.12 E+01 | 7.51 E+00 |
| 282 | 1.00 E+02 | 8.18 E+01 | 6.26 E+01 | 4.23 E+01 | 2.22 E+01 | 8.33 E+00 |
| 739 | 1.00 E+02 | 8.18 E+01 | 6.41 E+01 | 4.40 E+01 | 2.34 E+01 | 8.93 E+00 |
| 4 | 1.00 E+02 | 8.89 E+01 | 7.17 E+01 | 5.22 E+01 | 3.02 E+01 | 1.27 E+01 |
| 5 | 1.00 E+02 | 8.83 E+01 | 7.05 E+01 | 5.08 E+01 | 2.84 E+01 | 1.17 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : CTR5 degr

Unit : %
No spec limit specified.



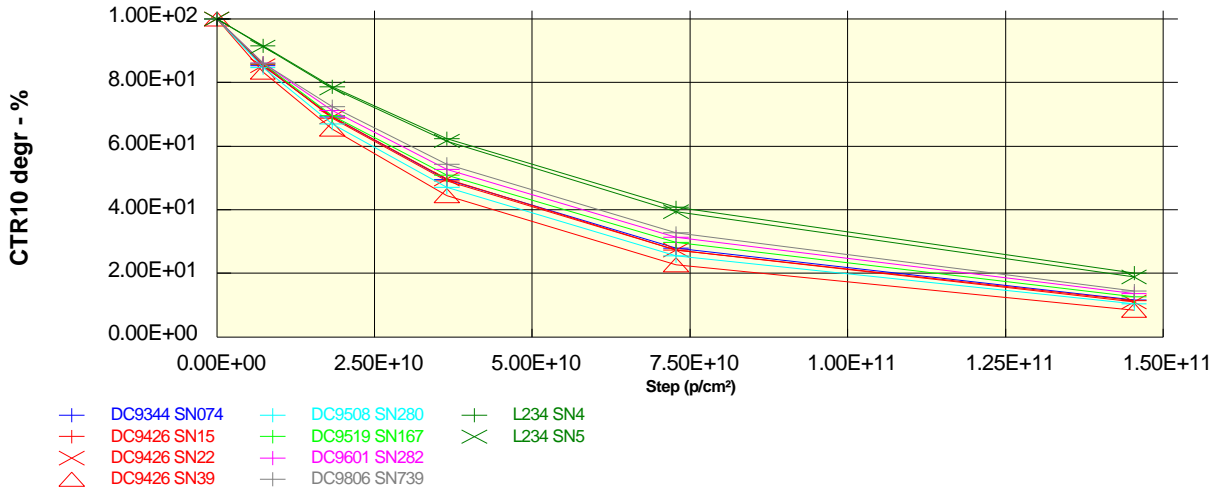
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 074 | 1.00 E+02 | 8.30 E+01 | 6.49 E+01 | 4.41 E+01 | 2.33 E+01 | 8.95 E+00 |
| 15 | 1.00 E+02 | 8.35 E+01 | 6.48 E+01 | 4.40 E+01 | 2.28 E+01 | 8.79 E+00 |
| 22 | 1.00 E+02 | 8.30 E+01 | 6.47 E+01 | 4.41 E+01 | 2.25 E+01 | 8.33 E+00 |
| 39 | 1.00 E+02 | 8.09 E+01 | 6.09 E+01 | 3.93 E+01 | 1.86 E+01 | 6.26 E+00 |
| 280 | 1.00 E+02 | 8.24 E+01 | 6.29 E+01 | 4.19 E+01 | 2.11 E+01 | 7.95 E+00 |
| 167 | 1.00 E+02 | 8.40 E+01 | 6.60 E+01 | 4.60 E+01 | 2.53 E+01 | 9.85 E+00 |
| 282 | 1.00 E+02 | 8.37 E+01 | 6.68 E+01 | 4.73 E+01 | 2.64 E+01 | 1.07 E+01 |
| 739 | 1.00 E+02 | 8.38 E+01 | 6.84 E+01 | 4.91 E+01 | 2.79 E+01 | 1.15 E+01 |
| 4 | 1.00 E+02 | 9.01 E+01 | 7.53 E+01 | 5.74 E+01 | 3.54 E+01 | 1.61 E+01 |
| 5 | 1.00 E+02 | 8.97 E+01 | 7.47 E+01 | 5.66 E+01 | 3.39 E+01 | 1.50 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 2mA
Parameter : CTR10 degr

Unit : %
No spec limit specified.



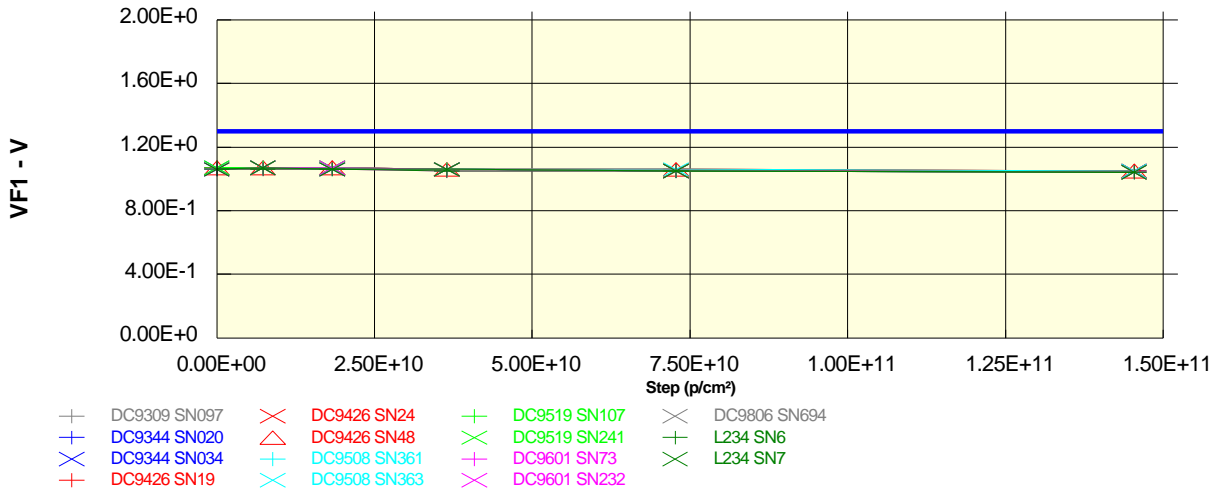
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 074 | 1.00 E+02 | 8.53 E+01 | 6.92 E+01 | 4.94 E+01 | 2.79 E+01 | 1.16 E+01 |
| 15 | 1.00 E+02 | 8.56 E+01 | 6.89 E+01 | 4.91 E+01 | 2.73 E+01 | 1.14 E+01 |
| 22 | 1.00 E+02 | 8.53 E+01 | 6.92 E+01 | 4.97 E+01 | 2.74 E+01 | 1.10 E+01 |
| 39 | 1.00 E+02 | 8.33 E+01 | 6.53 E+01 | 4.45 E+01 | 2.27 E+01 | 8.38 E+00 |
| 280 | 1.00 E+02 | 8.46 E+01 | 6.71 E+01 | 4.71 E+01 | 2.55 E+01 | 1.04 E+01 |
| 167 | 1.00 E+02 | 8.59 E+01 | 6.97 E+01 | 5.09 E+01 | 2.98 E+01 | 1.26 E+01 |
| 282 | 1.00 E+02 | 8.60 E+01 | 7.11 E+01 | 5.27 E+01 | 3.13 E+01 | 1.36 E+01 |
| 739 | 1.00 E+02 | 8.60 E+01 | 7.24 E+01 | 5.42 E+01 | 3.27 E+01 | 1.44 E+01 |
| 4 | 1.00 E+02 | 9.15 E+01 | 7.86 E+01 | 6.23 E+01 | 4.07 E+01 | 2.01 E+01 |
| 5 | 1.00 E+02 | 9.12 E+01 | 7.82 E+01 | 6.16 E+01 | 3.94 E+01 | 1.89 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Forward Voltage 1 : VF1
IF=2.0mA

Unit : V
Spec Limit Max : 1.30 E+00
Spec limits are represented in bold lines on the graphic.



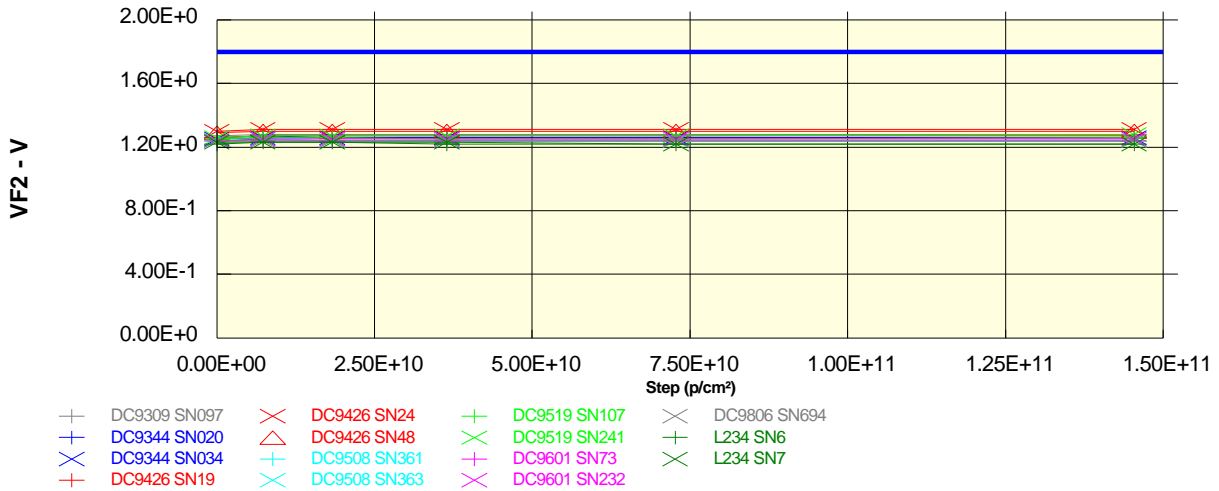
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 020 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 034 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 19 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |
| 24 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 48 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |
| 361 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 363 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |
| 107 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 241 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 73 | 1.06 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 232 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 694 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 6 | 1.06 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 7 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Forward Voltage 2 : VF2
IF=50mA

Unit : V
Spec Limit Max : 1.80 E+00
Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.27 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 |
| 020 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 034 | 1.25 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 19 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 |
| 24 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 |
| 48 | 1.29 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 |
| 361 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 363 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 107 | 1.25 E+00 | 1.26 E+00 | 1.26 E+00 | 1.25 E+00 | 1.25 E+00 | 1.26 E+00 |
| 241 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.28 E+00 |
| 73 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 232 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |
| 694 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 6 | 1.22 E+00 | 1.23 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 |
| 7 | 1.23 E+00 | 1.23 E+00 | 1.23 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 |

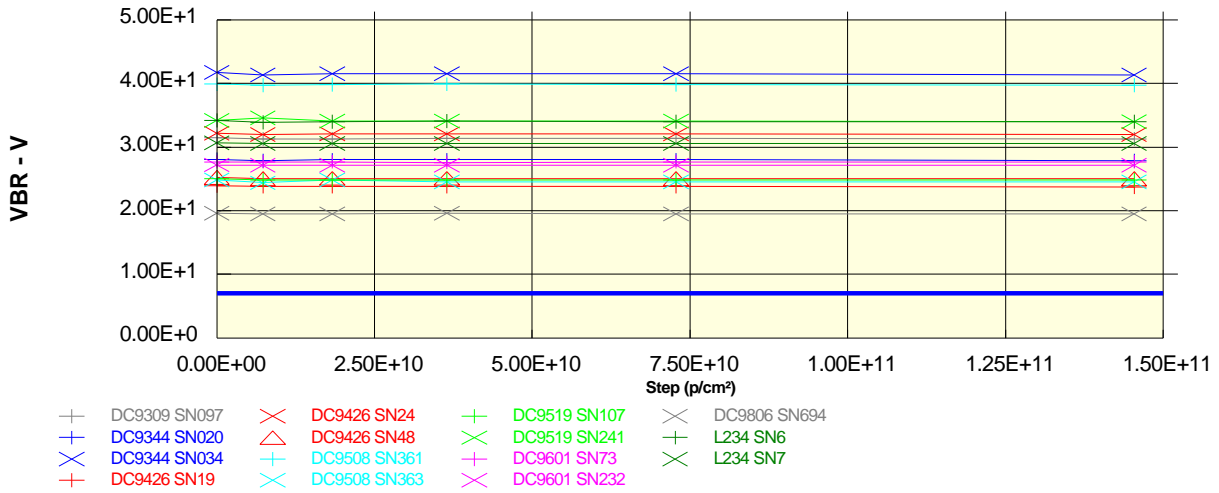
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Breakdown Voltage : VBR
IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

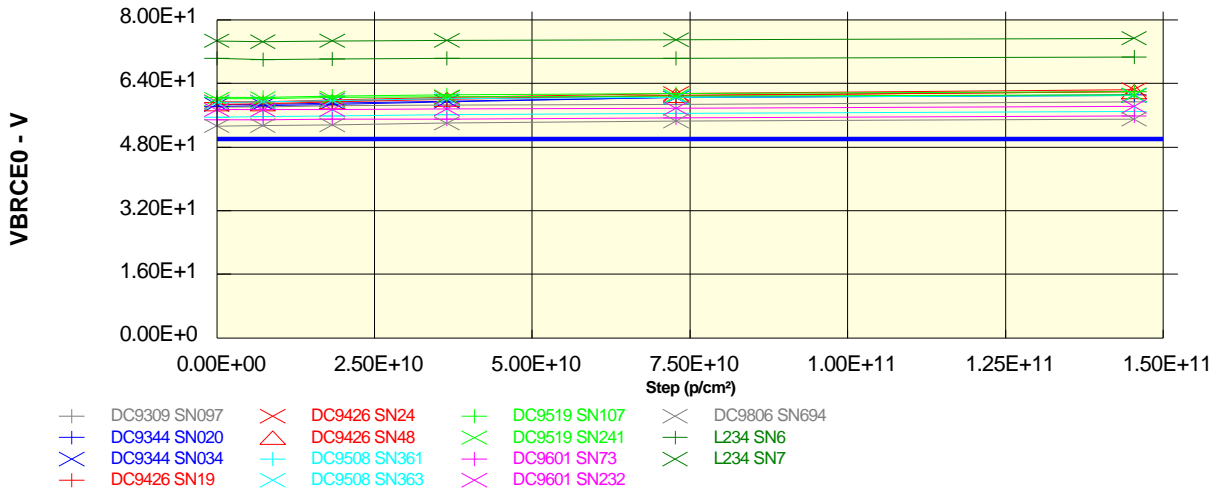


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 3.15 E+01 | 3.13 E+01 | 3.13 E+01 | 3.14 E+01 | 3.14 E+01 | 3.13 E+01 |
| 020 | 2.81 E+01 | 2.79 E+01 | 2.80 E+01 | 2.80 E+01 | 2.80 E+01 | 2.79 E+01 |
| 034 | 4.17 E+01 | 4.13 E+01 | 4.15 E+01 | 4.15 E+01 | 4.15 E+01 | 4.13 E+01 |
| 19 | 2.39 E+01 | 2.38 E+01 | 2.38 E+01 | 2.38 E+01 | 2.38 E+01 | 2.37 E+01 |
| 24 | 3.22 E+01 | 3.20 E+01 | 3.21 E+01 | 3.21 E+01 | 3.21 E+01 | 3.20 E+01 |
| 48 | 2.52 E+01 | 2.50 E+01 | 2.51 E+01 | 2.51 E+01 | 2.50 E+01 | 2.50 E+01 |
| 361 | 3.99 E+01 | 3.97 E+01 | 3.98 E+01 | 3.99 E+01 | 3.98 E+01 | 3.97 E+01 |
| 363 | 2.48 E+01 | 2.44 E+01 | 2.48 E+01 | 2.45 E+01 | 2.45 E+01 | 2.45 E+01 |
| 107 | 2.50 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 |
| 241 | 3.42 E+01 | 3.46 E+01 | 3.41 E+01 | 3.41 E+01 | 3.41 E+01 | 3.40 E+01 |
| 73 | 2.77 E+01 | 2.77 E+01 | 2.77 E+01 | 2.76 E+01 | 2.77 E+01 | 2.77 E+01 |
| 232 | 2.72 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 |
| 694 | 1.96 E+01 | 1.95 E+01 | 1.95 E+01 | 1.96 E+01 | 1.95 E+01 | 1.95 E+01 |
| 6 | 3.42 E+01 | 3.39 E+01 | 3.40 E+01 | 3.41 E+01 | 3.40 E+01 | 3.40 E+01 |
| 7 | 3.07 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 5.81 E+01 | 5.81 E+01 | 5.84 E+01 | 5.86 E+01 | 5.88 E+01 | 5.93 E+01 |
| 020 | 5.83 E+01 | 5.84 E+01 | 5.88 E+01 | 5.94 E+01 | 6.04 E+01 | 6.11 E+01 |
| 034 | 5.87 E+01 | 5.88 E+01 | 5.91 E+01 | 5.96 E+01 | 6.04 E+01 | 6.10 E+01 |
| 19 | 5.92 E+01 | 5.93 E+01 | 5.96 E+01 | 6.01 E+01 | 6.10 E+01 | 6.20 E+01 |
| 24 | 5.93 E+01 | 5.94 E+01 | 5.99 E+01 | 6.05 E+01 | 6.15 E+01 | 6.25 E+01 |
| 48 | 5.88 E+01 | 5.89 E+01 | 5.94 E+01 | 6.00 E+01 | 6.10 E+01 | 6.19 E+01 |
| 361 | 5.55 E+01 | 5.56 E+01 | 5.59 E+01 | 5.62 E+01 | 5.65 E+01 | 5.70 E+01 |
| 363 | 5.92 E+01 | 5.93 E+01 | 5.97 E+01 | 6.01 E+01 | 6.05 E+01 | 6.10 E+01 |
| 107 | 6.05 E+01 | 6.05 E+01 | 6.09 E+01 | 6.12 E+01 | 6.15 E+01 | 6.20 E+01 |
| 241 | 6.01 E+01 | 6.02 E+01 | 6.04 E+01 | 6.06 E+01 | 6.08 E+01 | 6.12 E+01 |
| 73 | 5.48 E+01 | 5.49 E+01 | 5.50 E+01 | 5.51 E+01 | 5.54 E+01 | 5.58 E+01 |
| 232 | 5.74 E+01 | 5.74 E+01 | 5.75 E+01 | 5.76 E+01 | 5.78 E+01 | 5.82 E+01 |
| 694 | 5.33 E+01 | 5.34 E+01 | 5.36 E+01 | 5.40 E+01 | 5.45 E+01 | 5.51 E+01 |
| 6 | 7.03 E+01 | 7.00 E+01 | 7.01 E+01 | 7.03 E+01 | 7.04 E+01 | 7.07 E+01 |
| 7 | 7.47 E+01 | 7.45 E+01 | 7.47 E+01 | 7.48 E+01 | 7.50 E+01 | 7.54 E+01 |

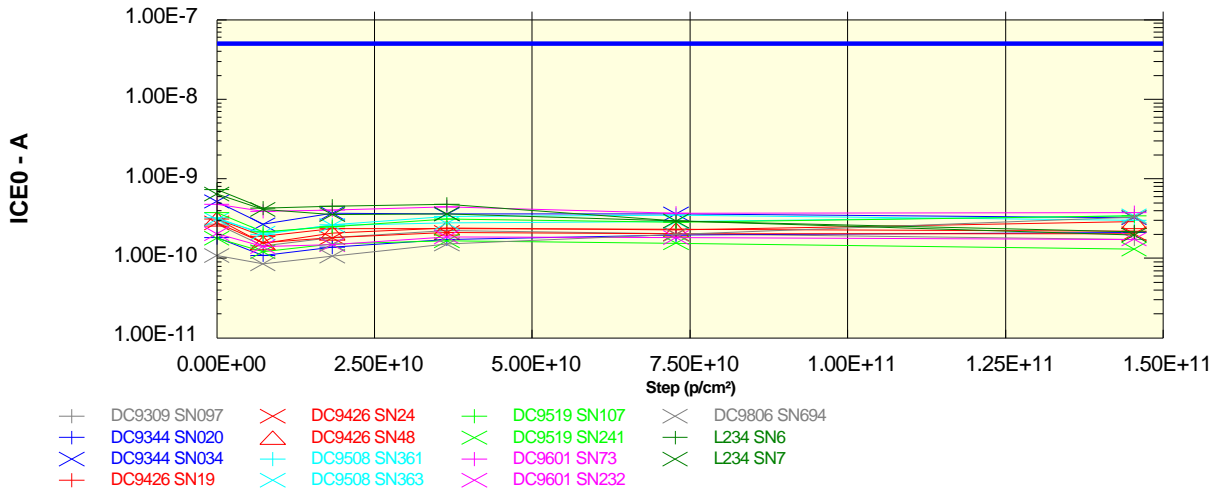
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A

Spec Limit Max : 5.00 E-08

Spec limits are represented in bold lines on the graphic.

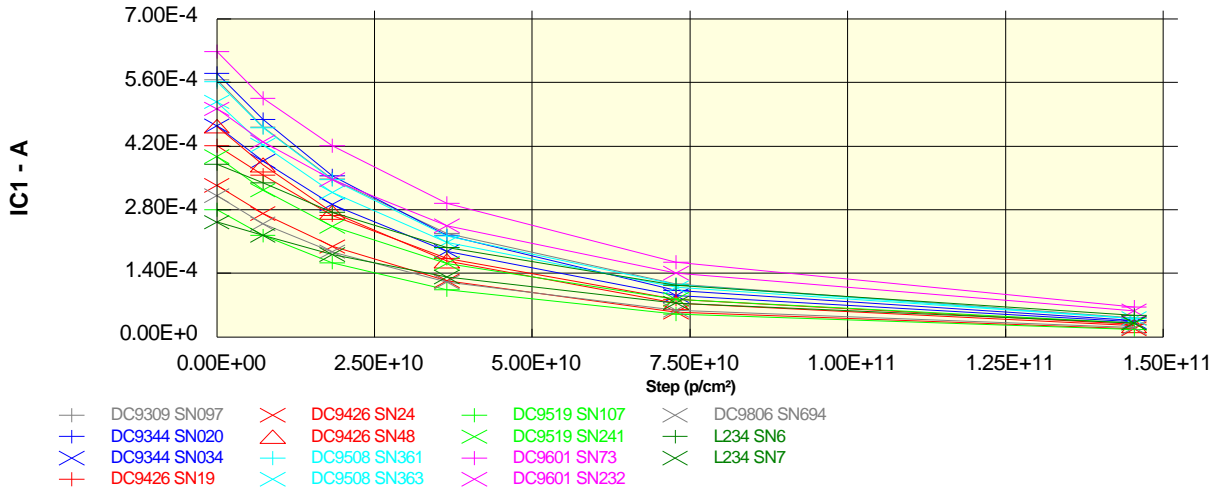


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 2.71 E-10 | 1.43 E-10 | 1.83 E-10 | 2.23 E-10 | 2.04 E-10 | 1.74 E-10 |
| 020 | 1.82 E-10 | 1.10 E-10 | 1.39 E-10 | 1.75 E-10 | 1.98 E-10 | 2.10 E-10 |
| 034 | 5.20 E-10 | 2.67 E-10 | 3.70 E-10 | 3.60 E-10 | 3.65 E-10 | 3.26 E-10 |
| 19 | 3.15 E-10 | 1.91 E-10 | 2.38 E-10 | 2.37 E-10 | 2.33 E-10 | 2.18 E-10 |
| 24 | 2.81 E-10 | 1.57 E-10 | 1.81 E-10 | 2.14 E-10 | 2.03 E-10 | 2.05 E-10 |
| 48 | 3.16 E-10 | 1.56 E-10 | 2.09 E-10 | 2.43 E-10 | 2.28 E-10 | 2.92 E-10 |
| 361 | 3.27 E-10 | 2.01 E-10 | 2.63 E-10 | 3.40 E-10 | 3.53 E-10 | 3.05 E-10 |
| 363 | 3.10 E-10 | 2.08 E-10 | 2.61 E-10 | 2.77 E-10 | 2.91 E-10 | 3.43 E-10 |
| 107 | 3.76 E-10 | 2.16 E-10 | 2.51 E-10 | 3.11 E-10 | 2.84 E-10 | 3.43 E-10 |
| 241 | 1.80 E-10 | 1.21 E-10 | 1.51 E-10 | 1.66 E-10 | 1.56 E-10 | 1.31 E-10 |
| 73 | 4.82 E-10 | 3.89 E-10 | 4.05 E-10 | 4.46 E-10 | 3.71 E-10 | 3.76 E-10 |
| 232 | 2.06 E-10 | 1.42 E-10 | 1.50 E-10 | 1.87 E-10 | 1.84 E-10 | 1.75 E-10 |
| 694 | 1.08 E-10 | 8.56 E-11 | 1.07 E-10 | 1.51 E-10 | 2.01 E-10 | 3.33 E-10 |
| 6 | 7.39 E-10 | 4.32 E-10 | 4.57 E-10 | 4.80 E-10 | 2.94 E-10 | 2.16 E-10 |
| 7 | 6.46 E-10 | 4.15 E-10 | 3.55 E-10 | 3.63 E-10 | 2.95 E-10 | 1.97 E-10 |

| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Bias condition : 10mA
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

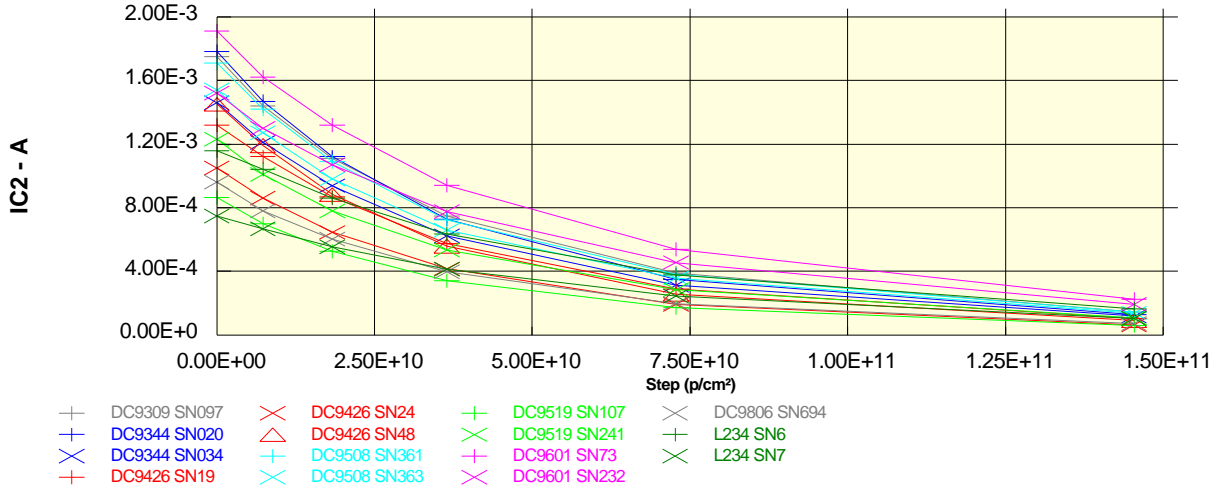


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 5.66 E-04 | 4.62 E-04 | 3.47 E-04 | 2.28 E-04 | 1.16 E-04 | 4.15 E-05 |
| 020 | 5.80 E-04 | 4.79 E-04 | 3.55 E-04 | 2.23 E-04 | 1.03 E-04 | 3.59 E-05 |
| 034 | 4.65 E-04 | 3.87 E-04 | 2.92 E-04 | 1.89 E-04 | 9.18 E-05 | 3.33 E-05 |
| 19 | 4.21 E-04 | 3.56 E-04 | 2.68 E-04 | 1.73 E-04 | 8.25 E-05 | 2.85 E-05 |
| 24 | 3.34 E-04 | 2.72 E-04 | 1.99 E-04 | 1.24 E-04 | 5.48 E-05 | 1.77 E-05 |
| 48 | 4.64 E-04 | 3.79 E-04 | 2.75 E-04 | 1.68 E-04 | 7.52 E-05 | 2.55 E-05 |
| 361 | 5.62 E-04 | 4.60 E-04 | 3.46 E-04 | 2.22 E-04 | 1.15 E-04 | 4.06 E-05 |
| 363 | 5.17 E-04 | 4.23 E-04 | 3.18 E-04 | 2.08 E-04 | 1.09 E-04 | 4.05 E-05 |
| 107 | 2.80 E-04 | 2.23 E-04 | 1.64 E-04 | 1.04 E-04 | 5.08 E-05 | 1.67 E-05 |
| 241 | 3.97 E-04 | 3.23 E-04 | 2.43 E-04 | 1.62 E-04 | 8.33 E-05 | 3.00 E-05 |
| 73 | 6.28 E-04 | 5.25 E-04 | 4.21 E-04 | 2.94 E-04 | 1.65 E-04 | 6.64 E-05 |
| 232 | 5.02 E-04 | 4.29 E-04 | 3.46 E-04 | 2.45 E-04 | 1.41 E-04 | 5.81 E-05 |
| 694 | 3.11 E-04 | 2.49 E-04 | 1.88 E-04 | 1.21 E-04 | 5.89 E-05 | 2.08 E-05 |
| 6 | 3.81 E-04 | 3.40 E-04 | 2.75 E-04 | 1.97 E-04 | 1.14 E-04 | 4.86 E-05 |
| 7 | 2.53 E-04 | 2.24 E-04 | 1.81 E-04 | 1.32 E-04 | 7.51 E-05 | 3.07 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

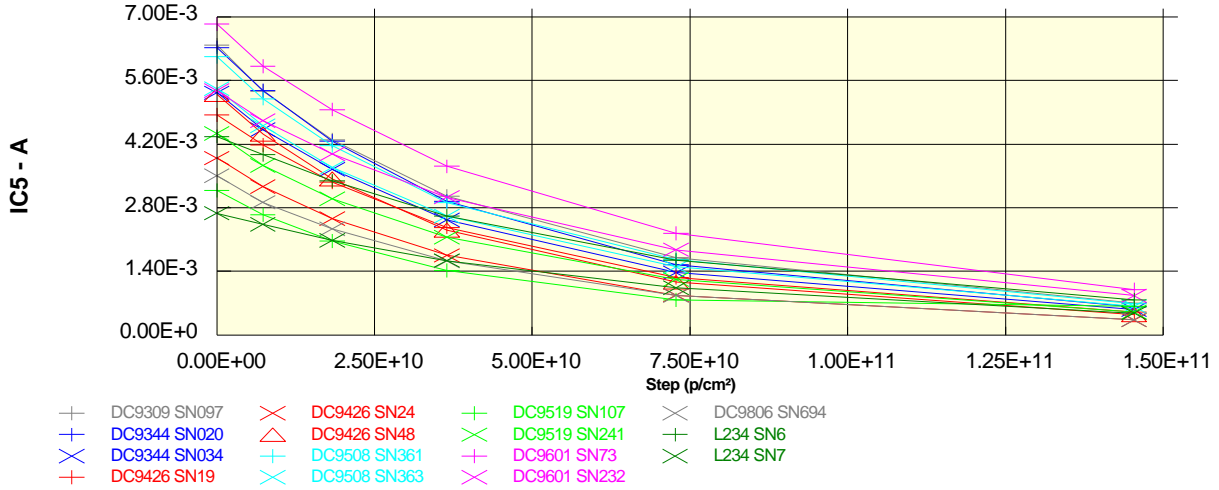


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 1.75 E-03 | 1.44 E-03 | 1.11 E-03 | 7.46 E-04 | 3.90 E-04 | 1.47 E-04 |
| 020 | 1.78 E-03 | 1.47 E-03 | 1.12 E-03 | 7.27 E-04 | 3.50 E-04 | 1.28 E-04 |
| 034 | 1.46 E-03 | 1.21 E-03 | 9.39 E-04 | 6.23 E-04 | 3.12 E-04 | 1.18 E-04 |
| 19 | 1.32 E-03 | 1.12 E-03 | 8.69 E-04 | 5.76 E-04 | 2.87 E-04 | 1.04 E-04 |
| 24 | 1.05 E-03 | 8.62 E-04 | 6.46 E-04 | 4.16 E-04 | 1.93 E-04 | 6.54 E-05 |
| 48 | 1.45 E-03 | 1.19 E-03 | 8.83 E-04 | 5.59 E-04 | 2.59 E-04 | 9.17 E-05 |
| 361 | 1.71 E-03 | 1.42 E-03 | 1.09 E-03 | 7.23 E-04 | 3.84 E-04 | 1.44 E-04 |
| 363 | 1.54 E-03 | 1.27 E-03 | 9.80 E-04 | 6.59 E-04 | 3.56 E-04 | 1.39 E-04 |
| 107 | 8.64 E-04 | 7.00 E-04 | 5.25 E-04 | 3.42 E-04 | 1.73 E-04 | 5.99 E-05 |
| 241 | 1.23 E-03 | 1.01 E-03 | 7.79 E-04 | 5.34 E-04 | 2.84 E-04 | 1.07 E-04 |
| 73 | 1.91 E-03 | 1.62 E-03 | 1.32 E-03 | 9.40 E-04 | 5.38 E-04 | 2.24 E-04 |
| 232 | 1.52 E-03 | 1.30 E-03 | 1.07 E-03 | 7.75 E-04 | 4.56 E-04 | 1.94 E-04 |
| 694 | 9.62 E-04 | 7.80 E-04 | 6.01 E-04 | 3.97 E-04 | 1.98 E-04 | 7.19 E-05 |
| 6 | 1.16 E-03 | 1.04 E-03 | 8.62 E-04 | 6.35 E-04 | 3.78 E-04 | 1.65 E-04 |
| 7 | 7.48 E-04 | 6.68 E-04 | 5.54 E-04 | 4.15 E-04 | 2.45 E-04 | 1.04 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



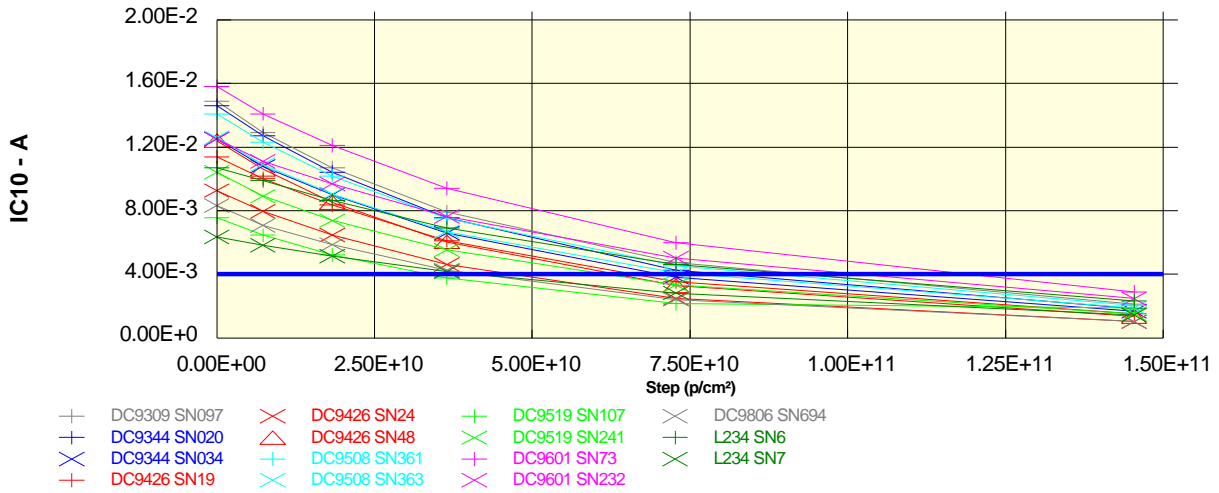
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 6.38 E-03 | 5.36 E-03 | 4.29 E-03 | 3.05 E-03 | 1.70 E-03 | 7.00 E-04 |
| 020 | 6.33 E-03 | 5.38 E-03 | 4.27 E-03 | 2.94 E-03 | 1.54 E-03 | 6.15 E-04 |
| 034 | 5.33 E-03 | 4.52 E-03 | 3.64 E-03 | 2.54 E-03 | 1.37 E-03 | 5.62 E-04 |
| 19 | 4.84 E-03 | 4.18 E-03 | 3.37 E-03 | 2.37 E-03 | 1.27 E-03 | 5.06 E-04 |
| 24 | 3.89 E-03 | 3.26 E-03 | 2.56 E-03 | 1.75 E-03 | 8.79 E-04 | 3.29 E-04 |
| 48 | 5.29 E-03 | 4.42 E-03 | 3.43 E-03 | 2.31 E-03 | 1.16 E-03 | 4.43 E-04 |
| 361 | 6.12 E-03 | 5.20 E-03 | 4.16 E-03 | 2.92 E-03 | 1.66 E-03 | 6.84 E-04 |
| 363 | 5.42 E-03 | 4.60 E-03 | 3.69 E-03 | 2.61 E-03 | 1.50 E-03 | 6.39 E-04 |
| 107 | 3.18 E-03 | 2.64 E-03 | 2.07 E-03 | 1.42 E-03 | 7.70 E-04 | 6.39 E-04 |
| 241 | 4.44 E-03 | 3.73 E-03 | 3.00 E-03 | 2.15 E-03 | 1.22 E-03 | 5.08 E-04 |
| 73 | 6.84 E-03 | 5.92 E-03 | 4.96 E-03 | 3.71 E-03 | 2.24 E-03 | 1.00 E-03 |
| 232 | 5.38 E-03 | 4.71 E-03 | 3.99 E-03 | 3.03 E-03 | 1.88 E-03 | 8.64 E-04 |
| 694 | 3.50 E-03 | 2.92 E-03 | 2.34 E-03 | 1.63 E-03 | 8.69 E-04 | 3.38 E-04 |
| 6 | 4.37 E-03 | 3.97 E-03 | 3.39 E-03 | 2.61 E-03 | 1.65 E-03 | 7.76 E-04 |
| 7 | 2.68 E-03 | 2.43 E-03 | 2.08 E-03 | 1.64 E-03 | 1.04 E-03 | 4.81 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Output Current10 : IC10
VCE=5.0V. IF=10mA

Unit : A
Spec Limit Min : 4.00 E-03
Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 1.49 E-02 | 1.29 E-02 | 1.07 E-02 | 7.93 E-03 | 4.73 E-03 | 2.11 E-03 |
| 020 | 1.46 E-02 | 1.27 E-02 | 1.04 E-02 | 7.54 E-03 | 4.27 E-03 | 1.86 E-03 |
| 034 | 1.25 E-02 | 1.08 E-02 | 9.01 E-03 | 6.59 E-03 | 3.81 E-03 | 1.69 E-03 |
| 19 | 1.14 E-02 | 1.00 E-02 | 8.35 E-03 | 6.13 E-03 | 3.55 E-03 | 1.53 E-03 |
| 24 | 9.27 E-03 | 7.96 E-03 | 6.47 E-03 | 4.63 E-03 | 2.51 E-03 | 1.03 E-03 |
| 48 | 1.24 E-02 | 1.06 E-02 | 8.54 E-03 | 6.05 E-03 | 3.28 E-03 | 1.35 E-03 |
| 361 | 1.41 E-02 | 1.23 E-02 | 1.02 E-02 | 7.53 E-03 | 4.54 E-03 | 2.05 E-03 |
| 363 | 1.26 E-02 | 1.09 E-02 | 9.04 E-03 | 6.69 E-03 | 4.08 E-03 | 1.88 E-03 |
| 107 | 7.58 E-03 | 6.45 E-03 | 5.23 E-03 | 3.77 E-03 | 2.17 E-03 | 1.88 E-03 |
| 241 | 1.04 E-02 | 8.91 E-03 | 7.39 E-03 | 5.53 E-03 | 3.34 E-03 | 1.51 E-03 |
| 73 | 1.58 E-02 | 1.41 E-02 | 1.21 E-02 | 9.42 E-03 | 6.00 E-03 | 2.89 E-03 |
| 232 | 1.25 E-02 | 1.11 E-02 | 9.70 E-03 | 7.64 E-03 | 5.02 E-03 | 2.48 E-03 |
| 694 | 8.31 E-03 | 7.09 E-03 | 5.87 E-03 | 4.28 E-03 | 2.43 E-03 | 1.02 E-03 |
| 6 | 1.07 E-02 | 9.88 E-03 | 8.64 E-03 | 6.91 E-03 | 4.62 E-03 | 2.34 E-03 |
| 7 | 6.34 E-03 | 5.84 E-03 | 5.14 E-03 | 4.18 E-03 | 2.83 E-03 | 1.43 E-03 |

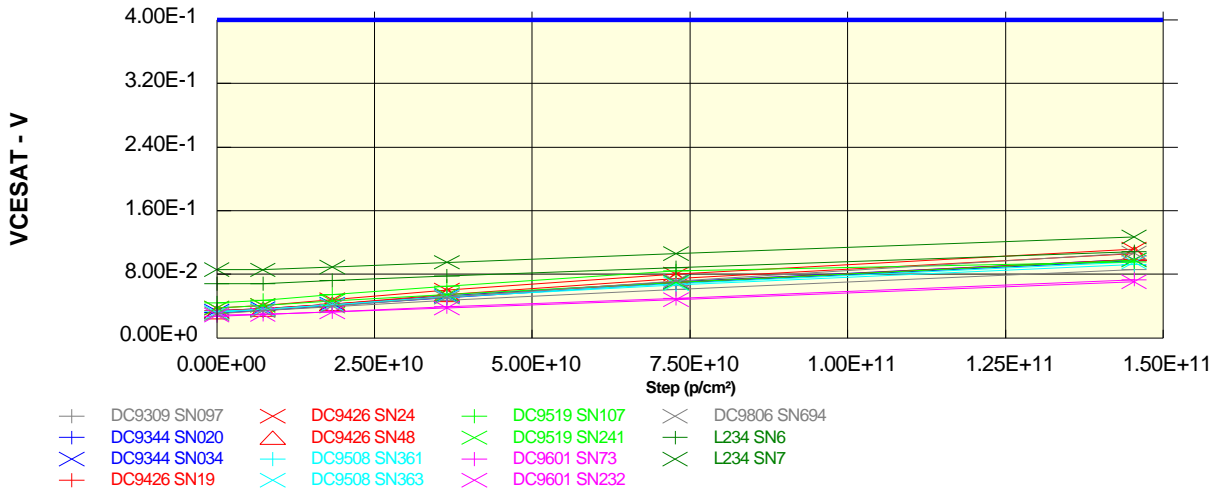
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Collector Emitter Saturation Voltage : VCESAT
IC=2mA. IF=50mA

Unit : V

Spec Limit Max : 4.00 E-01

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 3.15 E-02 | 3.42 E-02 | 3.94 E-02 | 4.71 E-02 | 6.11 E-02 | 8.63 E-02 |
| 020 | 3.20 E-02 | 3.46 E-02 | 4.07 E-02 | 5.07 E-02 | 6.90 E-02 | 9.69 E-02 |
| 034 | 3.43 E-02 | 3.70 E-02 | 4.30 E-02 | 5.29 E-02 | 7.08 E-02 | 9.84 E-02 |
| 19 | 3.45 E-02 | 3.67 E-02 | 4.25 E-02 | 5.22 E-02 | 7.00 E-02 | 9.88 E-02 |
| 24 | 3.78 E-02 | 4.12 E-02 | 4.83 E-02 | 6.01 E-02 | 8.04 E-02 | 1.12 E-01 |
| 48 | 3.27 E-02 | 3.60 E-02 | 4.28 E-02 | 5.45 E-02 | 7.44 E-02 | 1.06 E-01 |
| 361 | 3.35 E-02 | 3.63 E-02 | 4.20 E-02 | 5.14 E-02 | 6.66 E-02 | 9.25 E-02 |
| 363 | 3.20 E-02 | 3.57 E-02 | 4.20 E-02 | 5.20 E-02 | 6.85 E-02 | 9.53 E-02 |
| 107 | 4.40 E-02 | 4.75 E-02 | 5.43 E-02 | 6.55 E-02 | 8.42 E-02 | 9.53 E-02 |
| 241 | 3.77 E-02 | 4.08 E-02 | 4.64 E-02 | 5.48 E-02 | 6.97 E-02 | 9.78 E-02 |
| 73 | 2.76 E-02 | 2.96 E-02 | 3.29 E-02 | 3.89 E-02 | 5.01 E-02 | 7.36 E-02 |
| 232 | 2.85 E-02 | 2.99 E-02 | 3.26 E-02 | 3.78 E-02 | 4.84 E-02 | 7.09 E-02 |
| 694 | 3.05 E-02 | 3.40 E-02 | 4.01 E-02 | 5.11 E-02 | 7.18 E-02 | 1.07 E-01 |
| 6 | 6.82 E-02 | 6.87 E-02 | 7.22 E-02 | 7.80 E-02 | 8.84 E-02 | 1.09 E-01 |
| 7 | 8.61 E-02 | 8.57 E-02 | 8.93 E-02 | 9.51 E-02 | 1.06 E-01 | 1.27 E-01 |

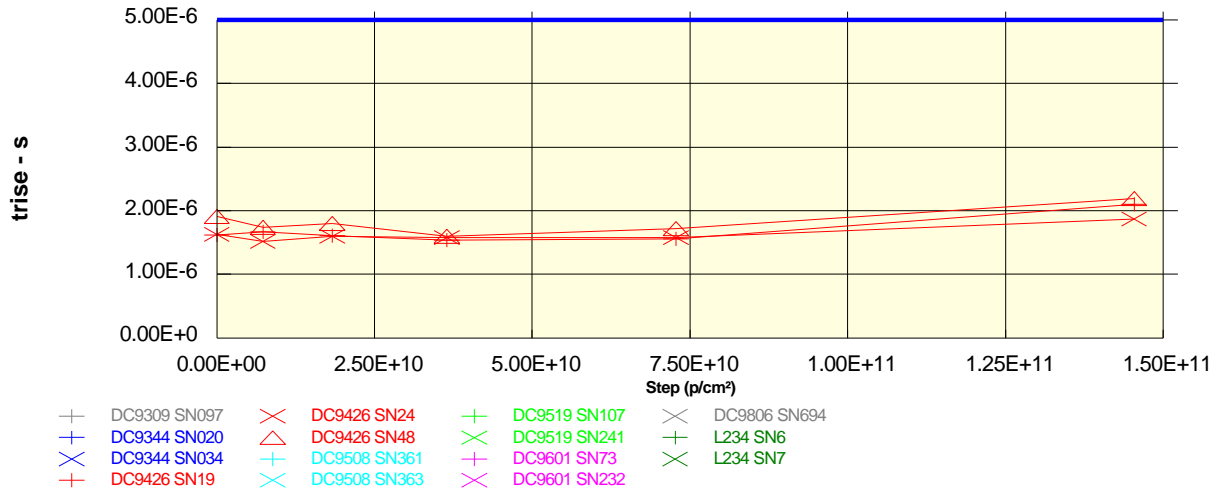
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Rise Time : trise
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

Spec limits are represented in bold lines on the graphic.



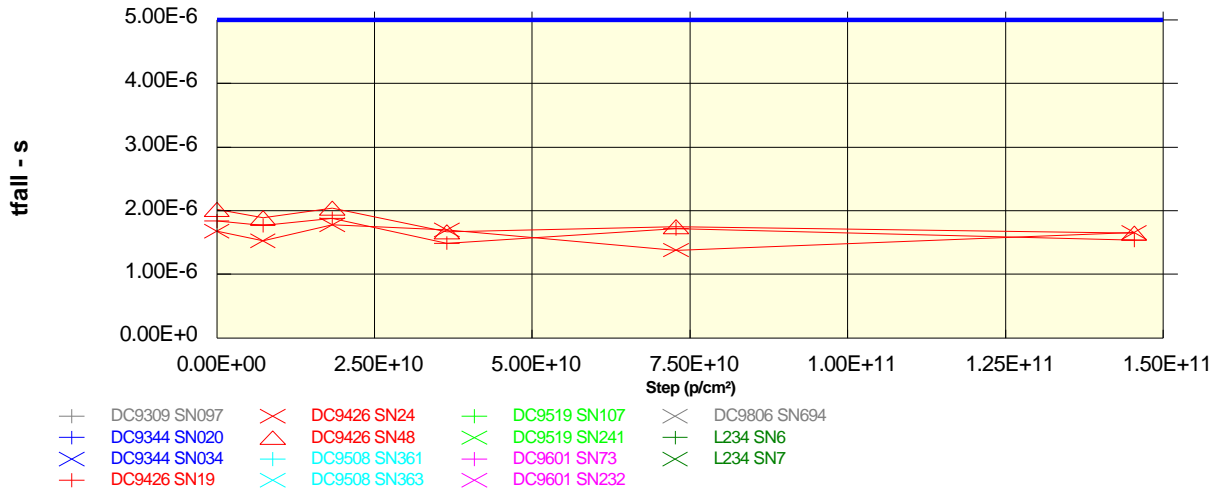
| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : Fall Time : tfall
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

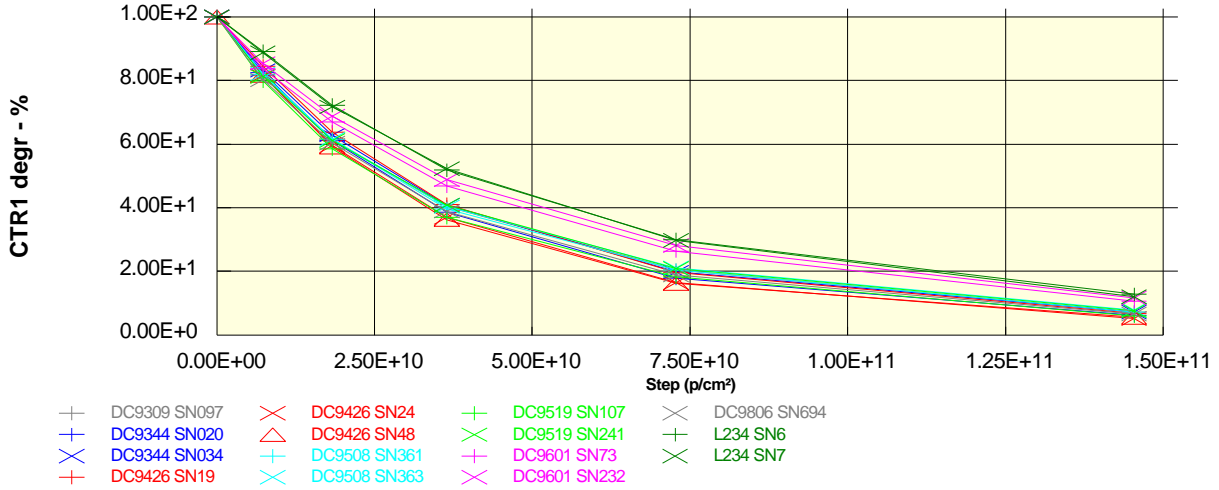
Spec limits are represented in bold lines on the graphic.



| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : CTR1 degr

Unit : %
No spec limit specified.



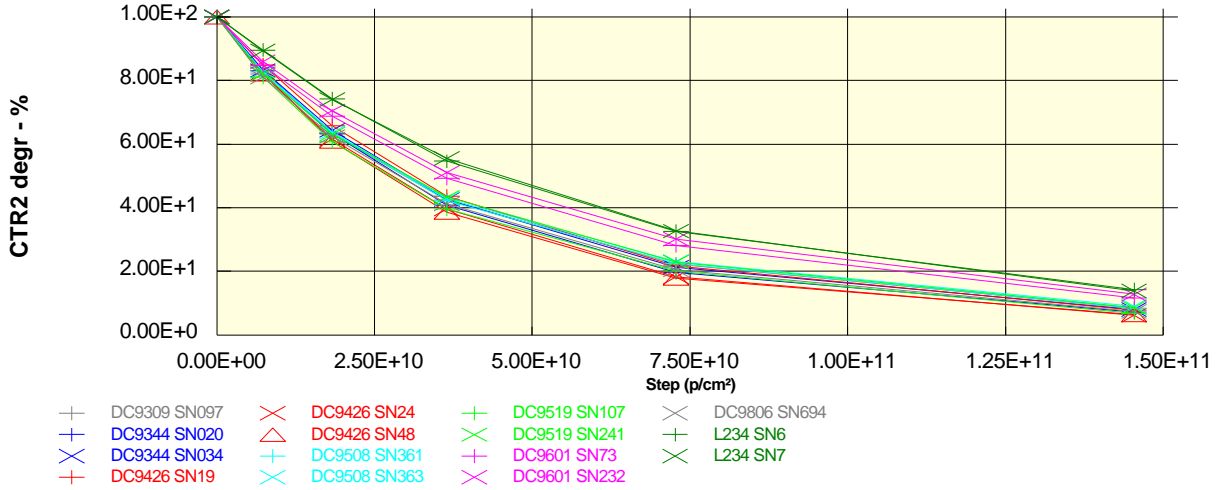
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.00 E+02 | 8.16 E+01 | 6.13 E+01 | 4.03 E+01 | 2.04 E+01 | 7.32 E+00 |
| 020 | 1.00 E+02 | 8.25 E+01 | 6.12 E+01 | 3.85 E+01 | 1.78 E+01 | 6.20 E+00 |
| 034 | 1.00 E+02 | 8.32 E+01 | 6.28 E+01 | 4.08 E+01 | 1.98 E+01 | 7.17 E+00 |
| 19 | 1.00 E+02 | 8.45 E+01 | 6.38 E+01 | 4.10 E+01 | 1.96 E+01 | 6.76 E+00 |
| 24 | 1.00 E+02 | 8.15 E+01 | 5.95 E+01 | 3.70 E+01 | 1.64 E+01 | 5.30 E+00 |
| 48 | 1.00 E+02 | 8.17 E+01 | 5.92 E+01 | 3.63 E+01 | 1.62 E+01 | 5.51 E+00 |
| 361 | 1.00 E+02 | 8.19 E+01 | 6.15 E+01 | 3.96 E+01 | 2.04 E+01 | 7.22 E+00 |
| 363 | 1.00 E+02 | 8.20 E+01 | 6.15 E+01 | 4.03 E+01 | 2.11 E+01 | 7.83 E+00 |
| 107 | 1.00 E+02 | 7.98 E+01 | 5.85 E+01 | 3.71 E+01 | 1.82 E+01 | 5.97 E+00 |
| 241 | 1.00 E+02 | 8.12 E+01 | 6.12 E+01 | 4.08 E+01 | 2.10 E+01 | 7.55 E+00 |
| 73 | 1.00 E+02 | 8.36 E+01 | 6.71 E+01 | 4.69 E+01 | 2.64 E+01 | 1.06 E+01 |
| 232 | 1.00 E+02 | 8.54 E+01 | 6.88 E+01 | 4.89 E+01 | 2.82 E+01 | 1.16 E+01 |
| 694 | 1.00 E+02 | 8.02 E+01 | 6.04 E+01 | 3.89 E+01 | 1.89 E+01 | 6.68 E+00 |
| 6 | 1.00 E+02 | 8.91 E+01 | 7.23 E+01 | 5.18 E+01 | 3.00 E+01 | 1.28 E+01 |
| 7 | 1.00 E+02 | 8.87 E+01 | 7.17 E+01 | 5.23 E+01 | 2.97 E+01 | 1.21 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : 10mA
Parameter : CTR2 degr

Unit : %
No spec limit specified.



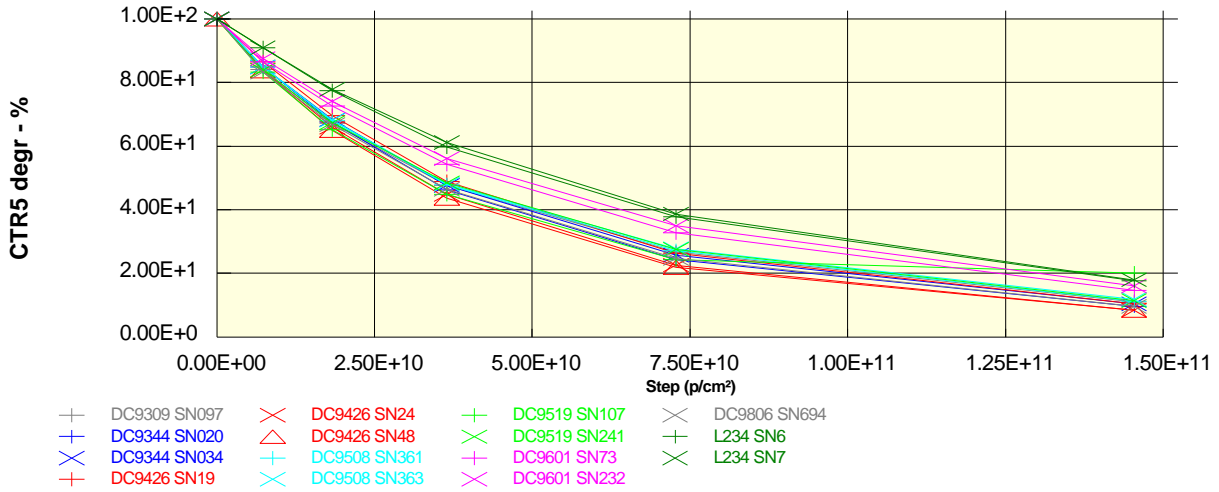
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 097 | 1.00 E+02 | 8.20 E+01 | 6.31 E+01 | 4.25 E+01 | 2.23 E+01 | 8.37 E+00 |
| 020 | 1.00 E+02 | 8.30 E+01 | 6.33 E+01 | 4.09 E+01 | 1.97 E+01 | 7.20 E+00 |
| 034 | 1.00 E+02 | 8.32 E+01 | 6.44 E+01 | 4.27 E+01 | 2.14 E+01 | 8.06 E+00 |
| 19 | 1.00 E+02 | 8.49 E+01 | 6.58 E+01 | 4.36 E+01 | 2.17 E+01 | 7.86 E+00 |
| 24 | 1.00 E+02 | 8.21 E+01 | 6.15 E+01 | 3.96 E+01 | 1.83 E+01 | 6.23 E+00 |
| 48 | 1.00 E+02 | 8.20 E+01 | 6.09 E+01 | 3.86 E+01 | 1.79 E+01 | 6.33 E+00 |
| 361 | 1.00 E+02 | 8.27 E+01 | 6.35 E+01 | 4.22 E+01 | 2.24 E+01 | 8.38 E+00 |
| 363 | 1.00 E+02 | 8.28 E+01 | 6.37 E+01 | 4.28 E+01 | 2.31 E+01 | 9.01 E+00 |
| 107 | 1.00 E+02 | 8.10 E+01 | 6.07 E+01 | 3.96 E+01 | 2.00 E+01 | 6.94 E+00 |
| 241 | 1.00 E+02 | 8.20 E+01 | 6.32 E+01 | 4.33 E+01 | 2.30 E+01 | 8.69 E+00 |
| 73 | 1.00 E+02 | 8.46 E+01 | 6.88 E+01 | 4.92 E+01 | 2.82 E+01 | 1.17 E+01 |
| 232 | 1.00 E+02 | 8.59 E+01 | 7.05 E+01 | 5.11 E+01 | 3.01 E+01 | 1.28 E+01 |
| 694 | 1.00 E+02 | 8.11 E+01 | 6.24 E+01 | 4.12 E+01 | 2.06 E+01 | 7.47 E+00 |
| 6 | 1.00 E+02 | 8.96 E+01 | 7.42 E+01 | 5.46 E+01 | 3.25 E+01 | 1.42 E+01 |
| 7 | 1.00 E+02 | 8.93 E+01 | 7.40 E+01 | 5.55 E+01 | 3.27 E+01 | 1.38 E+01 |

| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Bias condition : 10mA
Parameter : CTR5 degr

Unit : %
No spec limit specified.



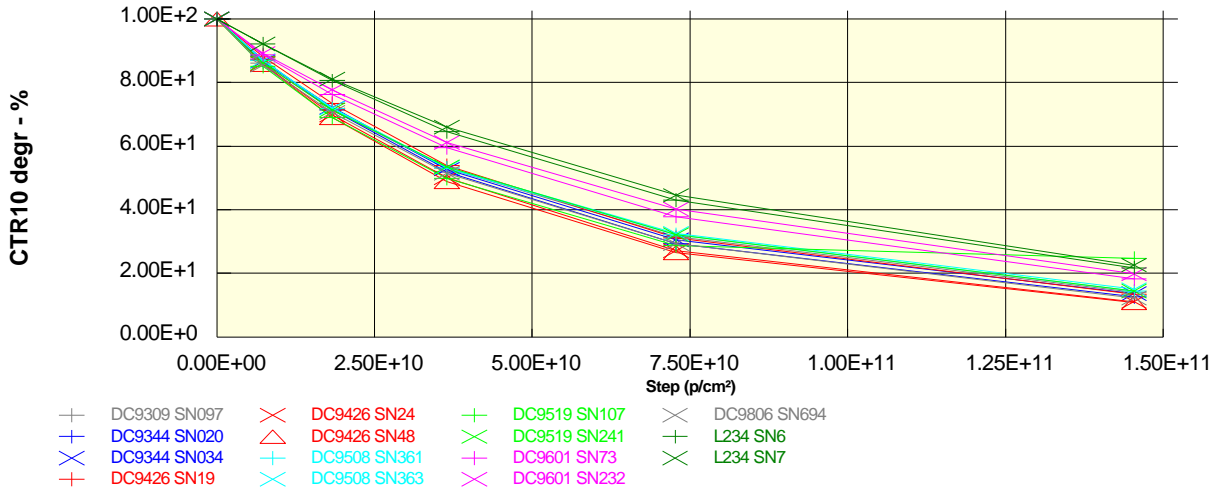
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.00 E+02 | 8.40 E+01 | 6.72 E+01 | 4.77 E+01 | 2.67 E+01 | 1.10 E+01 |
| 020 | 1.00 E+02 | 8.49 E+01 | 6.75 E+01 | 4.63 E+01 | 2.43 E+01 | 9.71 E+00 |
| 034 | 1.00 E+02 | 8.48 E+01 | 6.83 E+01 | 4.77 E+01 | 2.57 E+01 | 1.05 E+01 |
| 19 | 1.00 E+02 | 8.64 E+01 | 6.97 E+01 | 4.89 E+01 | 2.63 E+01 | 1.05 E+01 |
| 24 | 1.00 E+02 | 8.39 E+01 | 6.59 E+01 | 4.49 E+01 | 2.26 E+01 | 8.47 E+00 |
| 48 | 1.00 E+02 | 8.36 E+01 | 6.49 E+01 | 4.36 E+01 | 2.19 E+01 | 8.38 E+00 |
| 361 | 1.00 E+02 | 8.49 E+01 | 6.79 E+01 | 4.78 E+01 | 2.71 E+01 | 1.12 E+01 |
| 363 | 1.00 E+02 | 8.48 E+01 | 6.81 E+01 | 4.81 E+01 | 2.77 E+01 | 1.18 E+01 |
| 107 | 1.00 E+02 | 8.32 E+01 | 6.51 E+01 | 4.48 E+01 | 2.42 E+01 | 2.01 E+01 |
| 241 | 1.00 E+02 | 8.39 E+01 | 6.74 E+01 | 4.85 E+01 | 2.75 E+01 | 1.14 E+01 |
| 73 | 1.00 E+02 | 8.66 E+01 | 7.26 E+01 | 5.42 E+01 | 3.27 E+01 | 1.47 E+01 |
| 232 | 1.00 E+02 | 8.75 E+01 | 7.41 E+01 | 5.62 E+01 | 3.50 E+01 | 1.60 E+01 |
| 694 | 1.00 E+02 | 8.33 E+01 | 6.68 E+01 | 4.65 E+01 | 2.48 E+01 | 9.65 E+00 |
| 6 | 1.00 E+02 | 9.09 E+01 | 7.75 E+01 | 5.97 E+01 | 3.78 E+01 | 1.77 E+01 |
| 7 | 1.00 E+02 | 9.09 E+01 | 7.79 E+01 | 6.11 E+01 | 3.87 E+01 | 1.80 E+01 |

| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Bias condition : 10mA
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.00 E+02 | 8.62 E+01 | 7.13 E+01 | 5.31 E+01 | 3.16 E+01 | 1.41 E+01 |
| 020 | 1.00 E+02 | 8.70 E+01 | 7.15 E+01 | 5.18 E+01 | 2.93 E+01 | 1.27 E+01 |
| 034 | 1.00 E+02 | 8.66 E+01 | 7.21 E+01 | 5.28 E+01 | 3.05 E+01 | 1.36 E+01 |
| 19 | 1.00 E+02 | 8.81 E+01 | 7.35 E+01 | 5.40 E+01 | 3.12 E+01 | 1.35 E+01 |
| 24 | 1.00 E+02 | 8.59 E+01 | 6.98 E+01 | 5.00 E+01 | 2.71 E+01 | 1.11 E+01 |
| 48 | 1.00 E+02 | 8.56 E+01 | 6.90 E+01 | 4.89 E+01 | 2.65 E+01 | 1.09 E+01 |
| 361 | 1.00 E+02 | 8.69 E+01 | 7.19 E+01 | 5.32 E+01 | 3.21 E+01 | 1.45 E+01 |
| 363 | 1.00 E+02 | 8.68 E+01 | 7.20 E+01 | 5.33 E+01 | 3.25 E+01 | 1.50 E+01 |
| 107 | 1.00 E+02 | 8.51 E+01 | 6.90 E+01 | 4.98 E+01 | 2.87 E+01 | 2.48 E+01 |
| 241 | 1.00 E+02 | 8.60 E+01 | 7.14 E+01 | 5.34 E+01 | 3.22 E+01 | 1.45 E+01 |
| 73 | 1.00 E+02 | 8.88 E+01 | 7.63 E+01 | 5.95 E+01 | 3.79 E+01 | 1.83 E+01 |
| 232 | 1.00 E+02 | 8.92 E+01 | 7.77 E+01 | 6.12 E+01 | 4.02 E+01 | 1.98 E+01 |
| 694 | 1.00 E+02 | 8.54 E+01 | 7.06 E+01 | 5.15 E+01 | 2.93 E+01 | 1.23 E+01 |
| 6 | 1.00 E+02 | 9.22 E+01 | 8.06 E+01 | 6.45 E+01 | 4.31 E+01 | 2.18 E+01 |
| 7 | 1.00 E+02 | 9.22 E+01 | 8.11 E+01 | 6.60 E+01 | 4.46 E+01 | 2.26 E+01 |

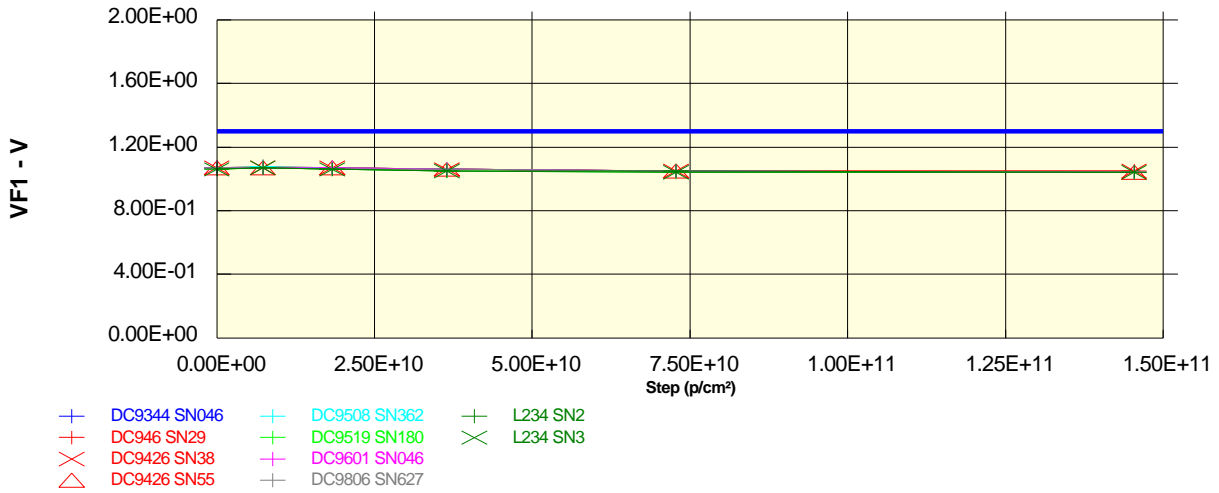
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Forward Voltage 1 : VF1
IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



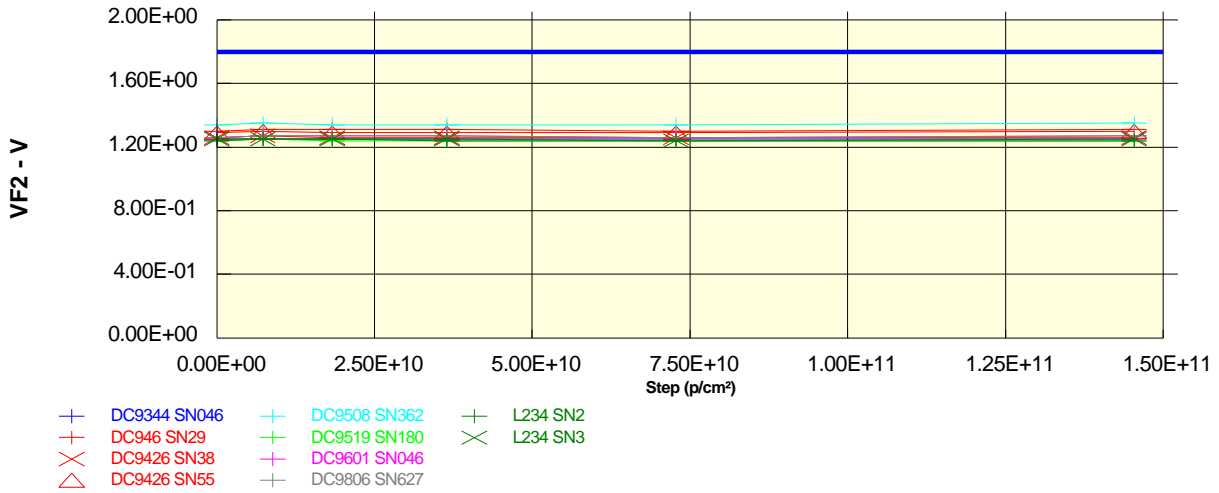
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 29 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 38 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 55 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 362 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 180 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 | 1.04 E+00 |
| 270 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 627 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 2 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 3 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 | 1.04 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Forward Voltage 2 : VF2
IF=50mA

Unit : V
Spec Limit Max : 1.80 E+00
Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |
| 29 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.30 E+00 | 1.31 E+00 |
| 38 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 55 | 1.29 E+00 | 1.30 E+00 | 1.29 E+00 | 1.29 E+00 | 1.29 E+00 | 1.30 E+00 |
| 362 | 1.34 E+00 | 1.35 E+00 | 1.34 E+00 | 1.34 E+00 | 1.34 E+00 | 1.35 E+00 |
| 180 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 270 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.26 E+00 | 1.27 E+00 |
| 627 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.26 E+00 | 1.27 E+00 |
| 2 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 3 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.25 E+00 |

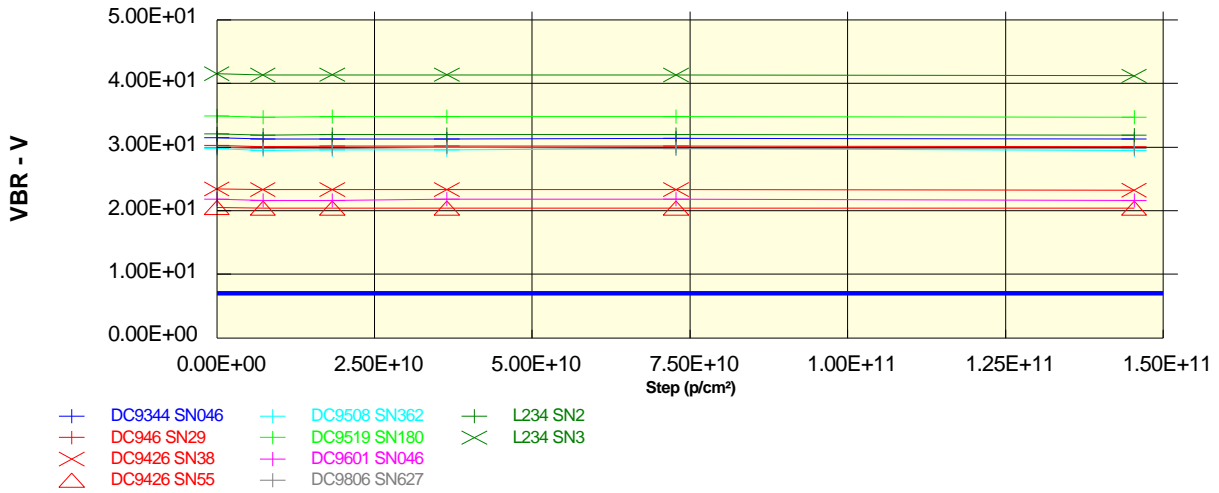
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Breakdown Voltage : VBR
IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.15 E+01 | 3.13 E+01 | 3.13 E+01 | 3.13 E+01 | 3.14 E+01 | 3.13 E+01 |
| 29 | 3.03 E+01 | 3.01 E+01 | 3.02 E+01 | 3.02 E+01 | 3.02 E+01 | 3.01 E+01 |
| 38 | 2.34 E+01 | 2.33 E+01 | 2.33 E+01 | 2.33 E+01 | 2.33 E+01 | 2.32 E+01 |
| 55 | 2.05 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 |
| 362 | 2.97 E+01 | 2.95 E+01 | 2.96 E+01 | 2.96 E+01 | 2.97 E+01 | 2.95 E+01 |
| 180 | 3.49 E+01 | 3.47 E+01 | 3.48 E+01 | 3.48 E+01 | 3.48 E+01 | 3.47 E+01 |
| 270 | 2.18 E+01 | 2.16 E+01 | 2.16 E+01 | 2.18 E+01 | 2.18 E+01 | 2.16 E+01 |
| 627 | 3.00 E+01 | 2.97 E+01 | 2.98 E+01 | 2.99 E+01 | 2.98 E+01 | 2.98 E+01 |
| 2 | 3.21 E+01 | 3.19 E+01 | 3.20 E+01 | 3.20 E+01 | 3.20 E+01 | 3.19 E+01 |
| 3 | 4.15 E+01 | 4.13 E+01 | 4.14 E+01 | 4.14 E+01 | 4.13 E+01 | 4.12 E+01 |

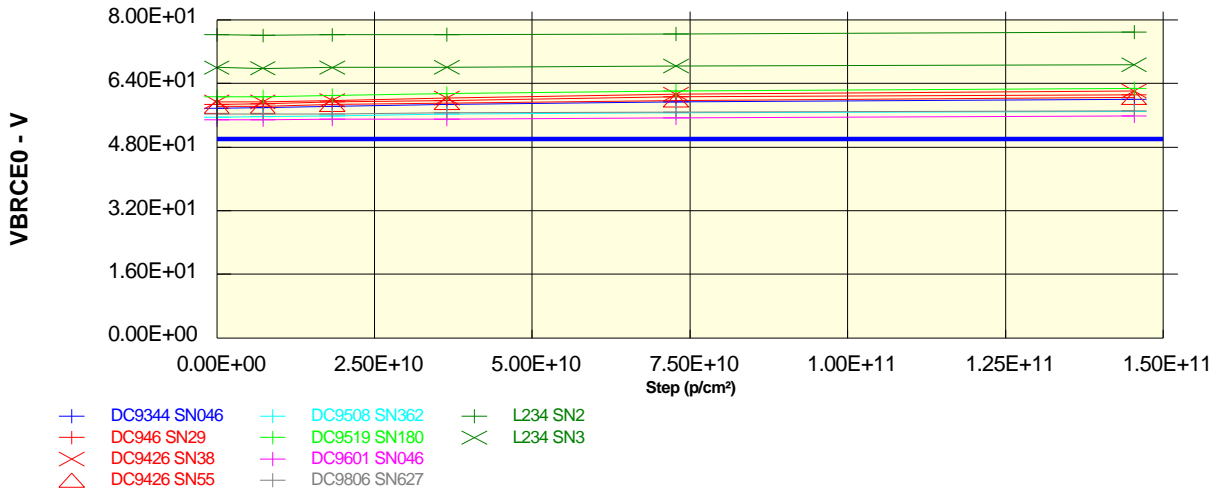
| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
IC=10mA

Unit : V

Spec Limit Min : 5.00 E+01

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 5.78 E+01 | 5.79 E+01 | 5.82 E+01 | 5.88 E+01 | 5.94 E+01 | 6.00 E+01 |
| 29 | 5.88 E+01 | 5.89 E+01 | 5.93 E+01 | 5.98 E+01 | 6.06 E+01 | 6.12 E+01 |
| 38 | 5.93 E+01 | 5.94 E+01 | 5.98 E+01 | 6.03 E+01 | 6.13 E+01 | 6.21 E+01 |
| 55 | 5.82 E+01 | 5.83 E+01 | 5.87 E+01 | 5.91 E+01 | 5.98 E+01 | 6.04 E+01 |
| 362 | 5.55 E+01 | 5.56 E+01 | 5.59 E+01 | 5.63 E+01 | 5.66 E+01 | 5.70 E+01 |
| 180 | 6.06 E+01 | 6.07 E+01 | 6.10 E+01 | 6.15 E+01 | 6.21 E+01 | 6.27 E+01 |
| 270 | 5.49 E+01 | 5.49 E+01 | 5.50 E+01 | 5.51 E+01 | 5.53 E+01 | 5.58 E+01 |
| 627 | 5.63 E+01 | 5.63 E+01 | 5.64 E+01 | 5.66 E+01 | 5.68 E+01 | 5.72 E+01 |
| 2 | 7.62 E+01 | 7.60 E+01 | 7.62 E+01 | 7.63 E+01 | 7.65 E+01 | 7.69 E+01 |
| 3 | 6.80 E+01 | 6.78 E+01 | 6.80 E+01 | 6.81 E+01 | 6.84 E+01 | 6.87 E+01 |

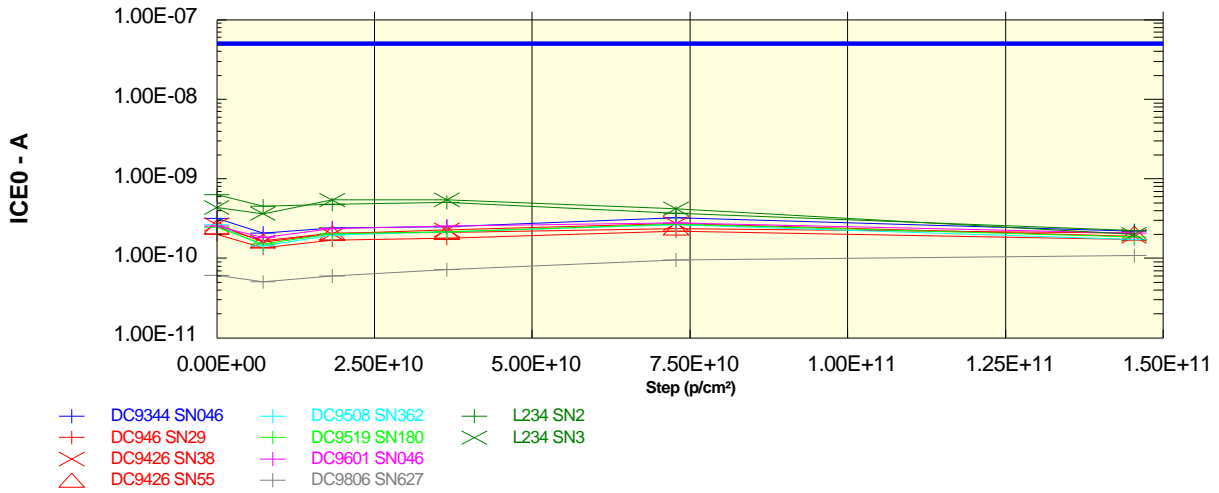
| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A

Spec Limit Max : 5.00 E-08

Spec limits are represented in bold lines on the graphic.

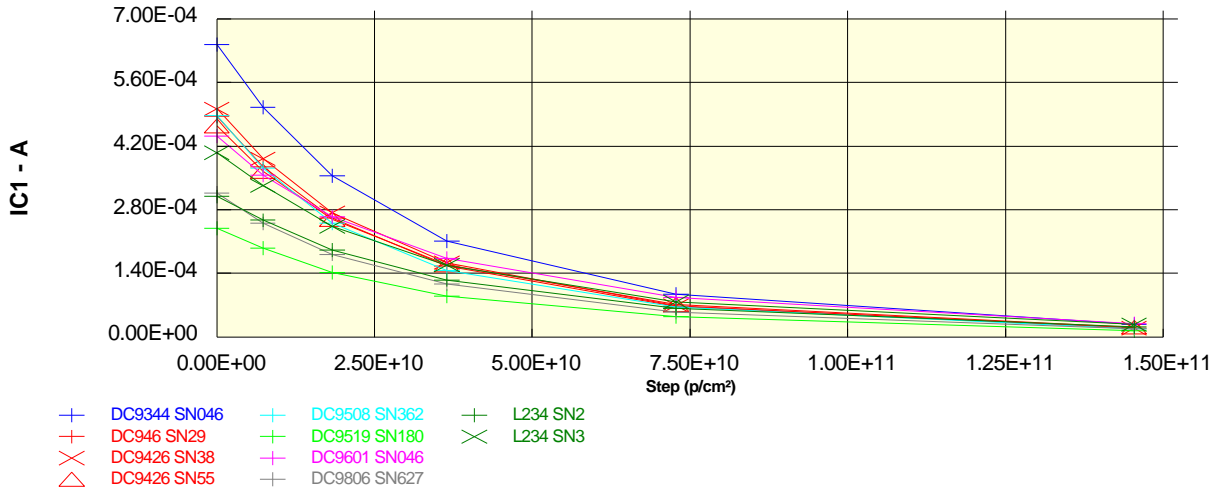


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.21 E-10 | 2.07 E-10 | 2.41 E-10 | 2.51 E-10 | 3.27 E-10 | 2.20 E-10 |
| 29 | 2.02 E-10 | 1.35 E-10 | 1.69 E-10 | 1.79 E-10 | 2.21 E-10 | 1.74 E-10 |
| 38 | 2.67 E-10 | 1.62 E-10 | 2.03 E-10 | 2.27 E-10 | 2.76 E-10 | 1.91 E-10 |
| 55 | 2.50 E-10 | 1.66 E-10 | 2.08 E-10 | 2.11 E-10 | 2.40 E-10 | 2.09 E-10 |
| 362 | 2.65 E-10 | 1.45 E-10 | 1.97 E-10 | 2.16 E-10 | 2.63 E-10 | 1.74 E-10 |
| 180 | 2.47 E-10 | 1.53 E-10 | 2.05 E-10 | 2.17 E-10 | 2.68 E-10 | 1.86 E-10 |
| 270 | 2.55 E-10 | 1.83 E-10 | 2.35 E-10 | 2.58 E-10 | 2.81 E-10 | 2.08 E-10 |
| 627 | 6.14 E-11 | 5.06 E-11 | 5.98 E-11 | 7.26 E-11 | 9.61 E-11 | 1.09 E-10 |
| 2 | 6.28 E-10 | 4.55 E-10 | 4.75 E-10 | 5.10 E-10 | 3.71 E-10 | 2.25 E-10 |
| 3 | 4.38 E-10 | 3.67 E-10 | 5.42 E-10 | 5.50 E-10 | 4.23 E-10 | 2.02 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

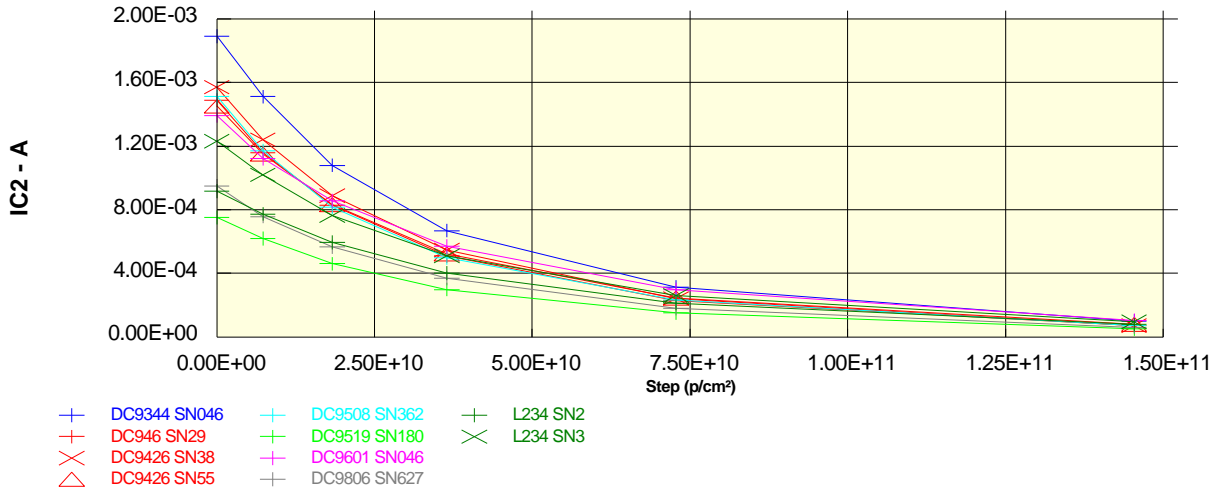


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 6.43 E-04 | 5.06 E-04 | 3.55 E-04 | 2.11 E-04 | 9.46 E-05 | 2.81 E-05 |
| 29 | 4.86 E-04 | 3.75 E-04 | 2.61 E-04 | 1.56 E-04 | 6.70 E-05 | 1.96 E-05 |
| 38 | 5.02 E-04 | 3.92 E-04 | 2.74 E-04 | 1.64 E-04 | 6.96 E-05 | 1.95 E-05 |
| 55 | 4.65 E-04 | 3.65 E-04 | 2.59 E-04 | 1.59 E-04 | 7.17 E-05 | 2.19 E-05 |
| 362 | 4.87 E-04 | 3.71 E-04 | 2.51 E-04 | 1.47 E-04 | 6.61 E-05 | 1.89 E-05 |
| 180 | 2.39 E-04 | 1.95 E-04 | 1.42 E-04 | 9.03 E-05 | 4.43 E-05 | 1.36 E-05 |
| 270 | 4.42 E-04 | 3.56 E-04 | 2.64 E-04 | 1.73 E-04 | 8.71 E-05 | 2.92 E-05 |
| 627 | 3.17 E-04 | 2.50 E-04 | 1.82 E-04 | 1.16 E-04 | 5.47 E-05 | 1.79 E-05 |
| 2 | 3.09 E-04 | 2.57 E-04 | 1.92 E-04 | 1.26 E-04 | 6.34 E-05 | 2.27 E-05 |
| 3 | 4.05 E-04 | 3.33 E-04 | 2.43 E-04 | 1.58 E-04 | 7.73 E-05 | 2.75 E-05 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

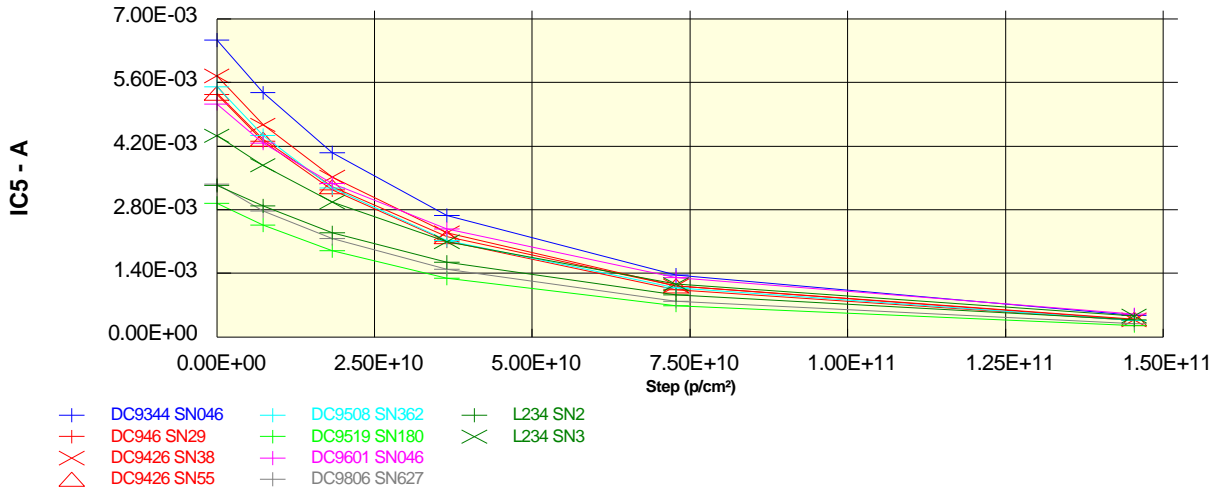


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.89 E-03 | 1.51 E-03 | 1.08 E-03 | 6.69 E-04 | 3.13 E-04 | 9.96 E-05 |
| 29 | 1.49 E-03 | 1.16 E-03 | 8.29 E-04 | 5.10 E-04 | 2.31 E-04 | 7.20 E-05 |
| 38 | 1.57 E-03 | 1.24 E-03 | 8.88 E-04 | 5.46 E-04 | 2.43 E-04 | 7.30 E-05 |
| 55 | 1.45 E-03 | 1.15 E-03 | 8.32 E-04 | 5.24 E-04 | 2.46 E-04 | 8.00 E-05 |
| 362 | 1.51 E-03 | 1.17 E-03 | 8.17 E-04 | 4.98 E-04 | 2.33 E-04 | 7.12 E-05 |
| 180 | 7.53 E-04 | 6.19 E-04 | 4.61 E-04 | 2.99 E-04 | 1.52 E-04 | 5.01 E-05 |
| 270 | 1.39 E-03 | 1.12 E-03 | 8.55 E-04 | 5.72 E-04 | 2.96 E-04 | 1.04 E-04 |
| 627 | 9.49 E-04 | 7.58 E-04 | 5.66 E-04 | 3.69 E-04 | 1.82 E-04 | 6.19 E-05 |
| 2 | 9.17 E-04 | 7.74 E-04 | 5.94 E-04 | 4.03 E-04 | 2.11 E-04 | 7.86 E-05 |
| 3 | 1.23 E-03 | 1.02 E-03 | 7.64 E-04 | 5.11 E-04 | 2.60 E-04 | 9.60 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



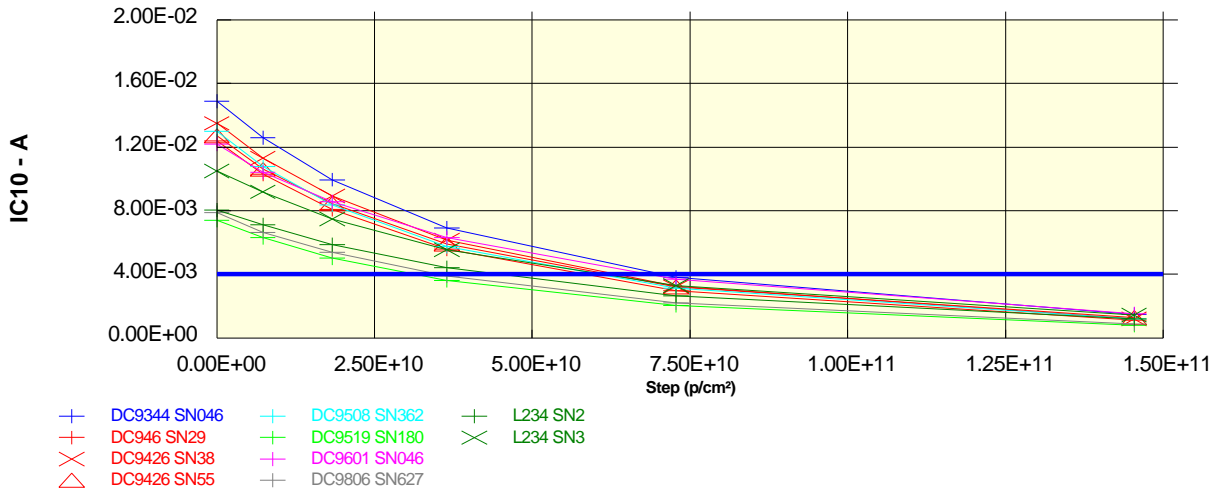
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 6.53 E-03 | 5.37 E-03 | 4.06 E-03 | 2.67 E-03 | 1.36 E-03 | 4.83 E-04 |
| 29 | 5.34 E-03 | 4.31 E-03 | 3.23 E-03 | 2.11 E-03 | 1.04 E-03 | 3.62 E-04 |
| 38 | 5.74 E-03 | 4.67 E-03 | 3.52 E-03 | 2.30 E-03 | 1.12 E-03 | 3.75 E-04 |
| 55 | 5.36 E-03 | 4.35 E-03 | 3.31 E-03 | 2.20 E-03 | 1.12 E-03 | 4.01 E-04 |
| 362 | 5.51 E-03 | 4.44 E-03 | 3.28 E-03 | 2.13 E-03 | 1.08 E-03 | 3.71 E-04 |
| 180 | 2.95 E-03 | 2.46 E-03 | 1.90 E-03 | 1.29 E-03 | 6.96 E-04 | 2.55 E-04 |
| 270 | 5.13 E-03 | 4.27 E-03 | 3.38 E-03 | 2.38 E-03 | 1.31 E-03 | 4.98 E-04 |
| 627 | 3.36 E-03 | 2.77 E-03 | 2.16 E-03 | 1.49 E-03 | 7.89 E-04 | 2.93 E-04 |
| 2 | 3.33 E-03 | 2.88 E-03 | 2.30 E-03 | 1.65 E-03 | 9.34 E-04 | 3.80 E-04 |
| 3 | 4.43 E-03 | 3.78 E-03 | 2.97 E-03 | 2.10 E-03 | 1.16 E-03 | 4.64 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Output Current10 : IC10
VCE=5.0V. IF=10mA

Unit : A
Spec Limit Min : 4.00 E-03
Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.49 E-02 | 1.26 E-02 | 9.95 E-03 | 6.92 E-03 | 3.80 E-03 | 1.49 E-03 |
| 29 | 1.24 E-02 | 1.03 E-02 | 8.10 E-03 | 5.59 E-03 | 2.98 E-03 | 1.14 E-03 |
| 38 | 1.35 E-02 | 1.13 E-02 | 8.94 E-03 | 6.16 E-03 | 3.24 E-03 | 1.20 E-03 |
| 55 | 1.27 E-02 | 1.06 E-02 | 8.44 E-03 | 5.91 E-03 | 3.22 E-03 | 1.27 E-03 |
| 362 | 1.30 E-02 | 1.08 E-02 | 8.36 E-03 | 5.74 E-03 | 3.14 E-03 | 1.19 E-03 |
| 180 | 7.42 E-03 | 6.33 E-03 | 5.04 E-03 | 3.61 E-03 | 2.04 E-03 | 8.14 E-04 |
| 270 | 1.22 E-02 | 1.04 E-02 | 8.56 E-03 | 6.30 E-03 | 3.69 E-03 | 1.52 E-03 |
| 627 | 7.87 E-03 | 6.65 E-03 | 5.40 E-03 | 3.90 E-03 | 2.21 E-03 | 8.92 E-04 |
| 2 | 8.05 E-03 | 7.11 E-03 | 5.89 E-03 | 4.41 E-03 | 2.66 E-03 | 1.18 E-03 |
| 3 | 1.05 E-02 | 9.18 E-03 | 7.49 E-03 | 5.56 E-03 | 3.29 E-03 | 1.44 E-03 |

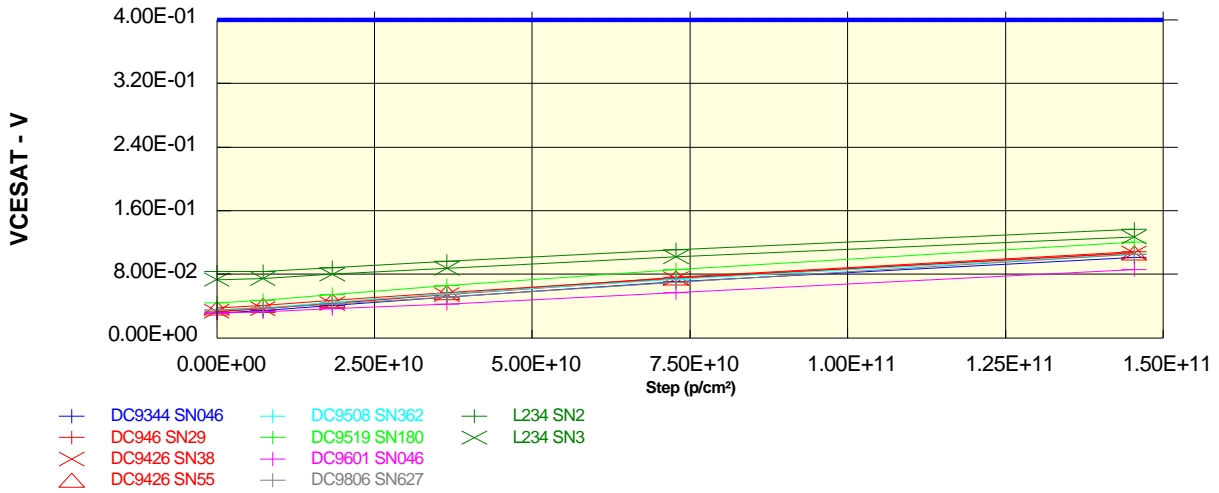
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Collector Emitter Saturation Voltage : VCESAT
IC=2mA. IF=50mA

Unit : V

Spec Limit Max : 4.00 E-01

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.14 E-02 | 3.46 E-02 | 4.11 E-02 | 5.15 E-02 | 7.09 E-02 | 1.01 E-01 |
| 29 | 3.29 E-02 | 3.66 E-02 | 4.42 E-02 | 5.55 E-02 | 7.64 E-02 | 1.09 E-01 |
| 38 | 3.36 E-02 | 3.68 E-02 | 4.36 E-02 | 5.43 E-02 | 7.44 E-02 | 1.07 E-01 |
| 55 | 3.73 E-02 | 4.08 E-02 | 4.70 E-02 | 5.71 E-02 | 7.58 E-02 | 1.07 E-01 |
| 362 | 3.51 E-02 | 3.82 E-02 | 4.53 E-02 | 5.56 E-02 | 7.41 E-02 | 1.05 E-01 |
| 180 | 4.38 E-02 | 4.74 E-02 | 5.48 E-02 | 6.61 E-02 | 8.63 E-02 | 1.21 E-01 |
| 270 | 3.08 E-02 | 3.26 E-02 | 3.67 E-02 | 4.30 E-02 | 5.70 E-02 | 8.63 E-02 |
| 627 | 3.52 E-02 | 3.76 E-02 | 4.28 E-02 | 5.15 E-02 | 7.00 E-02 | 1.05 E-01 |
| 2 | 8.33 E-02 | 8.38 E-02 | 8.88 E-02 | 9.65 E-02 | 1.11 E-01 | 1.37 E-01 |
| 3 | 7.35 E-02 | 7.48 E-02 | 8.00 E-02 | 8.74 E-02 | 1.02 E-01 | 1.27 E-01 |

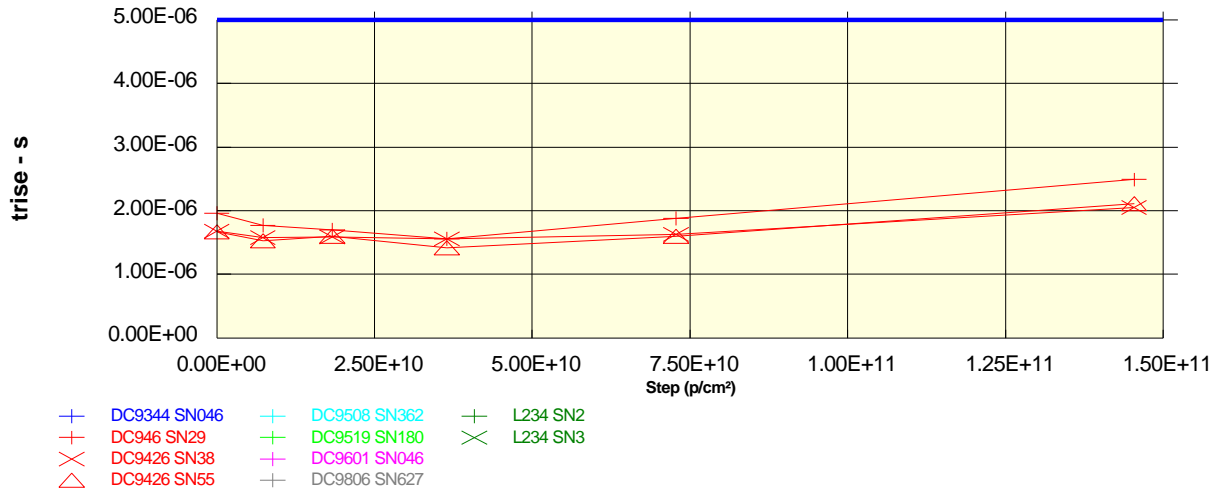
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Rise Time : trise
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

Spec limits are represented in bold lines on the graphic.



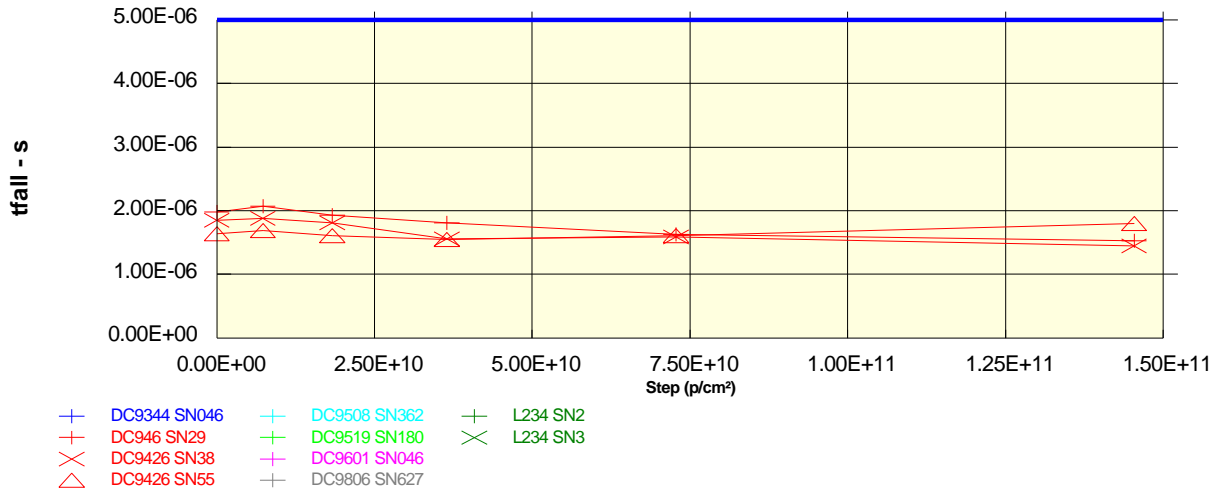
| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : Fall Time : t_{fall}
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

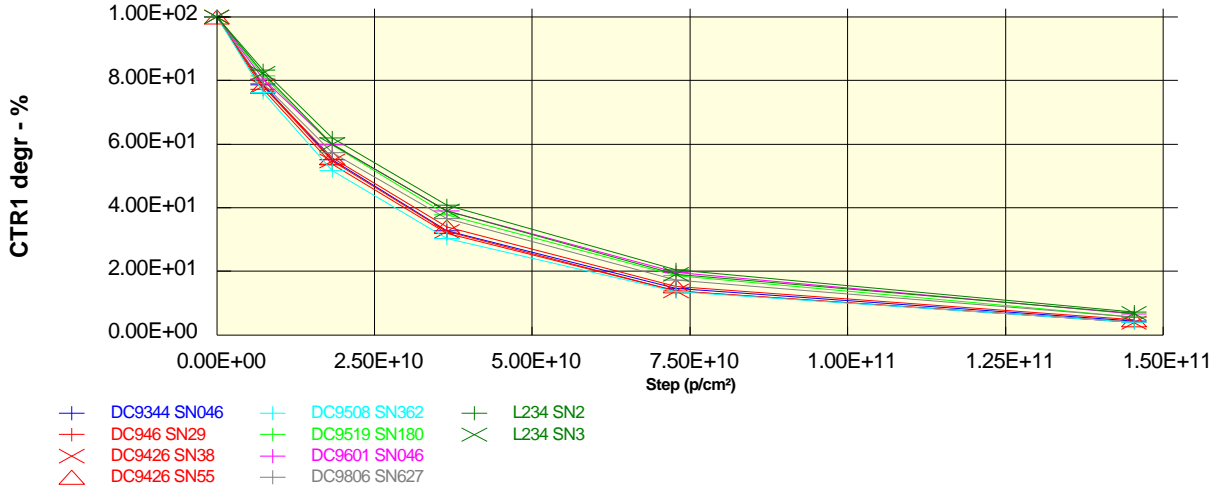
Spec limits are represented in bold lines on the graphic.



| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : CTR1 degr

Unit : %
No spec limit specified.



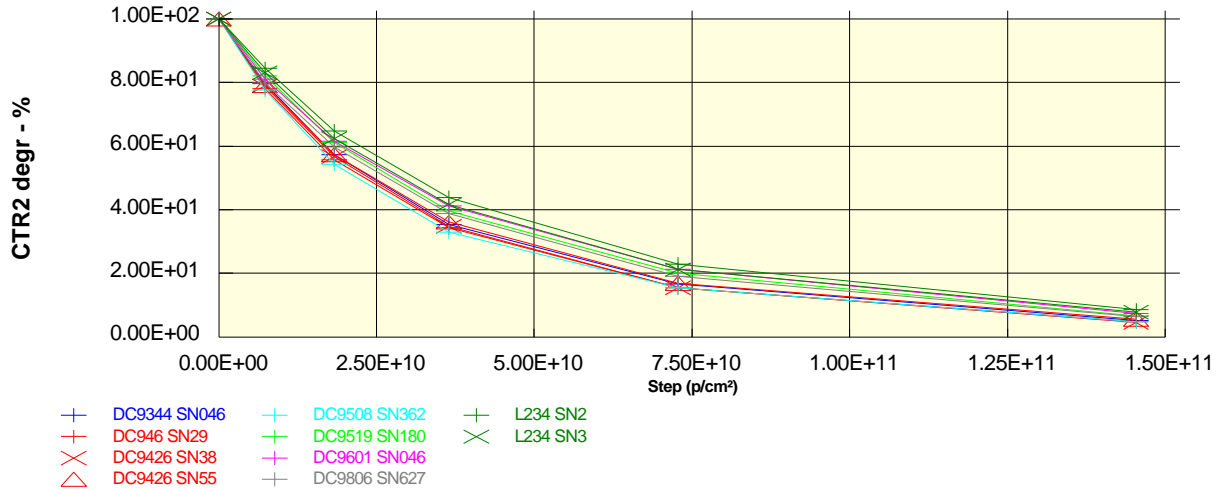
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 7.87 E+01 | 5.52 E+01 | 3.28 E+01 | 1.47 E+01 | 4.37 E+00 |
| 29 | 1.00 E+02 | 7.72 E+01 | 5.37 E+01 | 3.20 E+01 | 1.38 E+01 | 4.02 E+00 |
| 38 | 1.00 E+02 | 7.82 E+01 | 5.47 E+01 | 3.26 E+01 | 1.39 E+01 | 3.88 E+00 |
| 55 | 1.00 E+02 | 7.83 E+01 | 5.56 E+01 | 3.41 E+01 | 1.54 E+01 | 4.71 E+00 |
| 362 | 1.00 E+02 | 7.62 E+01 | 5.16 E+01 | 3.03 E+01 | 1.36 E+01 | 3.88 E+00 |
| 180 | 1.00 E+02 | 8.15 E+01 | 5.97 E+01 | 3.79 E+01 | 1.86 E+01 | 5.72 E+00 |
| 270 | 1.00 E+02 | 8.04 E+01 | 5.98 E+01 | 3.91 E+01 | 1.97 E+01 | 6.60 E+00 |
| 627 | 1.00 E+02 | 7.90 E+01 | 5.74 E+01 | 3.65 E+01 | 1.73 E+01 | 5.65 E+00 |
| 2 | 1.00 E+02 | 8.32 E+01 | 6.20 E+01 | 4.07 E+01 | 2.05 E+01 | 7.35 E+00 |
| 3 | 1.00 E+02 | 8.22 E+01 | 6.00 E+01 | 3.90 E+01 | 1.91 E+01 | 6.79 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : CTR2 degr

Unit : %
No spec limit specified.



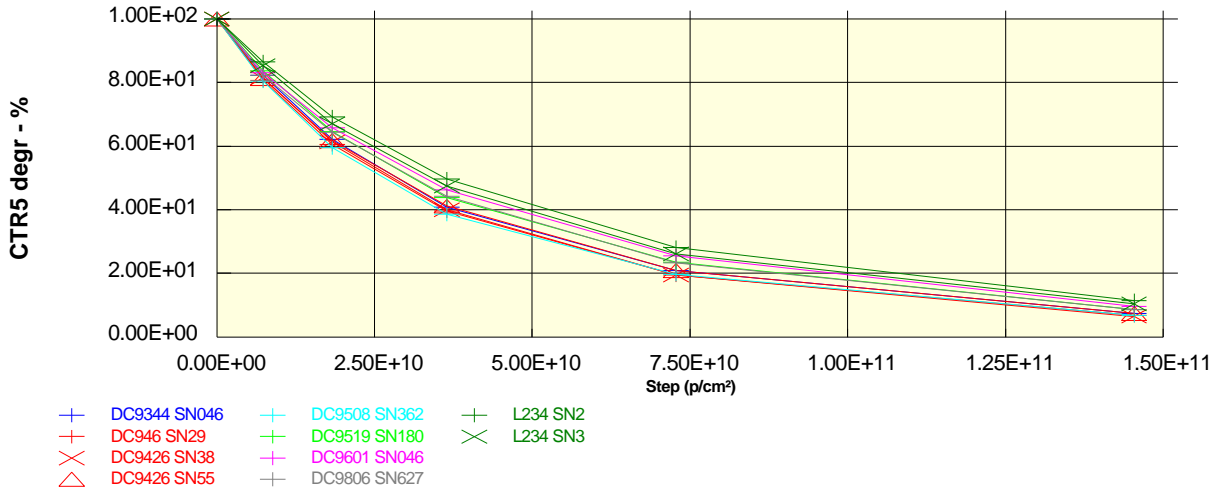
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 7.97 E+01 | 5.74 E+01 | 3.54 E+01 | 1.66 E+01 | 5.27 E+00 |
| 29 | 1.00 E+02 | 7.81 E+01 | 5.58 E+01 | 3.43 E+01 | 1.55 E+01 | 4.85 E+00 |
| 38 | 1.00 E+02 | 7.89 E+01 | 5.67 E+01 | 3.48 E+01 | 1.55 E+01 | 4.66 E+00 |
| 55 | 1.00 E+02 | 7.90 E+01 | 5.73 E+01 | 3.61 E+01 | 1.69 E+01 | 5.50 E+00 |
| 362 | 1.00 E+02 | 7.76 E+01 | 5.42 E+01 | 3.30 E+01 | 1.55 E+01 | 4.73 E+00 |
| 180 | 1.00 E+02 | 8.21 E+01 | 6.12 E+01 | 3.97 E+01 | 2.01 E+01 | 6.66 E+00 |
| 270 | 1.00 E+02 | 8.10 E+01 | 6.16 E+01 | 4.12 E+01 | 2.13 E+01 | 7.46 E+00 |
| 627 | 1.00 E+02 | 7.99 E+01 | 5.97 E+01 | 3.89 E+01 | 1.91 E+01 | 6.53 E+00 |
| 2 | 1.00 E+02 | 8.44 E+01 | 6.47 E+01 | 4.39 E+01 | 2.30 E+01 | 8.57 E+00 |
| 3 | 1.00 E+02 | 8.31 E+01 | 6.23 E+01 | 4.17 E+01 | 2.12 E+01 | 7.83 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : CTR5 degr

Unit : %
No spec limit specified.



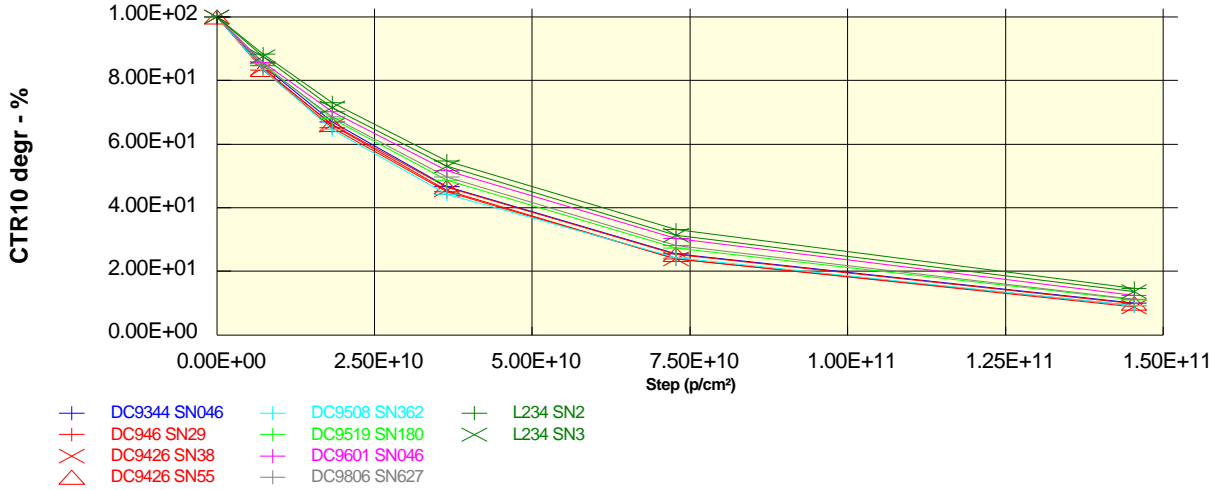
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.00 E+02 | 8.22 E+01 | 6.22 E+01 | 4.09 E+01 | 2.08 E+01 | 7.40 E+00 |
| 29 | 1.00 E+02 | 8.06 E+01 | 6.05 E+01 | 3.95 E+01 | 1.95 E+01 | 6.77 E+00 |
| 38 | 1.00 E+02 | 8.14 E+01 | 6.14 E+01 | 4.00 E+01 | 1.95 E+01 | 6.53 E+00 |
| 55 | 1.00 E+02 | 8.12 E+01 | 6.18 E+01 | 4.11 E+01 | 2.09 E+01 | 7.48 E+00 |
| 362 | 1.00 E+02 | 8.05 E+01 | 5.94 E+01 | 3.86 E+01 | 1.96 E+01 | 6.73 E+00 |
| 180 | 1.00 E+02 | 8.36 E+01 | 6.45 E+01 | 4.37 E+01 | 2.36 E+01 | 8.66 E+00 |
| 270 | 1.00 E+02 | 8.31 E+01 | 6.58 E+01 | 4.63 E+01 | 2.55 E+01 | 9.70 E+00 |
| 627 | 1.00 E+02 | 8.22 E+01 | 6.43 E+01 | 4.43 E+01 | 2.34 E+01 | 8.71 E+00 |
| 2 | 1.00 E+02 | 8.64 E+01 | 6.92 E+01 | 4.96 E+01 | 2.81 E+01 | 1.14 E+01 |
| 3 | 1.00 E+02 | 8.53 E+01 | 6.71 E+01 | 4.75 E+01 | 2.62 E+01 | 1.05 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Bias condition : Unbiased
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 8.47 E+01 | 6.69 E+01 | 4.66 E+01 | 2.55 E+01 | 1.00 E+01 |
| 29 | 1.00 E+02 | 8.32 E+01 | 6.52 E+01 | 4.50 E+01 | 2.40 E+01 | 9.16 E+00 |
| 38 | 1.00 E+02 | 8.38 E+01 | 6.60 E+01 | 4.55 E+01 | 2.40 E+01 | 8.88 E+00 |
| 55 | 1.00 E+02 | 8.35 E+01 | 6.62 E+01 | 4.64 E+01 | 2.53 E+01 | 9.93 E+00 |
| 362 | 1.00 E+02 | 8.34 E+01 | 6.46 E+01 | 4.43 E+01 | 2.42 E+01 | 9.19 E+00 |
| 180 | 1.00 E+02 | 8.53 E+01 | 6.80 E+01 | 4.86 E+01 | 2.74 E+01 | 1.10 E+01 |
| 270 | 1.00 E+02 | 8.56 E+01 | 7.02 E+01 | 5.17 E+01 | 3.03 E+01 | 1.25 E+01 |
| 627 | 1.00 E+02 | 8.46 E+01 | 6.86 E+01 | 4.96 E+01 | 2.81 E+01 | 1.13 E+01 |
| 2 | 1.00 E+02 | 8.84 E+01 | 7.31 E+01 | 5.48 E+01 | 3.31 E+01 | 1.47 E+01 |
| 3 | 1.00 E+02 | 8.75 E+01 | 7.15 E+01 | 5.30 E+01 | 3.14 E+01 | 1.37 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309

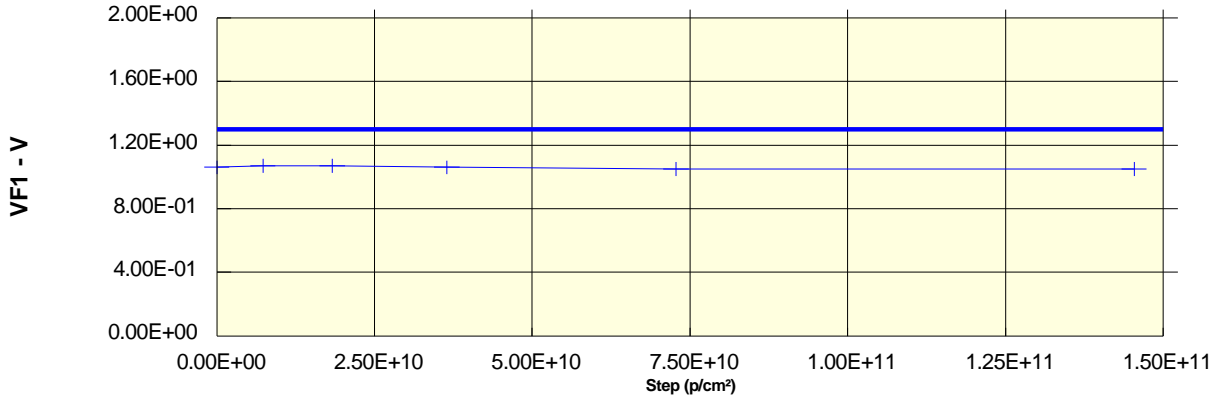
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



+ DC9309 SN097

Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309

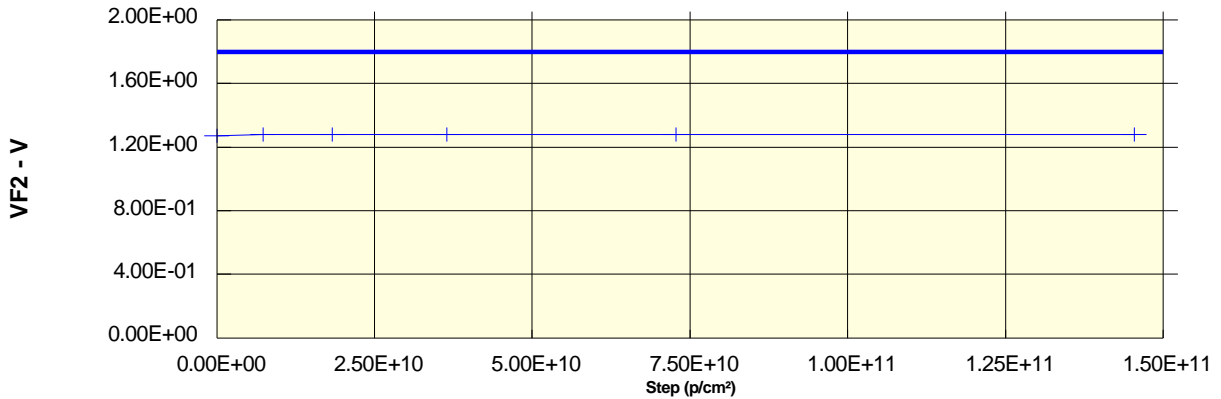
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



+ DC9309 SN097

Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 1.27 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 | 1.28 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309

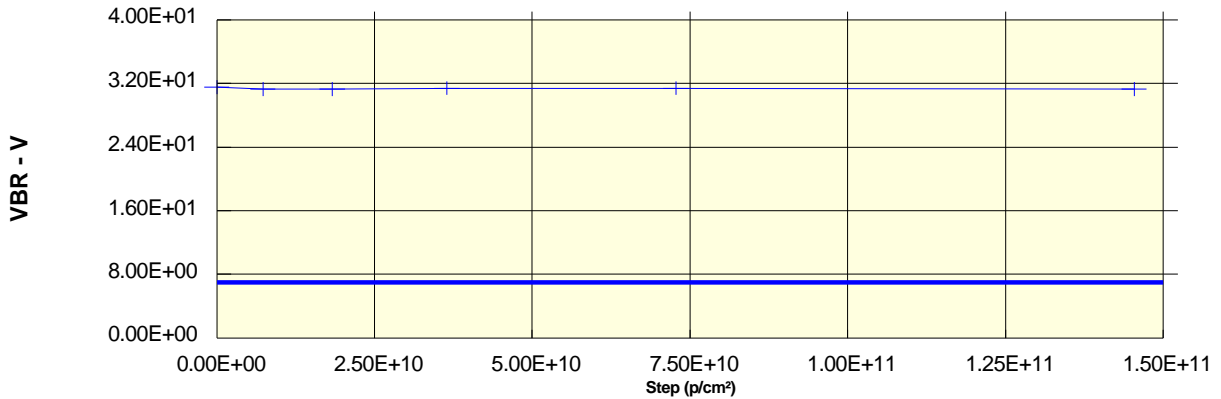
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 3.15 E+01 | 3.13 E+01 | 3.13 E+01 | 3.14 E+01 | 3.14 E+01 | 3.13 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309

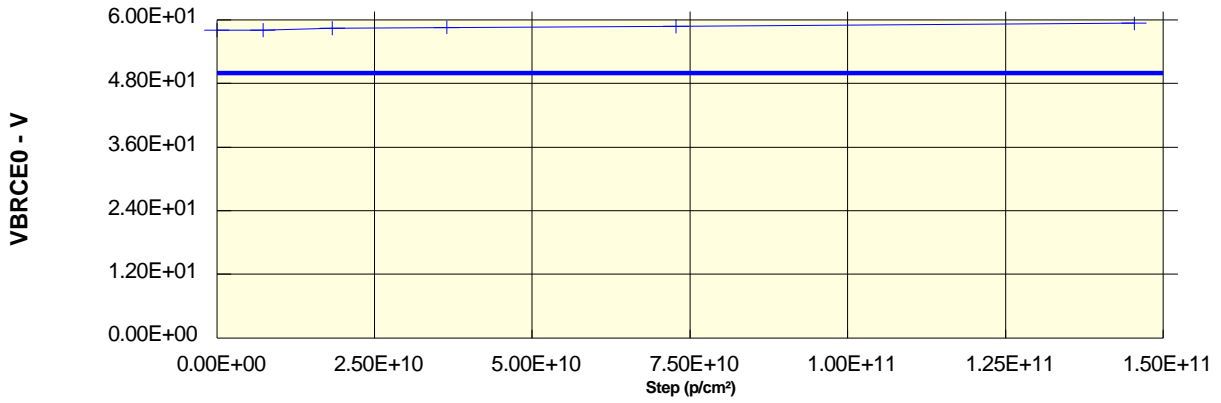
Parameter : Collector-Emitter Breakdown Voltage : VBRCE0

IC=10mA

Unit : V

Spec Limit Min : 5.00 E+01

Spec limits are represented in bold lines on the graphic.



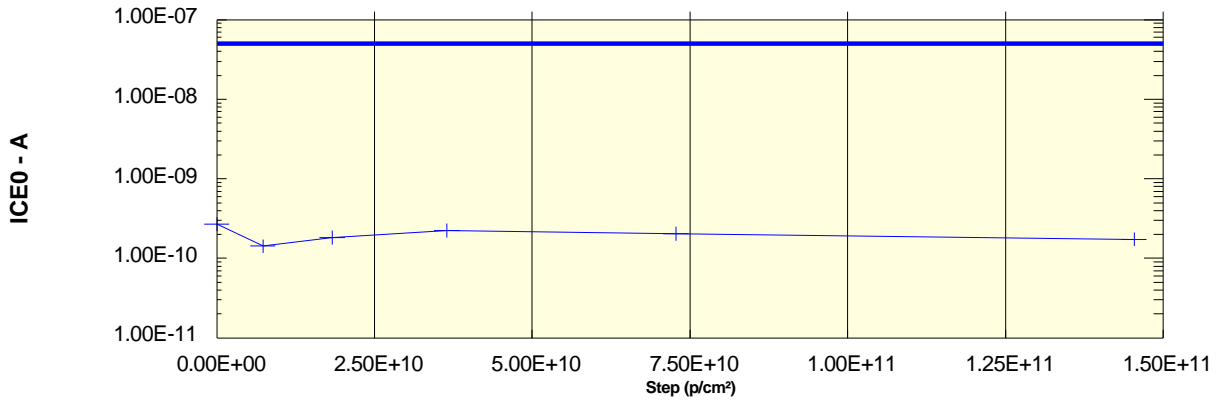
Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 5.81 E+01 | 5.81 E+01 | 5.84 E+01 | 5.86 E+01 | 5.88 E+01 | 5.93 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.



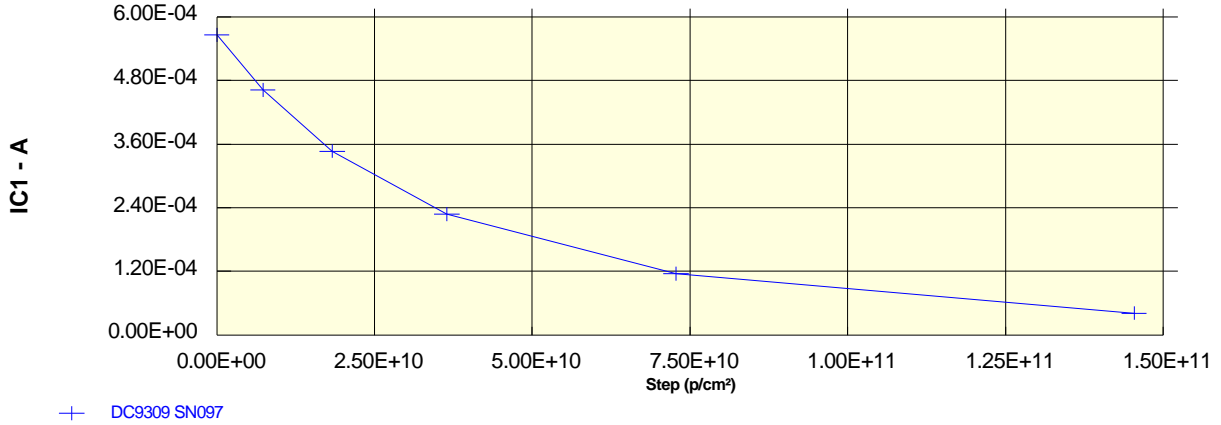
+ DC9309 SN097

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 2.71 E-10 | 1.43 E-10 | 1.83 E-10 | 2.23 E-10 | 2.04 E-10 | 1.74 E-10 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

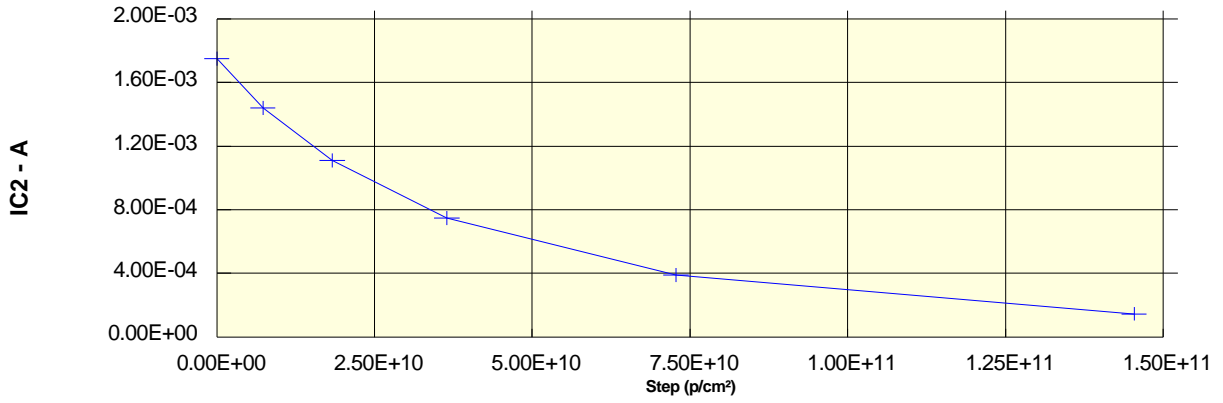


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 5.66 E-04 | 4.62 E-04 | 3.47 E-04 | 2.28 E-04 | 1.16 E-04 | 4.15 E-05 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.



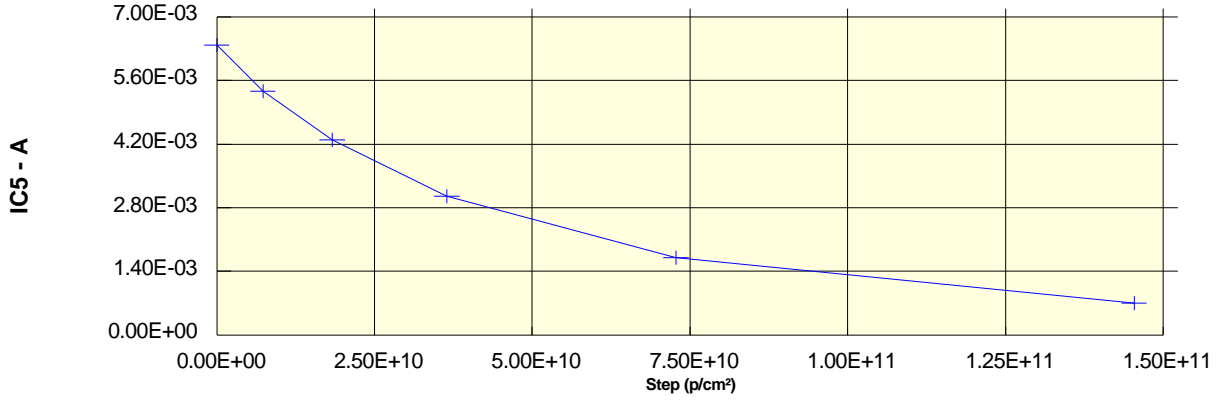
+ DC9309 SN097

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.75 E-03 | 1.44 E-03 | 1.11 E-03 | 7.46 E-04 | 3.90 E-04 | 1.47 E-04 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



+ DC9309 SN097

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 6.38 E-03 | 5.36 E-03 | 4.29 E-03 | 3.05 E-03 | 1.70 E-03 | 7.00 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309

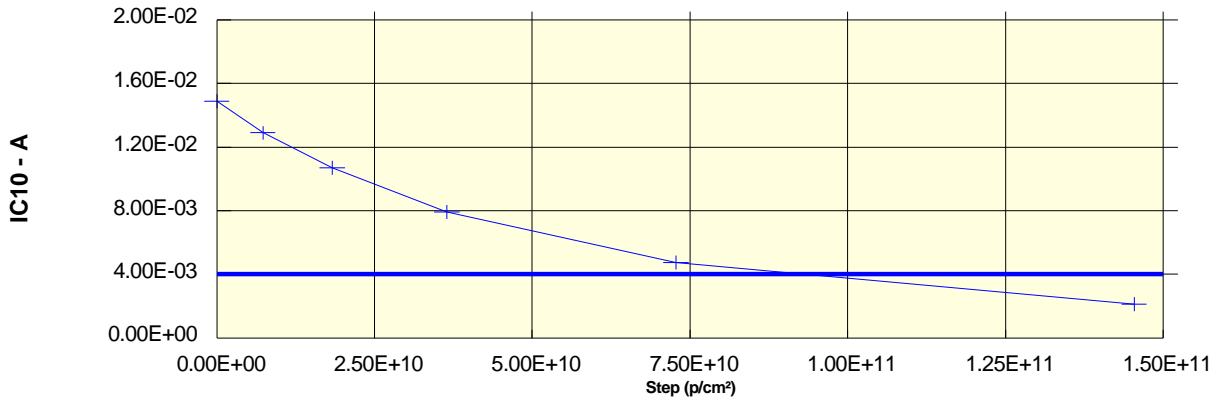
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

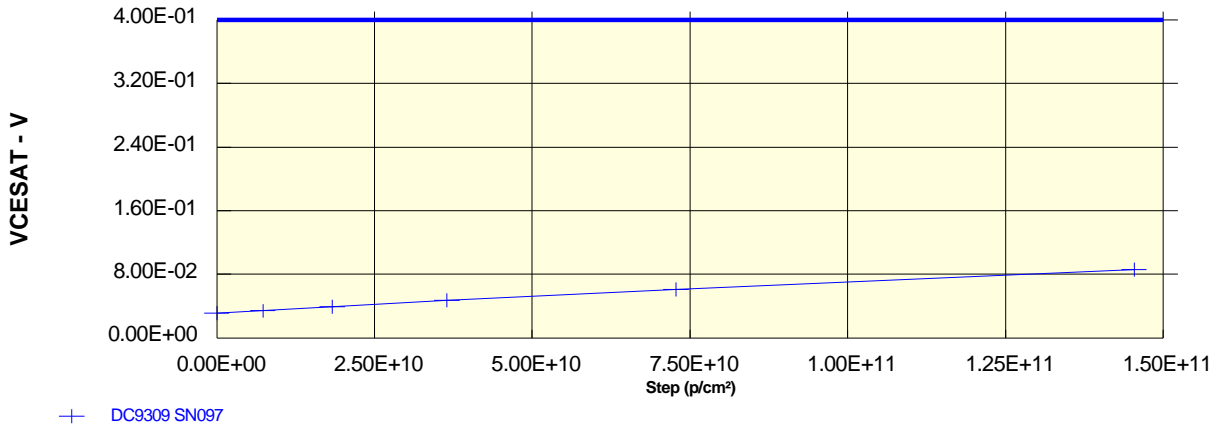


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.49 E-02 | 1.29 E-02 | 1.07 E-02 | 7.93 E-03 | 4.73 E-03 | 2.11 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9309
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



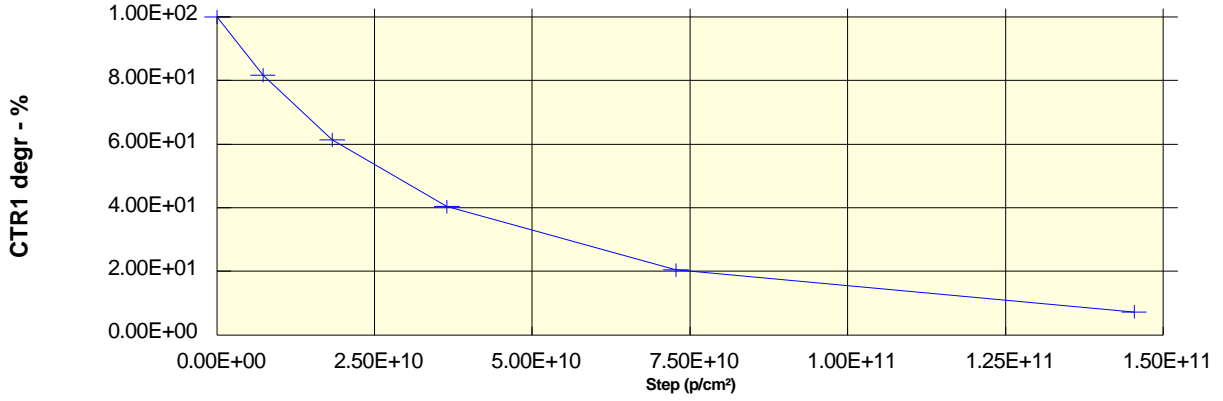
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 3.15 E-02 | 3.42 E-02 | 3.94 E-02 | 4.71 E-02 | 6.11 E-02 | 8.63 E-02 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : CTR1 degr

Unit : %
No spec limit specified.



+ DC9309 SN097

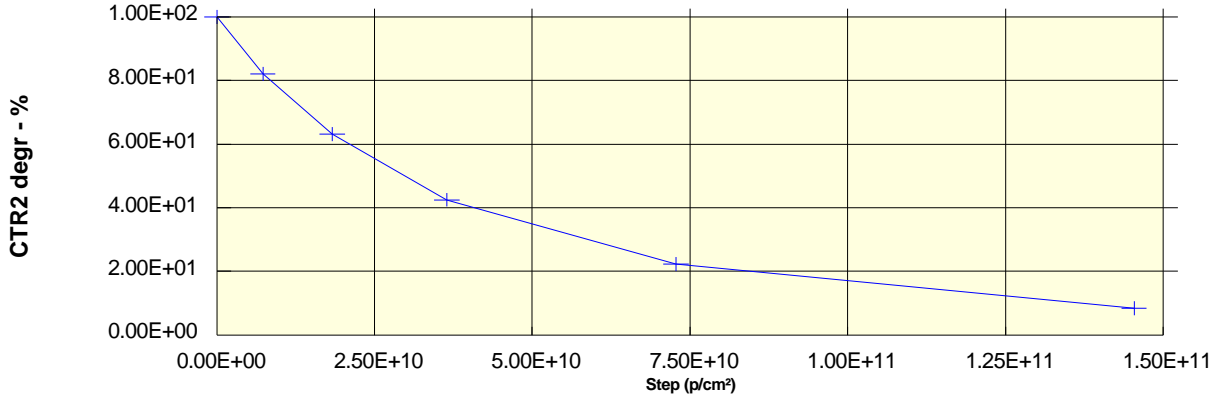
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.00 E+02 | 8.16 E+01 | 6.13 E+01 | 4.03 E+01 | 2.04 E+01 | 7.32 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : CTR2 degr

Unit : %
No spec limit specified.



+ DC9309 SN097

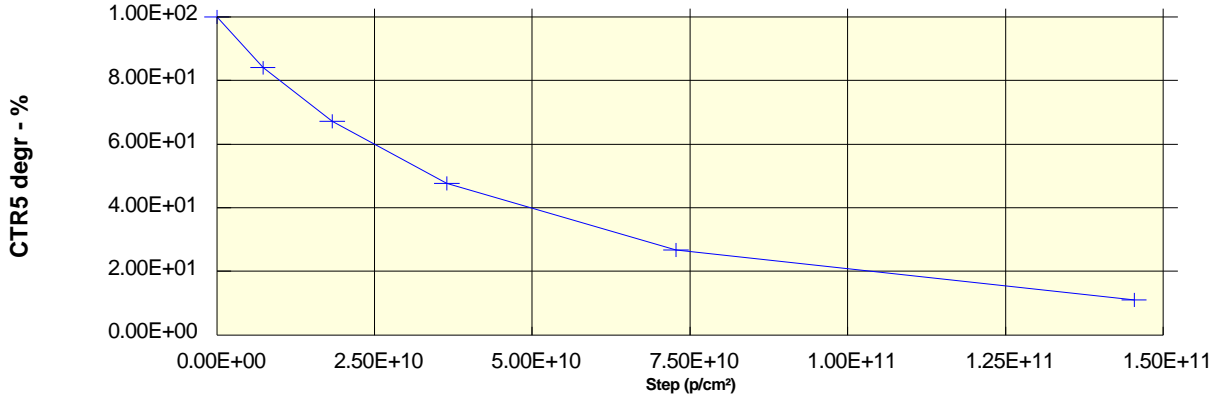
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 097 | 1.00 E+02 | 8.20 E+01 | 6.31 E+01 | 4.25 E+01 | 2.23 E+01 | 8.37 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : CTR5 degr

Unit : %
No spec limit specified.



+ DC9309 SN097

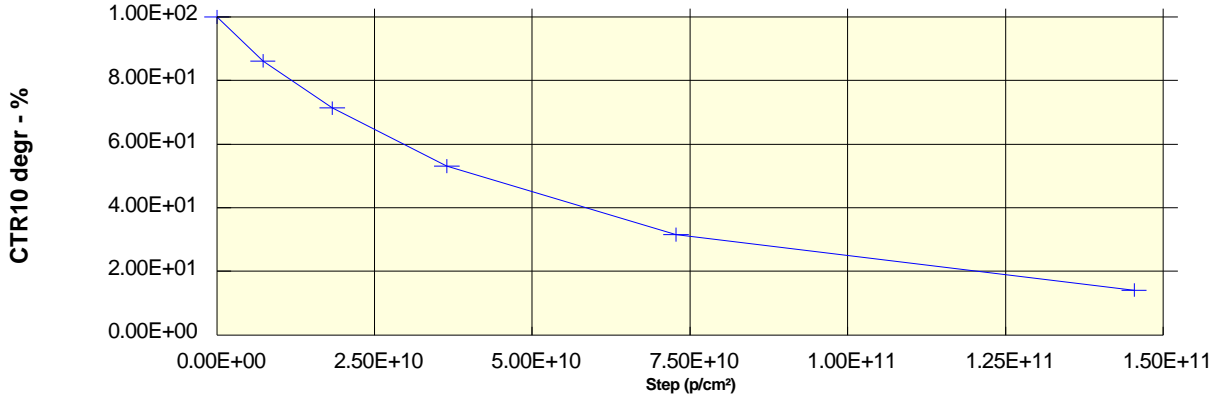
Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 1.00 E+02 | 8.40 E+01 | 6.72 E+01 | 4.77 E+01 | 2.67 E+01 | 1.10 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9309
Parameter : CTR10 degr

Unit : %
No spec limit specified.



+ DC9309 SN097

Test TST001 : 60 MeV proton

| | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
| 097 | 1.00 E+02 | 8.62 E+01 | 7.13 E+01 | 5.31 E+01 | 3.16 E+01 | 1.41 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9519

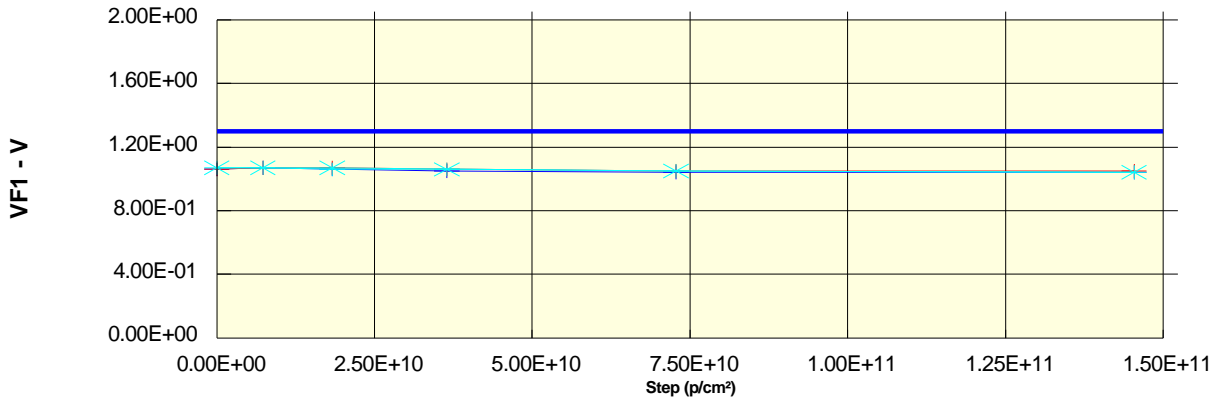
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



- + Unbiased SN180
- + 2mA SN167
- + 10mA SN107
- × 10mA SN241

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 | 1.04 E+00 |
| 167 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 107 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 241 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519

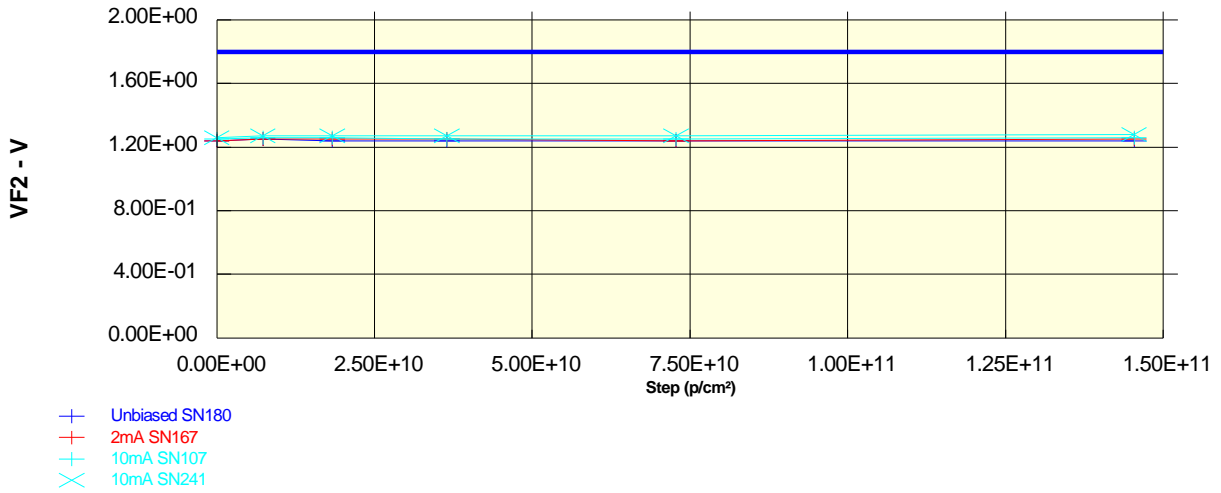
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 167 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.25 E+00 |
| 107 | 1.25 E+00 | 1.26 E+00 | 1.26 E+00 | 1.25 E+00 | 1.25 E+00 | 1.26 E+00 |
| 241 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.28 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519

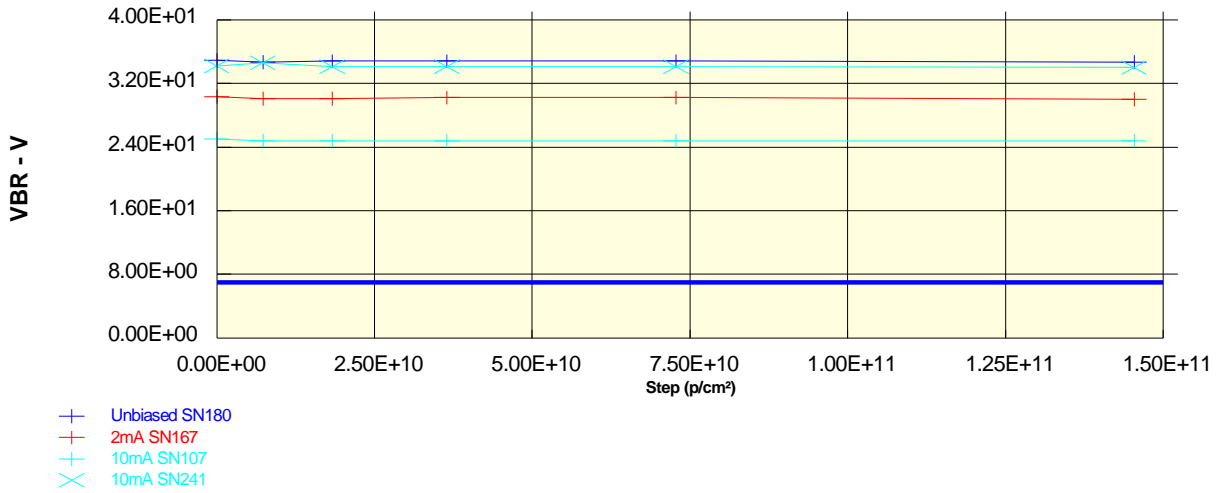
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

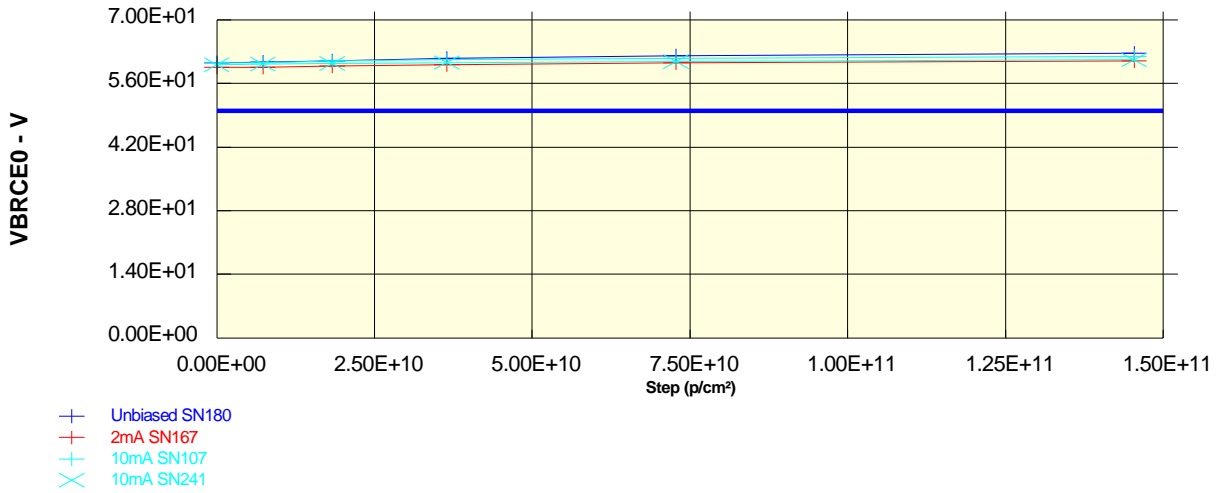


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 3.49 E+01 | 3.47 E+01 | 3.48 E+01 | 3.48 E+01 | 3.48 E+01 | 3.47 E+01 |
| 167 | 3.03 E+01 | 3.01 E+01 | 3.01 E+01 | 3.02 E+01 | 3.02 E+01 | 3.00 E+01 |
| 107 | 2.50 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 | 2.48 E+01 |
| 241 | 3.42 E+01 | 3.46 E+01 | 3.41 E+01 | 3.41 E+01 | 3.41 E+01 | 3.40 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



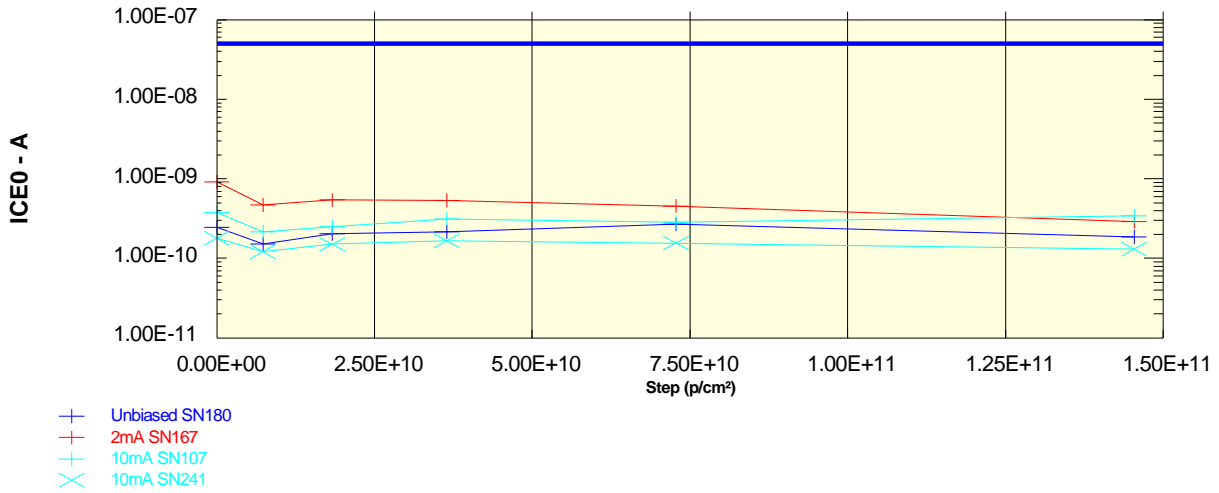
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 6.06 E+01 | 6.07 E+01 | 6.10 E+01 | 6.15 E+01 | 6.21 E+01 | 6.27 E+01 |
| 167 | 5.96 E+01 | 5.96 E+01 | 5.98 E+01 | 6.01 E+01 | 6.05 E+01 | 6.09 E+01 |
| 107 | 6.05 E+01 | 6.05 E+01 | 6.09 E+01 | 6.12 E+01 | 6.15 E+01 | 6.20 E+01 |
| 241 | 6.01 E+01 | 6.02 E+01 | 6.04 E+01 | 6.06 E+01 | 6.08 E+01 | 6.12 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

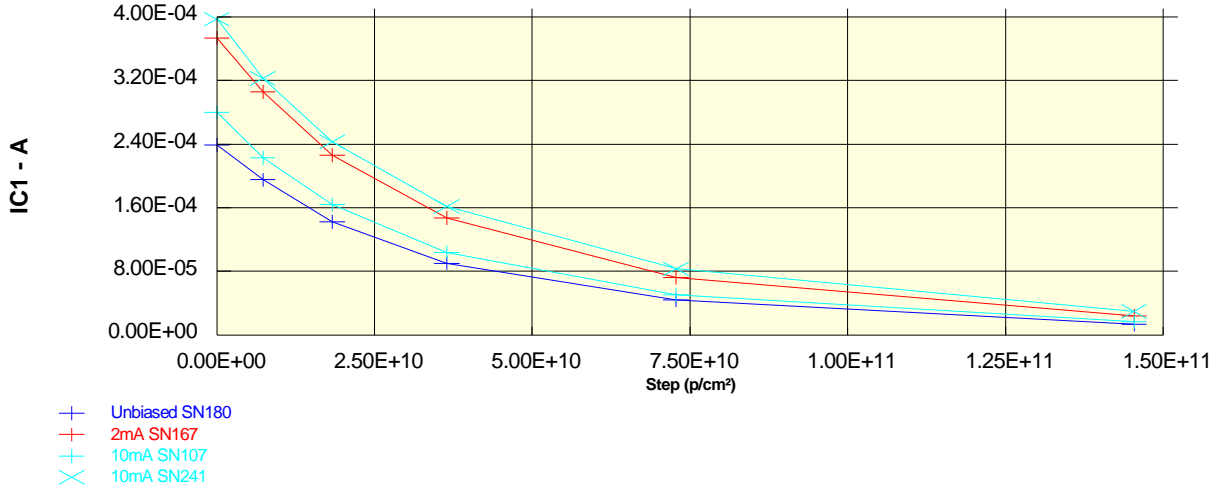


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 2.47 E-10 | 1.53 E-10 | 2.05 E-10 | 2.17 E-10 | 2.68 E-10 | 1.86 E-10 |
| 167 | 9.23 E-10 | 4.68 E-10 | 5.43 E-10 | 5.32 E-10 | 4.57 E-10 | 2.93 E-10 |
| 107 | 3.76 E-10 | 2.16 E-10 | 2.51 E-10 | 3.11 E-10 | 2.84 E-10 | 3.43 E-10 |
| 241 | 1.80 E-10 | 1.21 E-10 | 1.51 E-10 | 1.66 E-10 | 1.56 E-10 | 1.31 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
 Parameter : Output Current1 : IC1
 VCE=5.0V. IF=1mA
 Unit : A
 No spec limit specified.

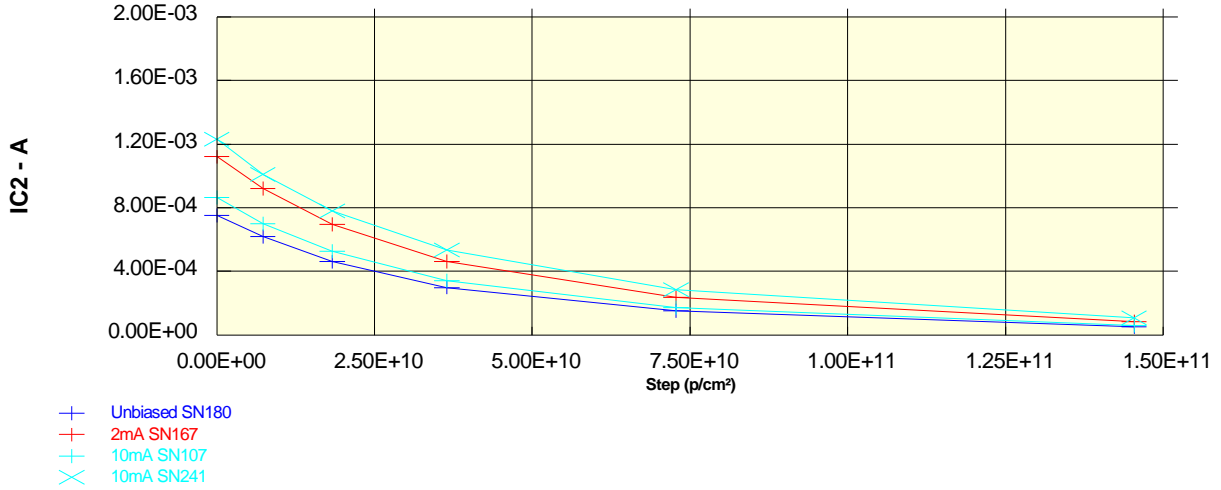


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 2.39 E-04 | 1.95 E-04 | 1.42 E-04 | 9.03 E-05 | 4.43 E-05 | 1.36 E-05 |
| 167 | 3.73 E-04 | 3.06 E-04 | 2.26 E-04 | 1.47 E-04 | 7.26 E-05 | 2.44 E-05 |
| 107 | 2.80 E-04 | 2.23 E-04 | 1.64 E-04 | 1.04 E-04 | 5.08 E-05 | 1.67 E-05 |
| 241 | 3.97 E-04 | 3.23 E-04 | 2.43 E-04 | 1.62 E-04 | 8.33 E-05 | 3.00 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
 Parameter : Output Current2 : IC2
 VCE=5.0V. IF=2mA
 Unit : A
 No spec limit specified.

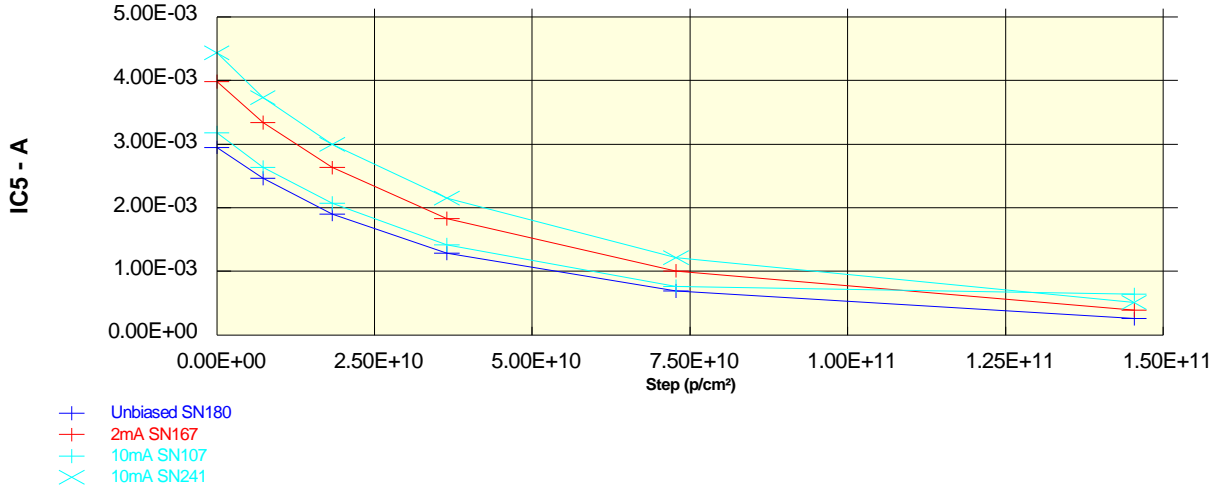


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 7.53 E-04 | 6.19 E-04 | 4.61 E-04 | 2.99 E-04 | 1.52 E-04 | 5.01 E-05 |
| 167 | 1.12 E-03 | 9.21 E-04 | 6.96 E-04 | 4.62 E-04 | 2.38 E-04 | 8.41 E-05 |
| 107 | 8.64 E-04 | 7.00 E-04 | 5.25 E-04 | 3.42 E-04 | 1.73 E-04 | 5.99 E-05 |
| 241 | 1.23 E-03 | 1.01 E-03 | 7.79 E-04 | 5.34 E-04 | 2.84 E-04 | 1.07 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
 Parameter : Output Current5 : IC5
 VCE=5.0V. IF=5mA
 Unit : A
 No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 2.95 E-03 | 2.46 E-03 | 1.90 E-03 | 1.29 E-03 | 6.96 E-04 | 2.55 E-04 |
| 167 | 3.98 E-03 | 3.34 E-03 | 2.63 E-03 | 1.83 E-03 | 1.01 E-03 | 3.92 E-04 |
| 107 | 3.18 E-03 | 2.64 E-03 | 2.07 E-03 | 1.42 E-03 | 7.70 E-04 | 6.39 E-04 |
| 241 | 4.44 E-03 | 3.73 E-03 | 3.00 E-03 | 2.15 E-03 | 1.22 E-03 | 5.08 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519

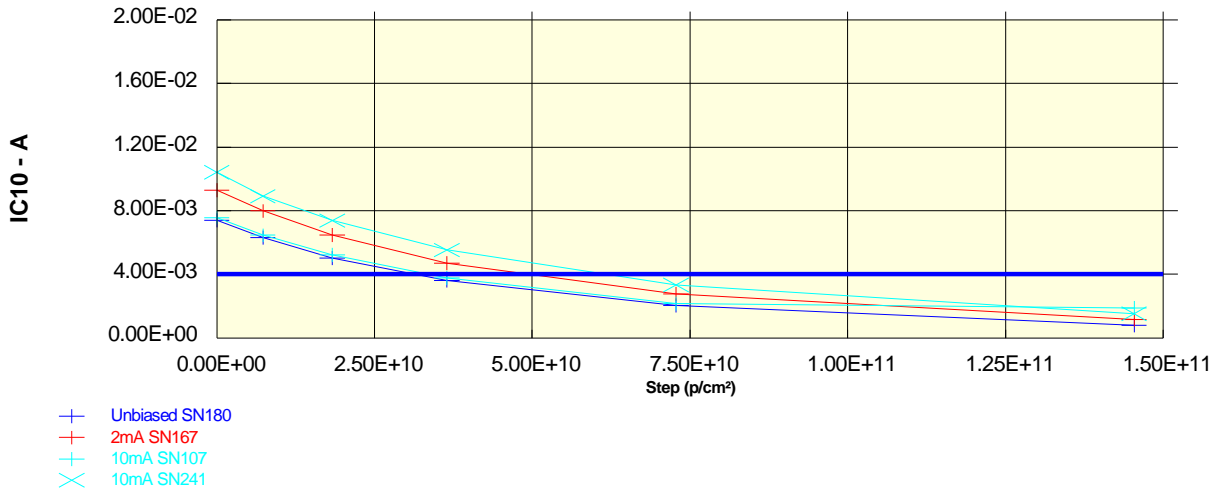
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

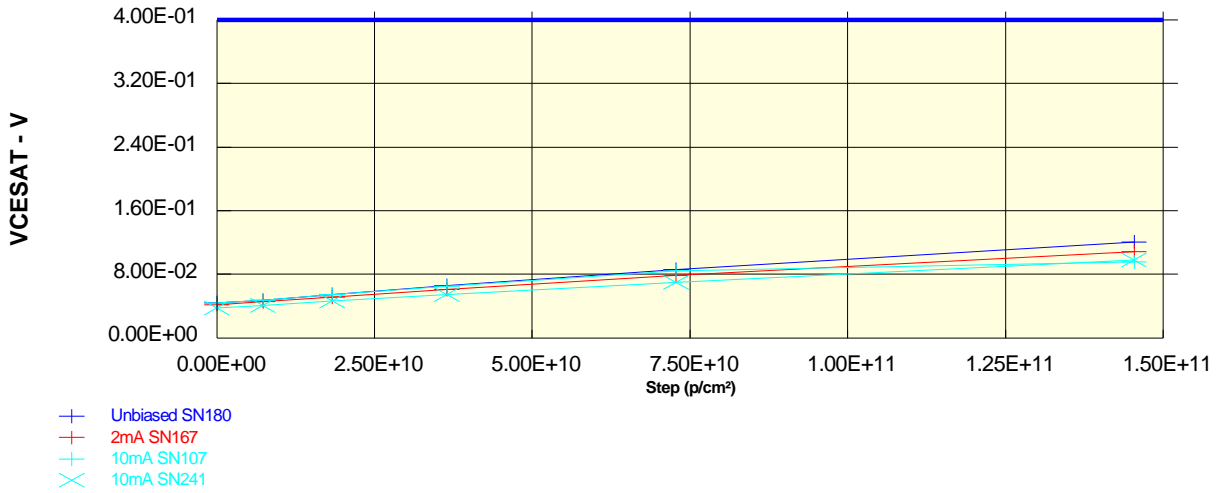


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 7.42 E-03 | 6.33 E-03 | 5.04 E-03 | 3.61 E-03 | 2.04 E-03 | 8.14 E-04 |
| 167 | 9.29 E-03 | 7.98 E-03 | 6.48 E-03 | 4.72 E-03 | 2.77 E-03 | 1.17 E-03 |
| 107 | 7.58 E-03 | 6.45 E-03 | 5.23 E-03 | 3.77 E-03 | 2.17 E-03 | 1.88 E-03 |
| 241 | 1.04 E-02 | 8.91 E-03 | 7.39 E-03 | 5.53 E-03 | 3.34 E-03 | 1.51 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



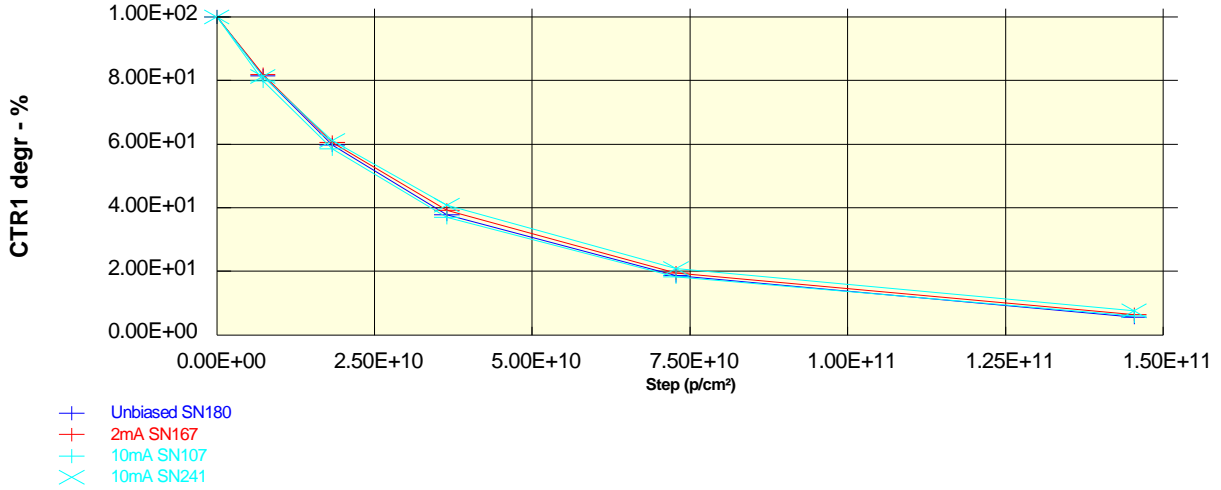
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 4.38 E-02 | 4.74 E-02 | 5.48 E-02 | 6.61 E-02 | 8.63 E-02 | 1.21 E-01 |
| 167 | 4.21 E-02 | 4.56 E-02 | 5.15 E-02 | 6.12 E-02 | 7.88 E-02 | 1.09 E-01 |
| 107 | 4.40 E-02 | 4.75 E-02 | 5.43 E-02 | 6.55 E-02 | 8.42 E-02 | 9.53 E-02 |
| 241 | 3.77 E-02 | 4.08 E-02 | 4.64 E-02 | 5.48 E-02 | 6.97 E-02 | 9.78 E-02 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
Parameter : CTR1 degr

Unit : %
No spec limit specified.



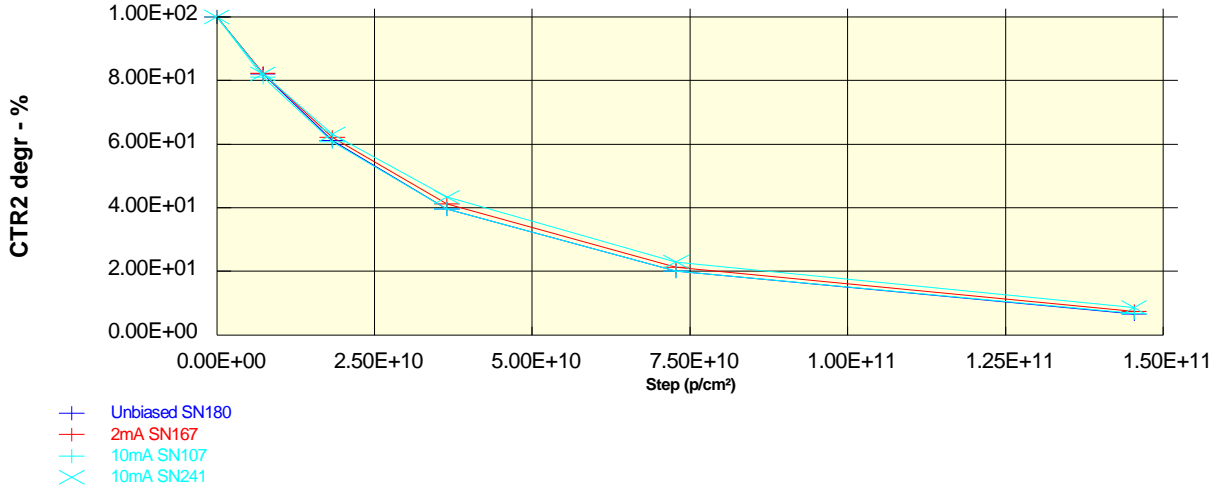
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 1.00 E+02 | 8.15 E+01 | 5.97 E+01 | 3.79 E+01 | 1.86 E+01 | 5.72 E+00 |
| 167 | 1.00 E+02 | 8.18 E+01 | 6.06 E+01 | 3.93 E+01 | 1.94 E+01 | 6.53 E+00 |
| 107 | 1.00 E+02 | 7.98 E+01 | 5.85 E+01 | 3.71 E+01 | 1.82 E+01 | 5.97 E+00 |
| 241 | 1.00 E+02 | 8.12 E+01 | 6.12 E+01 | 4.08 E+01 | 2.10 E+01 | 7.55 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
Parameter : CTR2 degr

Unit : %
No spec limit specified.



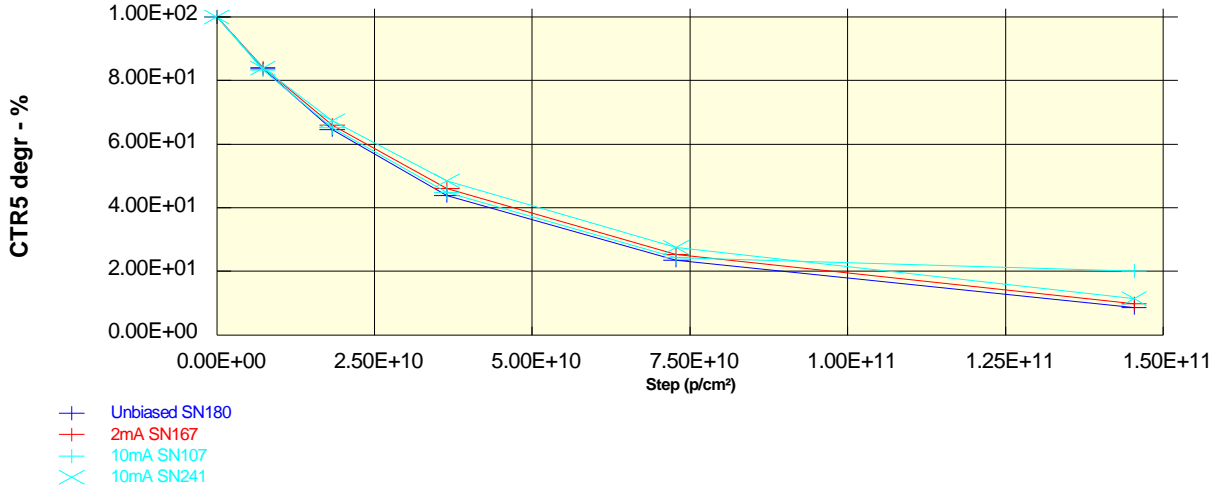
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 1.00 E+02 | 8.21 E+01 | 6.12 E+01 | 3.97 E+01 | 2.01 E+01 | 6.66 E+00 |
| 167 | 1.00 E+02 | 8.23 E+01 | 6.22 E+01 | 4.13 E+01 | 2.12 E+01 | 7.51 E+00 |
| 107 | 1.00 E+02 | 8.10 E+01 | 6.07 E+01 | 3.96 E+01 | 2.00 E+01 | 6.94 E+00 |
| 241 | 1.00 E+02 | 8.20 E+01 | 6.32 E+01 | 4.33 E+01 | 2.30 E+01 | 8.69 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9519
Parameter : CTR5 degr

Unit : %
No spec limit specified.



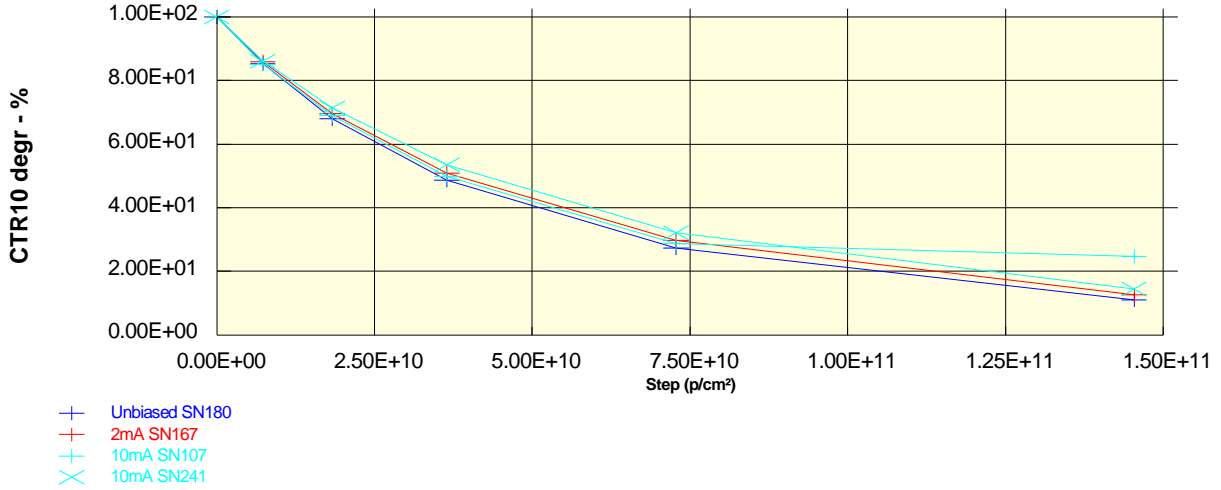
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 180 | 1.00 E+02 | 8.36 E+01 | 6.45 E+01 | 4.37 E+01 | 2.36 E+01 | 8.66 E+00 |
| 167 | 1.00 E+02 | 8.40 E+01 | 6.60 E+01 | 4.60 E+01 | 2.53 E+01 | 9.85 E+00 |
| 107 | 1.00 E+02 | 8.32 E+01 | 6.51 E+01 | 4.48 E+01 | 2.42 E+01 | 2.01 E+01 |
| 241 | 1.00 E+02 | 8.39 E+01 | 6.74 E+01 | 4.85 E+01 | 2.75 E+01 | 1.14 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9519
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 180 | 1.00 E+02 | 8.53 E+01 | 6.80 E+01 | 4.86 E+01 | 2.74 E+01 | 1.10 E+01 |
| 167 | 1.00 E+02 | 8.59 E+01 | 6.97 E+01 | 5.09 E+01 | 2.98 E+01 | 1.26 E+01 |
| 107 | 1.00 E+02 | 8.51 E+01 | 6.90 E+01 | 4.98 E+01 | 2.87 E+01 | 2.48 E+01 |
| 241 | 1.00 E+02 | 8.60 E+01 | 7.14 E+01 | 5.34 E+01 | 3.22 E+01 | 1.45 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9806

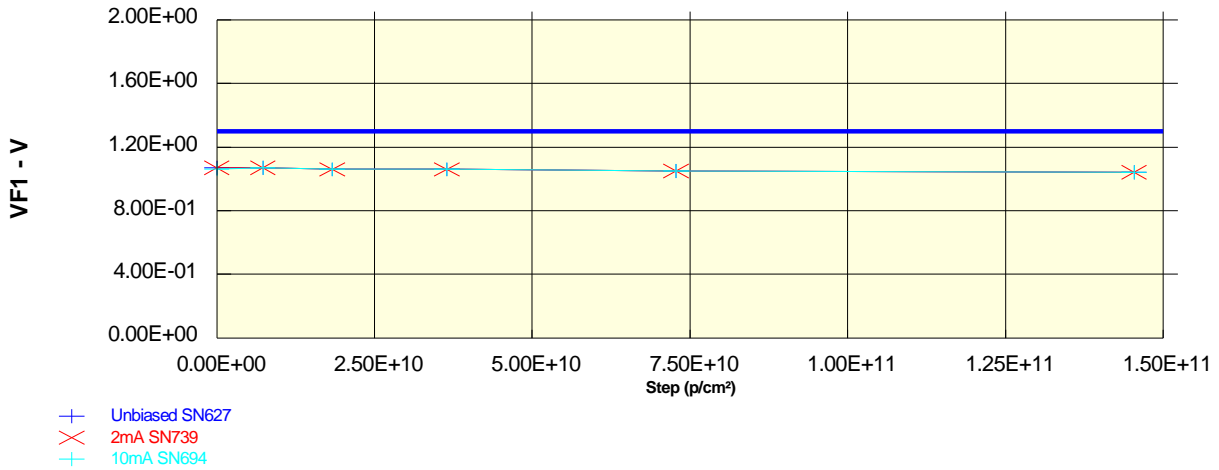
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 739 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 694 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9806

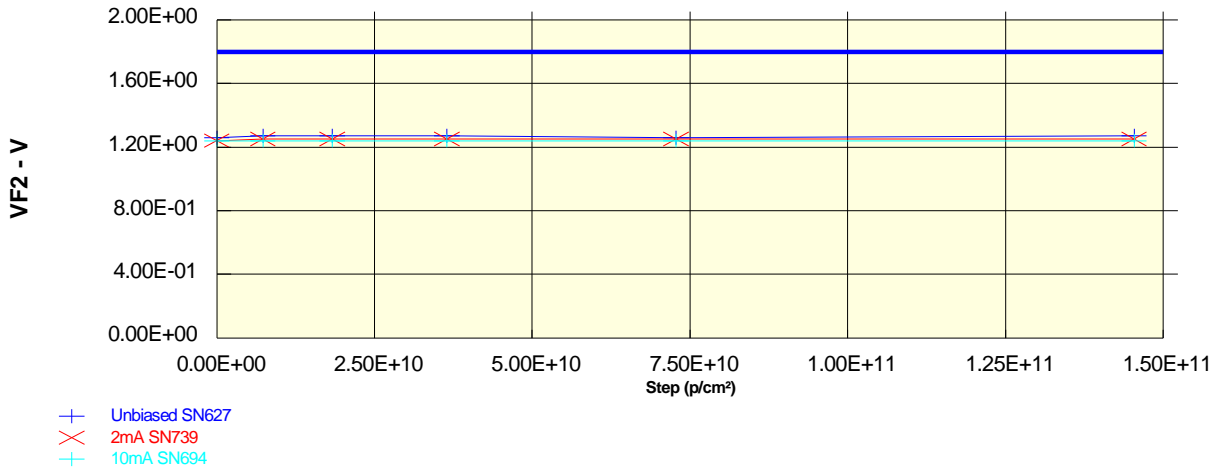
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.26 E+00 | 1.27 E+00 |
| 739 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |
| 694 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806

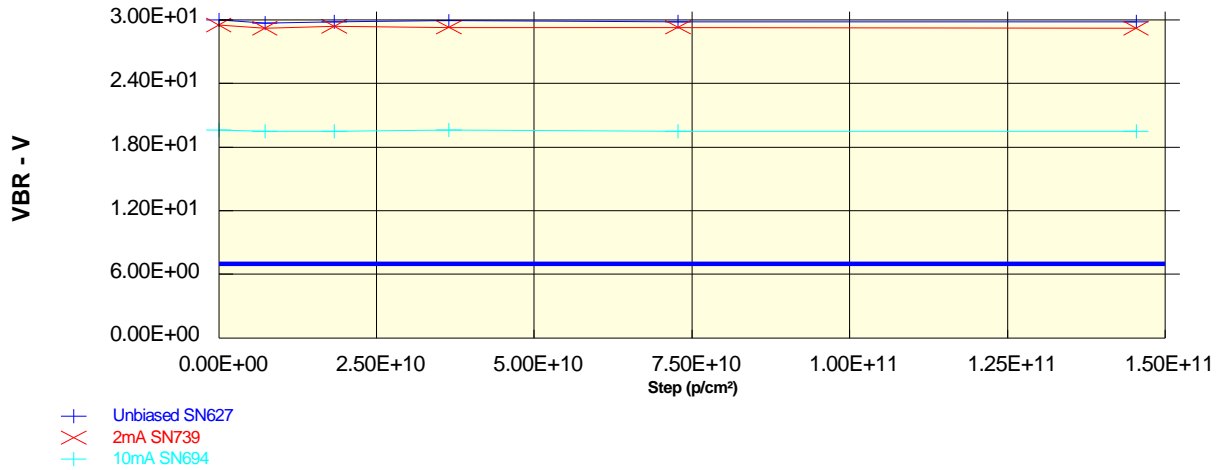
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

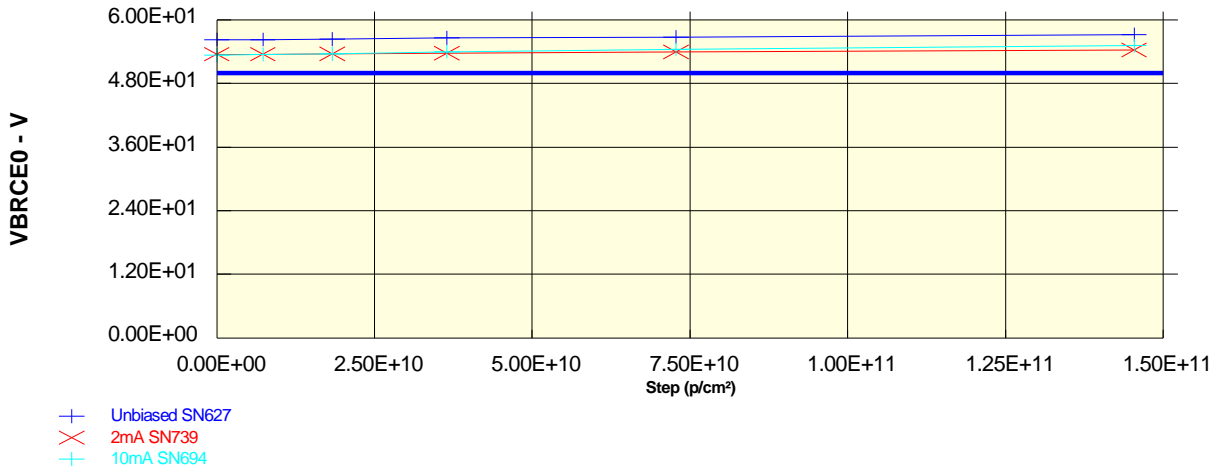


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 3.00 E+01 | 2.97 E+01 | 2.98 E+01 | 2.99 E+01 | 2.98 E+01 | 2.98 E+01 |
| 739 | 2.95 E+01 | 2.92 E+01 | 2.94 E+01 | 2.93 E+01 | 2.93 E+01 | 2.92 E+01 |
| 694 | 1.96 E+01 | 1.95 E+01 | 1.95 E+01 | 1.96 E+01 | 1.95 E+01 | 1.95 E+01 |

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|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
IC=10mA
Unit : V
Spec Limit Min : 5.00 E+01
Spec limits are represented in bold lines on the graphic.



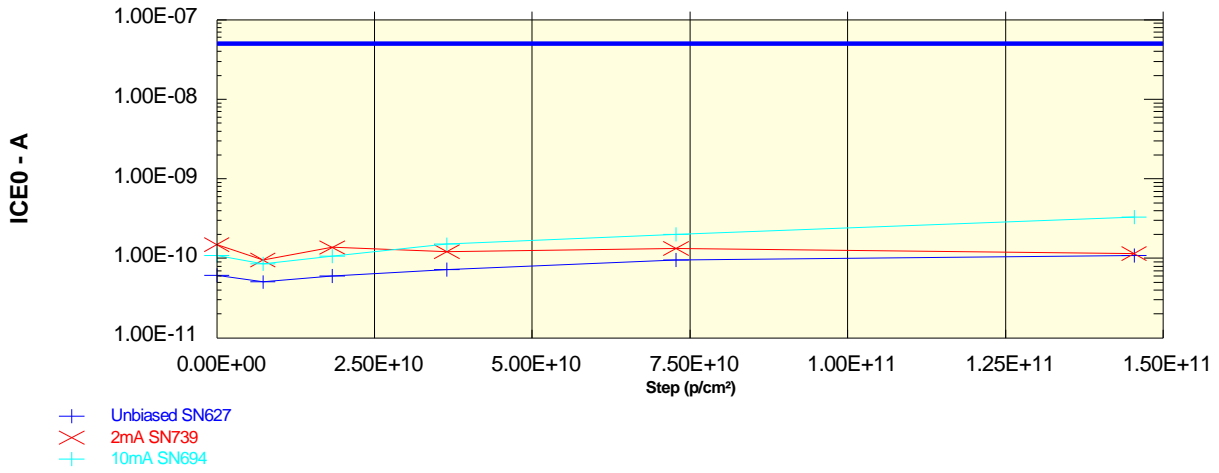
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 5.63 E+01 | 5.63 E+01 | 5.64 E+01 | 5.66 E+01 | 5.68 E+01 | 5.72 E+01 |
| 739 | 5.35 E+01 | 5.35 E+01 | 5.36 E+01 | 5.37 E+01 | 5.39 E+01 | 5.43 E+01 |
| 694 | 5.33 E+01 | 5.34 E+01 | 5.36 E+01 | 5.40 E+01 | 5.45 E+01 | 5.51 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

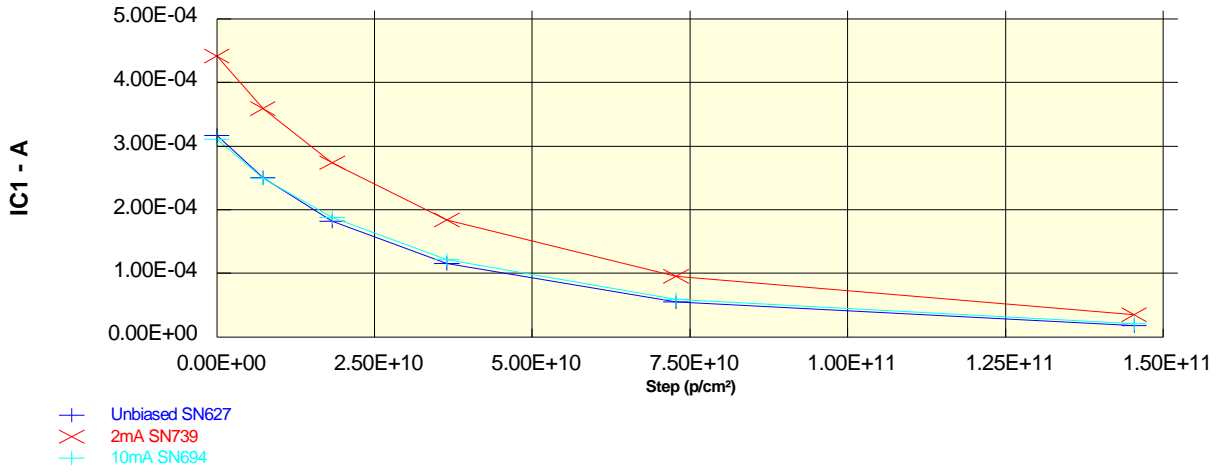


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 6.14 E-11 | 5.06 E-11 | 5.98 E-11 | 7.26 E-11 | 9.61 E-11 | 1.09 E-10 |
| 739 | 1.48 E-10 | 9.61 E-11 | 1.37 E-10 | 1.22 E-10 | 1.34 E-10 | 1.16 E-10 |
| 694 | 1.08 E-10 | 8.56 E-11 | 1.07 E-10 | 1.51 E-10 | 2.01 E-10 | 3.33 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

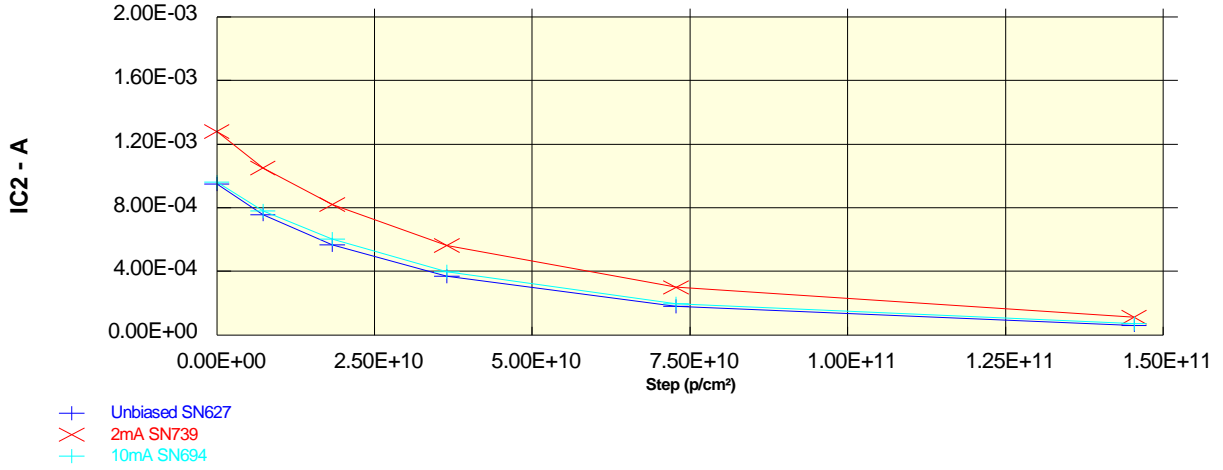


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 3.17 E-04 | 2.50 E-04 | 1.82 E-04 | 1.16 E-04 | 5.47 E-05 | 1.79 E-05 |
| 739 | 4.42 E-04 | 3.59 E-04 | 2.74 E-04 | 1.84 E-04 | 9.51 E-05 | 3.50 E-05 |
| 694 | 3.11 E-04 | 2.49 E-04 | 1.88 E-04 | 1.21 E-04 | 5.89 E-05 | 2.08 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

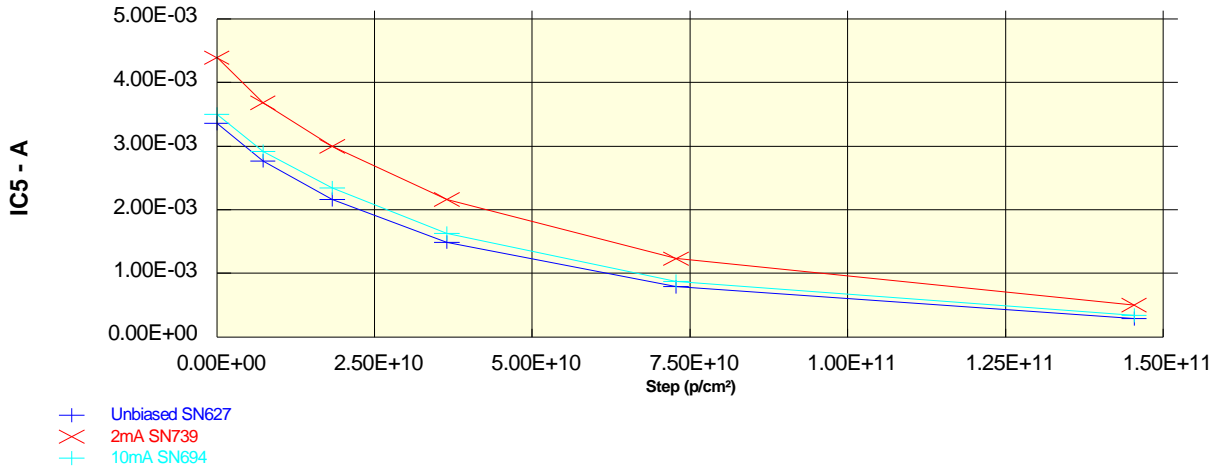


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 9.49 E-04 | 7.58 E-04 | 5.66 E-04 | 3.69 E-04 | 1.82 E-04 | 6.19 E-05 |
| 739 | 1.28 E-03 | 1.05 E-03 | 8.21 E-04 | 5.63 E-04 | 3.00 E-04 | 1.14 E-04 |
| 694 | 9.62 E-04 | 7.80 E-04 | 6.01 E-04 | 3.97 E-04 | 1.98 E-04 | 7.19 E-05 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9806
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 3.36 E-03 | 2.77 E-03 | 2.16 E-03 | 1.49 E-03 | 7.89 E-04 | 2.93 E-04 |
| 739 | 4.39 E-03 | 3.68 E-03 | 3.00 E-03 | 2.16 E-03 | 1.23 E-03 | 5.03 E-04 |
| 694 | 3.50 E-03 | 2.92 E-03 | 2.34 E-03 | 1.63 E-03 | 8.69 E-04 | 3.38 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806

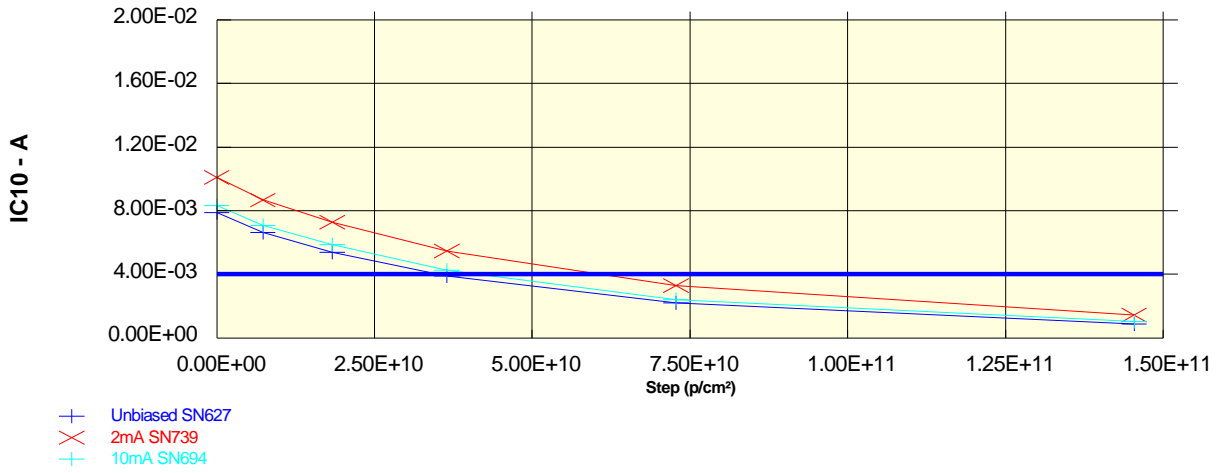
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

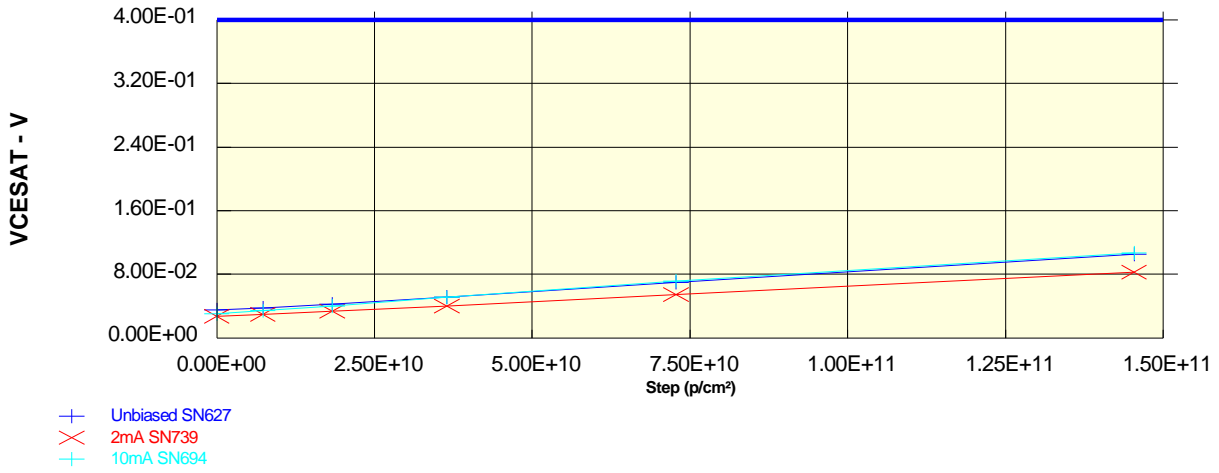


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 627 | 7.87 E-03 | 6.65 E-03 | 5.40 E-03 | 3.90 E-03 | 2.21 E-03 | 8.92 E-04 |
| 739 | 1.01 E-02 | 8.66 E-03 | 7.29 E-03 | 5.46 E-03 | 3.29 E-03 | 1.45 E-03 |
| 694 | 8.31 E-03 | 7.09 E-03 | 5.87 E-03 | 4.28 E-03 | 2.43 E-03 | 1.02 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



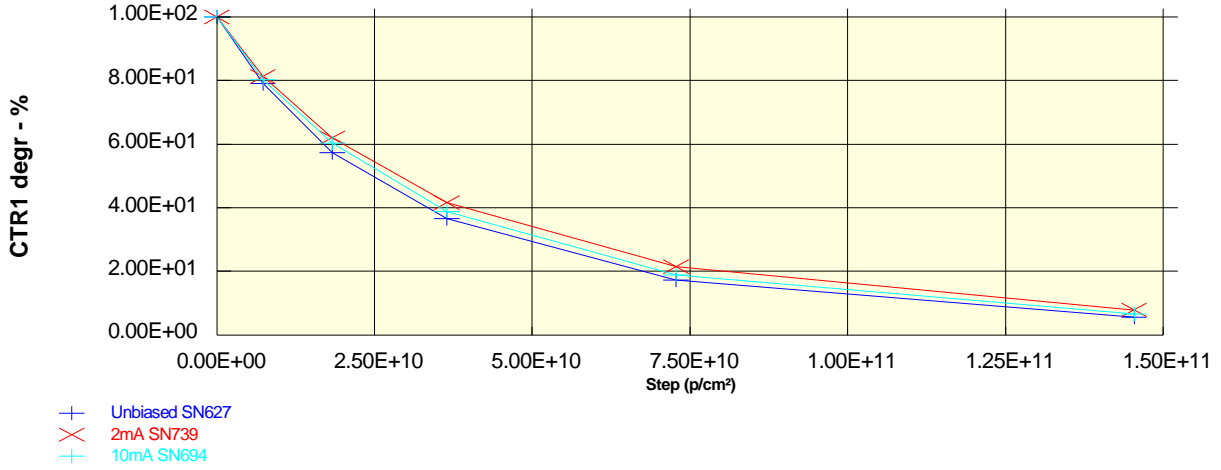
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 3.52 E-02 | 3.76 E-02 | 4.28 E-02 | 5.15 E-02 | 7.00 E-02 | 1.05 E-01 |
| 739 | 2.74 E-02 | 2.95 E-02 | 3.38 E-02 | 4.03 E-02 | 5.45 E-02 | 8.30 E-02 |
| 694 | 3.05 E-02 | 3.40 E-02 | 4.01 E-02 | 5.11 E-02 | 7.18 E-02 | 1.07 E-01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : CTR1 degr

Unit : %
No spec limit specified.



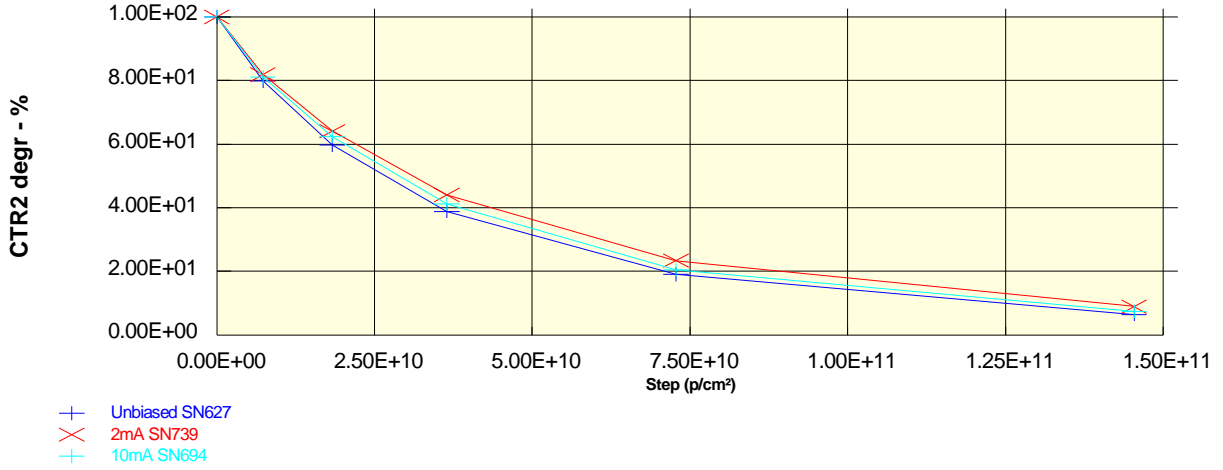
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 1.00 E+02 | 7.90 E+01 | 5.74 E+01 | 3.65 E+01 | 1.73 E+01 | 5.65 E+00 |
| 739 | 1.00 E+02 | 8.12 E+01 | 6.20 E+01 | 4.16 E+01 | 2.15 E+01 | 7.92 E+00 |
| 694 | 1.00 E+02 | 8.02 E+01 | 6.04 E+01 | 3.89 E+01 | 1.89 E+01 | 6.68 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : CTR2 degr

Unit : %
No spec limit specified.



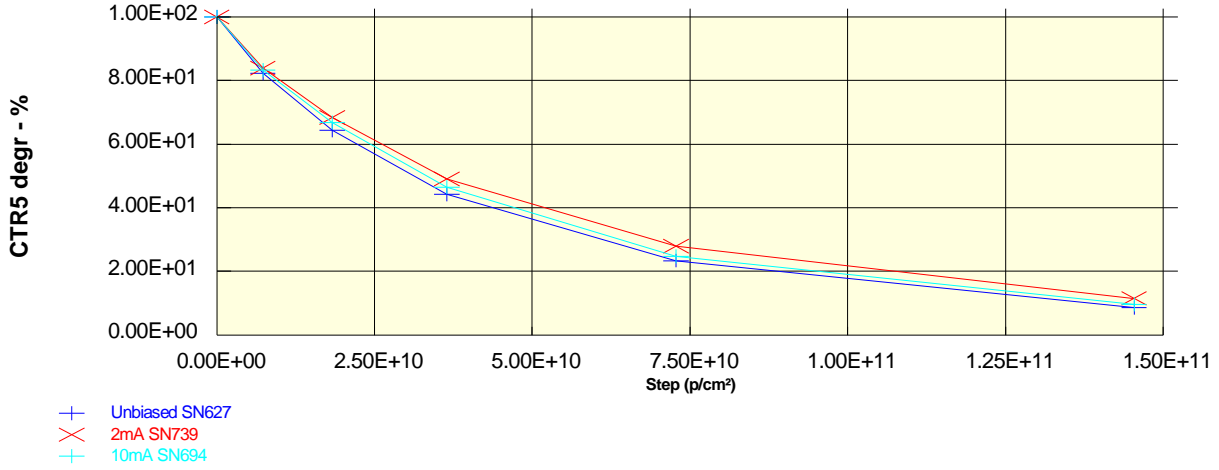
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 1.00 E+02 | 7.99 E+01 | 5.97 E+01 | 3.89 E+01 | 1.91 E+01 | 6.53 E+00 |
| 739 | 1.00 E+02 | 8.18 E+01 | 6.41 E+01 | 4.40 E+01 | 2.34 E+01 | 8.93 E+00 |
| 694 | 1.00 E+02 | 8.11 E+01 | 6.24 E+01 | 4.12 E+01 | 2.06 E+01 | 7.47 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : CTR5 degr

Unit : %
No spec limit specified.



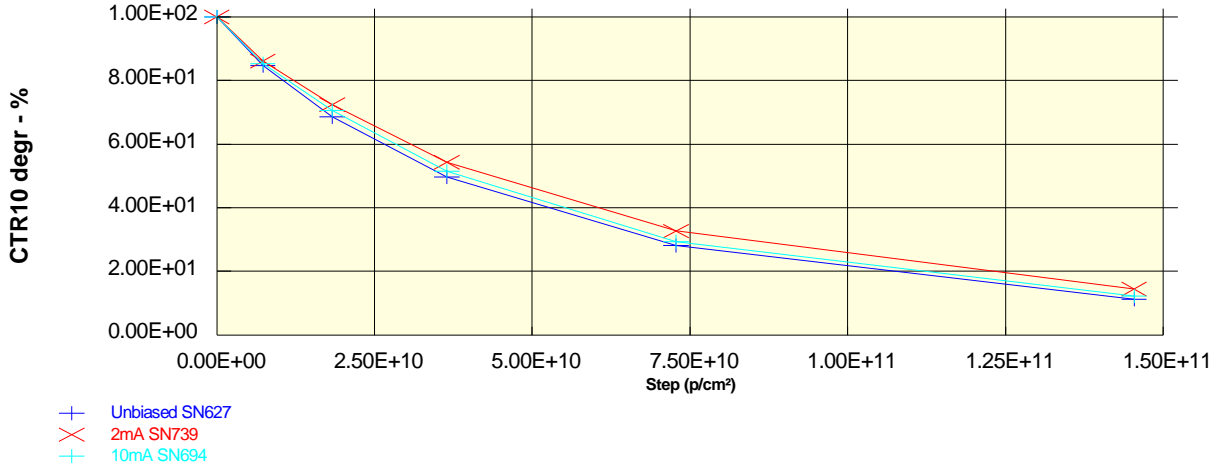
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 1.00 E+02 | 8.22 E+01 | 6.43 E+01 | 4.43 E+01 | 2.34 E+01 | 8.71 E+00 |
| 739 | 1.00 E+02 | 8.38 E+01 | 6.84 E+01 | 4.91 E+01 | 2.79 E+01 | 1.15 E+01 |
| 694 | 1.00 E+02 | 8.33 E+01 | 6.68 E+01 | 4.65 E+01 | 2.48 E+01 | 9.65 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9806
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 627 | 1.00 E+02 | 8.46 E+01 | 6.86 E+01 | 4.96 E+01 | 2.81 E+01 | 1.13 E+01 |
| 739 | 1.00 E+02 | 8.60 E+01 | 7.24 E+01 | 5.42 E+01 | 3.27 E+01 | 1.44 E+01 |
| 694 | 1.00 E+02 | 8.54 E+01 | 7.06 E+01 | 5.15 E+01 | 2.93 E+01 | 1.23 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9601

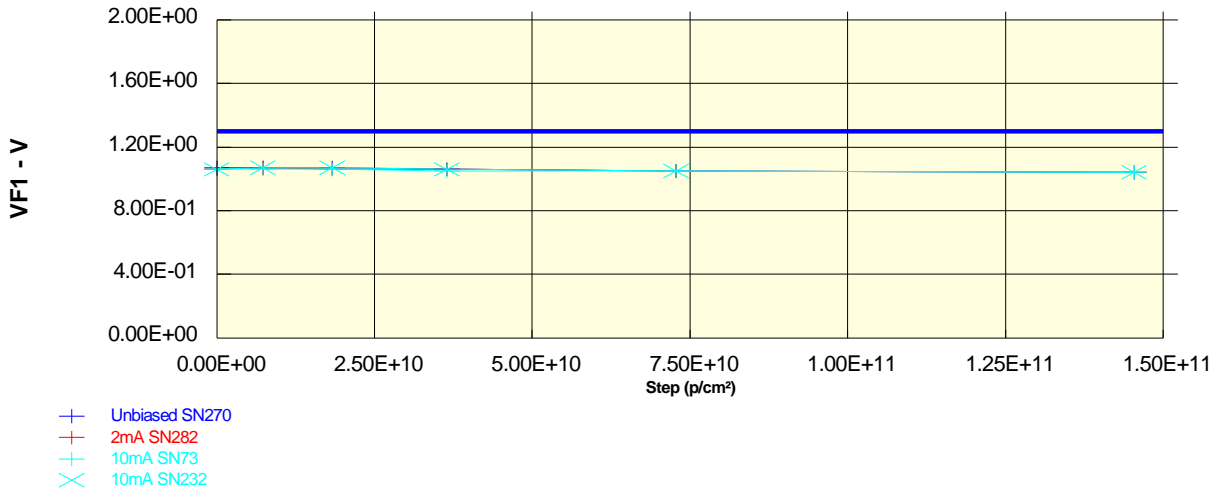
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 270 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 282 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 73 | 1.06 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 232 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9601

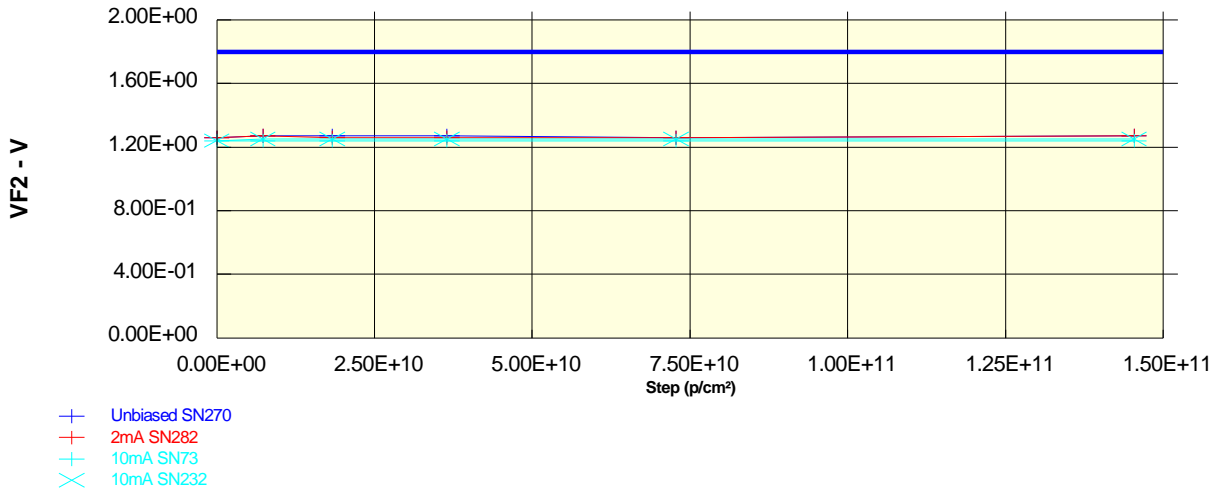
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.26 E+00 | 1.27 E+00 |
| 282 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.27 E+00 |
| 73 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 232 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601

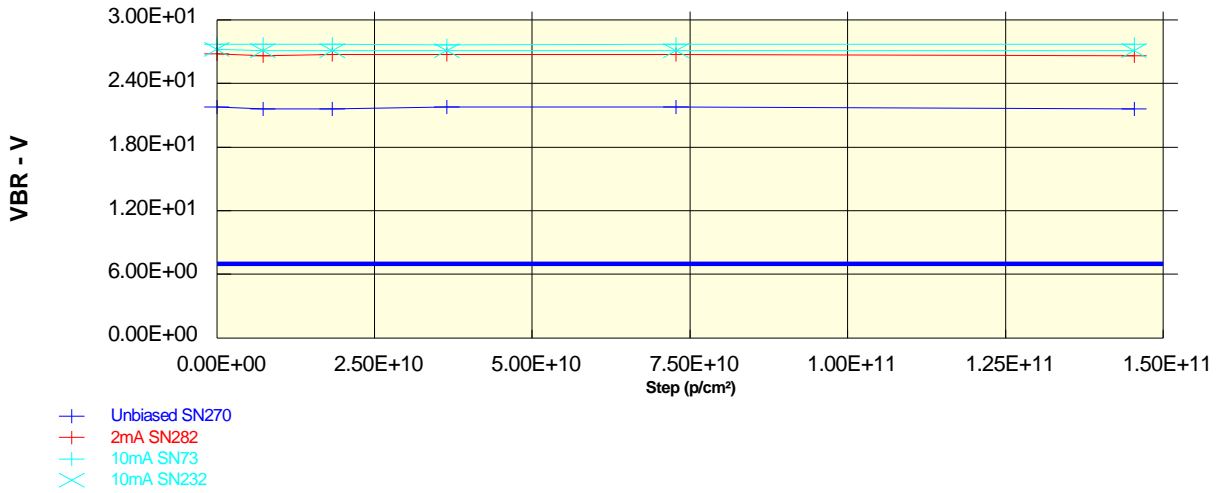
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

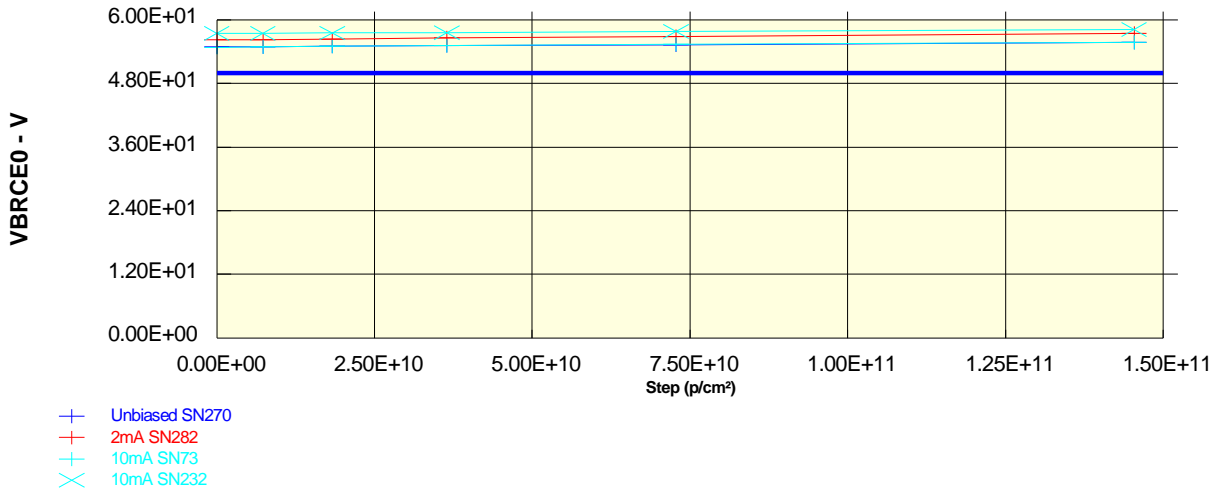


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 2.18 E+01 | 2.16 E+01 | 2.16 E+01 | 2.18 E+01 | 2.18 E+01 | 2.16 E+01 |
| 282 | 2.68 E+01 | 2.66 E+01 | 2.67 E+01 | 2.67 E+01 | 2.67 E+01 | 2.66 E+01 |
| 73 | 2.77 E+01 | 2.77 E+01 | 2.77 E+01 | 2.76 E+01 | 2.77 E+01 | 2.77 E+01 |
| 232 | 2.72 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 | 2.71 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
IC=10mA
Unit : V
Spec Limit Min : 5.00 E+01
Spec limits are represented in bold lines on the graphic.



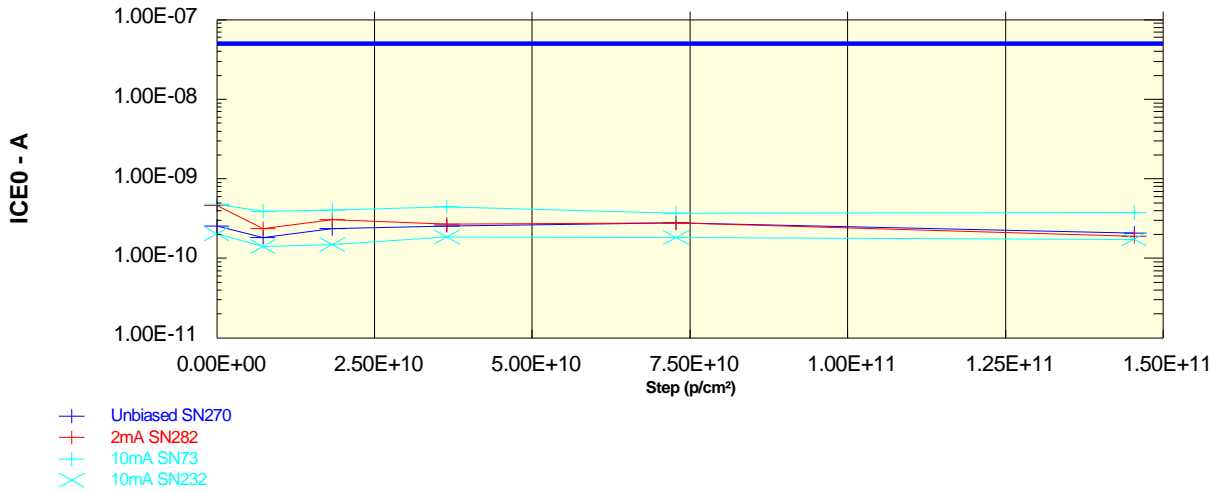
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 5.49 E+01 | 5.49 E+01 | 5.50 E+01 | 5.51 E+01 | 5.53 E+01 | 5.58 E+01 |
| 282 | 5.62 E+01 | 5.63 E+01 | 5.64 E+01 | 5.66 E+01 | 5.69 E+01 | 5.74 E+01 |
| 73 | 5.48 E+01 | 5.49 E+01 | 5.50 E+01 | 5.51 E+01 | 5.54 E+01 | 5.58 E+01 |
| 232 | 5.74 E+01 | 5.74 E+01 | 5.75 E+01 | 5.76 E+01 | 5.78 E+01 | 5.82 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

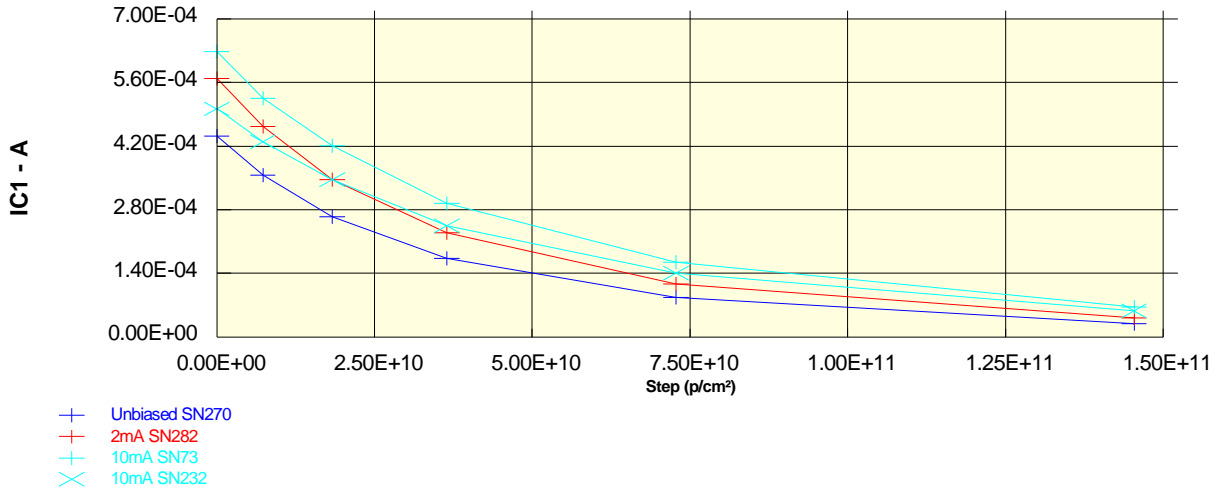


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 2.55 E-10 | 1.83 E-10 | 2.35 E-10 | 2.58 E-10 | 2.81 E-10 | 2.08 E-10 |
| 282 | 4.66 E-10 | 2.35 E-10 | 3.09 E-10 | 2.70 E-10 | 2.78 E-10 | 1.88 E-10 |
| 73 | 4.82 E-10 | 3.89 E-10 | 4.05 E-10 | 4.46 E-10 | 3.71 E-10 | 3.76 E-10 |
| 232 | 2.06 E-10 | 1.42 E-10 | 1.50 E-10 | 1.87 E-10 | 1.84 E-10 | 1.75 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
 Parameter : Output Current1 : IC1
 VCE=5.0V. IF=1mA
 Unit : A
 No spec limit specified.

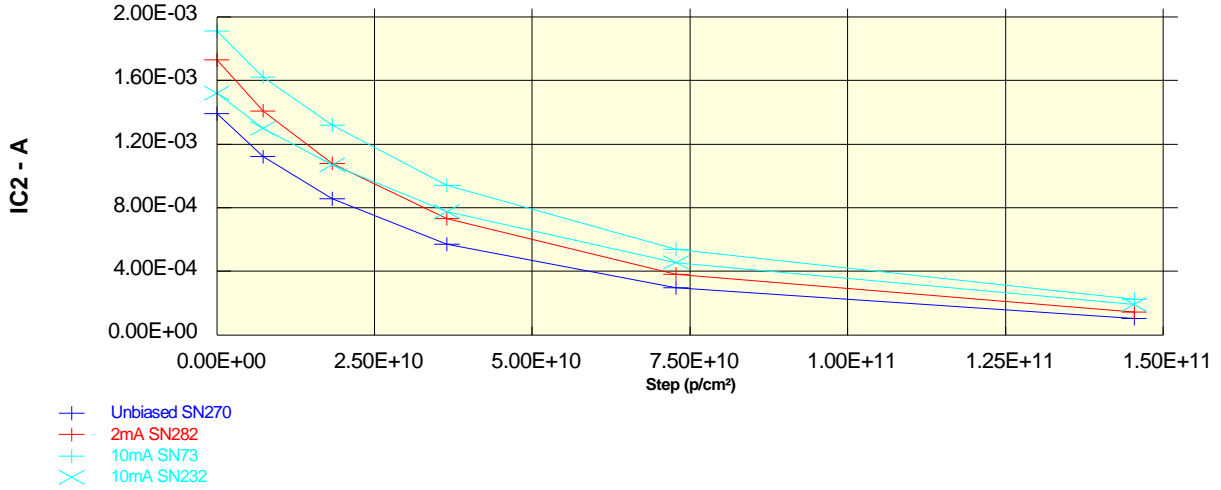


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 270 | 4.42 E-04 | 3.56 E-04 | 2.64 E-04 | 1.73 E-04 | 8.71 E-05 | 2.92 E-05 |
| 282 | 5.69 E-04 | 4.63 E-04 | 3.46 E-04 | 2.29 E-04 | 1.17 E-04 | 4.22 E-05 |
| 73 | 6.28 E-04 | 5.25 E-04 | 4.21 E-04 | 2.94 E-04 | 1.65 E-04 | 6.64 E-05 |
| 232 | 5.02 E-04 | 4.29 E-04 | 3.46 E-04 | 2.45 E-04 | 1.41 E-04 | 5.81 E-05 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

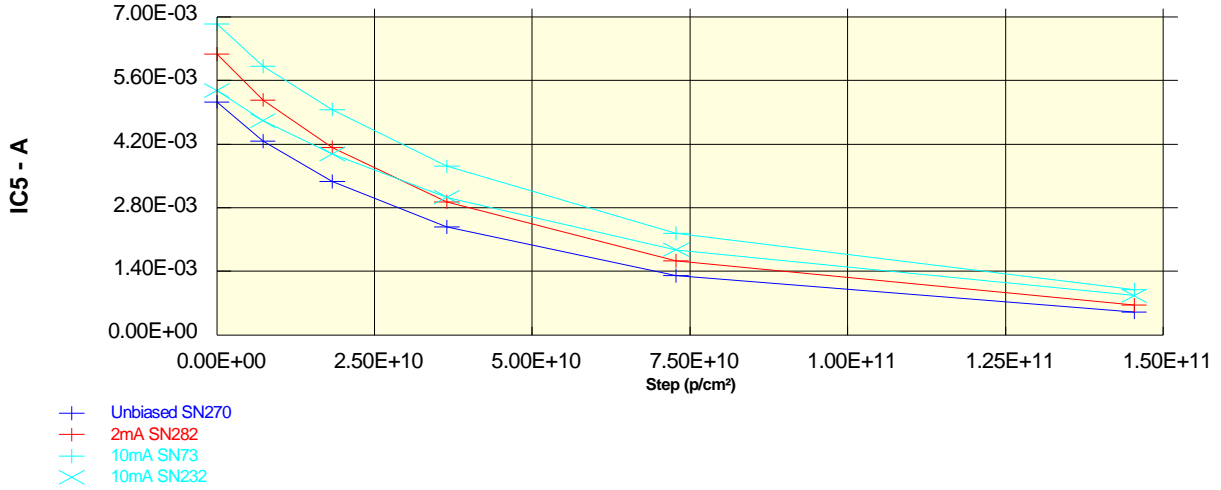


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 270 | 1.39 E-03 | 1.12 E-03 | 8.55 E-04 | 5.72 E-04 | 2.96 E-04 | 1.04 E-04 |
| 282 | 1.73 E-03 | 1.41 E-03 | 1.08 E-03 | 7.31 E-04 | 3.84 E-04 | 1.44 E-04 |
| 73 | 1.91 E-03 | 1.62 E-03 | 1.32 E-03 | 9.40 E-04 | 5.38 E-04 | 2.24 E-04 |
| 232 | 1.52 E-03 | 1.30 E-03 | 1.07 E-03 | 7.75 E-04 | 4.56 E-04 | 1.94 E-04 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9601
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 5.13 E-03 | 4.27 E-03 | 3.38 E-03 | 2.38 E-03 | 1.31 E-03 | 4.98 E-04 |
| 282 | 6.18 E-03 | 5.17 E-03 | 4.13 E-03 | 2.93 E-03 | 1.63 E-03 | 6.59 E-04 |
| 73 | 6.84 E-03 | 5.92 E-03 | 4.96 E-03 | 3.71 E-03 | 2.24 E-03 | 1.00 E-03 |
| 232 | 5.38 E-03 | 4.71 E-03 | 3.99 E-03 | 3.03 E-03 | 1.88 E-03 | 8.64 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601

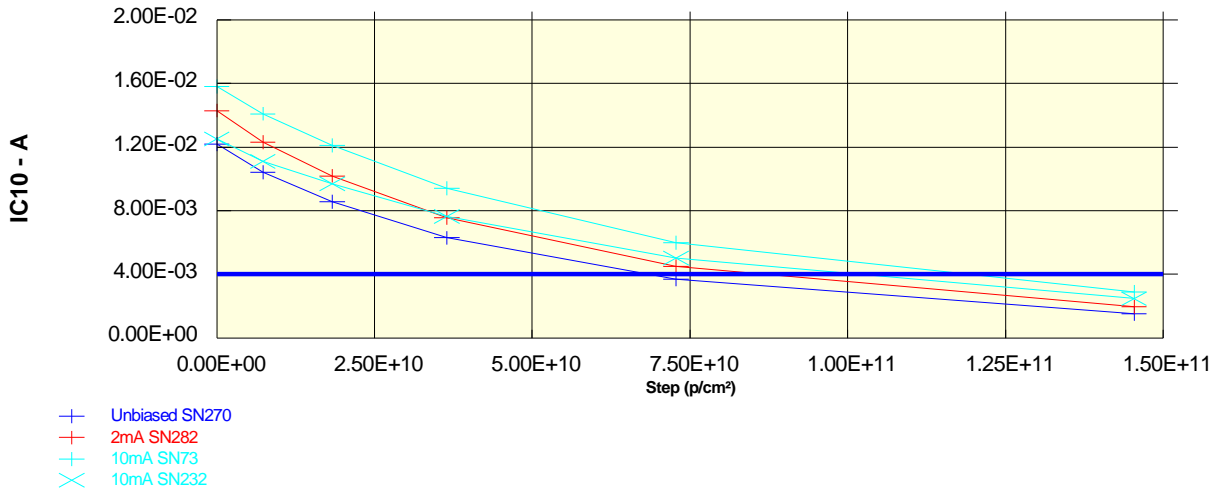
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

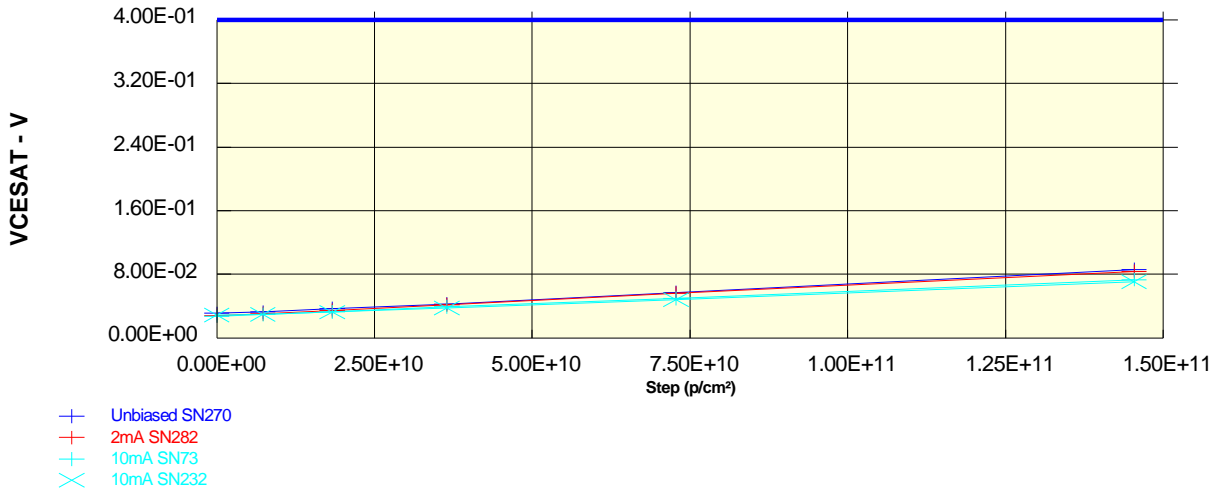


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 1.22 E-02 | 1.04 E-02 | 8.56 E-03 | 6.30 E-03 | 3.69 E-03 | 1.52 E-03 |
| 282 | 1.43 E-02 | 1.23 E-02 | 1.02 E-02 | 7.56 E-03 | 4.49 E-03 | 1.95 E-03 |
| 73 | 1.58 E-02 | 1.41 E-02 | 1.21 E-02 | 9.42 E-03 | 6.00 E-03 | 2.89 E-03 |
| 232 | 1.25 E-02 | 1.11 E-02 | 9.70 E-03 | 7.64 E-03 | 5.02 E-03 | 2.48 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



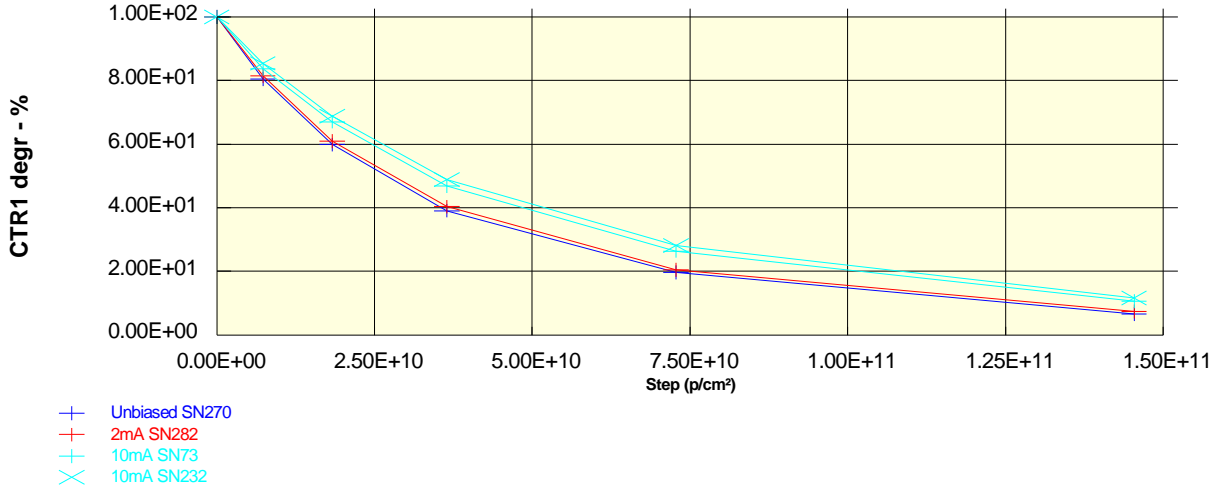
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 3.08 E-02 | 3.26 E-02 | 3.67 E-02 | 4.30 E-02 | 5.70 E-02 | 8.63 E-02 |
| 282 | 2.83 E-02 | 3.03 E-02 | 3.48 E-02 | 4.19 E-02 | 5.67 E-02 | 8.40 E-02 |
| 73 | 2.76 E-02 | 2.96 E-02 | 3.29 E-02 | 3.89 E-02 | 5.01 E-02 | 7.36 E-02 |
| 232 | 2.85 E-02 | 2.99 E-02 | 3.26 E-02 | 3.78 E-02 | 4.84 E-02 | 7.09 E-02 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : CTR1 degr

Unit : %
No spec limit specified.



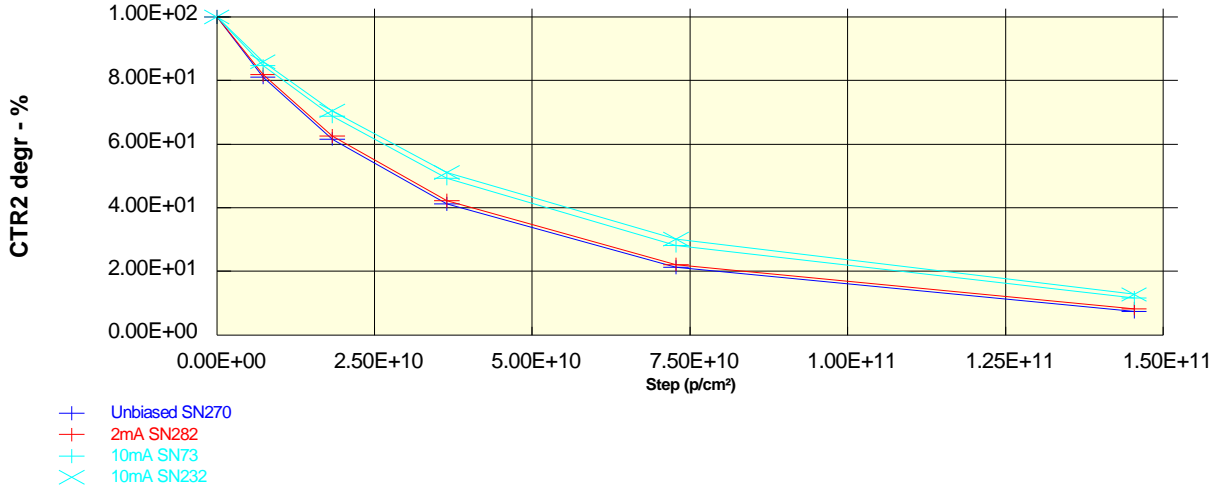
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 1.00 E+02 | 8.04 E+01 | 5.98 E+01 | 3.91 E+01 | 1.97 E+01 | 6.60 E+00 |
| 282 | 1.00 E+02 | 8.14 E+01 | 6.09 E+01 | 4.03 E+01 | 2.05 E+01 | 7.42 E+00 |
| 73 | 1.00 E+02 | 8.36 E+01 | 6.71 E+01 | 4.69 E+01 | 2.64 E+01 | 1.06 E+01 |
| 232 | 1.00 E+02 | 8.54 E+01 | 6.88 E+01 | 4.89 E+01 | 2.82 E+01 | 1.16 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9601
Parameter : CTR2 degr

Unit : %
No spec limit specified.



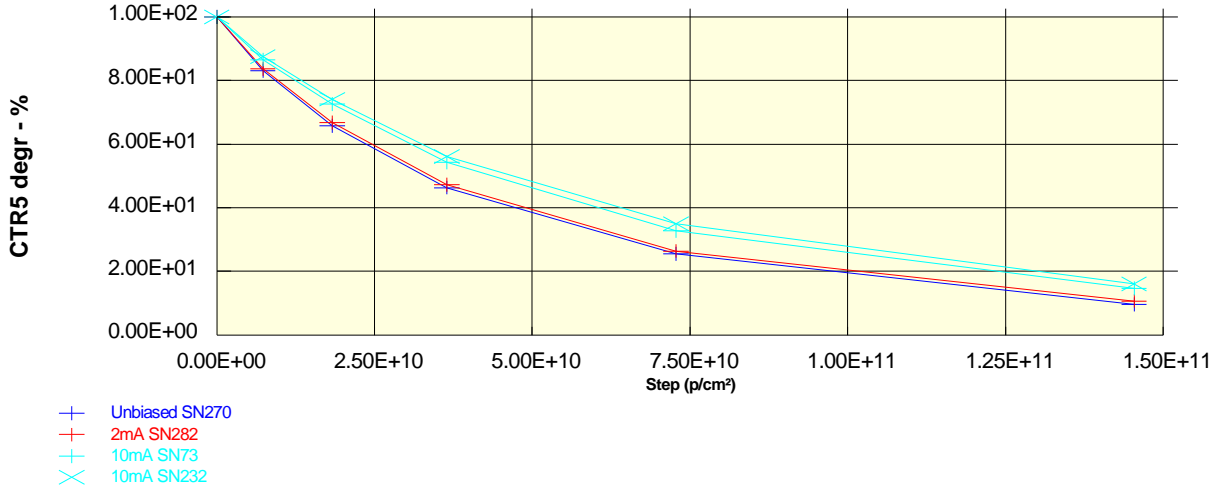
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 270 | 1.00 E+02 | 8.10 E+01 | 6.16 E+01 | 4.12 E+01 | 2.13 E+01 | 7.46 E+00 |
| 282 | 1.00 E+02 | 8.18 E+01 | 6.26 E+01 | 4.23 E+01 | 2.22 E+01 | 8.33 E+00 |
| 73 | 1.00 E+02 | 8.46 E+01 | 6.88 E+01 | 4.92 E+01 | 2.82 E+01 | 1.17 E+01 |
| 232 | 1.00 E+02 | 8.59 E+01 | 7.05 E+01 | 5.11 E+01 | 3.01 E+01 | 1.28 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : CTR5 degr

Unit : %
No spec limit specified.



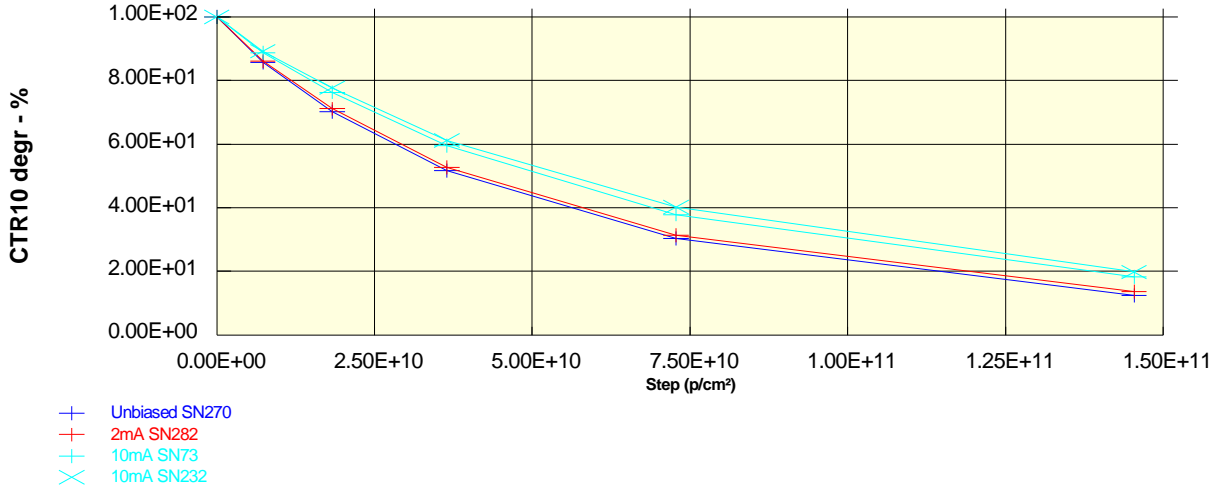
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 270 | 1.00 E+02 | 8.31 E+01 | 6.58 E+01 | 4.63 E+01 | 2.55 E+01 | 9.70 E+00 |
| 282 | 1.00 E+02 | 8.37 E+01 | 6.68 E+01 | 4.73 E+01 | 2.64 E+01 | 1.07 E+01 |
| 73 | 1.00 E+02 | 8.66 E+01 | 7.26 E+01 | 5.42 E+01 | 3.27 E+01 | 1.47 E+01 |
| 232 | 1.00 E+02 | 8.75 E+01 | 7.41 E+01 | 5.62 E+01 | 3.50 E+01 | 1.60 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9601
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 270 | 1.00 E+02 | 8.56 E+01 | 7.02 E+01 | 5.17 E+01 | 3.03 E+01 | 1.25 E+01 |
| 282 | 1.00 E+02 | 8.60 E+01 | 7.11 E+01 | 5.27 E+01 | 3.13 E+01 | 1.36 E+01 |
| 73 | 1.00 E+02 | 8.88 E+01 | 7.63 E+01 | 5.95 E+01 | 3.79 E+01 | 1.83 E+01 |
| 232 | 1.00 E+02 | 8.92 E+01 | 7.77 E+01 | 6.12 E+01 | 4.02 E+01 | 1.98 E+01 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9508

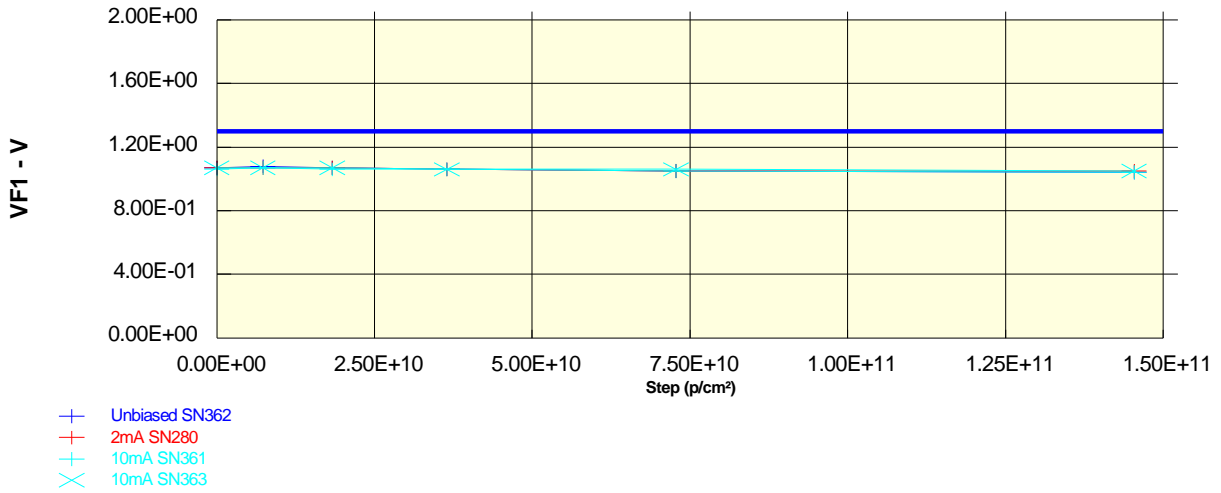
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 280 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 361 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 363 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508

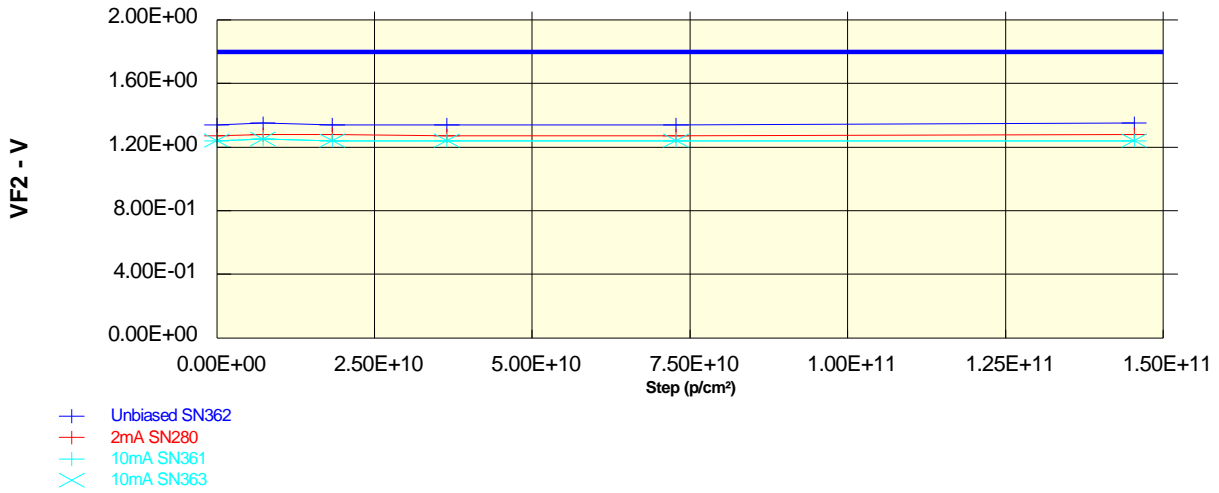
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 1.34 E+00 | 1.35 E+00 | 1.34 E+00 | 1.34 E+00 | 1.34 E+00 | 1.35 E+00 |
| 280 | 1.27 E+00 | 1.28 E+00 | 1.28 E+00 | 1.27 E+00 | 1.27 E+00 | 1.28 E+00 |
| 361 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 363 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508

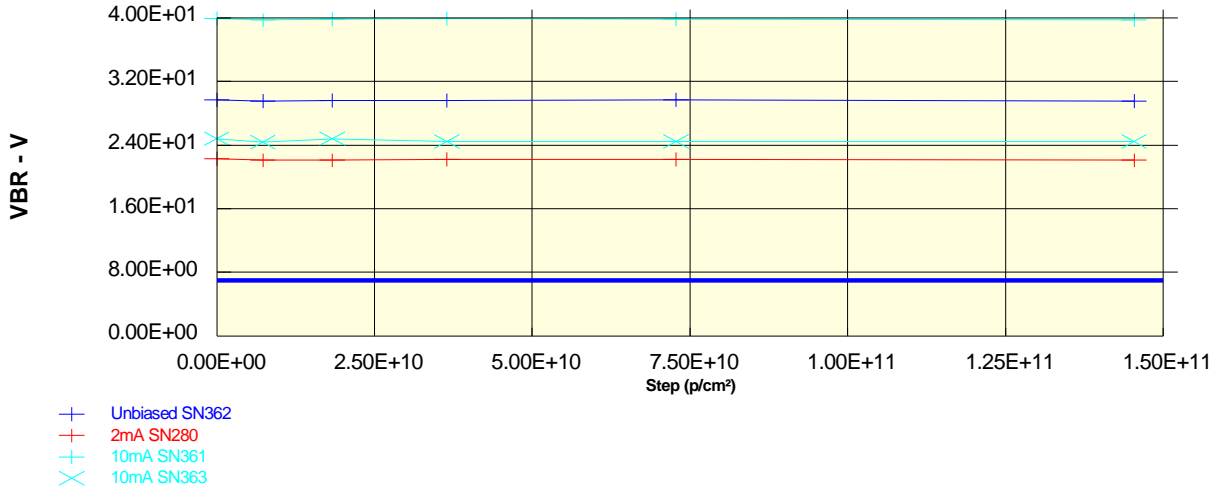
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

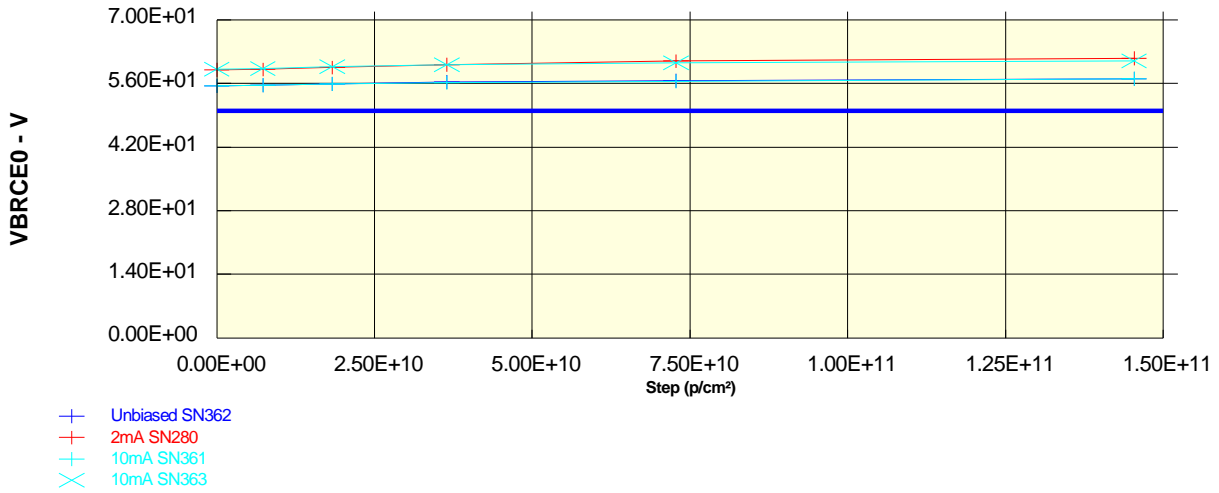


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 2.97 E+01 | 2.95 E+01 | 2.96 E+01 | 2.96 E+01 | 2.97 E+01 | 2.95 E+01 |
| 280 | 2.23 E+01 | 2.21 E+01 | 2.21 E+01 | 2.22 E+01 | 2.22 E+01 | 2.21 E+01 |
| 361 | 3.99 E+01 | 3.97 E+01 | 3.98 E+01 | 3.99 E+01 | 3.98 E+01 | 3.97 E+01 |
| 363 | 2.48 E+01 | 2.44 E+01 | 2.48 E+01 | 2.45 E+01 | 2.45 E+01 | 2.45 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



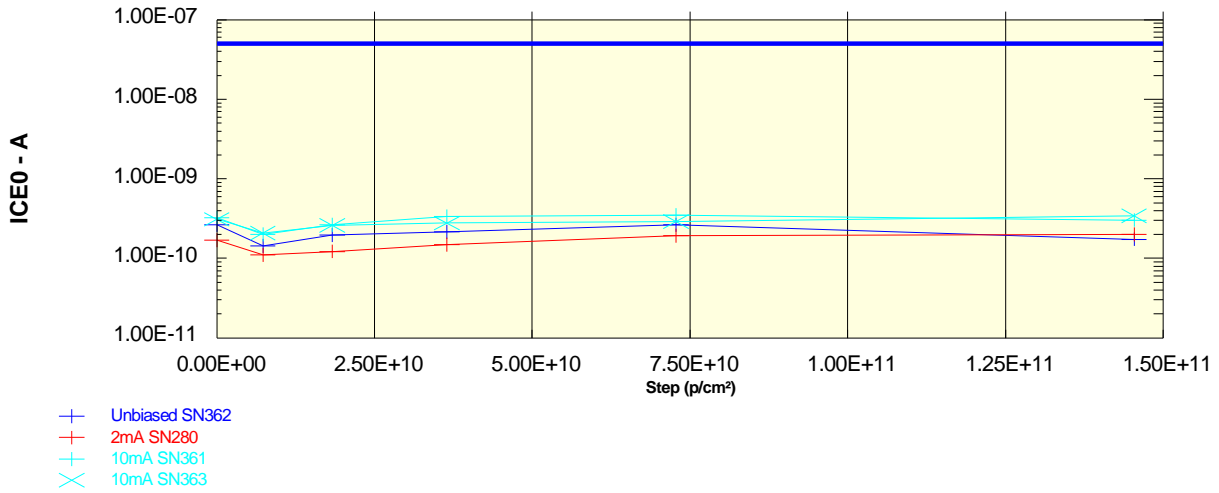
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 5.55 E+01 | 5.56 E+01 | 5.59 E+01 | 5.63 E+01 | 5.66 E+01 | 5.70 E+01 |
| 280 | 5.90 E+01 | 5.91 E+01 | 5.95 E+01 | 6.01 E+01 | 6.09 E+01 | 6.16 E+01 |
| 361 | 5.55 E+01 | 5.56 E+01 | 5.59 E+01 | 5.62 E+01 | 5.65 E+01 | 5.70 E+01 |
| 363 | 5.92 E+01 | 5.93 E+01 | 5.97 E+01 | 6.01 E+01 | 6.05 E+01 | 6.10 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

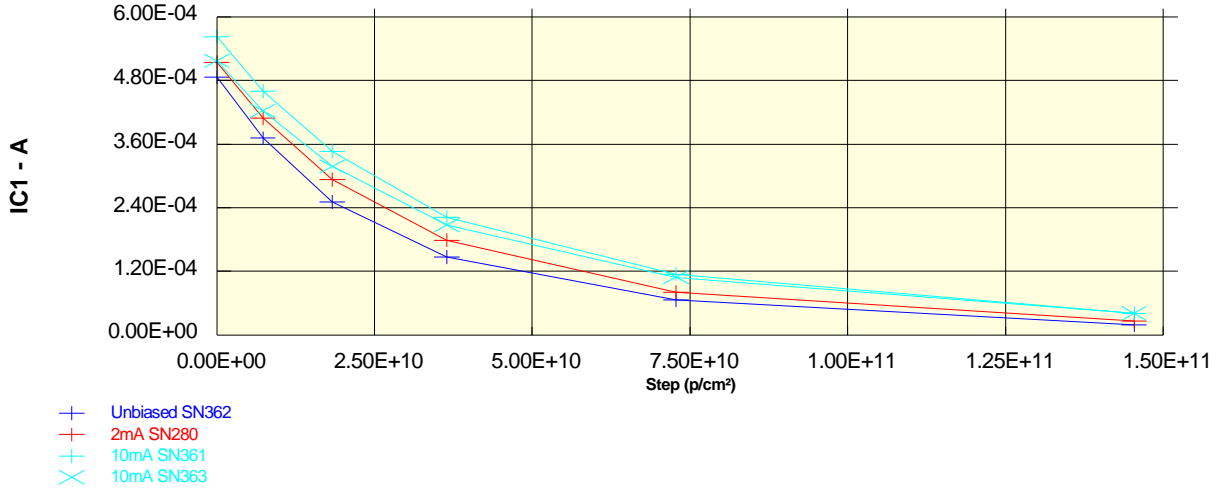


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 2.65 E-10 | 1.45 E-10 | 1.97 E-10 | 2.16 E-10 | 2.63 E-10 | 1.74 E-10 |
| 280 | 1.70 E-10 | 1.11 E-10 | 1.23 E-10 | 1.50 E-10 | 1.93 E-10 | 2.01 E-10 |
| 361 | 3.27 E-10 | 2.01 E-10 | 2.63 E-10 | 3.40 E-10 | 3.53 E-10 | 3.05 E-10 |
| 363 | 3.10 E-10 | 2.08 E-10 | 2.61 E-10 | 2.77 E-10 | 2.91 E-10 | 3.43 E-10 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

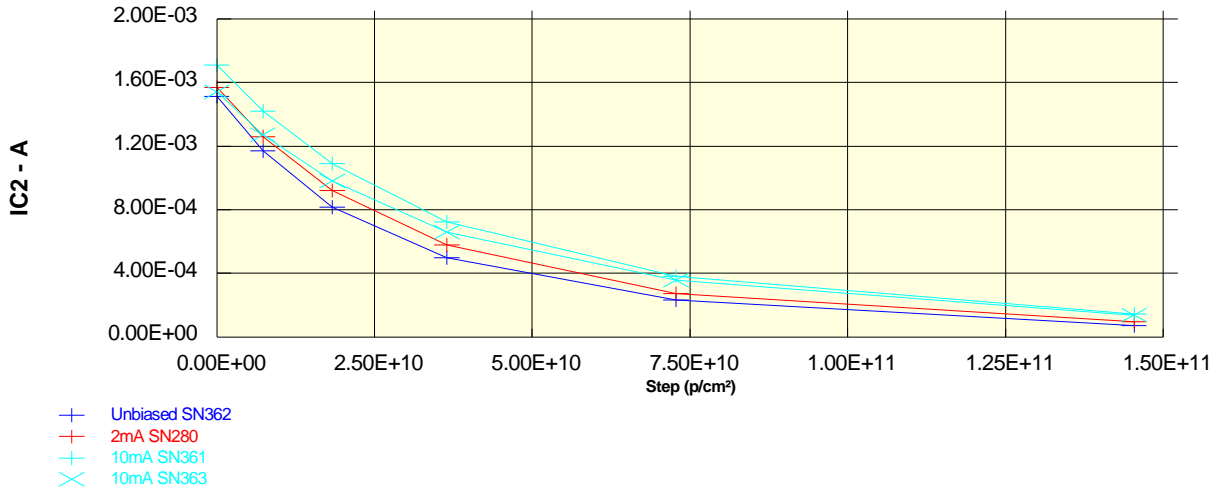


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 4.87 E-04 | 3.71 E-04 | 2.51 E-04 | 1.47 E-04 | 6.61 E-05 | 1.89 E-05 |
| 280 | 5.14 E-04 | 4.09 E-04 | 2.93 E-04 | 1.79 E-04 | 8.04 E-05 | 2.66 E-05 |
| 361 | 5.62 E-04 | 4.60 E-04 | 3.46 E-04 | 2.22 E-04 | 1.15 E-04 | 4.06 E-05 |
| 363 | 5.17 E-04 | 4.23 E-04 | 3.18 E-04 | 2.08 E-04 | 1.09 E-04 | 4.05 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

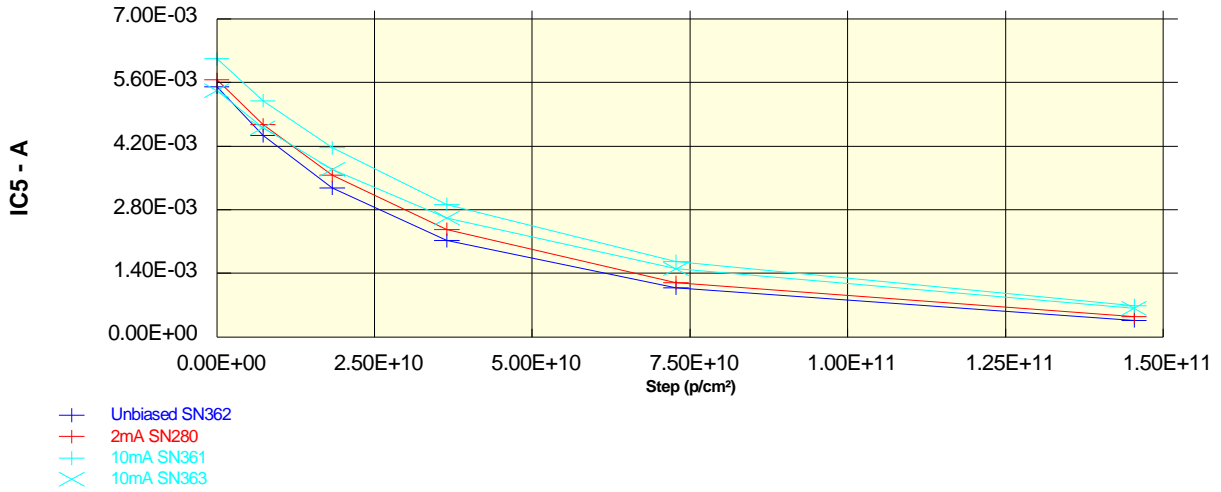


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 1.51 E-03 | 1.17 E-03 | 8.17 E-04 | 4.98 E-04 | 2.33 E-04 | 7.12 E-05 |
| 280 | 1.57 E-03 | 1.26 E-03 | 9.22 E-04 | 5.80 E-04 | 2.71 E-04 | 9.37 E-05 |
| 361 | 1.71 E-03 | 1.42 E-03 | 1.09 E-03 | 7.23 E-04 | 3.84 E-04 | 1.44 E-04 |
| 363 | 1.54 E-03 | 1.27 E-03 | 9.80 E-04 | 6.59 E-04 | 3.56 E-04 | 1.39 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
 Parameter : Output Current5 : IC5
 VCE=5.0V. IF=5mA
 Unit : A
 No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 5.51 E-03 | 4.44 E-03 | 3.28 E-03 | 2.13 E-03 | 1.08 E-03 | 3.71 E-04 |
| 280 | 5.66 E-03 | 4.67 E-03 | 3.56 E-03 | 2.37 E-03 | 1.20 E-03 | 4.50 E-04 |
| 361 | 6.12 E-03 | 5.20 E-03 | 4.16 E-03 | 2.92 E-03 | 1.66 E-03 | 6.84 E-04 |
| 363 | 5.42 E-03 | 4.60 E-03 | 3.69 E-03 | 2.61 E-03 | 1.50 E-03 | 6.39 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508

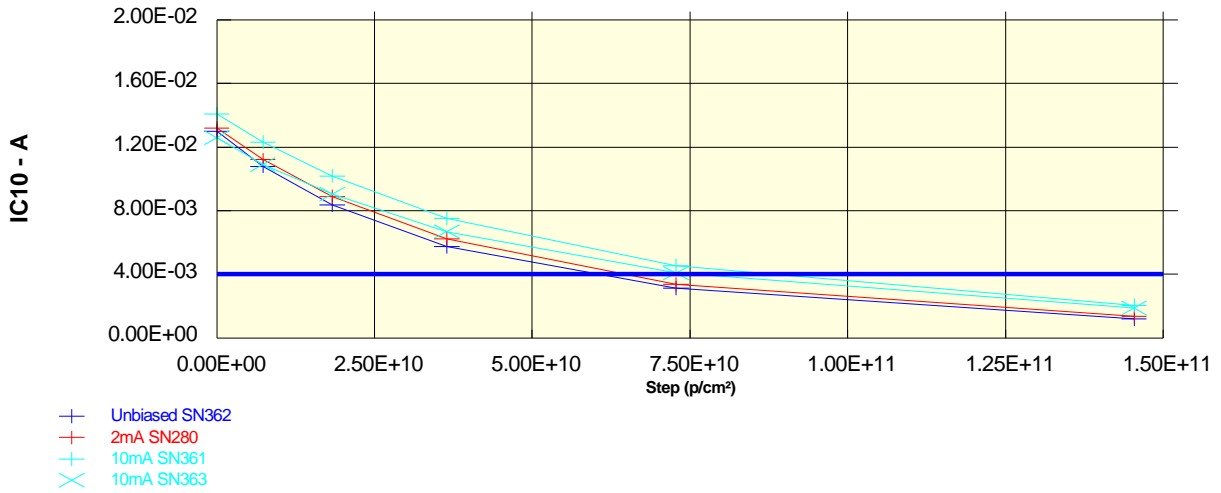
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

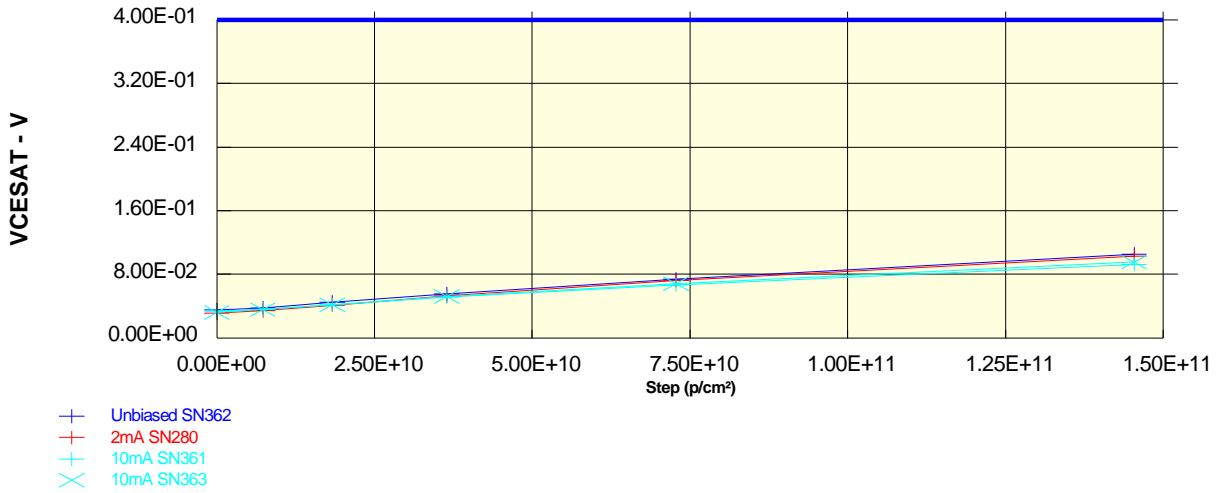


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 1.30 E-02 | 1.08 E-02 | 8.36 E-03 | 5.74 E-03 | 3.14 E-03 | 1.19 E-03 |
| 280 | 1.32 E-02 | 1.12 E-02 | 8.89 E-03 | 6.24 E-03 | 3.38 E-03 | 1.38 E-03 |
| 361 | 1.41 E-02 | 1.23 E-02 | 1.02 E-02 | 7.53 E-03 | 4.54 E-03 | 2.05 E-03 |
| 363 | 1.26 E-02 | 1.09 E-02 | 9.04 E-03 | 6.69 E-03 | 4.08 E-03 | 1.88 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



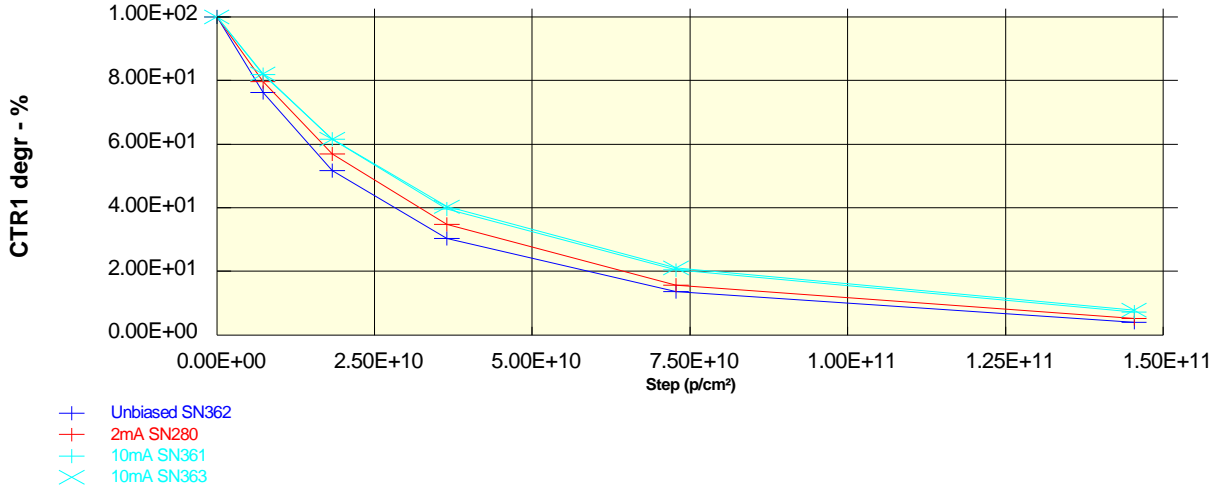
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 3.51 E-02 | 3.82 E-02 | 4.53 E-02 | 5.56 E-02 | 7.41 E-02 | 1.05 E-01 |
| 280 | 3.11 E-02 | 3.45 E-02 | 4.14 E-02 | 5.26 E-02 | 7.25 E-02 | 1.03 E-01 |
| 361 | 3.35 E-02 | 3.63 E-02 | 4.20 E-02 | 5.14 E-02 | 6.66 E-02 | 9.25 E-02 |
| 363 | 3.20 E-02 | 3.57 E-02 | 4.20 E-02 | 5.20 E-02 | 6.85 E-02 | 9.53 E-02 |

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|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : CTR1 degr

Unit : %
No spec limit specified.



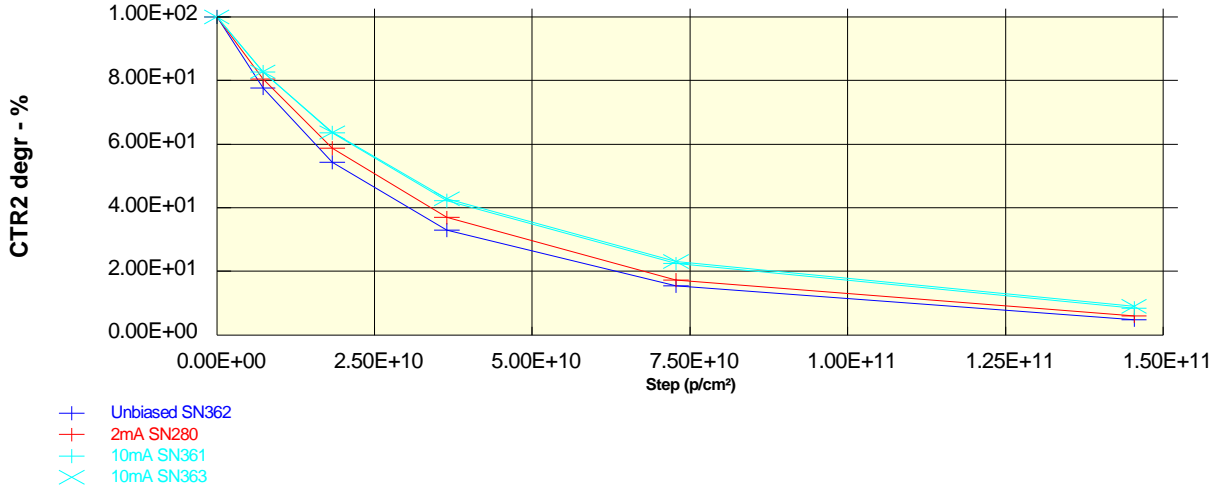
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 362 | 1.00 E+02 | 7.62 E+01 | 5.16 E+01 | 3.03 E+01 | 1.36 E+01 | 3.88 E+00 |
| 280 | 1.00 E+02 | 7.96 E+01 | 5.70 E+01 | 3.48 E+01 | 1.56 E+01 | 5.17 E+00 |
| 361 | 1.00 E+02 | 8.19 E+01 | 6.15 E+01 | 3.96 E+01 | 2.04 E+01 | 7.22 E+00 |
| 363 | 1.00 E+02 | 8.20 E+01 | 6.15 E+01 | 4.03 E+01 | 2.11 E+01 | 7.83 E+00 |

| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : DC9508
Parameter : CTR2 degr

Unit : %
No spec limit specified.



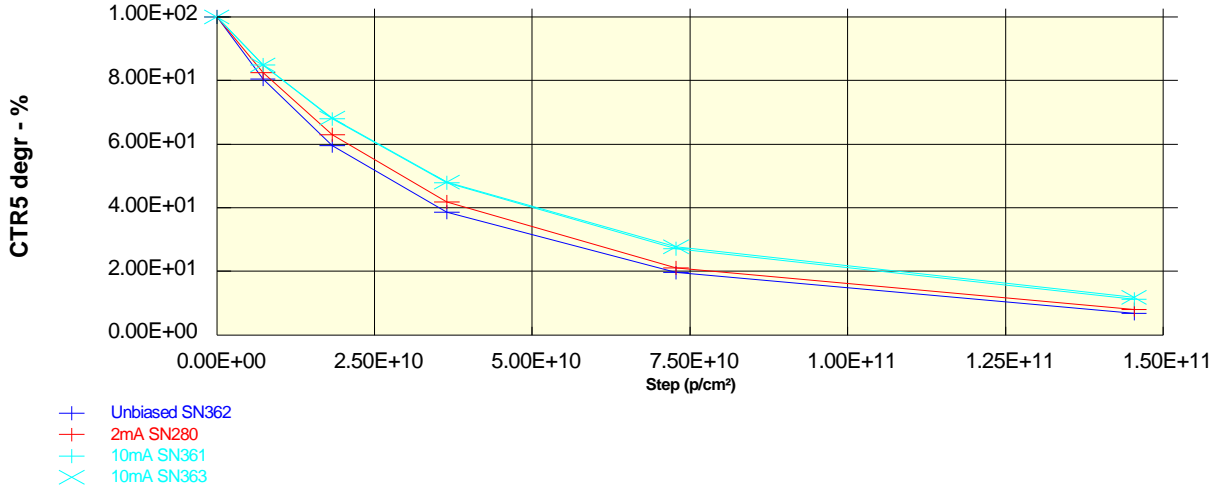
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 1.00 E+02 | 7.76 E+01 | 5.42 E+01 | 3.30 E+01 | 1.55 E+01 | 4.73 E+00 |
| 280 | 1.00 E+02 | 8.04 E+01 | 5.87 E+01 | 3.69 E+01 | 1.73 E+01 | 5.96 E+00 |
| 361 | 1.00 E+02 | 8.27 E+01 | 6.35 E+01 | 4.22 E+01 | 2.24 E+01 | 8.38 E+00 |
| 363 | 1.00 E+02 | 8.28 E+01 | 6.37 E+01 | 4.28 E+01 | 2.31 E+01 | 9.01 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : CTR5 degr

Unit : %
No spec limit specified.



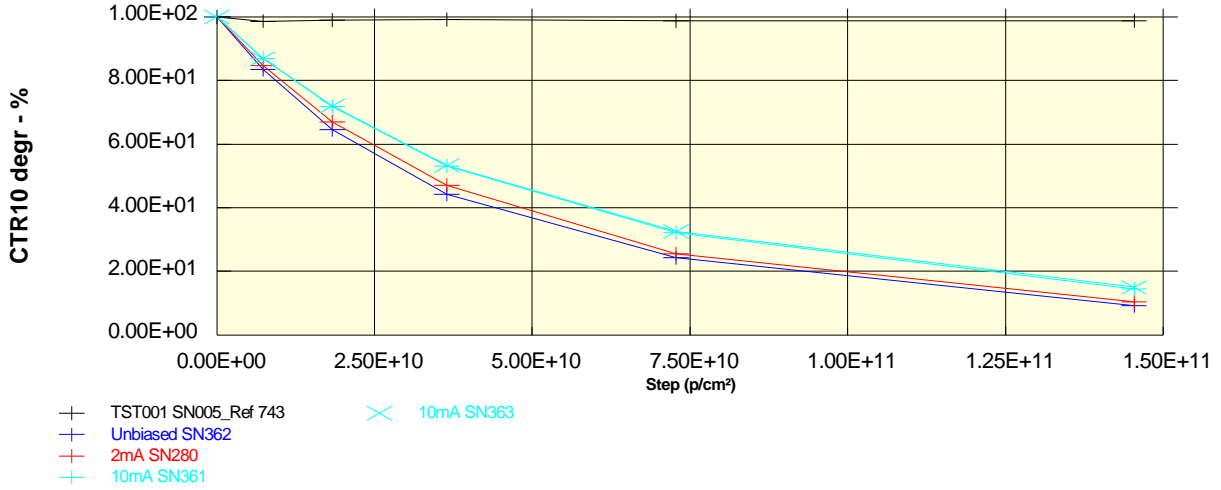
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 362 | 1.00 E+02 | 8.05 E+01 | 5.94 E+01 | 3.86 E+01 | 1.96 E+01 | 6.73 E+00 |
| 280 | 1.00 E+02 | 8.24 E+01 | 6.29 E+01 | 4.19 E+01 | 2.11 E+01 | 7.95 E+00 |
| 361 | 1.00 E+02 | 8.49 E+01 | 6.79 E+01 | 4.78 E+01 | 2.71 E+01 | 1.12 E+01 |
| 363 | 1.00 E+02 | 8.48 E+01 | 6.81 E+01 | 4.81 E+01 | 2.77 E+01 | 1.18 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9508
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 743 | 1.00 E+02 | 9.87 E+01 | 9.90 E+01 | 9.92 E+01 | 9.88 E+01 | 9.87 E+01 |
| 362 | 1.00 E+02 | 8.34 E+01 | 6.46 E+01 | 4.43 E+01 | 2.42 E+01 | 9.19 E+00 |
| 280 | 1.00 E+02 | 8.46 E+01 | 6.71 E+01 | 4.71 E+01 | 2.55 E+01 | 1.04 E+01 |
| 361 | 1.00 E+02 | 8.69 E+01 | 7.19 E+01 | 5.32 E+01 | 3.21 E+01 | 1.45 E+01 |
| 363 | 1.00 E+02 | 8.68 E+01 | 7.20 E+01 | 5.33 E+01 | 3.25 E+01 | 1.50 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344

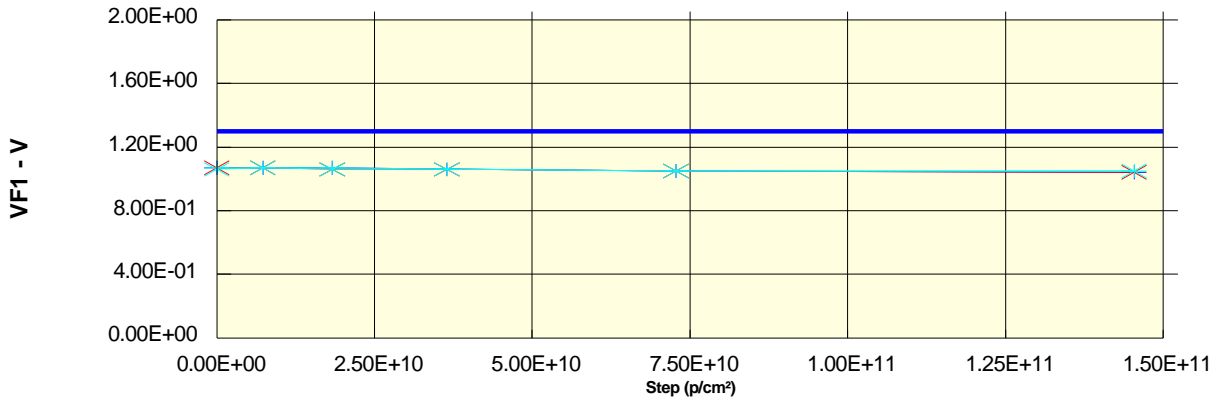
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



- + Unbiased SN046
- x 2mA SN074
- + TST001 SN028 020
- x TST001 SN029 034

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 074 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 020 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 034 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344

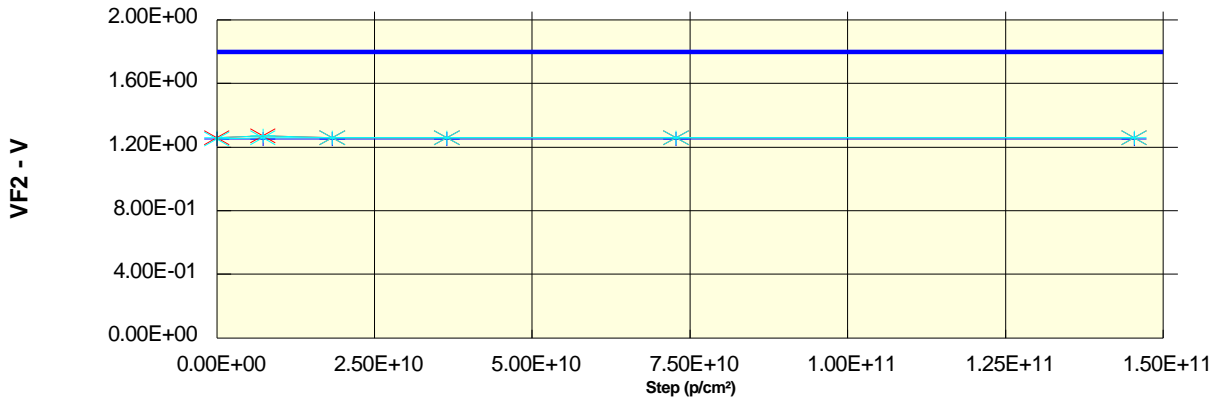
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



- + Unbiased SN046
- x 2mA SN074
- + TST001 SN028 020
- x TST001 SN029 034

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 |
| 074 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 020 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 034 | 1.25 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344

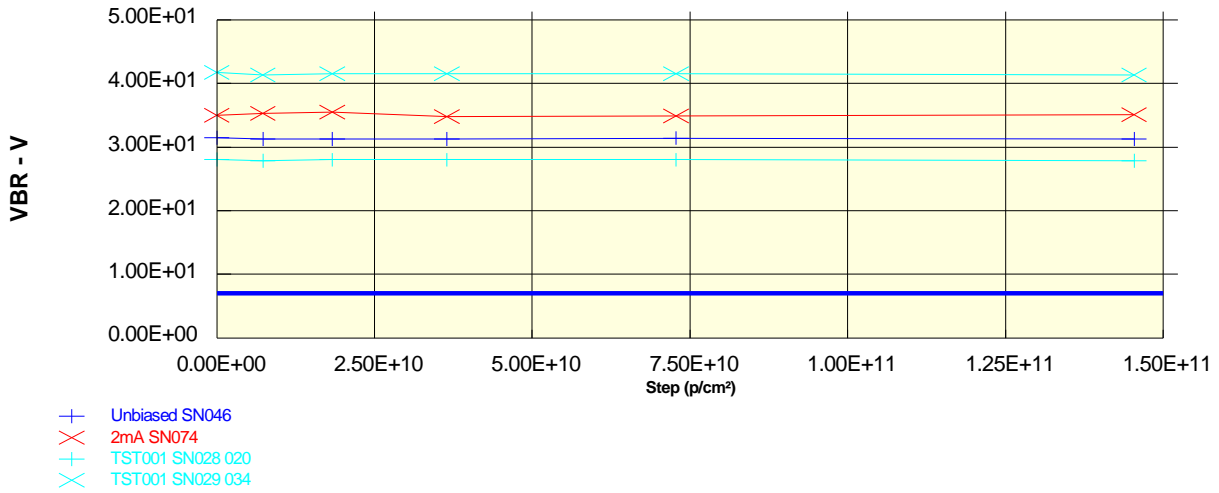
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

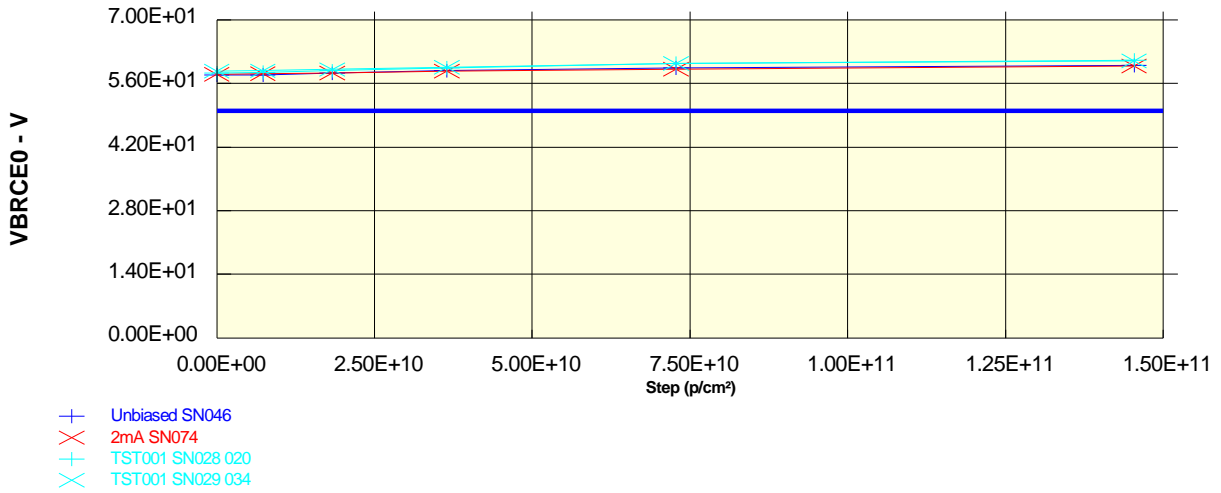


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.15 E+01 | 3.13 E+01 | 3.13 E+01 | 3.13 E+01 | 3.14 E+01 | 3.13 E+01 |
| 074 | 3.50 E+01 | 3.53 E+01 | 3.55 E+01 | 3.48 E+01 | 3.49 E+01 | 3.51 E+01 |
| 020 | 2.81 E+01 | 2.79 E+01 | 2.80 E+01 | 2.80 E+01 | 2.80 E+01 | 2.79 E+01 |
| 034 | 4.17 E+01 | 4.13 E+01 | 4.15 E+01 | 4.15 E+01 | 4.15 E+01 | 4.13 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



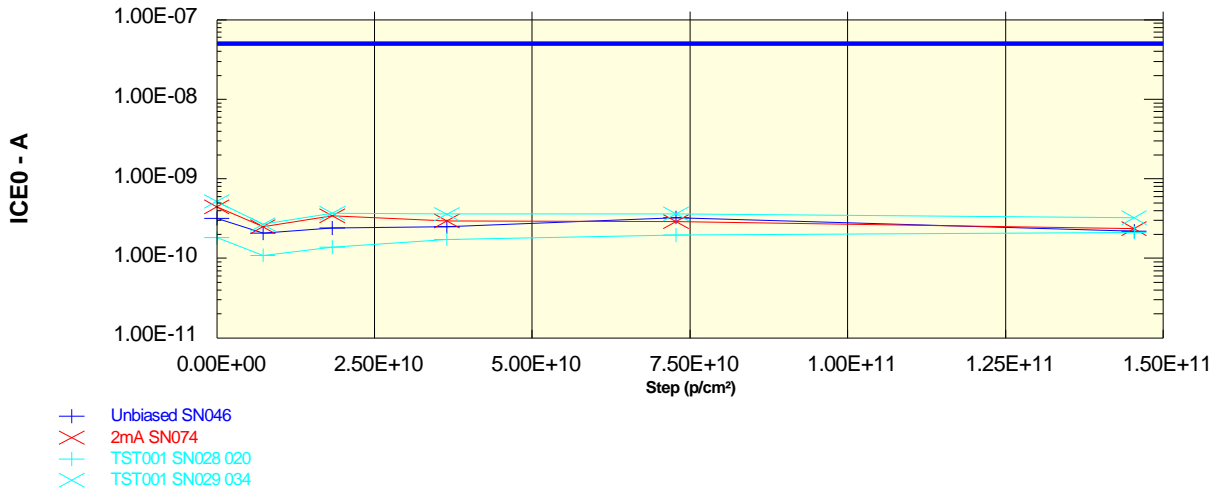
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 5.78 E+01 | 5.79 E+01 | 5.82 E+01 | 5.88 E+01 | 5.94 E+01 | 6.00 E+01 |
| 074 | 5.80 E+01 | 5.81 E+01 | 5.83 E+01 | 5.87 E+01 | 5.92 E+01 | 5.98 E+01 |
| 020 | 5.83 E+01 | 5.84 E+01 | 5.88 E+01 | 5.94 E+01 | 6.04 E+01 | 6.11 E+01 |
| 034 | 5.87 E+01 | 5.88 E+01 | 5.91 E+01 | 5.96 E+01 | 6.04 E+01 | 6.10 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

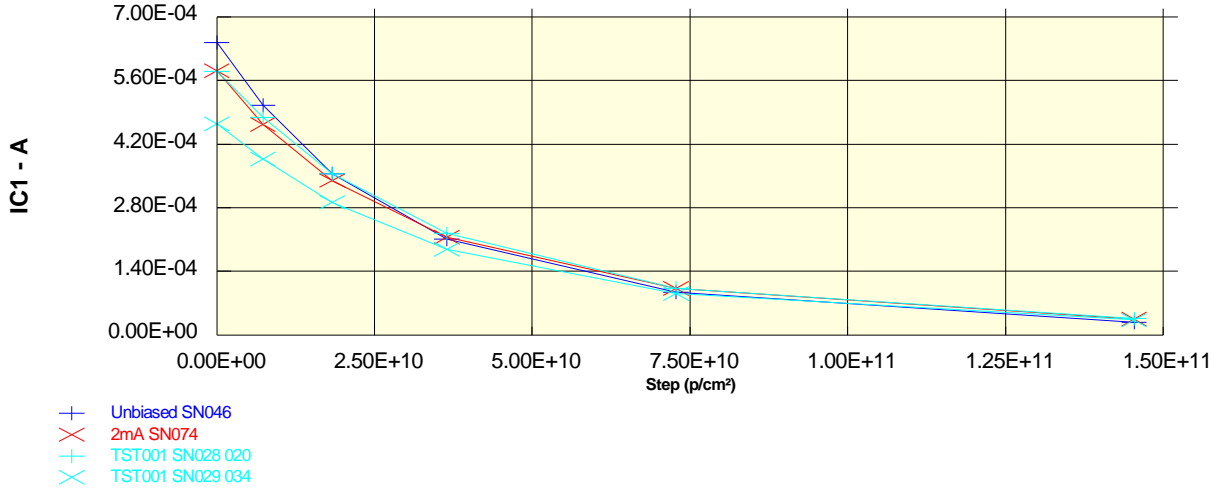


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.21 E-10 | 2.07 E-10 | 2.41 E-10 | 2.51 E-10 | 3.27 E-10 | 2.20 E-10 |
| 074 | 4.44 E-10 | 2.52 E-10 | 3.46 E-10 | 2.95 E-10 | 2.91 E-10 | 2.37 E-10 |
| 020 | 1.82 E-10 | 1.10 E-10 | 1.39 E-10 | 1.75 E-10 | 1.98 E-10 | 2.10 E-10 |
| 034 | 5.20 E-10 | 2.67 E-10 | 3.70 E-10 | 3.60 E-10 | 3.65 E-10 | 3.26 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

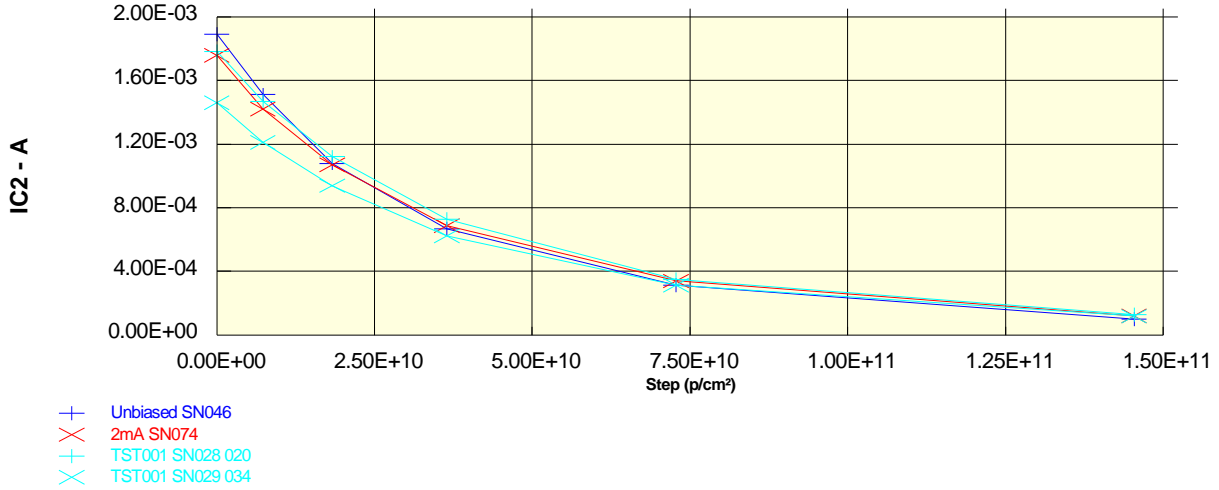


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 6.43 E-04 | 5.06 E-04 | 3.55 E-04 | 2.11 E-04 | 9.46 E-05 | 2.81 E-05 |
| 074 | 5.81 E-04 | 4.63 E-04 | 3.40 E-04 | 2.15 E-04 | 1.03 E-04 | 3.48 E-05 |
| 020 | 5.80 E-04 | 4.79 E-04 | 3.55 E-04 | 2.23 E-04 | 1.03 E-04 | 3.59 E-05 |
| 034 | 4.65 E-04 | 3.87 E-04 | 2.92 E-04 | 1.89 E-04 | 9.18 E-05 | 3.33 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

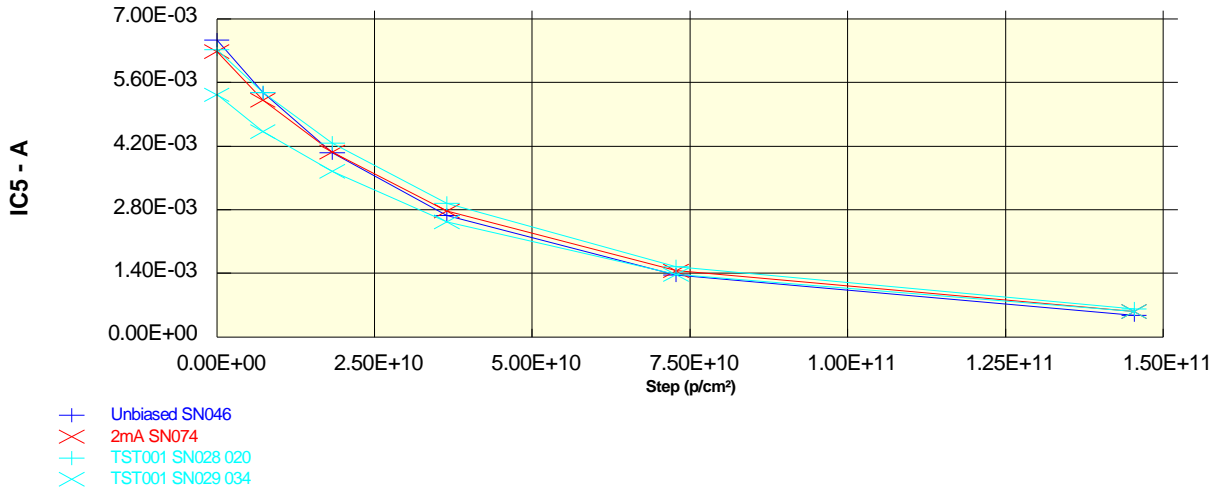


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.89 E-03 | 1.51 E-03 | 1.08 E-03 | 6.69 E-04 | 3.13 E-04 | 9.96 E-05 |
| 074 | 1.76 E-03 | 1.42 E-03 | 1.07 E-03 | 6.88 E-04 | 3.40 E-04 | 1.20 E-04 |
| 020 | 1.78 E-03 | 1.47 E-03 | 1.12 E-03 | 7.27 E-04 | 3.50 E-04 | 1.28 E-04 |
| 034 | 1.46 E-03 | 1.21 E-03 | 9.39 E-04 | 6.23 E-04 | 3.12 E-04 | 1.18 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : Output Current5 : IC5
VCE=5.0V. IF=5mA
Unit : A
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 6.53 E-03 | 5.37 E-03 | 4.06 E-03 | 2.67 E-03 | 1.36 E-03 | 4.83 E-04 |
| 074 | 6.28 E-03 | 5.21 E-03 | 4.07 E-03 | 2.77 E-03 | 1.46 E-03 | 5.62 E-04 |
| 020 | 6.33 E-03 | 5.38 E-03 | 4.27 E-03 | 2.94 E-03 | 1.54 E-03 | 6.15 E-04 |
| 034 | 5.33 E-03 | 4.52 E-03 | 3.64 E-03 | 2.54 E-03 | 1.37 E-03 | 5.62 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344

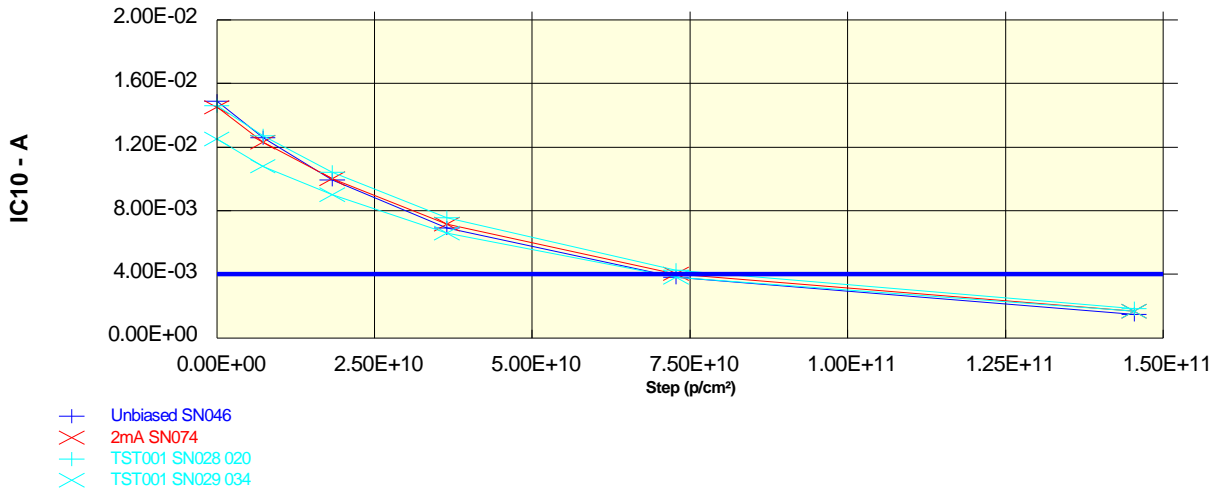
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.

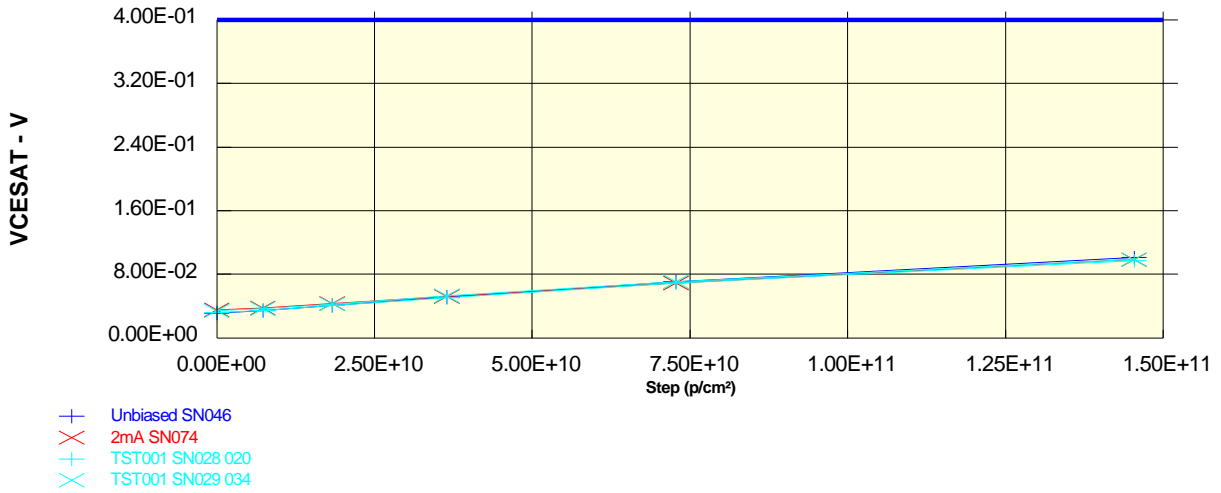


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.49 E-02 | 1.26 E-02 | 9.95 E-03 | 6.92 E-03 | 3.80 E-03 | 1.49 E-03 |
| 074 | 1.45 E-02 | 1.23 E-02 | 1.00 E-02 | 7.15 E-03 | 4.04 E-03 | 1.68 E-03 |
| 020 | 1.46 E-02 | 1.27 E-02 | 1.04 E-02 | 7.54 E-03 | 4.27 E-03 | 1.86 E-03 |
| 034 | 1.25 E-02 | 1.08 E-02 | 9.01 E-03 | 6.59 E-03 | 3.81 E-03 | 1.69 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



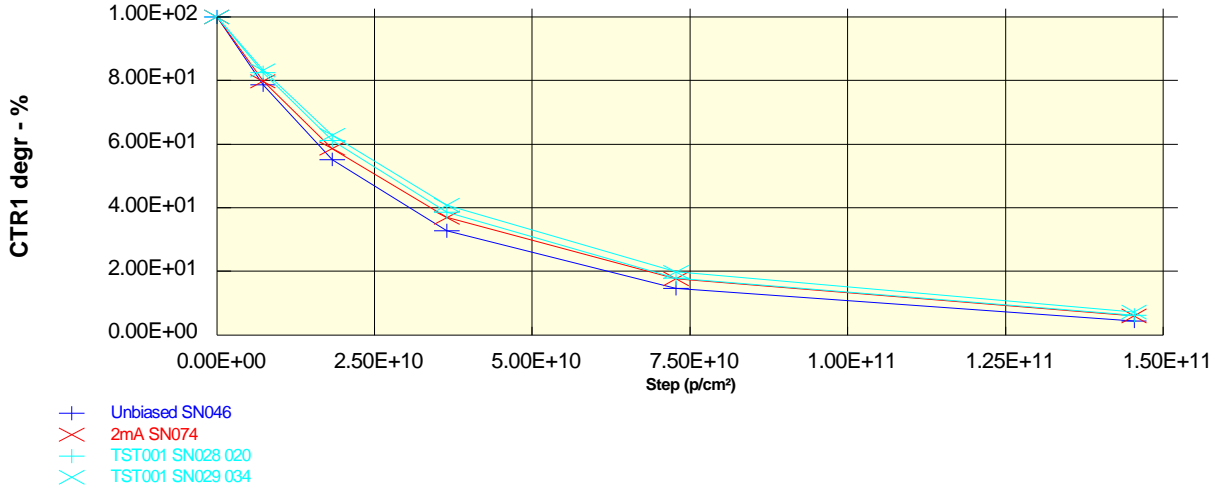
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 3.14 E-02 | 3.46 E-02 | 4.11 E-02 | 5.15 E-02 | 7.09 E-02 | 1.01 E-01 |
| 074 | 3.50 E-02 | 3.78 E-02 | 4.34 E-02 | 5.23 E-02 | 6.94 E-02 | 9.86 E-02 |
| 020 | 3.20 E-02 | 3.46 E-02 | 4.07 E-02 | 5.07 E-02 | 6.90 E-02 | 9.69 E-02 |
| 034 | 3.43 E-02 | 3.70 E-02 | 4.30 E-02 | 5.29 E-02 | 7.08 E-02 | 9.84 E-02 |

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|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : CTR1 degr

Unit : %
No spec limit specified.



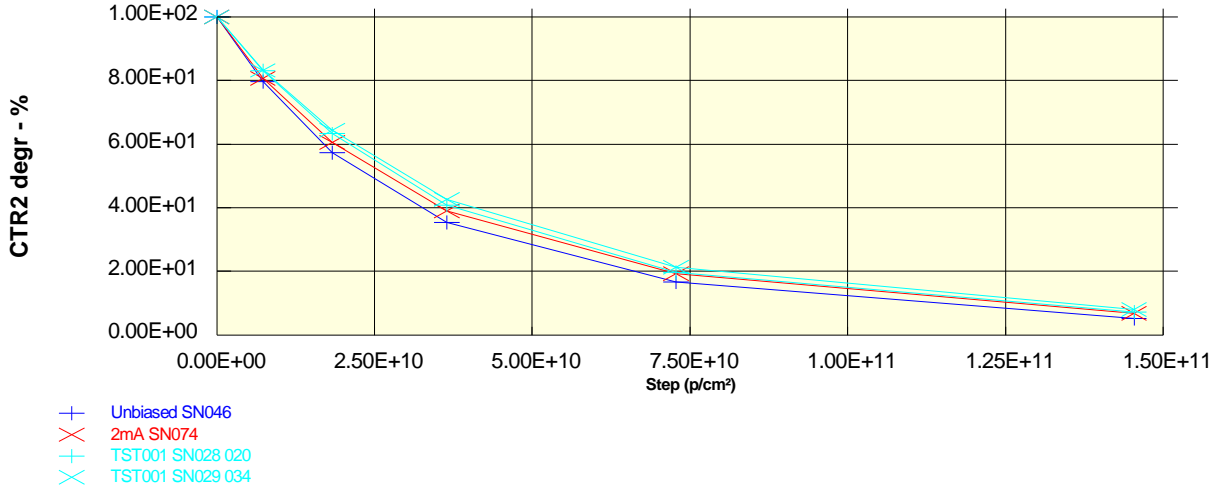
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 7.87 E+01 | 5.52 E+01 | 3.28 E+01 | 1.47 E+01 | 4.37 E+00 |
| 074 | 1.00 E+02 | 7.98 E+01 | 5.86 E+01 | 3.69 E+01 | 1.77 E+01 | 6.00 E+00 |
| 020 | 1.00 E+02 | 8.25 E+01 | 6.12 E+01 | 3.85 E+01 | 1.78 E+01 | 6.20 E+00 |
| 034 | 1.00 E+02 | 8.32 E+01 | 6.28 E+01 | 4.08 E+01 | 1.98 E+01 | 7.17 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : CTR2 degr

Unit : %
No spec limit specified.



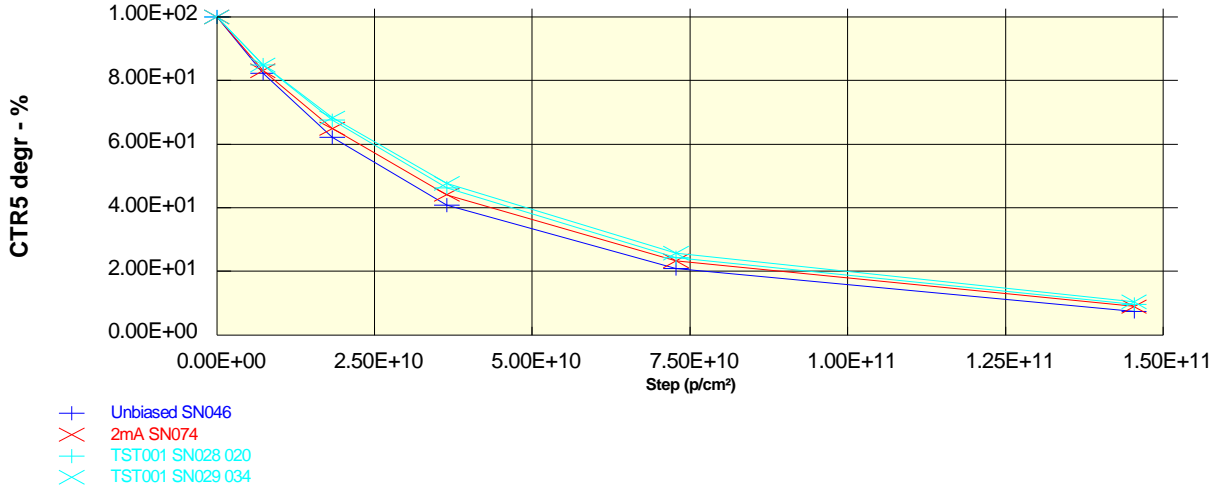
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 7.97 E+01 | 5.74 E+01 | 3.54 E+01 | 1.66 E+01 | 5.27 E+00 |
| 074 | 1.00 E+02 | 8.07 E+01 | 6.05 E+01 | 3.90 E+01 | 1.93 E+01 | 6.81 E+00 |
| 020 | 1.00 E+02 | 8.30 E+01 | 6.33 E+01 | 4.09 E+01 | 1.97 E+01 | 7.20 E+00 |
| 034 | 1.00 E+02 | 8.32 E+01 | 6.44 E+01 | 4.27 E+01 | 2.14 E+01 | 8.06 E+00 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : CTR5 degr

Unit : %
No spec limit specified.



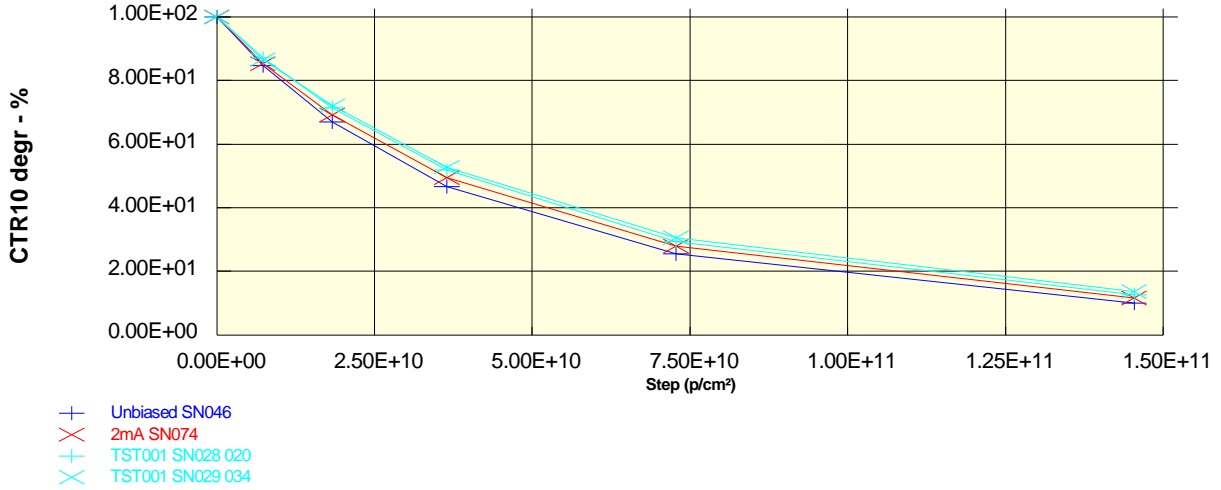
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|-----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 046 | 1.00 E+02 | 8.22 E+01 | 6.22 E+01 | 4.09 E+01 | 2.08 E+01 | 7.40 E+00 |
| 074 | 1.00 E+02 | 8.30 E+01 | 6.49 E+01 | 4.41 E+01 | 2.33 E+01 | 8.95 E+00 |
| 020 | 1.00 E+02 | 8.49 E+01 | 6.75 E+01 | 4.63 E+01 | 2.43 E+01 | 9.71 E+00 |
| 034 | 1.00 E+02 | 8.48 E+01 | 6.83 E+01 | 4.77 E+01 | 2.57 E+01 | 1.05 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9344
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| 046 | 1.00 E+02 | 8.47 E+01 | 6.69 E+01 | 4.66 E+01 | 2.55 E+01 | 1.00 E+01 |
| 074 | 1.00 E+02 | 8.53 E+01 | 6.92 E+01 | 4.94 E+01 | 2.79 E+01 | 1.16 E+01 |
| 020 | 1.00 E+02 | 8.70 E+01 | 7.15 E+01 | 5.18 E+01 | 2.93 E+01 | 1.27 E+01 |
| 034 | 1.00 E+02 | 8.66 E+01 | 7.21 E+01 | 5.28 E+01 | 3.05 E+01 | 1.36 E+01 |

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|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234

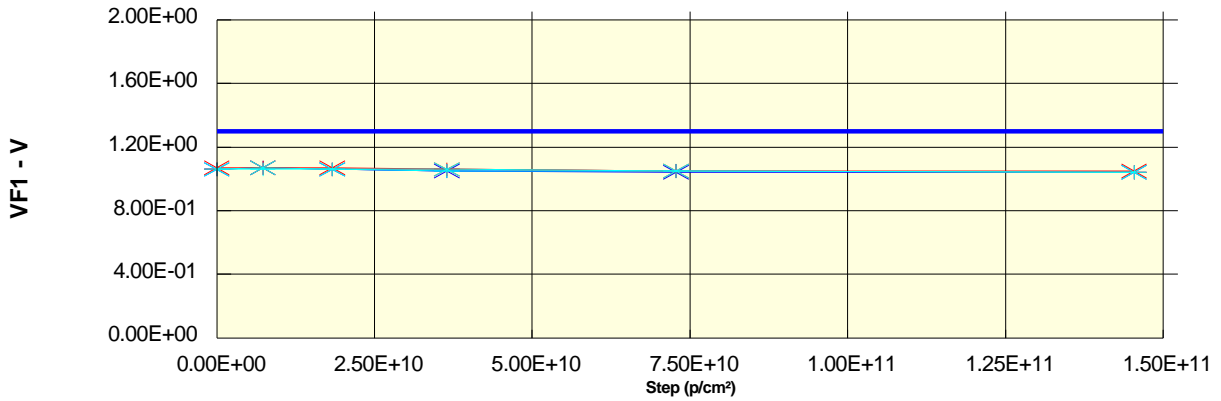
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



- + Unbiased SN2 + 10mA SN6
- × Unbiased SN3 × 10mA SN7
- + 2mA SN4
- × 2mA SN5

Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 2 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 3 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 | 1.04 E+00 |
| 4 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 5 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 6 | 1.06 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 | 1.04 E+00 |
| 7 | 1.06 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234

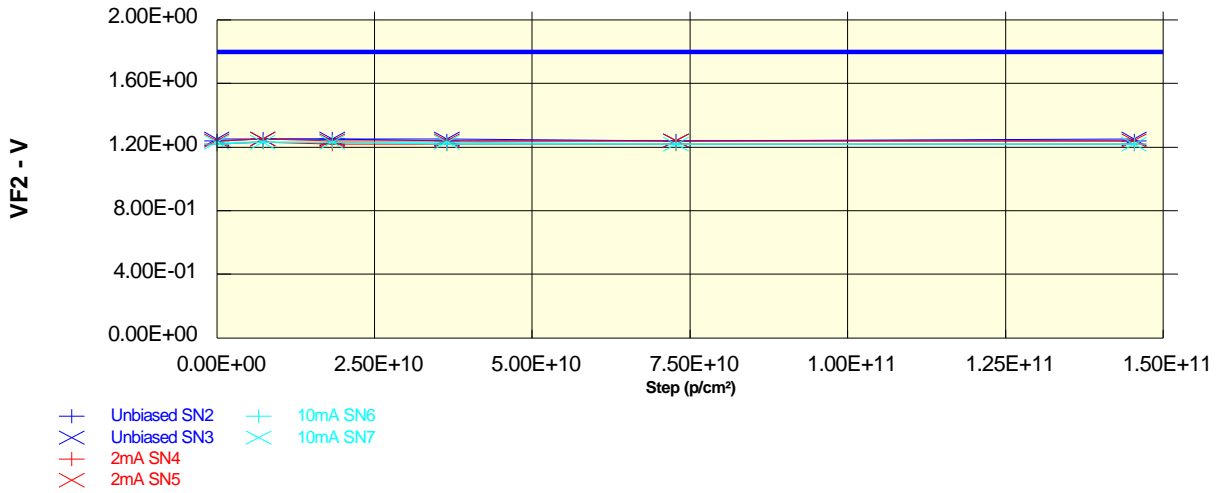
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 1.24 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 3 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.25 E+00 | 1.24 E+00 | 1.25 E+00 |
| 4 | 1.22 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 |
| 5 | 1.24 E+00 | 1.25 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 | 1.24 E+00 |
| 6 | 1.22 E+00 | 1.23 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 | 1.22 E+00 |
| 7 | 1.23 E+00 | 1.23 E+00 | 1.23 E+00 | 1.23 E+00 | 1.22 E+00 | 1.22 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234

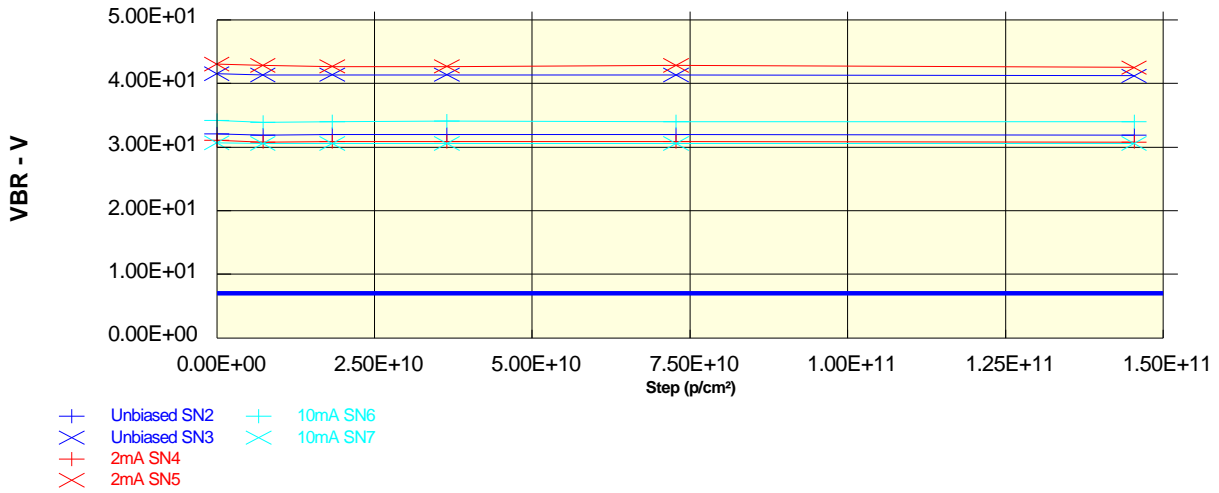
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.

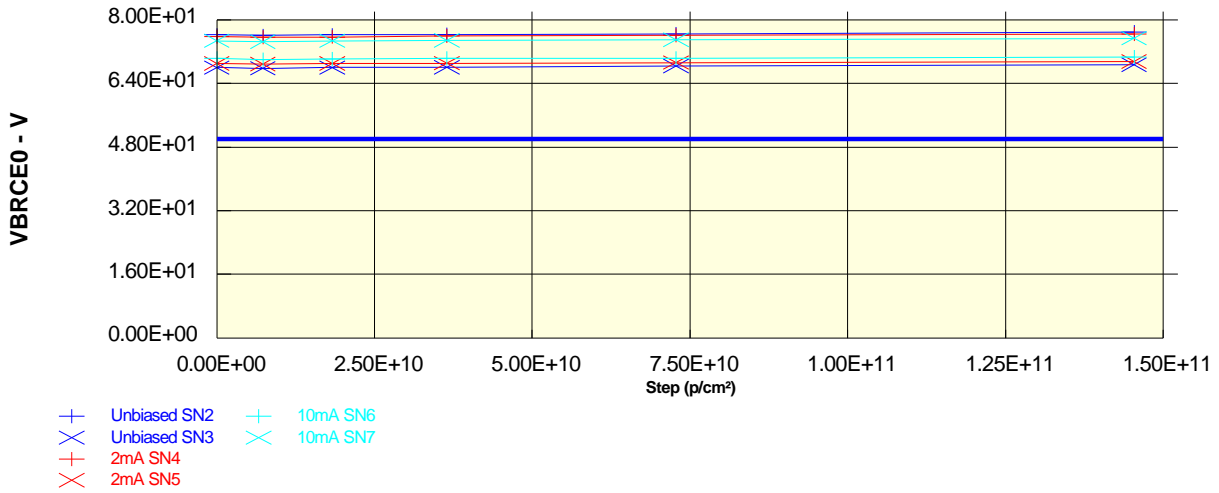


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 3.21 E+01 | 3.19 E+01 | 3.20 E+01 | 3.20 E+01 | 3.20 E+01 | 3.19 E+01 |
| 3 | 4.15 E+01 | 4.13 E+01 | 4.14 E+01 | 4.14 E+01 | 4.13 E+01 | 4.12 E+01 |
| 4 | 3.11 E+01 | 3.08 E+01 | 3.09 E+01 | 3.09 E+01 | 3.09 E+01 | 3.08 E+01 |
| 5 | 4.30 E+01 | 4.28 E+01 | 4.27 E+01 | 4.27 E+01 | 4.28 E+01 | 4.25 E+01 |
| 6 | 3.42 E+01 | 3.39 E+01 | 3.40 E+01 | 3.41 E+01 | 3.40 E+01 | 3.40 E+01 |
| 7 | 3.07 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 | 3.06 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
 Parameter : Collector-Emitter Breakdown Voltage : VBRCE0
 IC=10mA
 Unit : V
 Spec Limit Min : 5.00 E+01
 Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 2 | 7.62 E+01 | 7.60 E+01 | 7.62 E+01 | 7.63 E+01 | 7.65 E+01 | 7.69 E+01 |
| 3 | 6.80 E+01 | 6.78 E+01 | 6.80 E+01 | 6.81 E+01 | 6.84 E+01 | 6.87 E+01 |
| 4 | 7.58 E+01 | 7.56 E+01 | 7.57 E+01 | 7.59 E+01 | 7.61 E+01 | 7.64 E+01 |
| 5 | 6.90 E+01 | 6.89 E+01 | 6.90 E+01 | 6.91 E+01 | 6.93 E+01 | 6.95 E+01 |
| 6 | 7.03 E+01 | 7.00 E+01 | 7.01 E+01 | 7.03 E+01 | 7.04 E+01 | 7.07 E+01 |
| 7 | 7.47 E+01 | 7.45 E+01 | 7.47 E+01 | 7.48 E+01 | 7.50 E+01 | 7.54 E+01 |

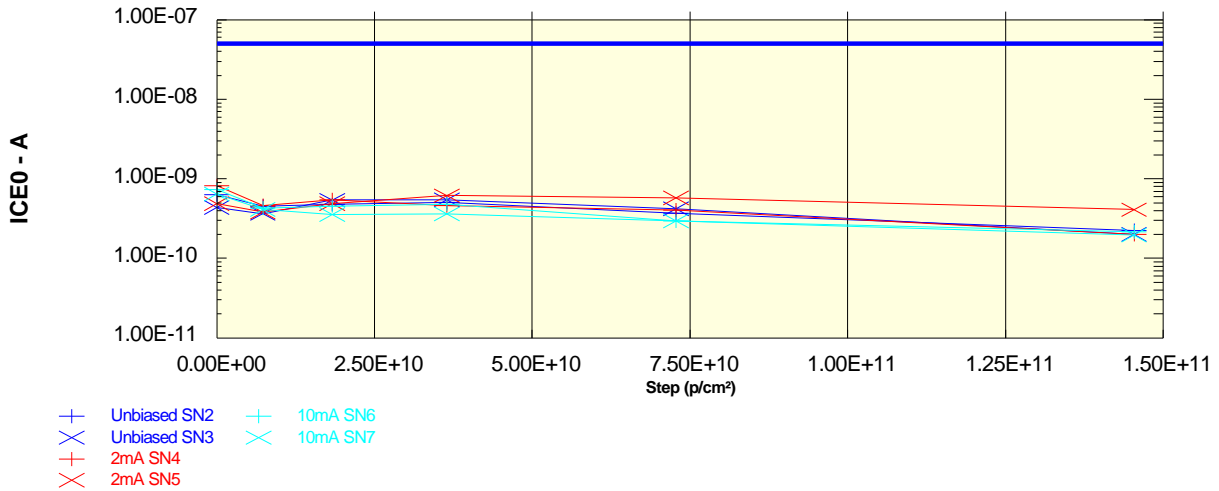
| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : L234
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A

Spec Limit Max : 5.00 E-08

Spec limits are represented in bold lines on the graphic.

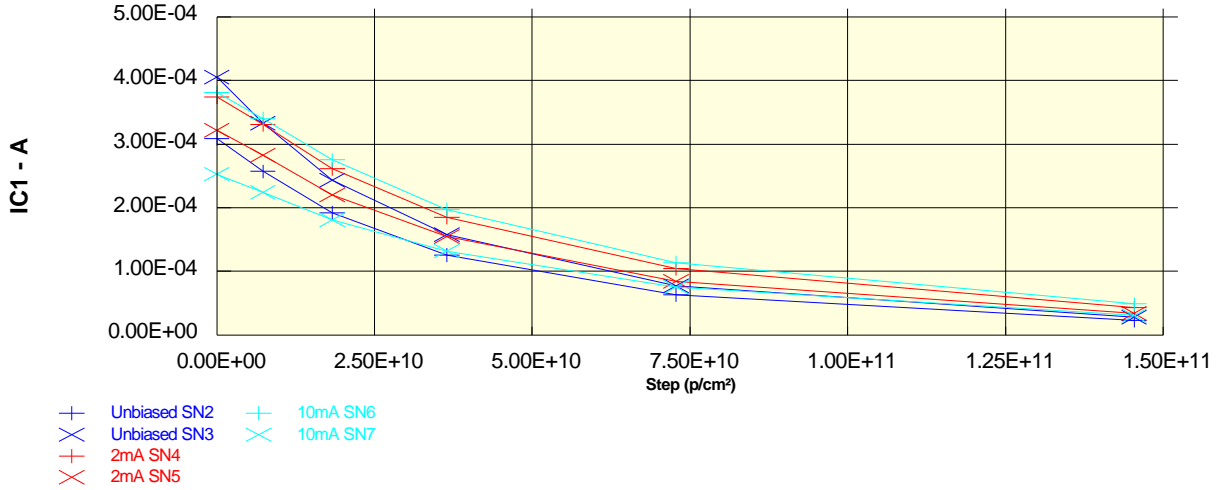


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 2 | 6.28 E-10 | 4.55 E-10 | 4.75 E-10 | 5.10 E-10 | 3.71 E-10 | 2.25 E-10 |
| 3 | 4.38 E-10 | 3.67 E-10 | 5.42 E-10 | 5.50 E-10 | 4.23 E-10 | 2.02 E-10 |
| 4 | 8.15 E-10 | 4.64 E-10 | 5.47 E-10 | 4.63 E-10 | 4.06 E-10 | 2.01 E-10 |
| 5 | 4.92 E-10 | 3.80 E-10 | 4.92 E-10 | 6.17 E-10 | 5.76 E-10 | 4.10 E-10 |
| 6 | 7.39 E-10 | 4.32 E-10 | 4.57 E-10 | 4.80 E-10 | 2.94 E-10 | 2.16 E-10 |
| 7 | 6.46 E-10 | 4.15 E-10 | 3.55 E-10 | 3.63 E-10 | 2.95 E-10 | 1.97 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
 Parameter : Output Current1 : IC1
 VCE=5.0V. IF=1mA
 Unit : A
 No spec limit specified.

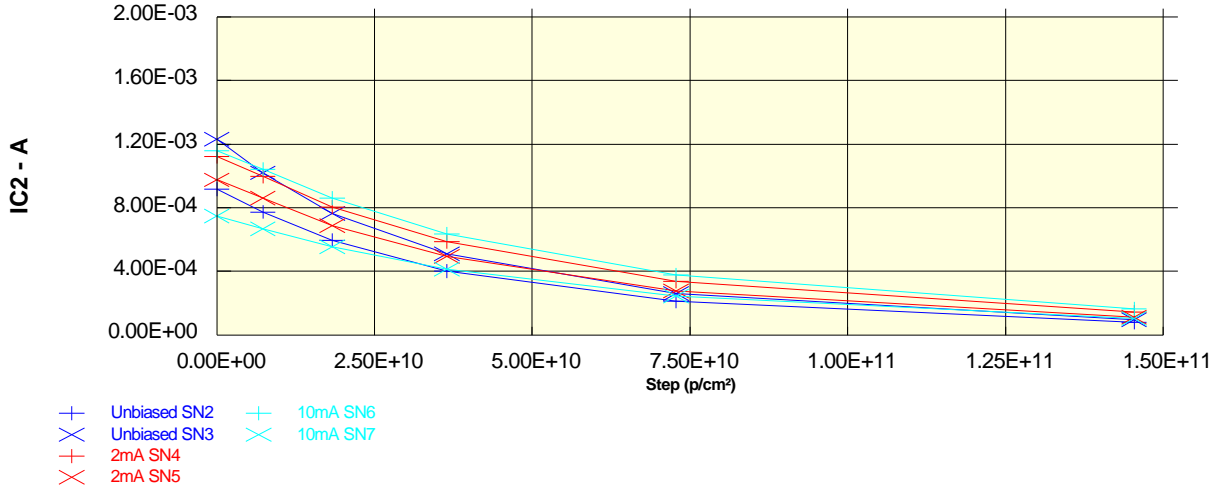


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 3.09 E-04 | 2.57 E-04 | 1.92 E-04 | 1.26 E-04 | 6.34 E-05 | 2.27 E-05 |
| 3 | 4.05 E-04 | 3.33 E-04 | 2.43 E-04 | 1.58 E-04 | 7.73 E-05 | 2.75 E-05 |
| 4 | 3.74 E-04 | 3.31 E-04 | 2.61 E-04 | 1.85 E-04 | 1.04 E-04 | 4.25 E-05 |
| 5 | 3.22 E-04 | 2.83 E-04 | 2.20 E-04 | 1.55 E-04 | 8.40 E-05 | 3.38 E-05 |
| 6 | 3.81 E-04 | 3.40 E-04 | 2.75 E-04 | 1.97 E-04 | 1.14 E-04 | 4.86 E-05 |
| 7 | 2.53 E-04 | 2.24 E-04 | 1.81 E-04 | 1.32 E-04 | 7.51 E-05 | 3.07 E-05 |

| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Datecode : L234
 Parameter : Output Current2 : IC2
 VCE=5.0V. IF=2mA
 Unit : A
 No spec limit specified.

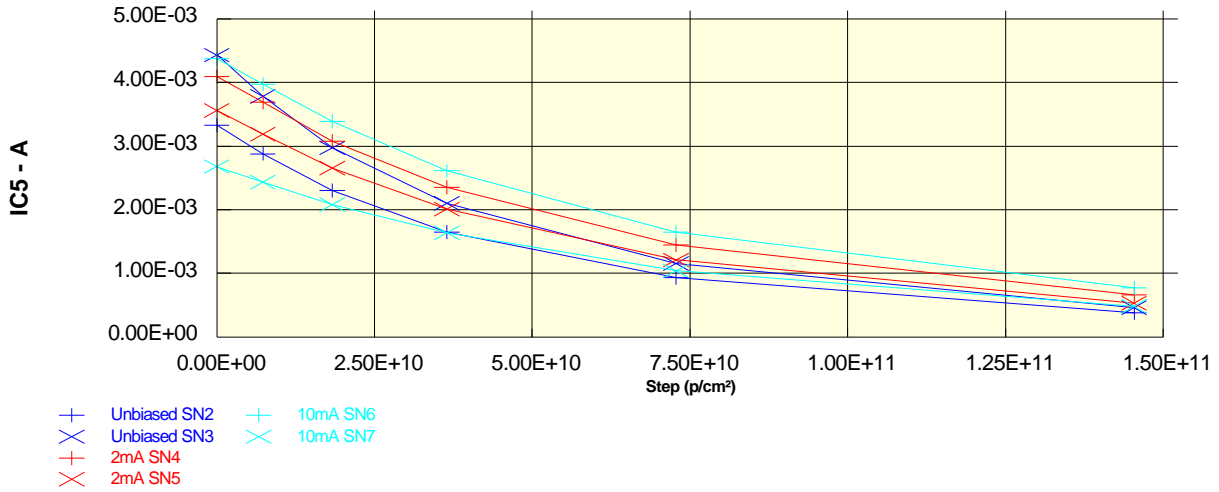


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 9.17 E-04 | 7.74 E-04 | 5.94 E-04 | 4.03 E-04 | 2.11 E-04 | 7.86 E-05 |
| 3 | 1.23 E-03 | 1.02 E-03 | 7.64 E-04 | 5.11 E-04 | 2.60 E-04 | 9.60 E-05 |
| 4 | 1.12 E-03 | 9.96 E-04 | 8.04 E-04 | 5.85 E-04 | 3.38 E-04 | 1.43 E-04 |
| 5 | 9.75 E-04 | 8.61 E-04 | 6.87 E-04 | 4.96 E-04 | 2.77 E-04 | 1.14 E-04 |
| 6 | 1.16 E-03 | 1.04 E-03 | 8.62 E-04 | 6.35 E-04 | 3.78 E-04 | 1.65 E-04 |
| 7 | 7.48 E-04 | 6.68 E-04 | 5.54 E-04 | 4.15 E-04 | 2.45 E-04 | 1.04 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
 Parameter : Output Current5 : IC5
 VCE=5.0V. IF=5mA
 Unit : A
 No spec limit specified.



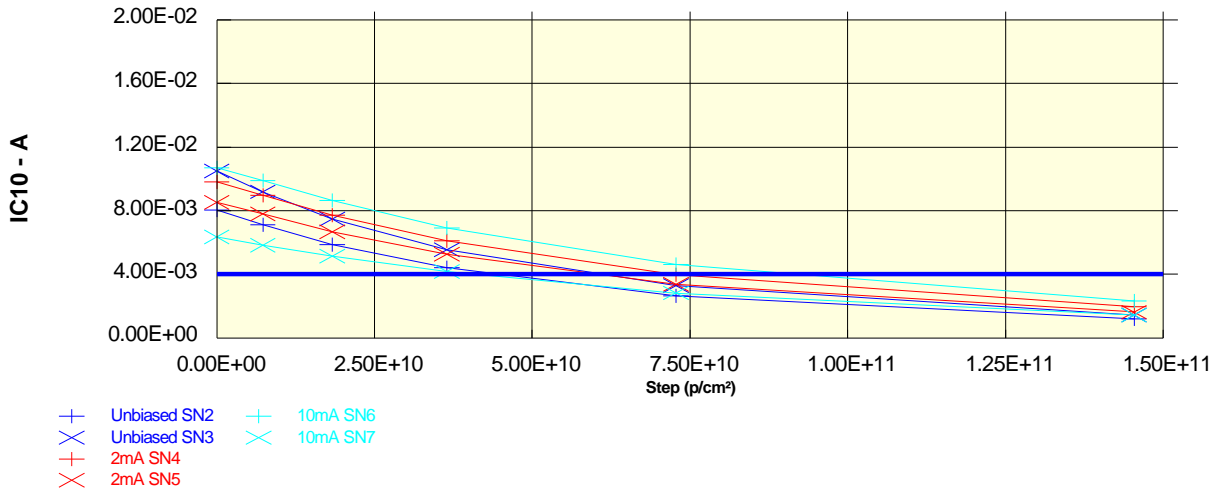
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 3.33 E-03 | 2.88 E-03 | 2.30 E-03 | 1.65 E-03 | 9.34 E-04 | 3.80 E-04 |
| 3 | 4.43 E-03 | 3.78 E-03 | 2.97 E-03 | 2.10 E-03 | 1.16 E-03 | 4.64 E-04 |
| 4 | 4.09 E-03 | 3.69 E-03 | 3.08 E-03 | 2.35 E-03 | 1.45 E-03 | 6.59 E-04 |
| 5 | 3.56 E-03 | 3.19 E-03 | 2.66 E-03 | 2.01 E-03 | 1.21 E-03 | 5.33 E-04 |
| 6 | 4.37 E-03 | 3.97 E-03 | 3.39 E-03 | 2.61 E-03 | 1.65 E-03 | 7.76 E-04 |
| 7 | 2.68 E-03 | 2.43 E-03 | 2.08 E-03 | 1.64 E-03 | 1.04 E-03 | 4.81 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
Parameter : Output Current10 : IC10
VCE=5.0V. IF=10mA

Unit : A
Spec Limit Min : 4.00 E-03
Spec limits are represented in bold lines on the graphic.

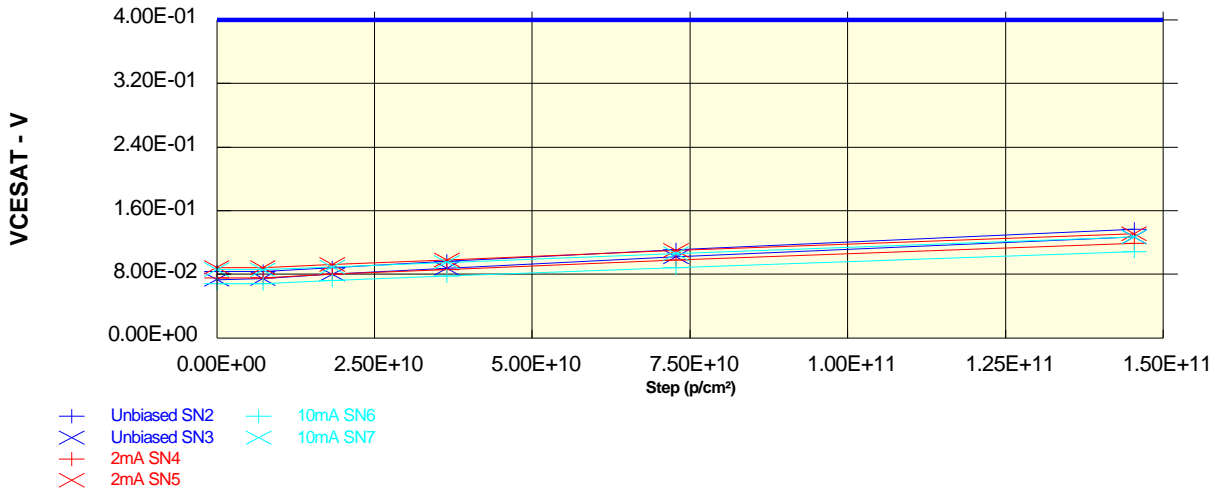


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 2 | 8.05 E-03 | 7.11 E-03 | 5.89 E-03 | 4.41 E-03 | 2.66 E-03 | 1.18 E-03 |
| 3 | 1.05 E-02 | 9.18 E-03 | 7.49 E-03 | 5.56 E-03 | 3.29 E-03 | 1.44 E-03 |
| 4 | 9.80 E-03 | 8.96 E-03 | 7.71 E-03 | 6.10 E-03 | 3.99 E-03 | 1.97 E-03 |
| 5 | 8.54 E-03 | 7.79 E-03 | 6.68 E-03 | 5.26 E-03 | 3.37 E-03 | 1.62 E-03 |
| 6 | 1.07 E-02 | 9.88 E-03 | 8.64 E-03 | 6.91 E-03 | 4.62 E-03 | 2.34 E-03 |
| 7 | 6.34 E-03 | 5.84 E-03 | 5.14 E-03 | 4.18 E-03 | 2.83 E-03 | 1.43 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
 Parameter : Collector Emitter Saturation Voltage : VCESAT
 IC=2mA. IF=50mA
 Unit : V
 Spec Limit Max : 4.00 E-01
 Spec limits are represented in bold lines on the graphic.



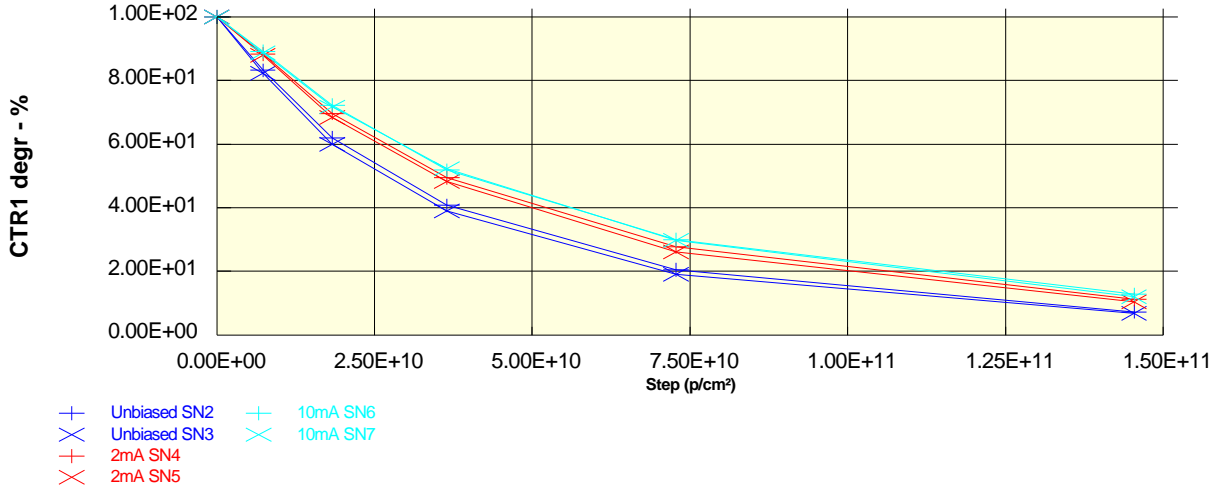
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 8.33 E-02 | 8.38 E-02 | 8.88 E-02 | 9.65 E-02 | 1.11 E-01 | 1.37 E-01 |
| 3 | 7.35 E-02 | 7.48 E-02 | 8.00 E-02 | 8.74 E-02 | 1.02 E-01 | 1.27 E-01 |
| 4 | 7.59 E-02 | 7.57 E-02 | 8.01 E-02 | 8.60 E-02 | 9.79 E-02 | 1.19 E-01 |
| 5 | 8.87 E-02 | 8.81 E-02 | 9.24 E-02 | 9.82 E-02 | 1.10 E-01 | 1.31 E-01 |
| 6 | 6.82 E-02 | 6.87 E-02 | 7.22 E-02 | 7.80 E-02 | 8.84 E-02 | 1.09 E-01 |
| 7 | 8.61 E-02 | 8.57 E-02 | 8.93 E-02 | 9.51 E-02 | 1.06 E-01 | 1.27 E-01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
Parameter : CTR1 degr

Unit : %
No spec limit specified.



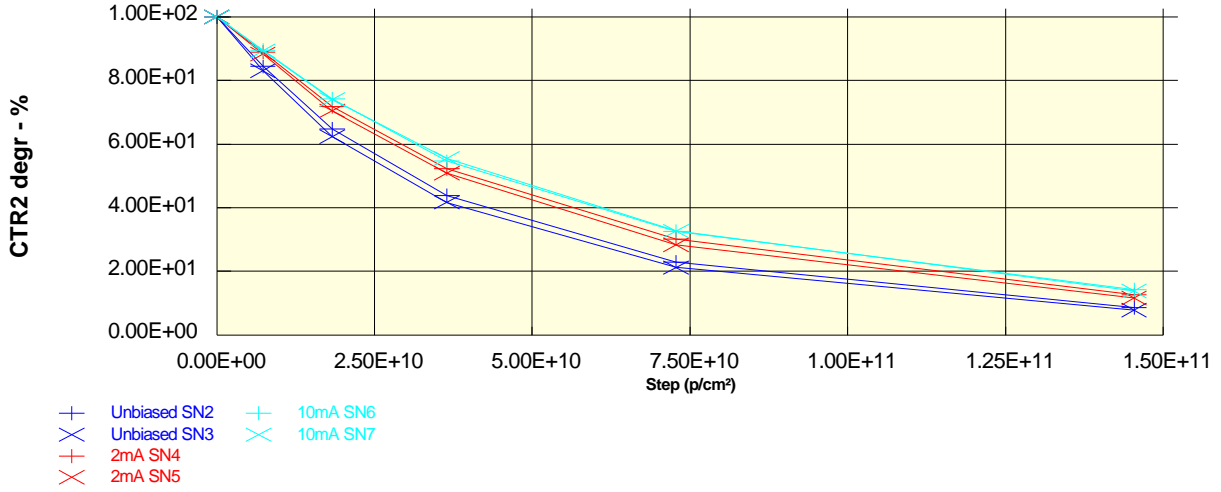
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 1.00 E+02 | 8.32 E+01 | 6.20 E+01 | 4.07 E+01 | 2.05 E+01 | 7.35 E+00 |
| 3 | 1.00 E+02 | 8.22 E+01 | 6.00 E+01 | 3.90 E+01 | 1.91 E+01 | 6.79 E+00 |
| 4 | 1.00 E+02 | 8.84 E+01 | 6.97 E+01 | 4.94 E+01 | 2.78 E+01 | 1.13 E+01 |
| 5 | 1.00 E+02 | 8.79 E+01 | 6.84 E+01 | 4.83 E+01 | 2.61 E+01 | 1.05 E+01 |
| 6 | 1.00 E+02 | 8.91 E+01 | 7.23 E+01 | 5.18 E+01 | 3.00 E+01 | 1.28 E+01 |
| 7 | 1.00 E+02 | 8.87 E+01 | 7.17 E+01 | 5.23 E+01 | 2.97 E+01 | 1.21 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
Parameter : CTR2 degr

Unit : %
No spec limit specified.



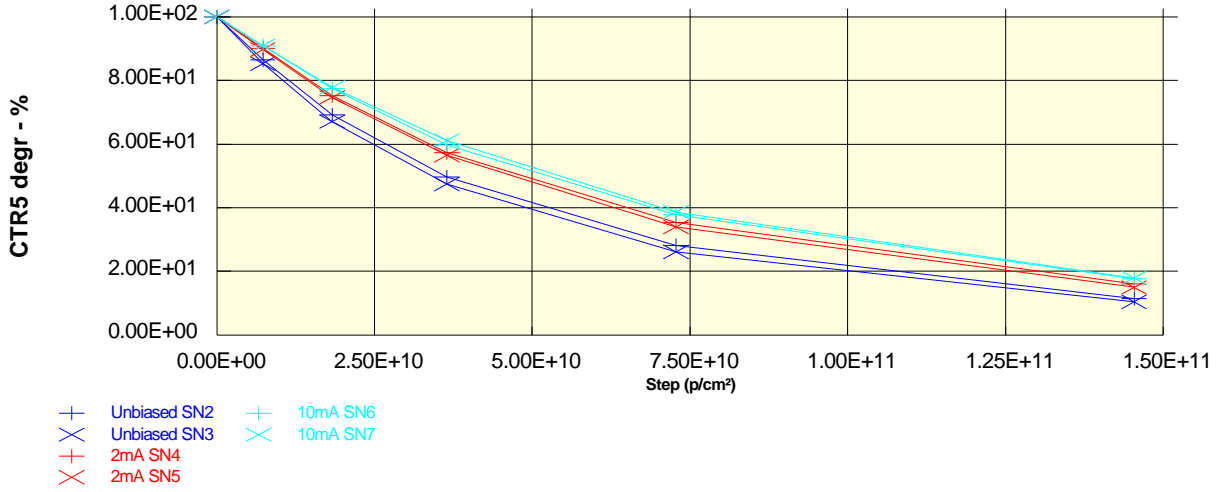
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 2 | 1.00 E+02 | 8.44 E+01 | 6.47 E+01 | 4.39 E+01 | 2.30 E+01 | 8.57 E+00 |
| 3 | 1.00 E+02 | 8.31 E+01 | 6.23 E+01 | 4.17 E+01 | 2.12 E+01 | 7.83 E+00 |
| 4 | 1.00 E+02 | 8.89 E+01 | 7.17 E+01 | 5.22 E+01 | 3.02 E+01 | 1.27 E+01 |
| 5 | 1.00 E+02 | 8.83 E+01 | 7.05 E+01 | 5.08 E+01 | 2.84 E+01 | 1.17 E+01 |
| 6 | 1.00 E+02 | 8.96 E+01 | 7.42 E+01 | 5.46 E+01 | 3.25 E+01 | 1.42 E+01 |
| 7 | 1.00 E+02 | 8.93 E+01 | 7.40 E+01 | 5.55 E+01 | 3.27 E+01 | 1.38 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
Parameter : CTR5 degr

Unit : %
No spec limit specified.



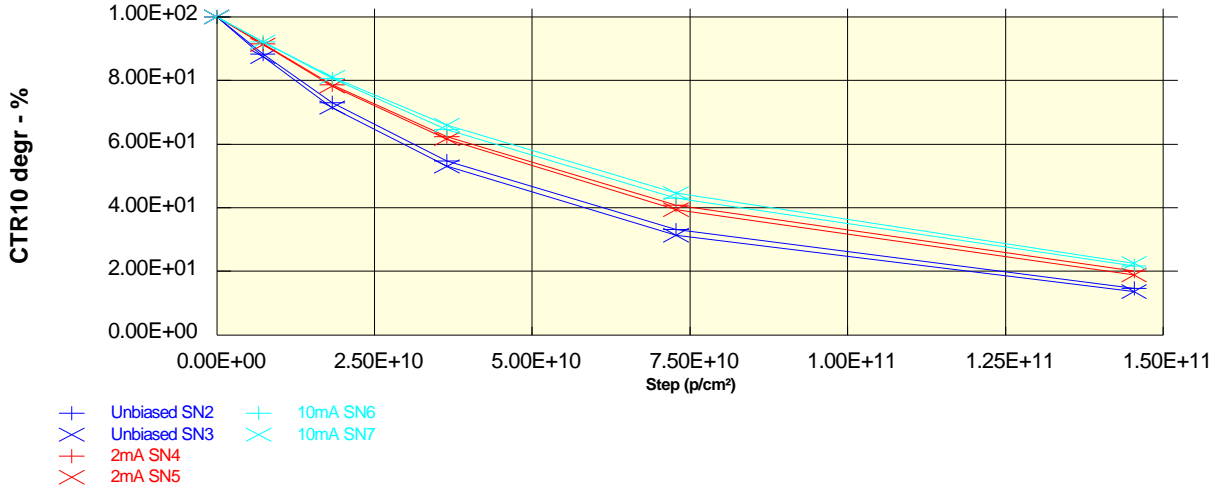
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 1.00 E+02 | 8.64 E+01 | 6.92 E+01 | 4.96 E+01 | 2.81 E+01 | 1.14 E+01 |
| 3 | 1.00 E+02 | 8.53 E+01 | 6.71 E+01 | 4.75 E+01 | 2.62 E+01 | 1.05 E+01 |
| 4 | 1.00 E+02 | 9.01 E+01 | 7.53 E+01 | 5.74 E+01 | 3.54 E+01 | 1.61 E+01 |
| 5 | 1.00 E+02 | 8.97 E+01 | 7.47 E+01 | 5.66 E+01 | 3.39 E+01 | 1.50 E+01 |
| 6 | 1.00 E+02 | 9.09 E+01 | 7.75 E+01 | 5.97 E+01 | 3.78 E+01 | 1.77 E+01 |
| 7 | 1.00 E+02 | 9.09 E+01 | 7.79 E+01 | 6.11 E+01 | 3.87 E+01 | 1.80 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : L234
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|---|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 2 | 1.00 E+02 | 8.84 E+01 | 7.31 E+01 | 5.48 E+01 | 3.31 E+01 | 1.47 E+01 |
| 3 | 1.00 E+02 | 8.75 E+01 | 7.15 E+01 | 5.30 E+01 | 3.14 E+01 | 1.37 E+01 |
| 4 | 1.00 E+02 | 9.15 E+01 | 7.86 E+01 | 6.23 E+01 | 4.07 E+01 | 2.01 E+01 |
| 5 | 1.00 E+02 | 9.12 E+01 | 7.82 E+01 | 6.16 E+01 | 3.94 E+01 | 1.89 E+01 |
| 6 | 1.00 E+02 | 9.22 E+01 | 8.06 E+01 | 6.45 E+01 | 4.31 E+01 | 2.18 E+01 |
| 7 | 1.00 E+02 | 9.22 E+01 | 8.11 E+01 | 6.60 E+01 | 4.46 E+01 | 2.26 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

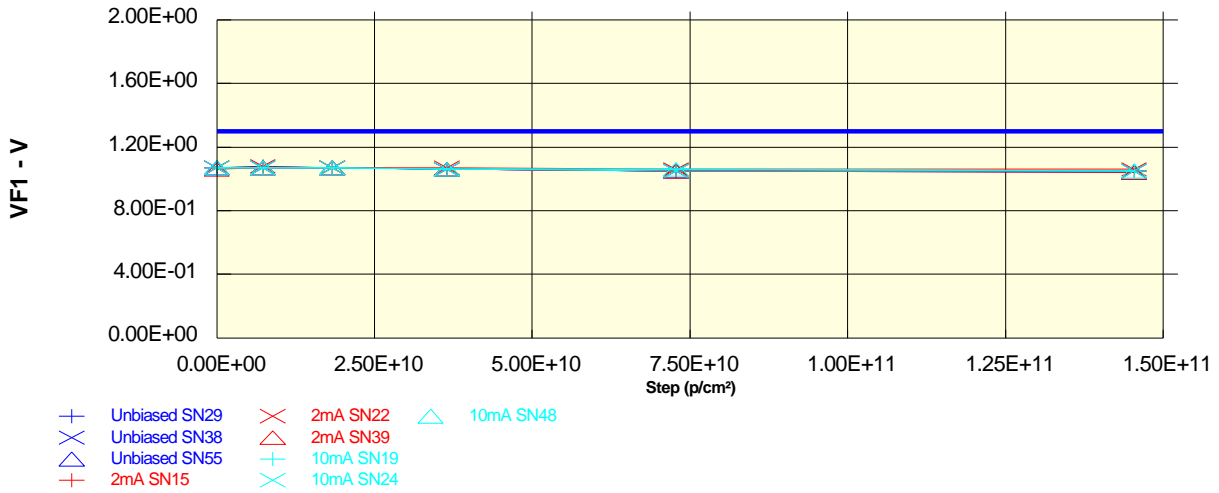
Parameter : Forward Voltage 1 : VF1

IF=2.0mA

Unit : V

Spec Limit Max : 1.30 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 38 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 55 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 15 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 22 | 1.07 E+00 | 1.08 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 |
| 39 | 1.06 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.04 E+00 |
| 19 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |
| 24 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.05 E+00 | 1.05 E+00 |
| 48 | 1.07 E+00 | 1.07 E+00 | 1.07 E+00 | 1.06 E+00 | 1.06 E+00 | 1.05 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

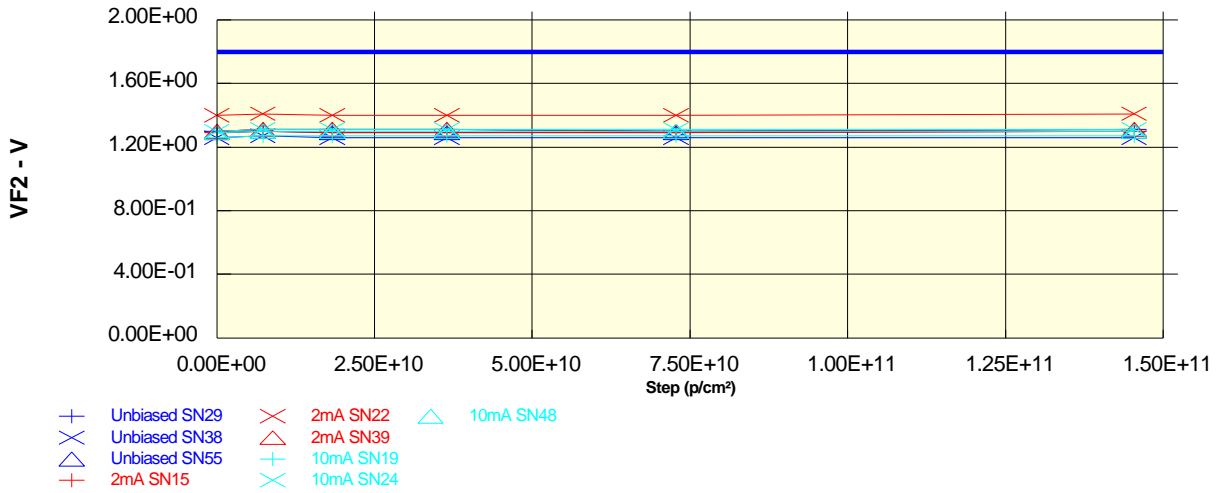
Parameter : Forward Voltage 2 : VF2

IF=50mA

Unit : V

Spec Limit Max : 1.80 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.30 E+00 | 1.31 E+00 |
| 38 | 1.26 E+00 | 1.27 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 | 1.26 E+00 |
| 55 | 1.29 E+00 | 1.30 E+00 | 1.29 E+00 | 1.29 E+00 | 1.29 E+00 | 1.30 E+00 |
| 15 | 1.29 E+00 | 1.30 E+00 | 1.29 E+00 | 1.29 E+00 | 1.29 E+00 | 1.30 E+00 |
| 22 | 1.40 E+00 | 1.41 E+00 | 1.40 E+00 | 1.40 E+00 | 1.40 E+00 | 1.41 E+00 |
| 39 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.30 E+00 | 1.31 E+00 |
| 19 | 1.26 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 | 1.27 E+00 |
| 24 | 1.30 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 | 1.31 E+00 |
| 48 | 1.29 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 | 1.30 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

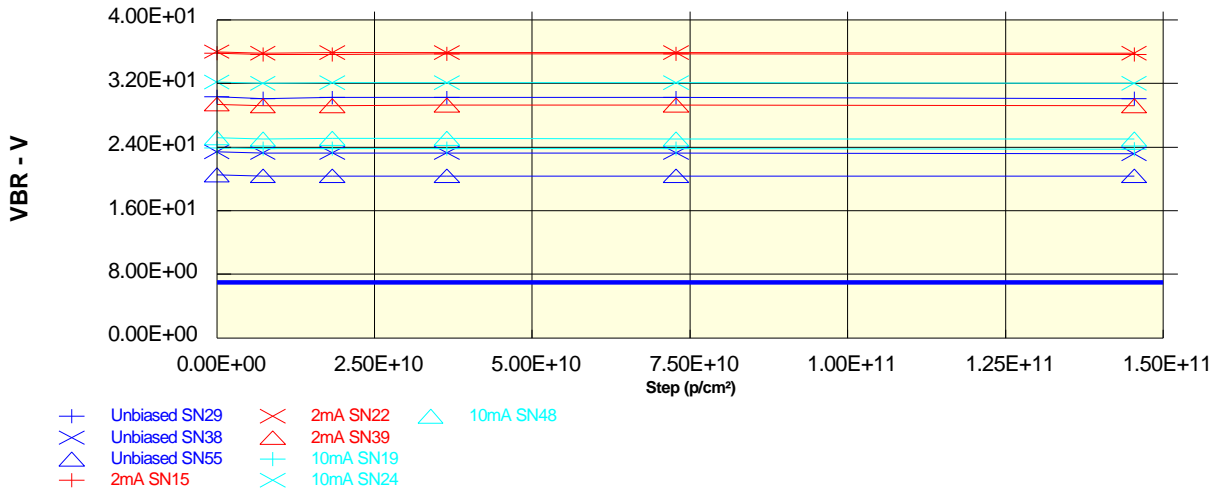
Parameter : Breakdown Voltage : VBR

IR=0.1mA

Unit : V

Spec Limit Min : 7.00 E+00

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 3.03 E+01 | 3.01 E+01 | 3.02 E+01 | 3.02 E+01 | 3.02 E+01 | 3.01 E+01 |
| 38 | 2.34 E+01 | 2.33 E+01 | 2.33 E+01 | 2.33 E+01 | 2.33 E+01 | 2.32 E+01 |
| 55 | 2.05 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 | 2.04 E+01 |
| 15 | 3.58 E+01 | 3.56 E+01 | 3.56 E+01 | 3.57 E+01 | 3.57 E+01 | 3.56 E+01 |
| 22 | 3.60 E+01 | 3.58 E+01 | 3.59 E+01 | 3.59 E+01 | 3.59 E+01 | 3.58 E+01 |
| 39 | 2.94 E+01 | 2.92 E+01 | 2.92 E+01 | 2.93 E+01 | 2.93 E+01 | 2.92 E+01 |
| 19 | 2.39 E+01 | 2.38 E+01 | 2.38 E+01 | 2.38 E+01 | 2.38 E+01 | 2.37 E+01 |
| 24 | 3.22 E+01 | 3.20 E+01 | 3.21 E+01 | 3.21 E+01 | 3.21 E+01 | 3.20 E+01 |
| 48 | 2.52 E+01 | 2.50 E+01 | 2.51 E+01 | 2.51 E+01 | 2.50 E+01 | 2.50 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

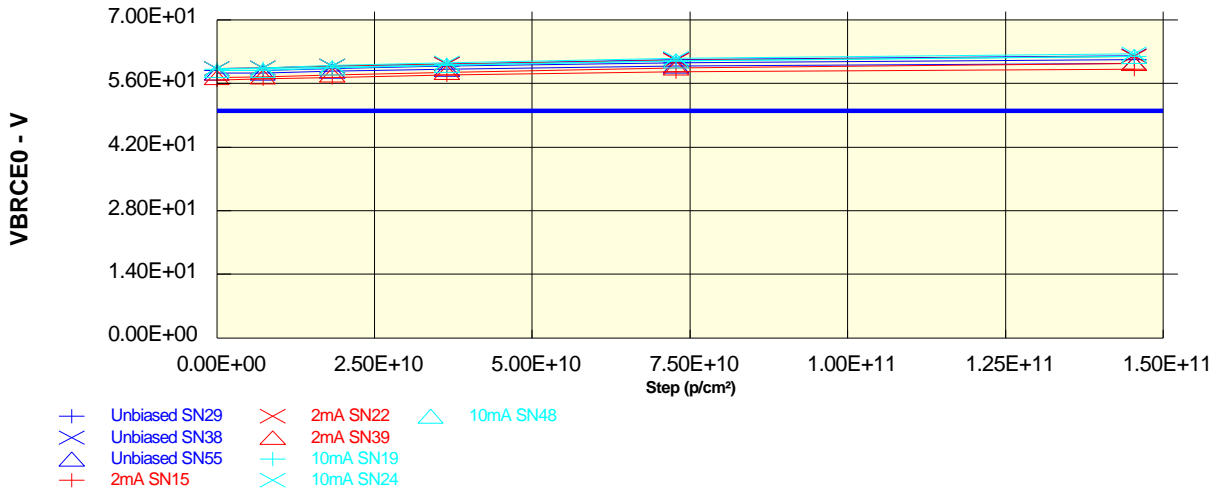
Parameter : Collector-Emitter Breakdown Voltage : VBRCE0

IC=10mA

Unit : V

Spec Limit Min : 5.00 E+01

Spec limits are represented in bold lines on the graphic.



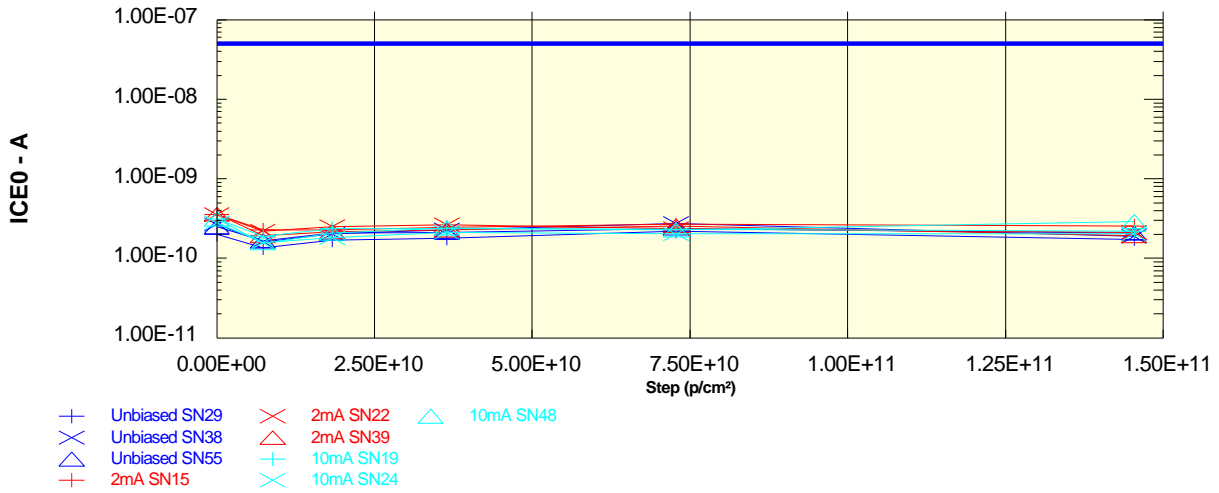
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 5.88 E+01 | 5.89 E+01 | 5.93 E+01 | 5.98 E+01 | 6.06 E+01 | 6.12 E+01 |
| 38 | 5.93 E+01 | 5.94 E+01 | 5.98 E+01 | 6.03 E+01 | 6.13 E+01 | 6.21 E+01 |
| 55 | 5.82 E+01 | 5.83 E+01 | 5.87 E+01 | 5.91 E+01 | 5.98 E+01 | 6.04 E+01 |
| 15 | 5.68 E+01 | 5.70 E+01 | 5.73 E+01 | 5.79 E+01 | 5.86 E+01 | 5.92 E+01 |
| 22 | 5.93 E+01 | 5.94 E+01 | 5.98 E+01 | 6.03 E+01 | 6.11 E+01 | 6.20 E+01 |
| 39 | 5.73 E+01 | 5.74 E+01 | 5.78 E+01 | 5.84 E+01 | 5.94 E+01 | 6.04 E+01 |
| 19 | 5.92 E+01 | 5.93 E+01 | 5.96 E+01 | 6.01 E+01 | 6.10 E+01 | 6.20 E+01 |
| 24 | 5.93 E+01 | 5.94 E+01 | 5.99 E+01 | 6.05 E+01 | 6.15 E+01 | 6.25 E+01 |
| 48 | 5.88 E+01 | 5.89 E+01 | 5.94 E+01 | 6.00 E+01 | 6.10 E+01 | 6.19 E+01 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : Dark Current : ICE0
VCE=5.0V. IF=0mA

Unit : A
Spec Limit Max : 5.00 E-08
Spec limits are represented in bold lines on the graphic.

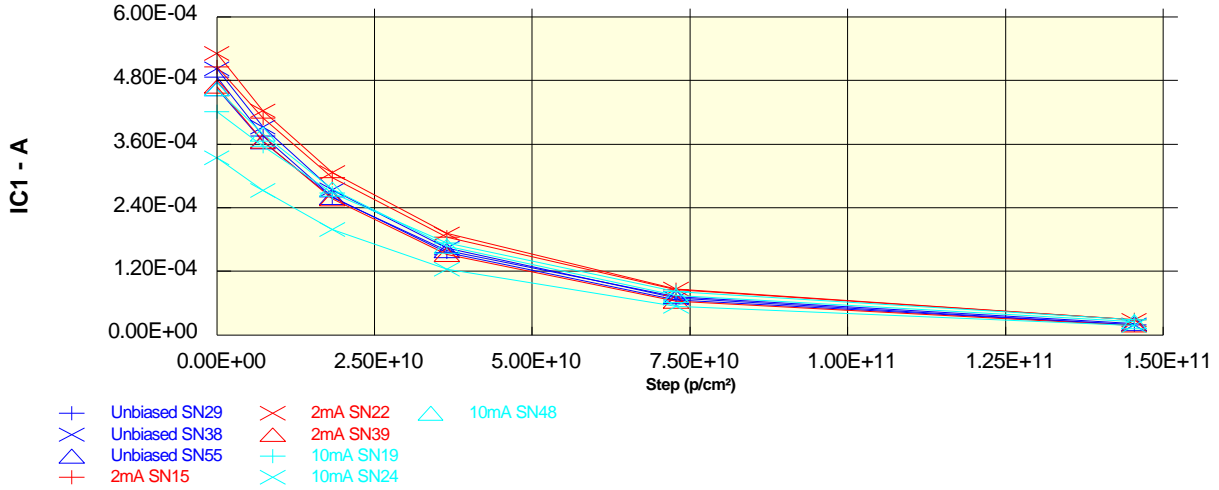


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 2.02 E-10 | 1.35 E-10 | 1.69 E-10 | 1.79 E-10 | 2.21 E-10 | 1.74 E-10 |
| 38 | 2.67 E-10 | 1.62 E-10 | 2.03 E-10 | 2.27 E-10 | 2.76 E-10 | 1.91 E-10 |
| 55 | 2.50 E-10 | 1.66 E-10 | 2.08 E-10 | 2.11 E-10 | 2.40 E-10 | 2.09 E-10 |
| 15 | 3.57 E-10 | 2.27 E-10 | 2.30 E-10 | 2.47 E-10 | 2.67 E-10 | 2.54 E-10 |
| 22 | 3.59 E-10 | 2.22 E-10 | 2.53 E-10 | 2.66 E-10 | 2.37 E-10 | 2.13 E-10 |
| 39 | 3.60 E-10 | 1.93 E-10 | 2.15 E-10 | 2.29 E-10 | 2.58 E-10 | 1.93 E-10 |
| 19 | 3.15 E-10 | 1.91 E-10 | 2.38 E-10 | 2.37 E-10 | 2.33 E-10 | 2.18 E-10 |
| 24 | 2.81 E-10 | 1.57 E-10 | 1.81 E-10 | 2.14 E-10 | 2.03 E-10 | 2.05 E-10 |
| 48 | 3.16 E-10 | 1.56 E-10 | 2.09 E-10 | 2.43 E-10 | 2.28 E-10 | 2.92 E-10 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : Output Current1 : IC1
VCE=5.0V. IF=1mA
Unit : A
No spec limit specified.

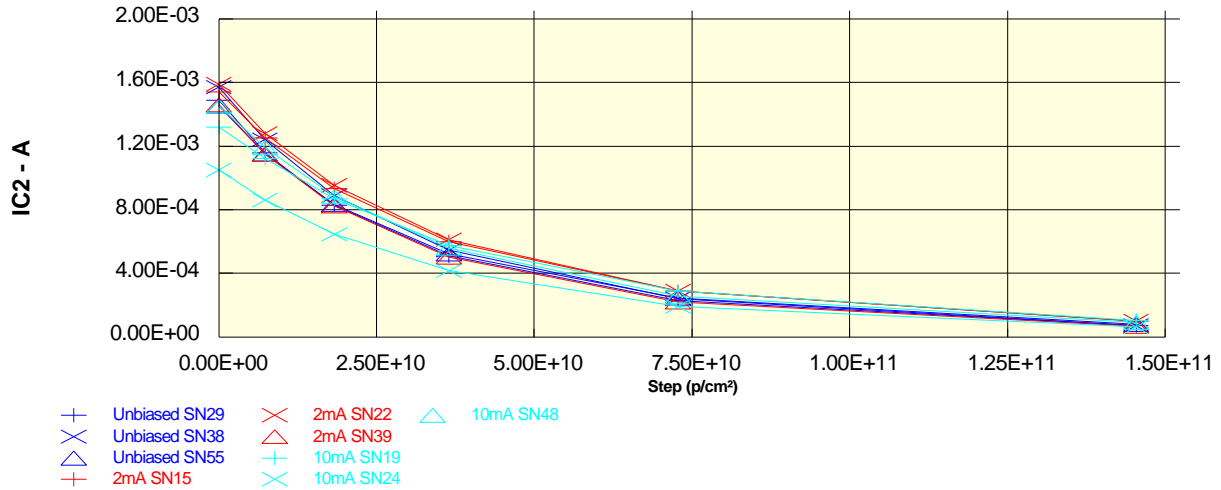


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 4.86 E-04 | 3.75 E-04 | 2.61 E-04 | 1.56 E-04 | 6.70 E-05 | 1.96 E-05 |
| 38 | 5.02 E-04 | 3.92 E-04 | 2.74 E-04 | 1.64 E-04 | 6.96 E-05 | 1.95 E-05 |
| 55 | 4.65 E-04 | 3.65 E-04 | 2.59 E-04 | 1.59 E-04 | 7.17 E-05 | 2.19 E-05 |
| 15 | 5.06 E-04 | 4.09 E-04 | 2.97 E-04 | 1.85 E-04 | 8.55 E-05 | 2.89 E-05 |
| 22 | 5.31 E-04 | 4.23 E-04 | 3.07 E-04 | 1.91 E-04 | 8.65 E-05 | 2.84 E-05 |
| 39 | 4.69 E-04 | 3.66 E-04 | 2.57 E-04 | 1.52 E-04 | 6.36 E-05 | 1.83 E-05 |
| 19 | 4.21 E-04 | 3.56 E-04 | 2.68 E-04 | 1.73 E-04 | 8.25 E-05 | 2.85 E-05 |
| 24 | 3.34 E-04 | 2.72 E-04 | 1.99 E-04 | 1.24 E-04 | 5.48 E-05 | 1.77 E-05 |
| 48 | 4.64 E-04 | 3.79 E-04 | 2.75 E-04 | 1.68 E-04 | 7.52 E-05 | 2.55 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : Output Current2 : IC2
VCE=5.0V. IF=2mA
Unit : A
No spec limit specified.

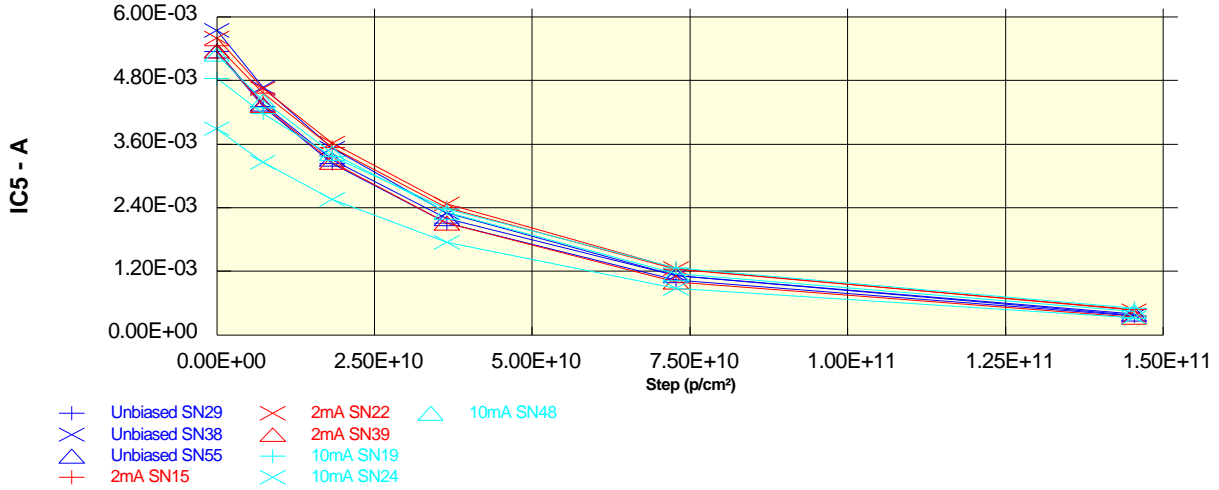


Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.49 E-03 | 1.16 E-03 | 8.29 E-04 | 5.10 E-04 | 2.31 E-04 | 7.20 E-05 |
| 38 | 1.57 E-03 | 1.24 E-03 | 8.88 E-04 | 5.46 E-04 | 2.43 E-04 | 7.30 E-05 |
| 55 | 1.45 E-03 | 1.15 E-03 | 8.32 E-04 | 5.24 E-04 | 2.46 E-04 | 8.00 E-05 |
| 15 | 1.54 E-03 | 1.25 E-03 | 9.32 E-04 | 5.99 E-04 | 2.87 E-04 | 1.01 E-04 |
| 22 | 1.59 E-03 | 1.28 E-03 | 9.55 E-04 | 6.13 E-04 | 2.89 E-04 | 9.87 E-05 |
| 39 | 1.46 E-03 | 1.15 E-03 | 8.26 E-04 | 5.02 E-04 | 2.19 E-04 | 6.69 E-05 |
| 19 | 1.32 E-03 | 1.12 E-03 | 8.69 E-04 | 5.76 E-04 | 2.87 E-04 | 1.04 E-04 |
| 24 | 1.05 E-03 | 8.62 E-04 | 6.46 E-04 | 4.16 E-04 | 1.93 E-04 | 6.54 E-05 |
| 48 | 1.45 E-03 | 1.19 E-03 | 8.83 E-04 | 5.59 E-04 | 2.59 E-04 | 9.17 E-05 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
 Parameter : Output Current5 : IC5
 VCE=5.0V. IF=5mA
 Unit : A
 No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 5.34 E-03 | 4.31 E-03 | 3.23 E-03 | 2.11 E-03 | 1.04 E-03 | 3.62 E-04 |
| 38 | 5.74 E-03 | 4.67 E-03 | 3.52 E-03 | 2.30 E-03 | 1.12 E-03 | 3.75 E-04 |
| 55 | 5.36 E-03 | 4.35 E-03 | 3.31 E-03 | 2.20 E-03 | 1.12 E-03 | 4.01 E-04 |
| 15 | 5.46 E-03 | 4.56 E-03 | 3.53 E-03 | 2.40 E-03 | 1.24 E-03 | 4.80 E-04 |
| 22 | 5.60 E-03 | 4.65 E-03 | 3.62 E-03 | 2.47 E-03 | 1.26 E-03 | 4.66 E-04 |
| 39 | 5.35 E-03 | 4.33 E-03 | 3.26 E-03 | 2.11 E-03 | 9.93 E-04 | 3.35 E-04 |
| 19 | 4.84 E-03 | 4.18 E-03 | 3.37 E-03 | 2.37 E-03 | 1.27 E-03 | 5.06 E-04 |
| 24 | 3.89 E-03 | 3.26 E-03 | 2.56 E-03 | 1.75 E-03 | 8.79 E-04 | 3.29 E-04 |
| 48 | 5.29 E-03 | 4.42 E-03 | 3.43 E-03 | 2.31 E-03 | 1.16 E-03 | 4.43 E-04 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

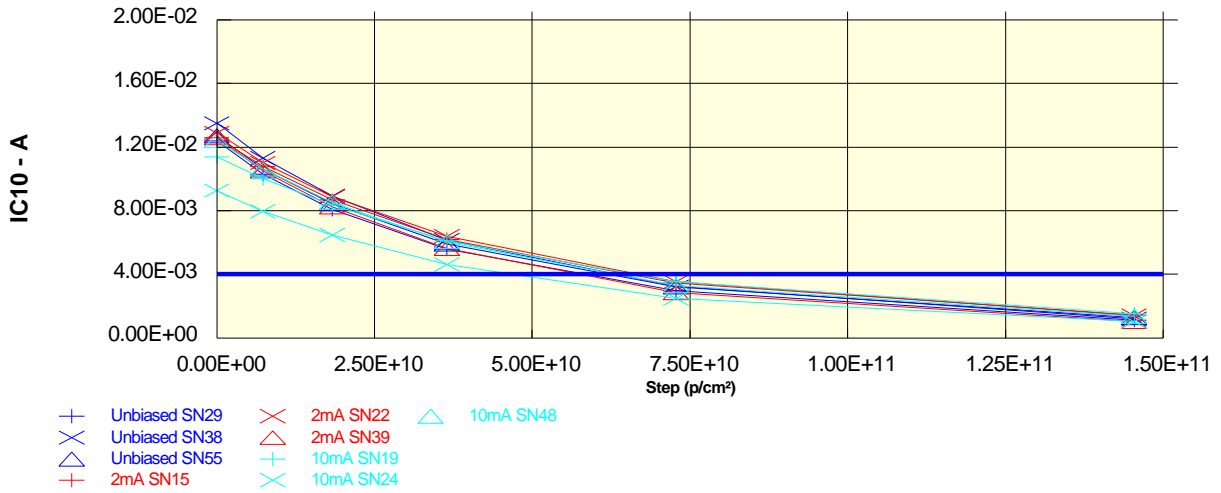
Parameter : Output Current10 : IC10

VCE=5.0V. IF=10mA

Unit : A

Spec Limit Min : 4.00 E-03

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.24 E-02 | 1.03 E-02 | 8.10 E-03 | 5.59 E-03 | 2.98 E-03 | 1.14 E-03 |
| 38 | 1.35 E-02 | 1.13 E-02 | 8.94 E-03 | 6.16 E-03 | 3.24 E-03 | 1.20 E-03 |
| 55 | 1.27 E-02 | 1.06 E-02 | 8.44 E-03 | 5.91 E-03 | 3.22 E-03 | 1.27 E-03 |
| 15 | 1.26 E-02 | 1.08 E-02 | 8.67 E-03 | 6.18 E-03 | 3.44 E-03 | 1.44 E-03 |
| 22 | 1.29 E-02 | 1.10 E-02 | 8.90 E-03 | 6.39 E-03 | 3.53 E-03 | 1.42 E-03 |
| 39 | 1.26 E-02 | 1.05 E-02 | 8.24 E-03 | 5.62 E-03 | 2.86 E-03 | 1.06 E-03 |
| 19 | 1.14 E-02 | 1.00 E-02 | 8.35 E-03 | 6.13 E-03 | 3.55 E-03 | 1.53 E-03 |
| 24 | 9.27 E-03 | 7.96 E-03 | 6.47 E-03 | 4.63 E-03 | 2.51 E-03 | 1.03 E-03 |
| 48 | 1.24 E-02 | 1.06 E-02 | 8.54 E-03 | 6.05 E-03 | 3.28 E-03 | 1.35 E-03 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426

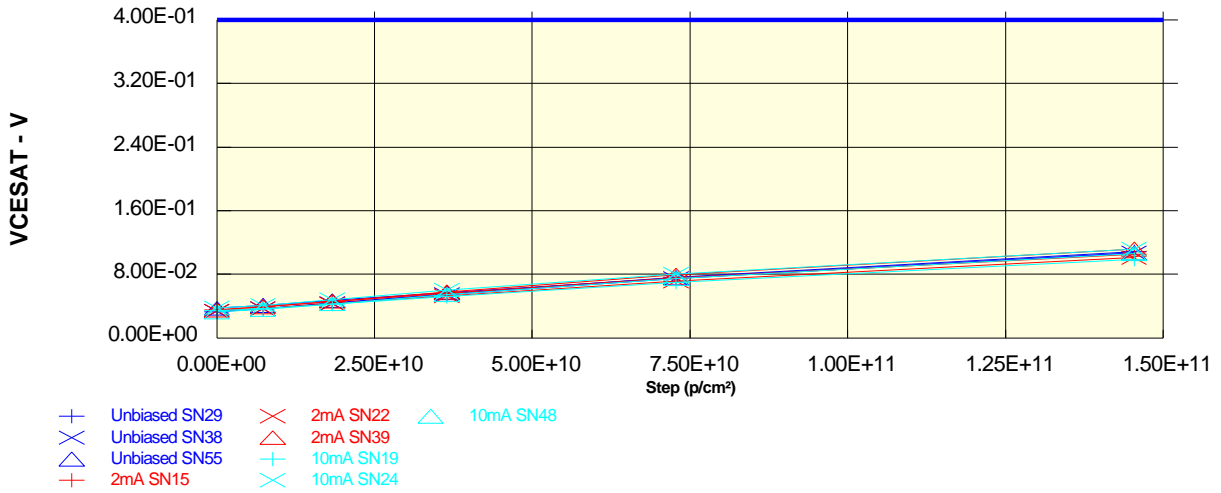
Parameter : Collector Emitter Saturation Voltage : VCESAT

IC=2mA. IF=50mA

Unit : V

Spec Limit Max : 4.00 E-01

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 3.29 E-02 | 3.66 E-02 | 4.42 E-02 | 5.55 E-02 | 7.64 E-02 | 1.09 E-01 |
| 38 | 3.36 E-02 | 3.68 E-02 | 4.36 E-02 | 5.43 E-02 | 7.44 E-02 | 1.07 E-01 |
| 55 | 3.73 E-02 | 4.08 E-02 | 4.70 E-02 | 5.71 E-02 | 7.58 E-02 | 1.07 E-01 |
| 15 | 3.56 E-02 | 3.90 E-02 | 4.56 E-02 | 5.62 E-02 | 7.53 E-02 | 1.05 E-01 |
| 22 | 3.40 E-02 | 3.70 E-02 | 4.31 E-02 | 5.30 E-02 | 7.15 E-02 | 1.01 E-01 |
| 39 | 3.54 E-02 | 3.92 E-02 | 4.62 E-02 | 5.79 E-02 | 7.92 E-02 | 1.12 E-01 |
| 19 | 3.45 E-02 | 3.67 E-02 | 4.25 E-02 | 5.22 E-02 | 7.00 E-02 | 9.88 E-02 |
| 24 | 3.78 E-02 | 4.12 E-02 | 4.83 E-02 | 6.01 E-02 | 8.04 E-02 | 1.12 E-01 |
| 48 | 3.27 E-02 | 3.60 E-02 | 4.28 E-02 | 5.45 E-02 | 7.44 E-02 | 1.06 E-01 |

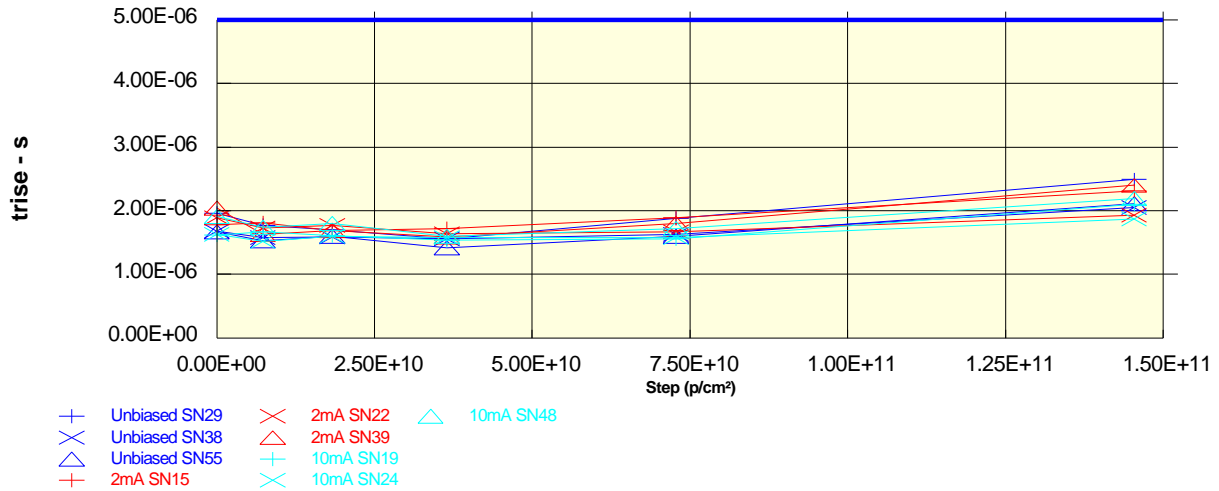
| | | | | |
|--------------------------|-------------------------------|----------------|------------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Test conditions : DC9426
Parameter : Rise Time : trise
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

Spec limits are represented in bold lines on the graphic.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 1.96 E-06 | 1.77 E-06 | 1.70 E-06 | 1.56 E-06 | 1.88 E-06 | 2.49 E-06 |
| 38 | 1.68 E-06 | 1.58 E-06 | 1.59 E-06 | 1.56 E-06 | 1.63 E-06 | 2.05 E-06 |
| 55 | 1.67 E-06 | 1.53 E-06 | 1.60 E-06 | 1.42 E-06 | 1.60 E-06 | 2.11 E-06 |
| 15 | 1.78 E-06 | 1.81 E-06 | 1.69 E-06 | 1.72 E-06 | 1.89 E-06 | 2.31 E-06 |
| 22 | 1.89 E-06 | 1.73 E-06 | 1.77 E-06 | 1.64 E-06 | 1.67 E-06 | 1.93 E-06 |
| 39 | 2.04 E-06 | 1.63 E-06 | 1.69 E-06 | 1.59 E-06 | 1.80 E-06 | 2.40 E-06 |
| 19 | 1.62 E-06 | 1.67 E-06 | 1.61 E-06 | 1.54 E-06 | 1.56 E-06 | 2.10 E-06 |
| 24 | 1.63 E-06 | 1.52 E-06 | 1.60 E-06 | 1.58 E-06 | 1.58 E-06 | 1.87 E-06 |
| 48 | 1.91 E-06 | 1.74 E-06 | 1.80 E-06 | 1.60 E-06 | 1.72 E-06 | 2.19 E-06 |

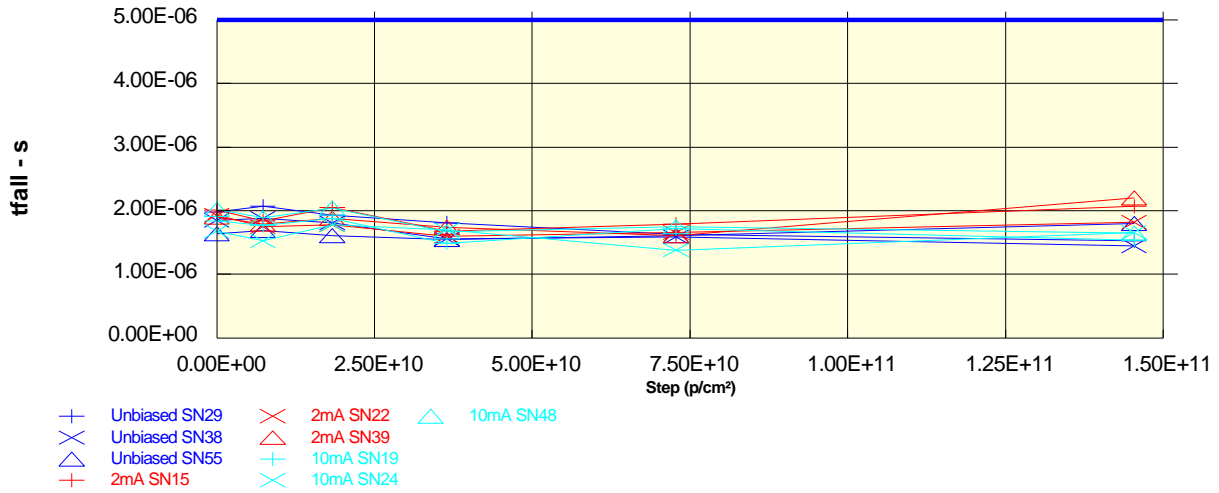
| | | | | |
|-------------------|------------------------|----------------|------------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | | Réf. : HRX/TID/0078 |
| | | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) | |

Test conditions : DC9426
Parameter : Fall Time : t_{fall}
RL=100 Ohms. IC=2.0mA. VCE=5.0V

Unit : s

Spec Limit Max : 5.00 E-06

Spec limits are represented in bold lines on the graphic.



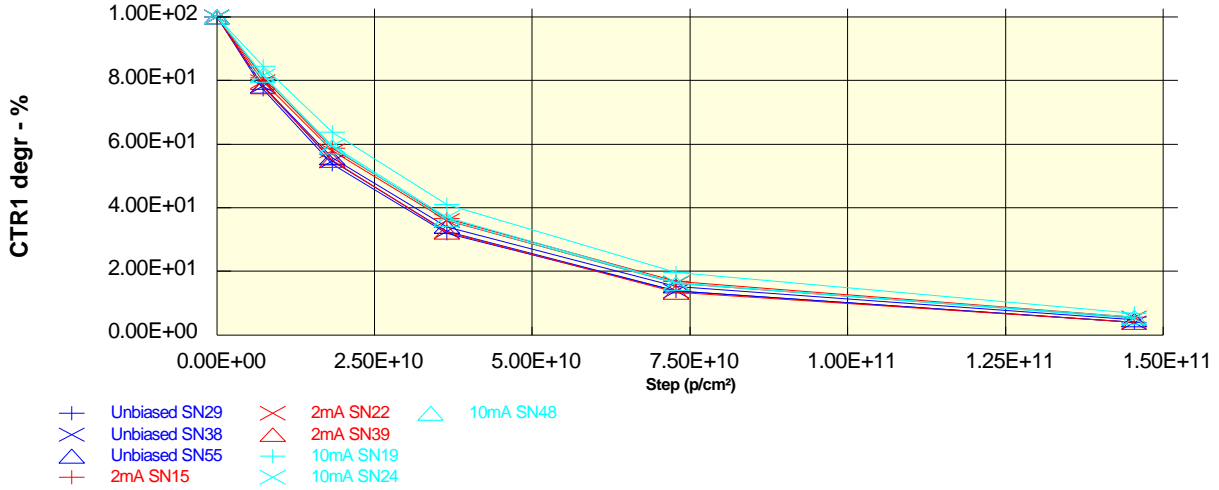
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.98 E-06 | 2.07 E-06 | 1.93 E-06 | 1.81 E-06 | 1.63 E-06 | 1.53 E-06 |
| 38 | 1.85 E-06 | 1.88 E-06 | 1.81 E-06 | 1.56 E-06 | 1.59 E-06 | 1.45 E-06 |
| 55 | 1.64 E-06 | 1.69 E-06 | 1.61 E-06 | 1.55 E-06 | 1.61 E-06 | 1.80 E-06 |
| 15 | 2.01 E-06 | 1.84 E-06 | 2.05 E-06 | 1.68 E-06 | 1.79 E-06 | 2.07 E-06 |
| 22 | 1.93 E-06 | 1.75 E-06 | 1.78 E-06 | 1.60 E-06 | 1.66 E-06 | 1.82 E-06 |
| 39 | 1.90 E-06 | 1.79 E-06 | 1.88 E-06 | 1.74 E-06 | 1.61 E-06 | 2.20 E-06 |
| 19 | 1.84 E-06 | 1.77 E-06 | 1.88 E-06 | 1.49 E-06 | 1.72 E-06 | 1.54 E-06 |
| 24 | 1.68 E-06 | 1.53 E-06 | 1.78 E-06 | 1.70 E-06 | 1.38 E-06 | 1.66 E-06 |
| 48 | 2.02 E-06 | 1.89 E-06 | 2.04 E-06 | 1.67 E-06 | 1.75 E-06 | 1.65 E-06 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : CTR1 degr

Unit : %
No spec limit specified.



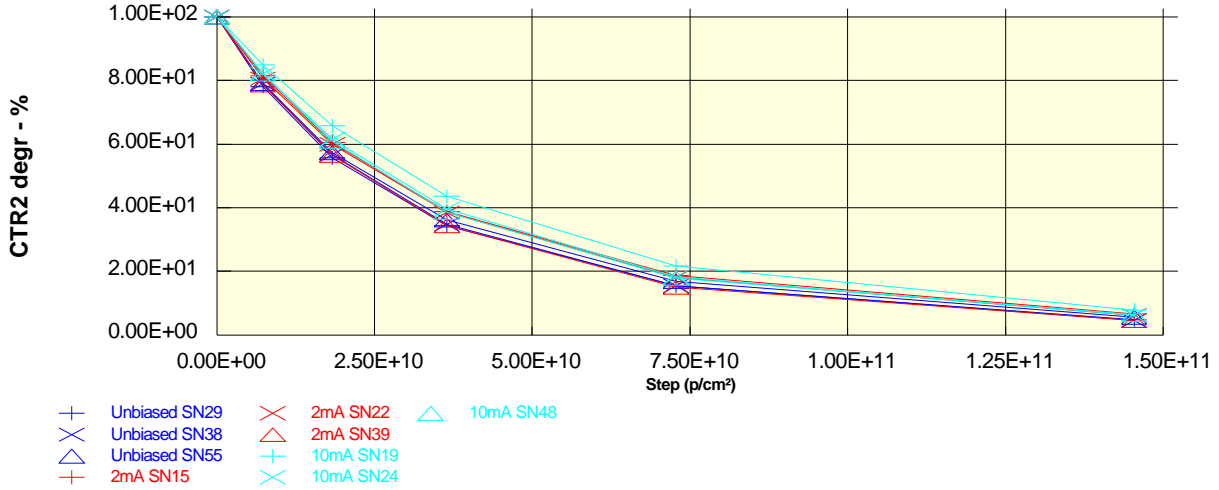
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 1.00 E+02 | 7.72 E+01 | 5.37 E+01 | 3.20 E+01 | 1.38 E+01 | 4.02 E+00 |
| 38 | 1.00 E+02 | 7.82 E+01 | 5.47 E+01 | 3.26 E+01 | 1.39 E+01 | 3.88 E+00 |
| 55 | 1.00 E+02 | 7.83 E+01 | 5.56 E+01 | 3.41 E+01 | 1.54 E+01 | 4.71 E+00 |
| 15 | 1.00 E+02 | 8.08 E+01 | 5.88 E+01 | 3.66 E+01 | 1.69 E+01 | 5.72 E+00 |
| 22 | 1.00 E+02 | 7.96 E+01 | 5.79 E+01 | 3.60 E+01 | 1.63 E+01 | 5.35 E+00 |
| 39 | 1.00 E+02 | 7.80 E+01 | 5.49 E+01 | 3.24 E+01 | 1.35 E+01 | 3.91 E+00 |
| 19 | 1.00 E+02 | 8.45 E+01 | 6.38 E+01 | 4.10 E+01 | 1.96 E+01 | 6.76 E+00 |
| 24 | 1.00 E+02 | 8.15 E+01 | 5.95 E+01 | 3.70 E+01 | 1.64 E+01 | 5.30 E+00 |
| 48 | 1.00 E+02 | 8.17 E+01 | 5.92 E+01 | 3.63 E+01 | 1.62 E+01 | 5.51 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : CTR2 degr

Unit : %
No spec limit specified.



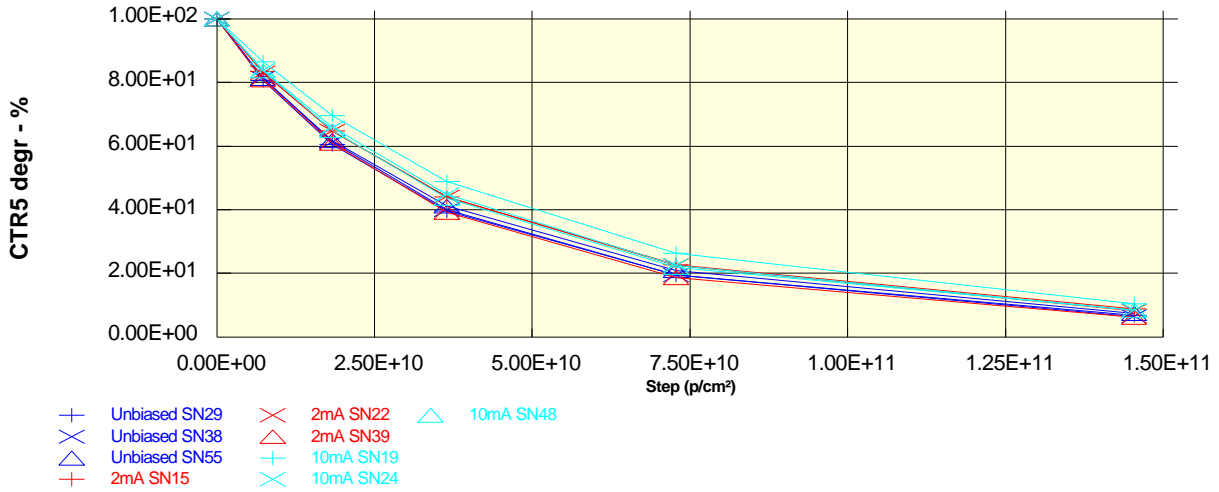
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.00 E+02 | 7.81 E+01 | 5.58 E+01 | 3.43 E+01 | 1.55 E+01 | 4.85 E+00 |
| 38 | 1.00 E+02 | 7.89 E+01 | 5.67 E+01 | 3.48 E+01 | 1.55 E+01 | 4.66 E+00 |
| 55 | 1.00 E+02 | 7.90 E+01 | 5.73 E+01 | 3.61 E+01 | 1.69 E+01 | 5.50 E+00 |
| 15 | 1.00 E+02 | 8.15 E+01 | 6.06 E+01 | 3.89 E+01 | 1.86 E+01 | 6.59 E+00 |
| 22 | 1.00 E+02 | 8.06 E+01 | 5.99 E+01 | 3.85 E+01 | 1.81 E+01 | 6.20 E+00 |
| 39 | 1.00 E+02 | 7.87 E+01 | 5.66 E+01 | 3.44 E+01 | 1.50 E+01 | 4.59 E+00 |
| 19 | 1.00 E+02 | 8.49 E+01 | 6.58 E+01 | 4.36 E+01 | 2.17 E+01 | 7.86 E+00 |
| 24 | 1.00 E+02 | 8.21 E+01 | 6.15 E+01 | 3.96 E+01 | 1.83 E+01 | 6.23 E+00 |
| 48 | 1.00 E+02 | 8.20 E+01 | 6.09 E+01 | 3.86 E+01 | 1.79 E+01 | 6.33 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : CTR5 degr

Unit : %
No spec limit specified.



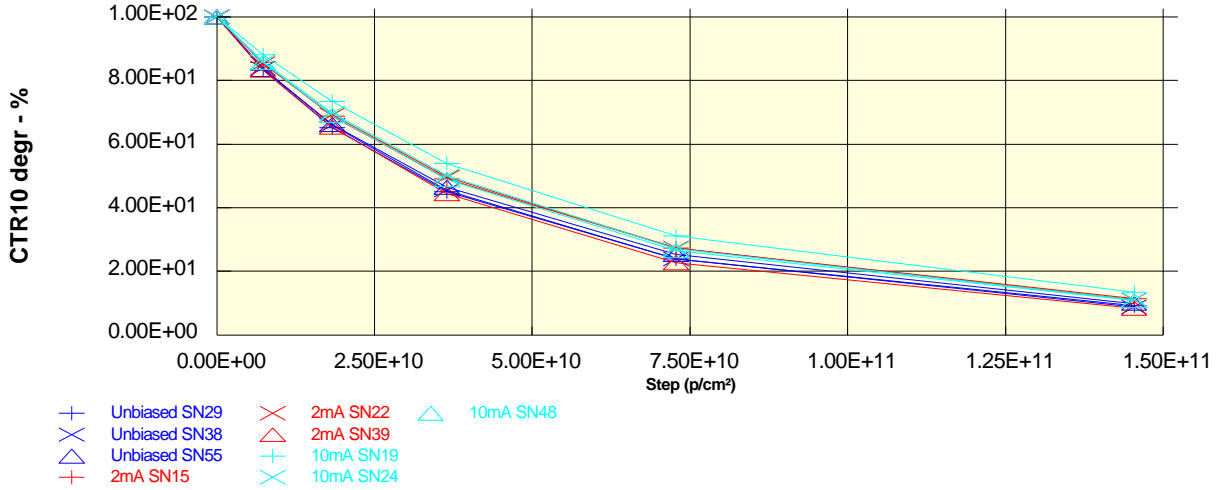
Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm² | 7.26E+09 p/cm² | 1.83E+10 p/cm² | 3.65E+10 p/cm² | 7.28E+10 p/cm² | 1.45E+11 p/cm² |
|----|----------------|----------------|----------------|----------------|----------------|----------------|
| 29 | 1.00 E+02 | 8.06 E+01 | 6.05 E+01 | 3.95 E+01 | 1.95 E+01 | 6.77 E+00 |
| 38 | 1.00 E+02 | 8.14 E+01 | 6.14 E+01 | 4.00 E+01 | 1.95 E+01 | 6.53 E+00 |
| 55 | 1.00 E+02 | 8.12 E+01 | 6.18 E+01 | 4.11 E+01 | 2.09 E+01 | 7.48 E+00 |
| 15 | 1.00 E+02 | 8.35 E+01 | 6.48 E+01 | 4.40 E+01 | 2.28 E+01 | 8.79 E+00 |
| 22 | 1.00 E+02 | 8.30 E+01 | 6.47 E+01 | 4.41 E+01 | 2.25 E+01 | 8.33 E+00 |
| 39 | 1.00 E+02 | 8.09 E+01 | 6.09 E+01 | 3.93 E+01 | 1.86 E+01 | 6.26 E+00 |
| 19 | 1.00 E+02 | 8.64 E+01 | 6.97 E+01 | 4.89 E+01 | 2.63 E+01 | 1.05 E+01 |
| 24 | 1.00 E+02 | 8.39 E+01 | 6.59 E+01 | 4.49 E+01 | 2.26 E+01 | 8.47 E+00 |
| 48 | 1.00 E+02 | 8.36 E+01 | 6.49 E+01 | 4.36 E+01 | 2.19 E+01 | 8.38 E+00 |

| | | | |
|-------------------|------------------------|----------------|---------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 |
| | | | Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

Datecode : DC9426
Parameter : CTR10 degr

Unit : %
No spec limit specified.



Test TST001 : 60 MeV proton

| | 0.00E+00 p/cm ² | 7.26E+09 p/cm ² | 1.83E+10 p/cm ² | 3.65E+10 p/cm ² | 7.28E+10 p/cm ² | 1.45E+11 p/cm ² |
|----|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 29 | 1.00 E+02 | 8.32 E+01 | 6.52 E+01 | 4.50 E+01 | 2.40 E+01 | 9.16 E+00 |
| 38 | 1.00 E+02 | 8.38 E+01 | 6.60 E+01 | 4.55 E+01 | 2.40 E+01 | 8.88 E+00 |
| 55 | 1.00 E+02 | 8.35 E+01 | 6.62 E+01 | 4.64 E+01 | 2.53 E+01 | 9.93 E+00 |
| 15 | 1.00 E+02 | 8.56 E+01 | 6.89 E+01 | 4.91 E+01 | 2.73 E+01 | 1.14 E+01 |
| 22 | 1.00 E+02 | 8.53 E+01 | 6.92 E+01 | 4.97 E+01 | 2.74 E+01 | 1.10 E+01 |
| 39 | 1.00 E+02 | 8.33 E+01 | 6.53 E+01 | 4.45 E+01 | 2.27 E+01 | 8.38 E+00 |
| 19 | 1.00 E+02 | 8.81 E+01 | 7.35 E+01 | 5.40 E+01 | 3.12 E+01 | 1.35 E+01 |
| 24 | 1.00 E+02 | 8.59 E+01 | 6.98 E+01 | 5.00 E+01 | 2.71 E+01 | 1.11 E+01 |
| 48 | 1.00 E+02 | 8.56 E+01 | 6.90 E+01 | 4.89 E+01 | 2.65 E+01 | 1.09 E+01 |

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |

APPENDIX 2 - CPO BEAM DOSIMETRY

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |



CENTRE DE PROTONTHERAPIE D'ORSAY

End-line dosimetry instrumentation

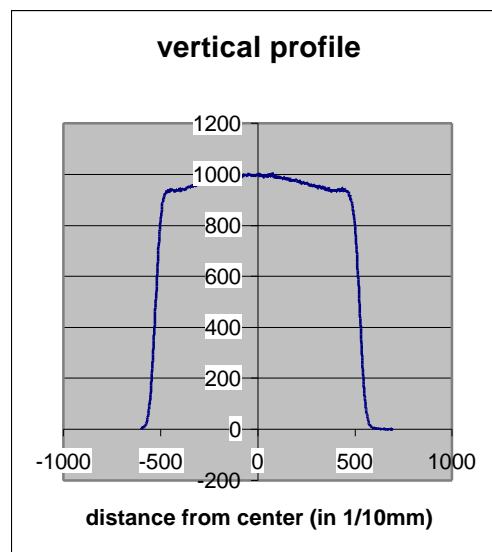
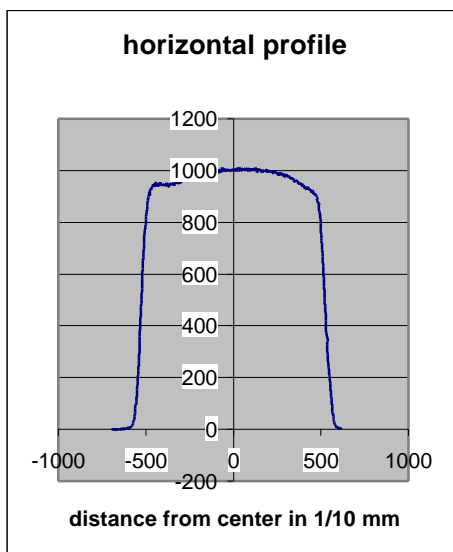
Off-line: a pencil ionization chamber (Wellhöfer IC15, vol. 0.1 cc) put in a water phantom achieves an accurate 3D dosimetry (standard system from the radiotherapy industry). The energy is calculated from the dose value.

(Code of practice for clinical proton dosimetry, Radiotherapy and Oncology 20, 1991)

On-line: the monitoring of the dose is realized with plates ionization chambers (control of the deposited dose with a resolution of 1cGy).

Beam calibration

| water cm | Energy | dose | S/Ro water | coef Z5 | time | Fluence rate |
|----------|--------|------|---|--|------|---|
| | MeV | Gy | MeV . g ⁻¹ . cm ² | .p . cm ⁻² . U.M. ⁻¹ | s | .p . cm ⁻² . s ⁻¹ |
| 3.1 | 60.07 | 1 | 10.77 | 1.159 E06 | 41 | 2.7 E07 |

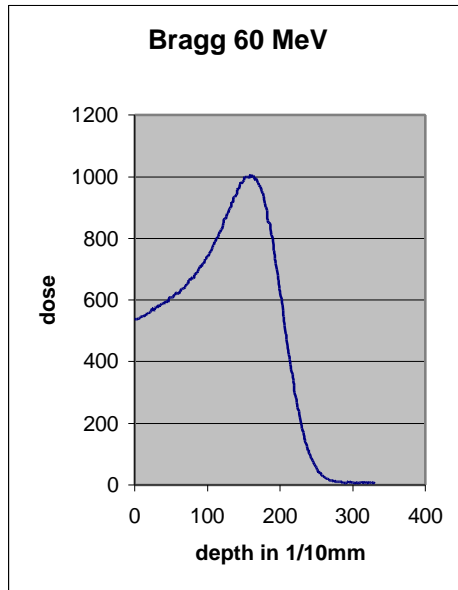


Beam profile

| | | | |
|--------------------------|-------------------------------|----------------|-----------------------------------|
| HIREX Engineering | Total Dose Test Report | | Réf. : HRX/TID/0078 Issue : 02 |
| Part Type : | 3C91C | Manufacturer : | ABB HAFO (MITEL) |



CENTRE DE PROTONTHERAPIE D'ORSAY



Bragg peak measured behind an equivalent 1.2 cm water