SINGLE EVENT LATCH-UP TEST REPORT ADRF5144-CSL

September 2025

Radiation Test Report	
Product:	ADRF5144-CSL
Effective LET:	≤ 54.0 MeV-cm^2/mg
Fluence:	1E7 Ions/cm^2
Facilities:	LBNL, TAMU
Tested:	June 2024, May 2025

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SEL Test Report for the ADRF5144-CSL – Silicon SPDT, Reflective Switch

Pryor Gibson, Tom Decker, Nolan Carr, Braxton Houlden, Eric Muire

Test Dates:
LBNL: June 13th-15th, 2024
TAMU: May 22nd-27th, 2025

I. Introduction

The purpose of this test is to determine the Single-Event Latch-up (SEL) susceptibility of the ADRF5144-CSL, a reflective SPDT switch rated for 1GHz to 20GHz operation. Single Event Latch-up (SEL) was verified on June 13th – 15th 2024, at the LBNL heavy ion facility and on May 22nd – 27th 2025, at the TAMU heavy ion facility.

II. Device Under Test (DUT)

The ADRF5144-CSL is a reflective SPDT switch operating in the 1GHz to 20GHz range.

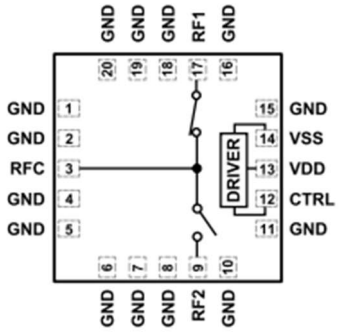


Figure 1. Functional block diagram.

Table 1
Part and test information.

Generic Part Number:	ADRF5144-CSL
Date of Test:	June 13th – 15th, 2024; May 22nd – May 27th, 2025
Manufacturer:	Analog Devices, Inc.
Die Rev:	ADRF5144_CS
Part Function:	Reflective SPDT Switch
Part Technology:	CMOS
Package Style:	20-lead, 3 mm x 3 mm LGA
Interconnect:	Flip Chip
Die Thickness	Thinned to 50µm

III. Test Facilities

The heavy-ion beam testing was carried out at the Lawrence Berkeley National Laboratory 88" Cyclotron Facility (LBNL) and at the Texas A&M University K500 cyclotron (TAMU). Both test setups were in an air environment.

Facility: LBNL, TAMU
Cocktail: 20; 24.8 MeV/nuc
Fluence: 1×10^7 cm^{-2} (per run)
Ions: Shown in Table 2

Table 2.
Heavy-ion species, effective linear energy transfer (LET), and location tested.

Ion	Effective LET ($MeV \cdot cm^2/mg$)	Facility
Xe	54.0	LBNL
Ag	50.9, 58.0	TAMU

IV. Test Method

A. Test Setup

The DUTs were de-processed to expose the die. The ADRF5144-CSL was configured as shown in Figure 2. The LTC5596 was attached to the output of the ADRF5144-CSL to convert to a readable DC voltage on the PXIe-5172 oscilloscope. The LTC5596 output voltage should be between 0.8V to 1.1V as shown in Figure 3. The supply current was monitored through the PXIe-4163 SMU. The power supply currents, power supply voltages and RF-DC outputs were recorded through a LabVIEW program. For SEL testing the supply voltages (±3.3V) were set to max rated (+10%) and the DUT was heated to high temperature (~125°C).

Table 3: Test Instrumentation

Name	Configured Values	Equipment
V_{DD}	3.6V, 3.5V (SEL); 3.0V (SET)	PXIe-4163
V_{SS}	-3.6V, -3.5V (SEL); -3.0V (SET)	PXIe-4163
V_{CTRL}	0	PXIe-4163
V_{EN}	0	PXIe-4163
RFIN	1GHz; -5dBm, -10dBm	HMC-T2240
RFOUT	Measured	LTC5596 + PXIe-5172

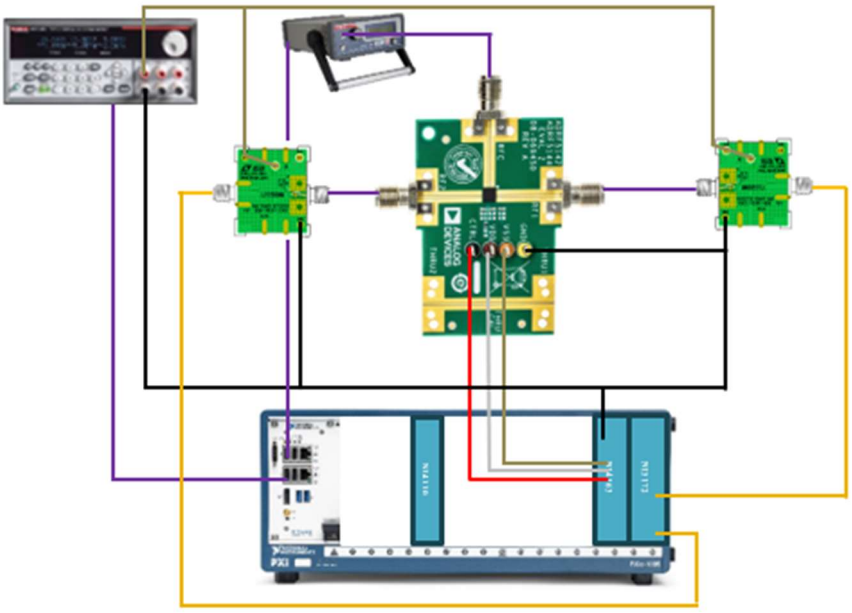


Figure 2. ADRF5144-CSL test setup.

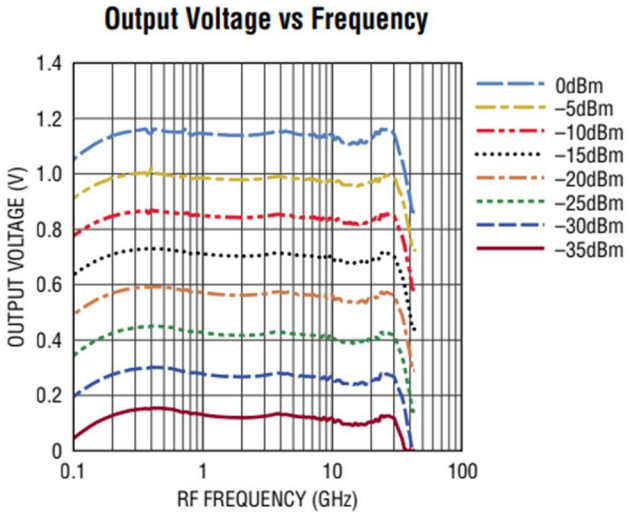


Figure 3. LTC5596 Frequency-Voltage Curve.

B. Irradiation procedure

SEL:

1. The device was powered on and brought up to ~125℃.
2. The software to monitor the supply current and voltages was turned on.
3. The ion beam was turned on.
4. Once the 1e+07 fluence was reached, the beam was turned off and the software was terminated.

V. Results

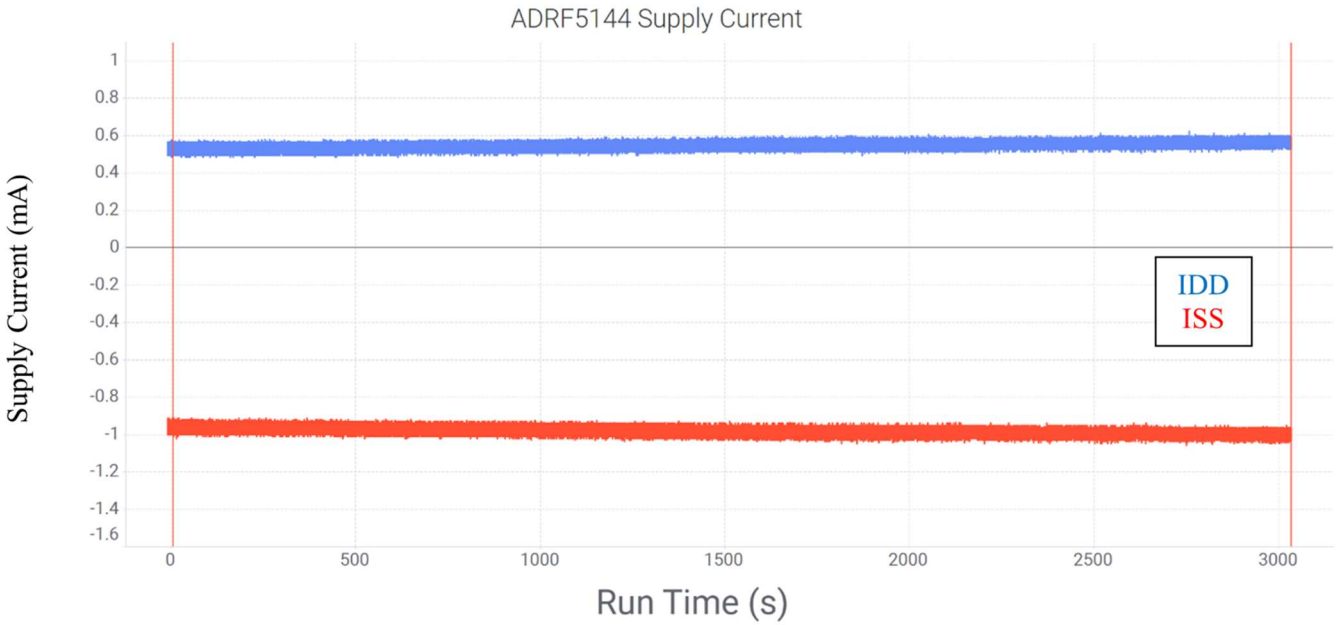
SEL – No latch-up or destructive events were observed on the ADRF5144-CSL to the highest effective LET tested at 54 or 58.0 MeV·cm^2/mg. Four devices were tested. The SEL plots are shown below.

Table 4
SEL Test Runs

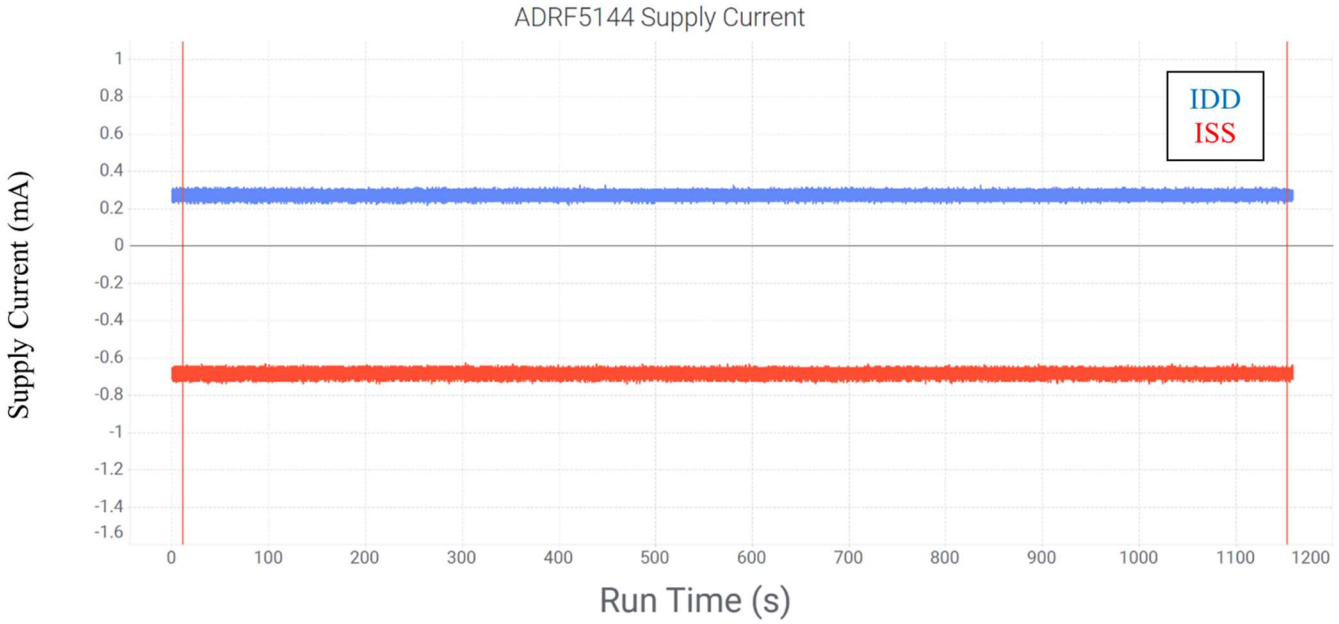
Run	Board Serial Number	Ion	Supply Voltage (VDD,VSS)	Effective LET	Angle	Ave. Flux	Fluence	SEL
#			*V*	*MeV·cm^2/mg*	*degrees*	*#/cm^2/sec*	*total ions*	
2	1	Xe	3.5, -3.5	54.0	0	3.070E+03	1.000E+07	0
5	3	Xe	3.6, -3.6	54.0	0	8.766E+03	1.000E+07	0
182	4	Ag	3.6, -3.6	58.0	0	5.904E+04	1.003E+07	0
183	7	Ag	3.6, -3.6	58.0	0	7.439E+04	9.972E+06	0

Appendix:

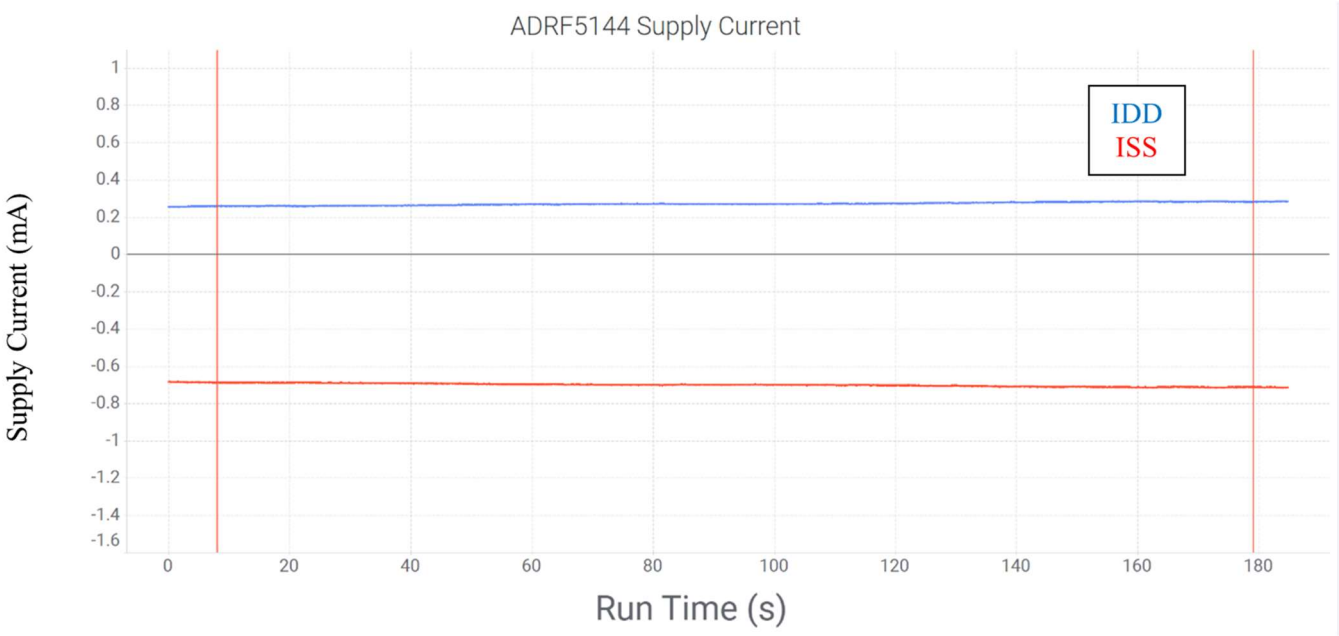
SEL



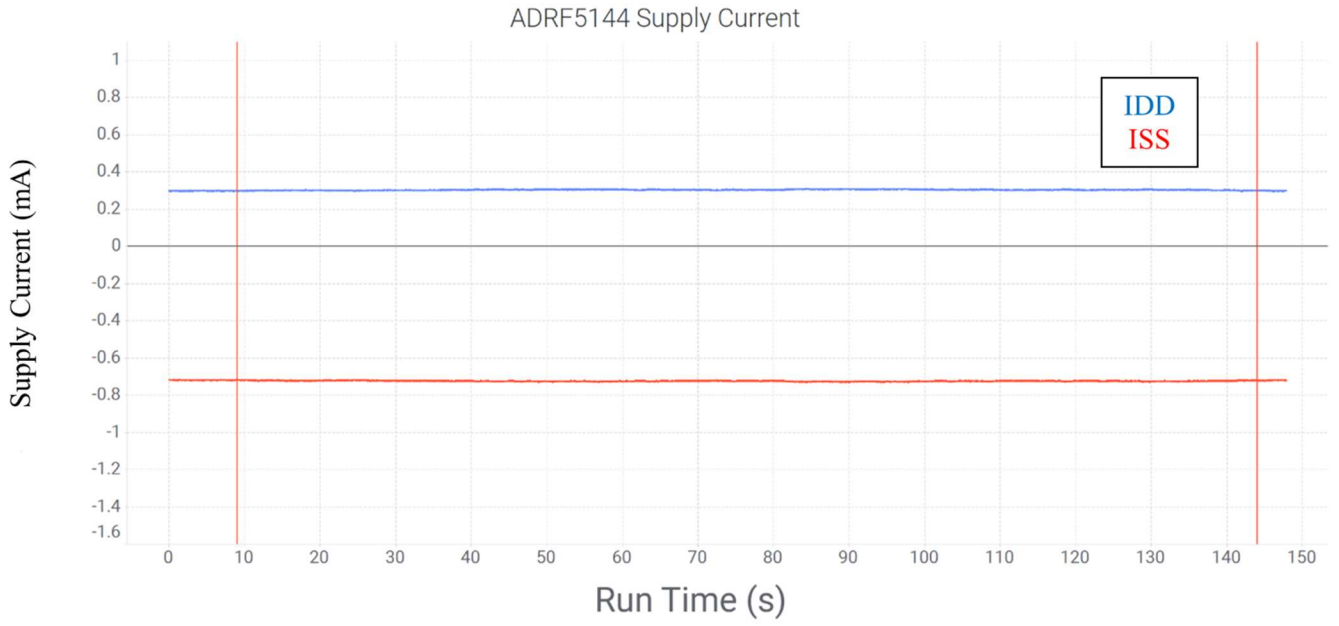
Run 2, Board 2, LET = 54.0 MeV·cm²/mg



Run 5, Board 3, LET = 54.0 MeV·cm²/mg



Run 182, Board 4, 58.0 MeV·cm²/mg



Run 183, Board 7, 58.0 MeV·cm²/mg