



HERADO
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Characterizing the Radiation Environment on Artemis I



ALMAR history

2016
Prototype



2017
Ver.1



2017
Ver. 2



2018
Ver. 3



2018
Ver. 4



2019
Ver. 5



2020
Ver. 6



2023
Ver. 7



Why to use ALMAR in space



High Stability



Lower detectable limit 0,6 μ Sv



Linearity up to 10 Sv



Measure the different types of radiation.



Fully calibrated (Los Alamos, HIMAC,)



Dose rate and angular dependence < 5%



No Electromagnetic interference



Very low power consumption/ Long battery lifetime/rechargeable



Compact Size and weight



Selection of the alarm levels



software/ telemetry system



User friendly



ALMAR characteristics

Power consumption

Active mode typical current: 5mA

Stand-by mode typical current: below of 0.5 μ A

Measurement of protons and neutrons

The battery may last for more than 3 months

Dimensions

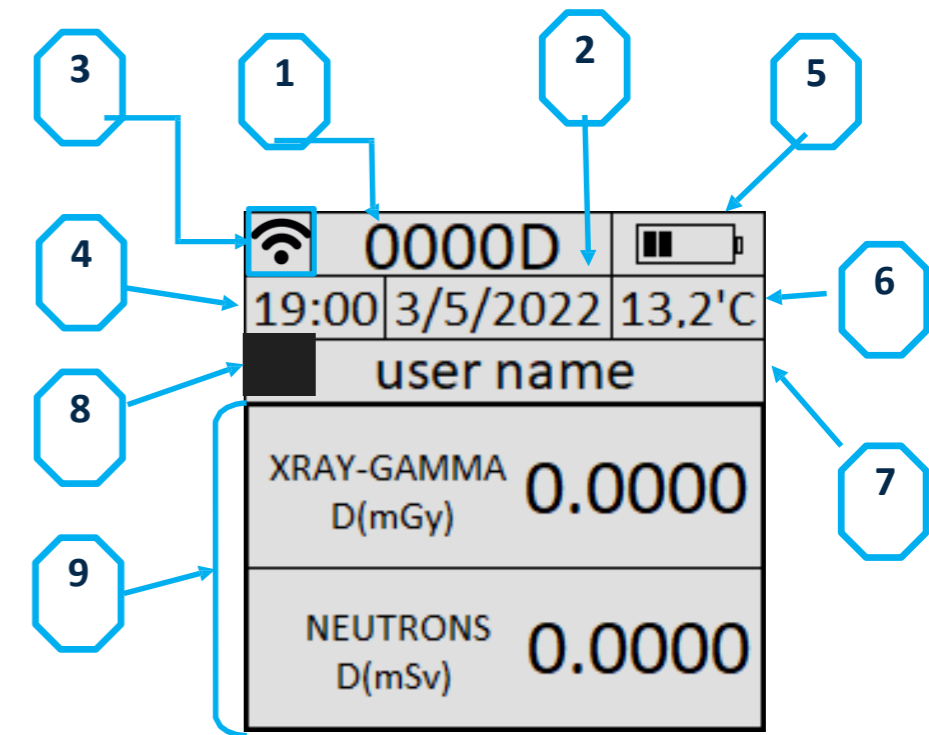
Compact size & weight Weight: 25 gr

Length: 65 mm

Width: 15 mm

Height: 48 mm

WiFi and USB connectivity



1. .Unique Device ID
2. .Date
3. .WiFi ON indicator
4. .Time
5. .Battery level indicator
6. .Temperature
7. .User name
8. Mode H
9. .Measurement Area

ALMAR test and measurements reports

ALMAR is fully licensed CE (EN 61526) and accredited, meets ICRU 95 recommendations.

Conforms with the following Harmonized standards:

EMC: EN 55032, Class B :2015+A11:2020
EN 55011, Class B/Group 1:2016+A11:2020
EN 61326-1:2020
RED: ETSI EN 300 328 V2.1.1(2016-11)
RoHS: EN 50581:2012
HUMAN EXPOSURE: EN 62311:2008



Photo 8.1: Setup for radiated emissions test (30MHz-1GHz)

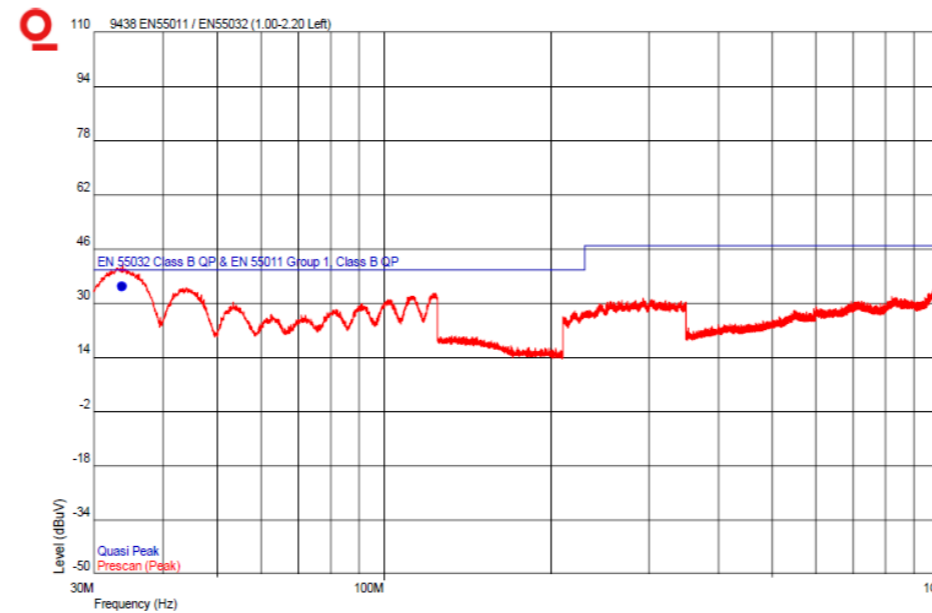


Fig. 8.3: Results for left side (90°), frequency range: 30MHz-1GHz.

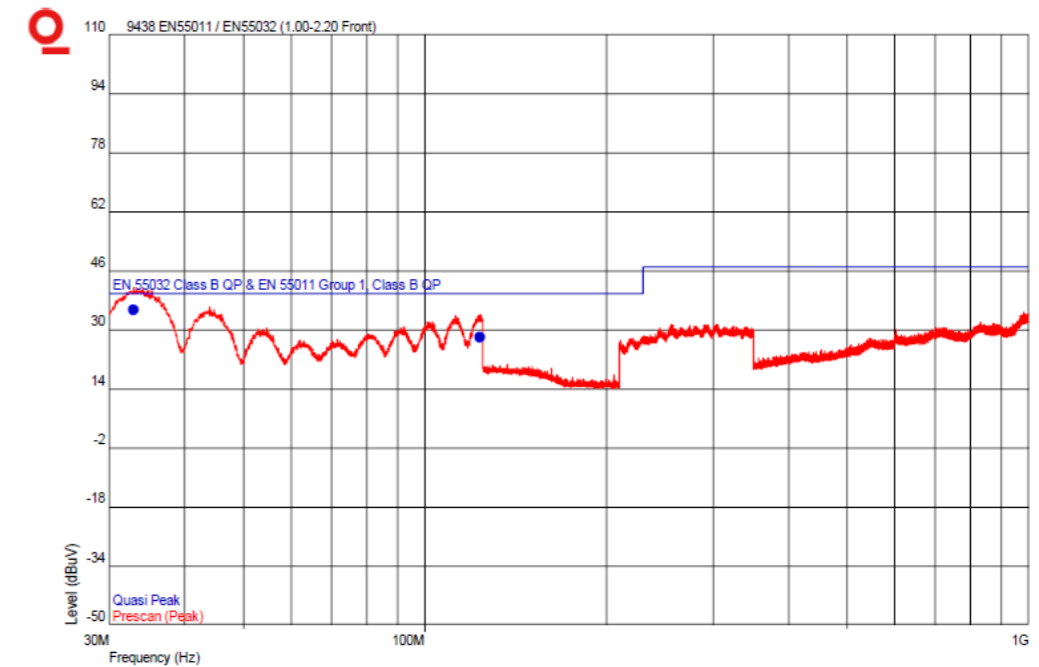


Fig. 8.2: Results for front side (0°), frequency range: 30MHz-1GHz.

Inter-comparison with Passive and other PED

Results from running Pilots

	ALMAR	Passive (TLD)	APDs
Full month comparison at nuclear medicine department	(0,13 ± 0,01) mGy	0,14 mGy	
Full month comparison at cardiovascular department	(1,85 ± 0,013) mGy	1,9 mGy	
APD in nuclear waste storage room (+/- 3 days), dose rate at start = 12-17 µSv/h)	0,108 ± 0,011 mGy		0,1385 mGy



ΕΛΛΗΝΙΚΗ ΕΠΙΤΡΟΠΗ ΑΤΟΜΙΚΗΣ ΕΝΕΡΓΕΙΑΣ
GREEK ATOMIC ENERGY COMMISSION



Oklahoma State University Hospital US



Uw ziekenhuis.
The biggest hospital
in West Flanders, Belgium



The biggest Government hospital in
Greece



Greek Red Cross
Government Hospital



The biggest hospital group
(CVC Capital Partners) in Greece



Solid Waste Management Bodies
(FODSA) in Greece

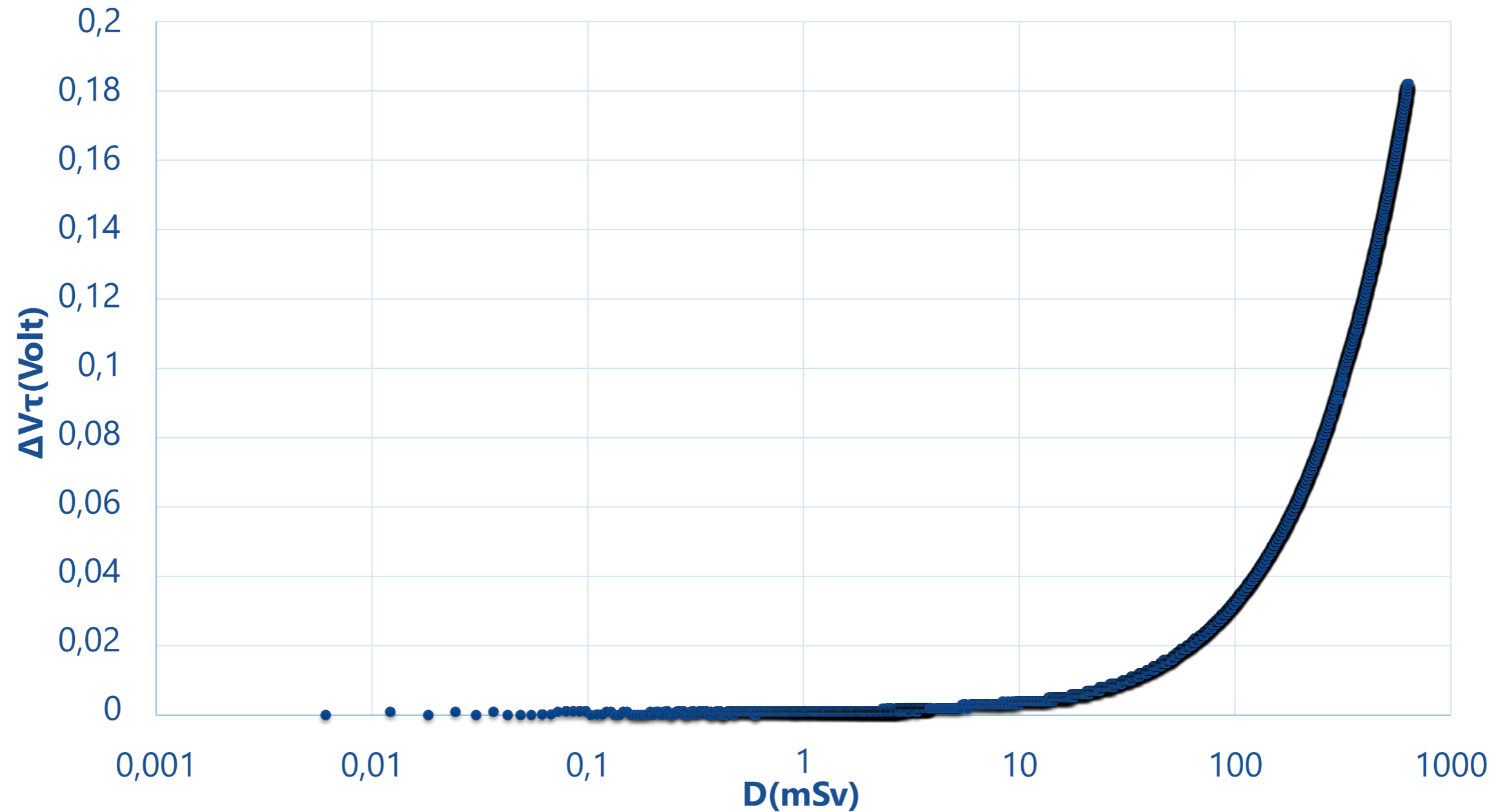


ALMAR Active dosimeter Properties According to IEC61526

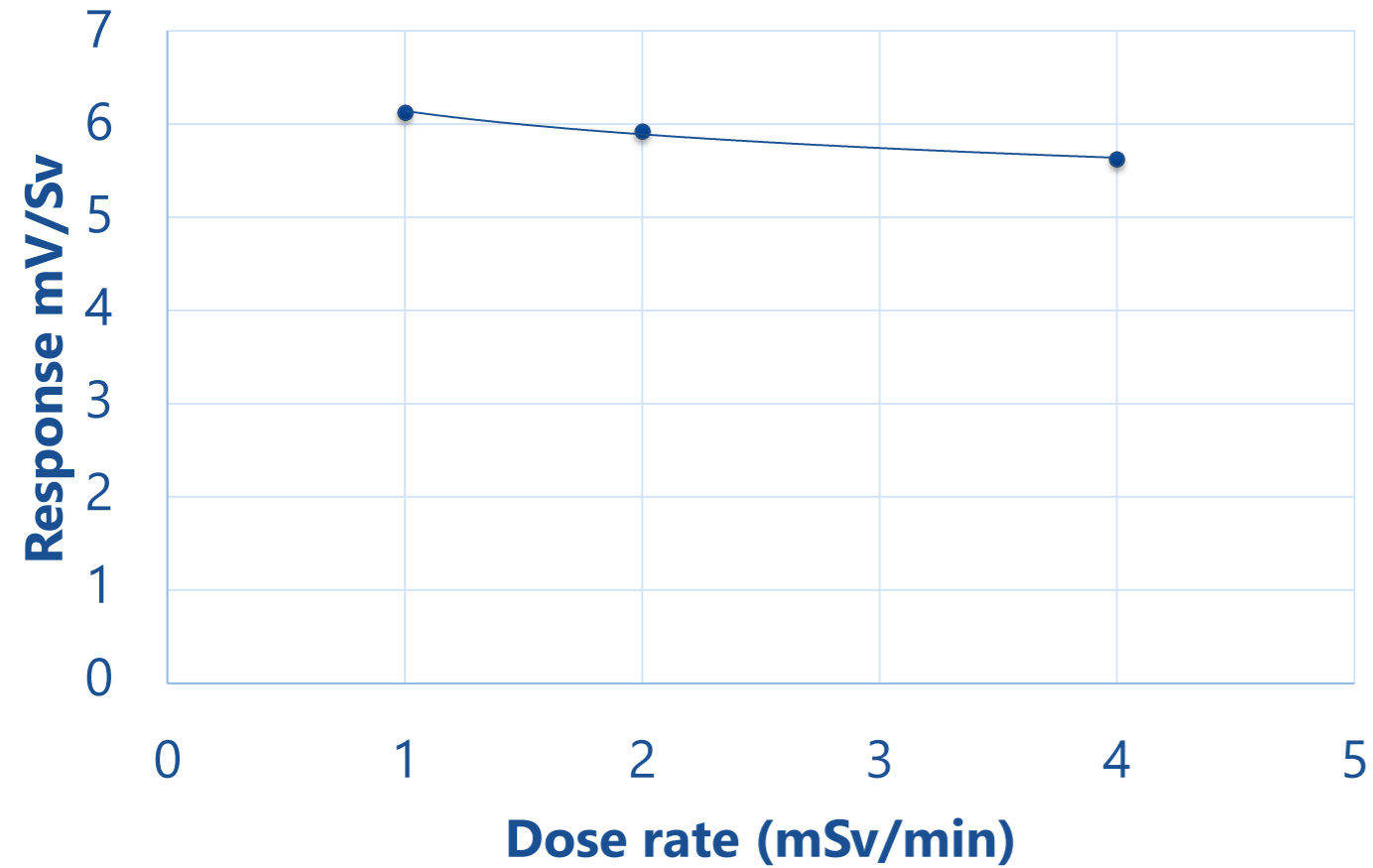
SPECIFICATIONS	ALMAR+ NEUTRONS	ALMAR
	Neutron Hp(10)	Gamma X-Rays Hp(10)
DETECTOR	Silicon based	Silicon based
MEASUREMENT RANGE	Dose: 1,5 μ Sv-10 Sv Dose rate 1 μ Sv/h-10 Sv/h	Dose: 0,65 μ Sv-10 Sv Dose rate: 1 μ Sv/h –10 Sv/h
ACCURACY	Dose: \pm 10% AmBe	Dose: \pm 10% Cs-137
DOSE RATE LINEARITY	Dose Rate : 5% AmBe	Dose Rate : 5% Cs-137
ENERGY RESPONSE	Linear up to 10 Sv Thermal-epithermal 0.025 eV to 100 keV intermediate fast 100 keV to 5 MeV	Linear up to 10 Sv From 3 KeV
ANGULAR DEPENDENCE	5 %	5 %
WEIGHT	25 gr	25 gr
BATTERY	Rechargeable 14 days (continuously)	Rechargeable 14 days (continuously)
TEMPERATURE	-30o to 50o	-30o to 50o
ALARM	Visual and audio	Visual and audio
ENVIROMENTAL PROTECTION	IP68	IP68



Linear Test of ALMAR

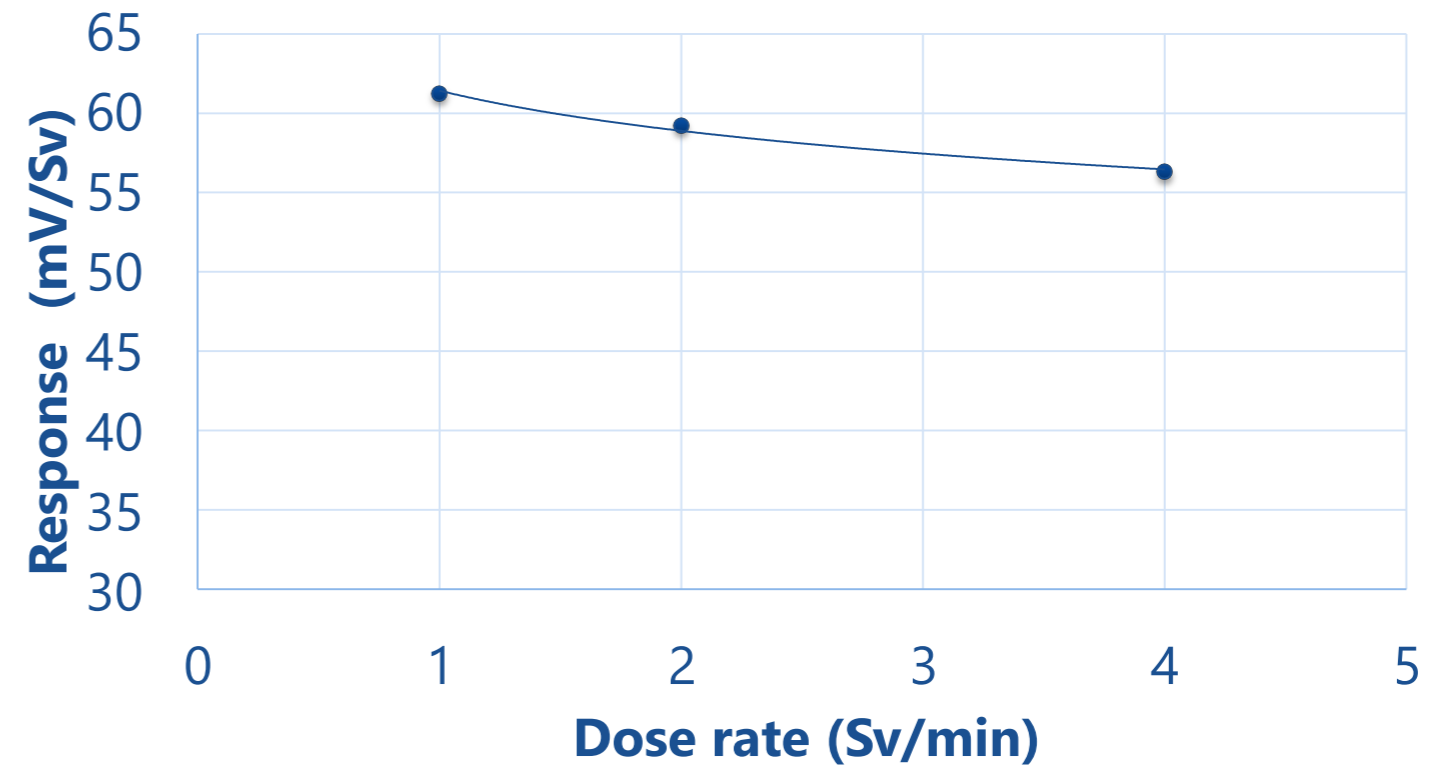


Dose Rate Test



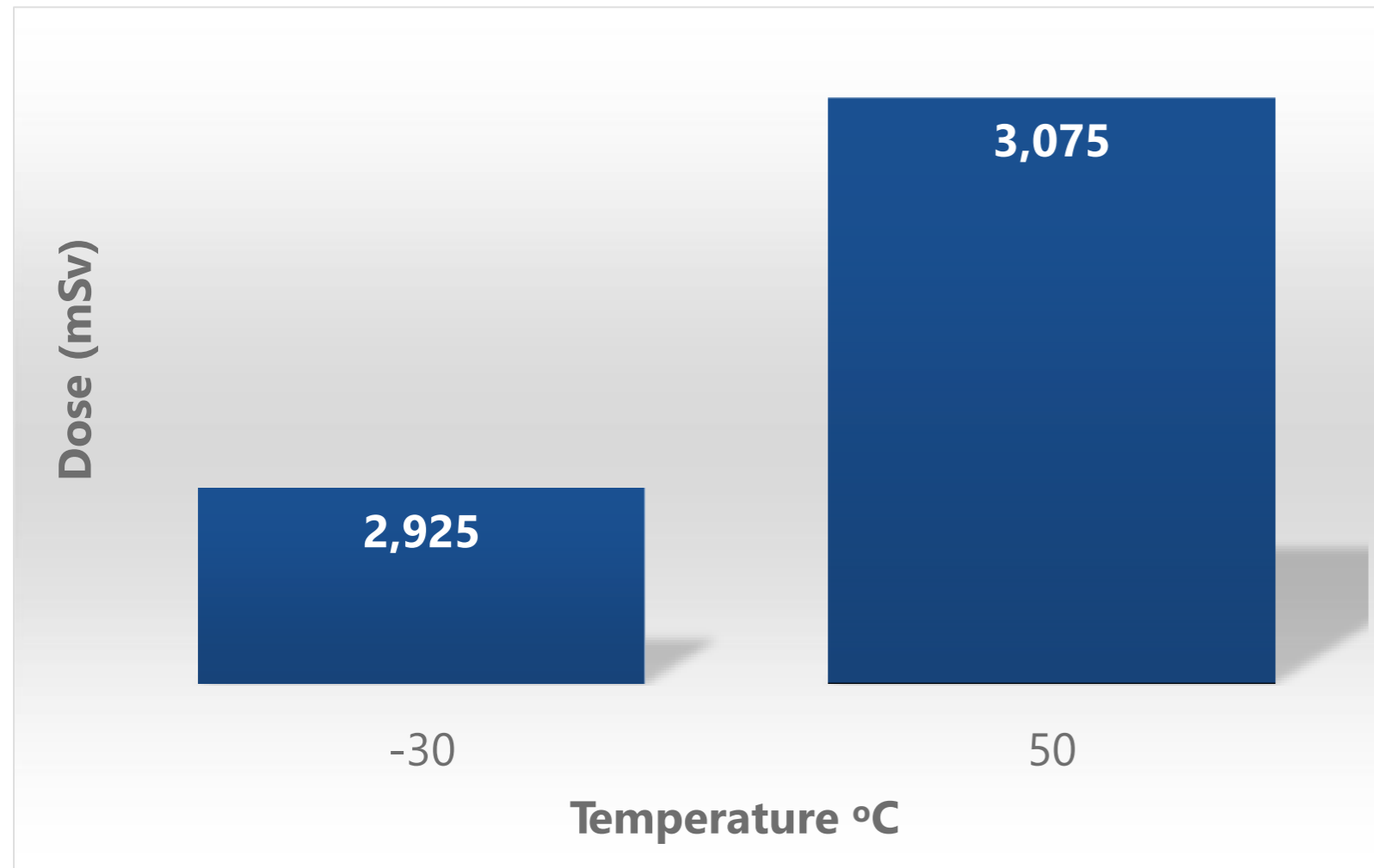
Low Dose

Response dose rate dependence

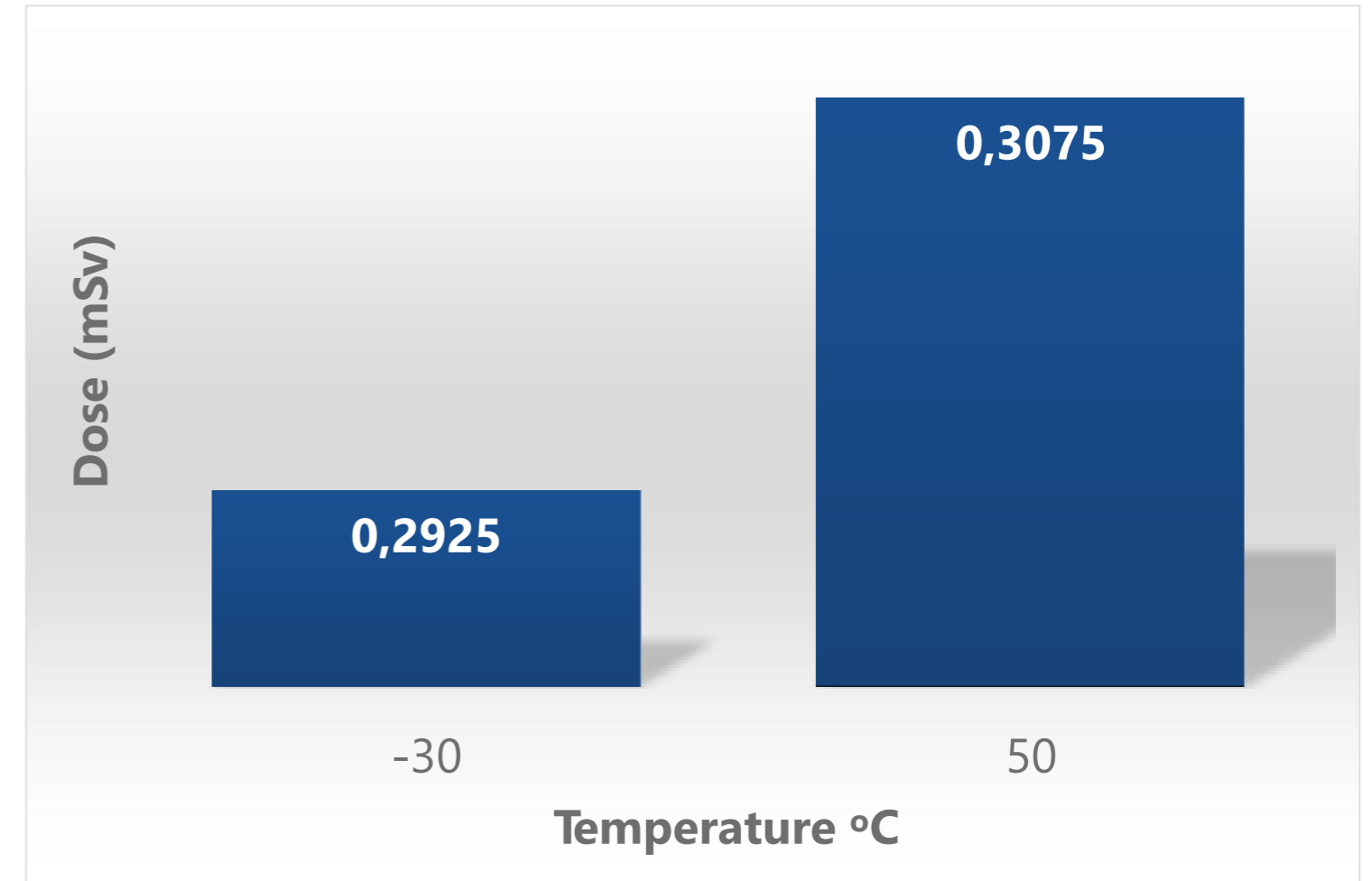


High Dose mode

Temperature Test



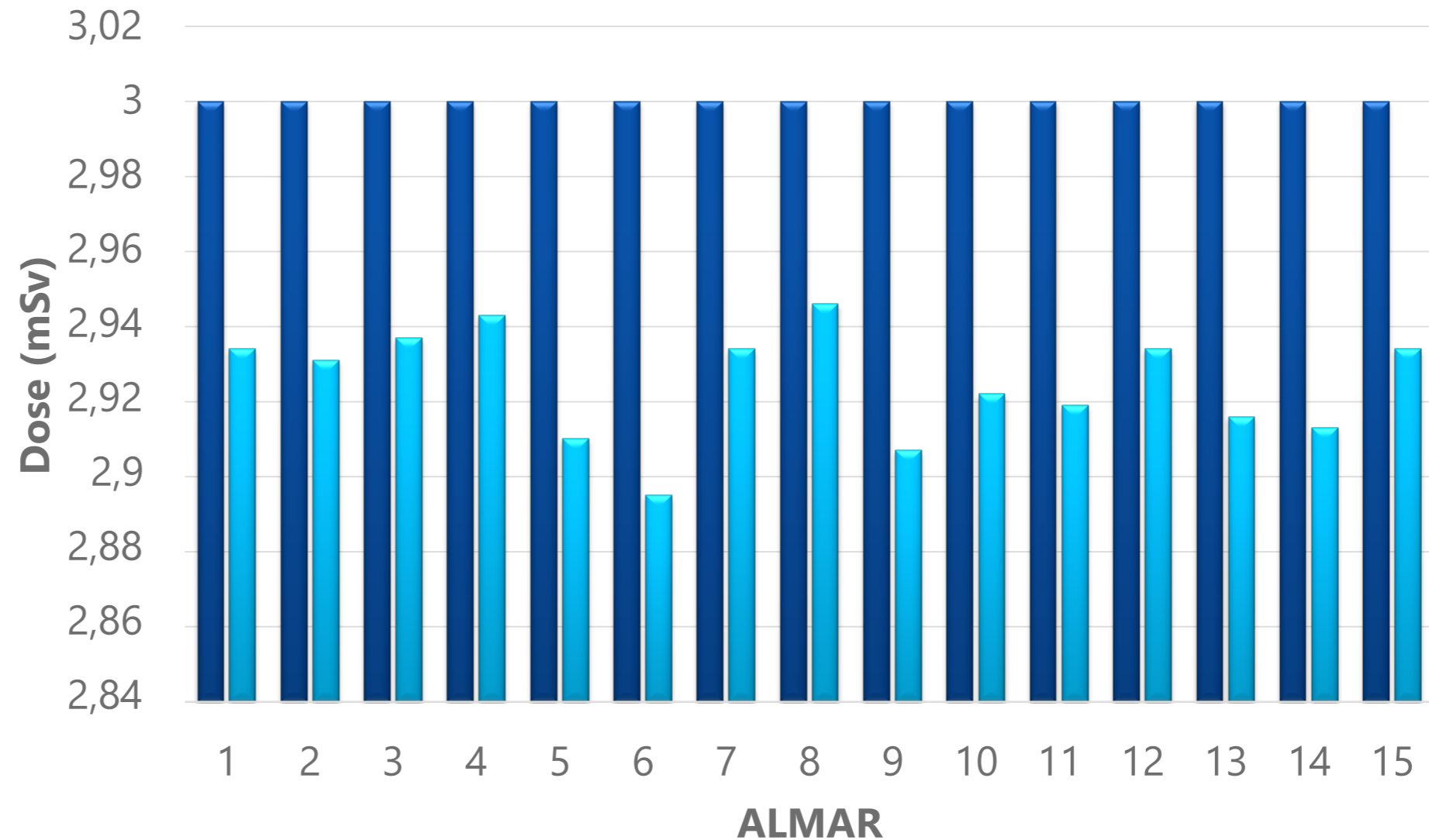
High Dose (3 mSv irradiated)



Low Dose (0,3 mSv irradiated)

Drop Test

Drop testing: was performed to ensure that if **ALMAR** was **dropped** from a distance of **one meter** that it will still be able to **accurately report dose** that was currently stored on the dosimeter as well as future doses (**irradiated dose 3mSv after dropped**).



Drop test (3 mSv irradiated)

HERADO Monitoring Platform (HRDS)

On top of **active radiation dosimeter ALMAR**, we have developed a **cloud radiation data management platform (HRDS)**.

HRDS provides **organizations** with an **instant overview** of **radiation potential safety issues**. It also allows the users to **analyze in real-time** the data and produce reports and statistics for their **organizations** and **government institutions**.

Automatic transmission of **radiation data** and a **complete radiation monitoring program** that can send **data** to the **National Dose Registry** using **AI-** and **cloud-** based technologies.

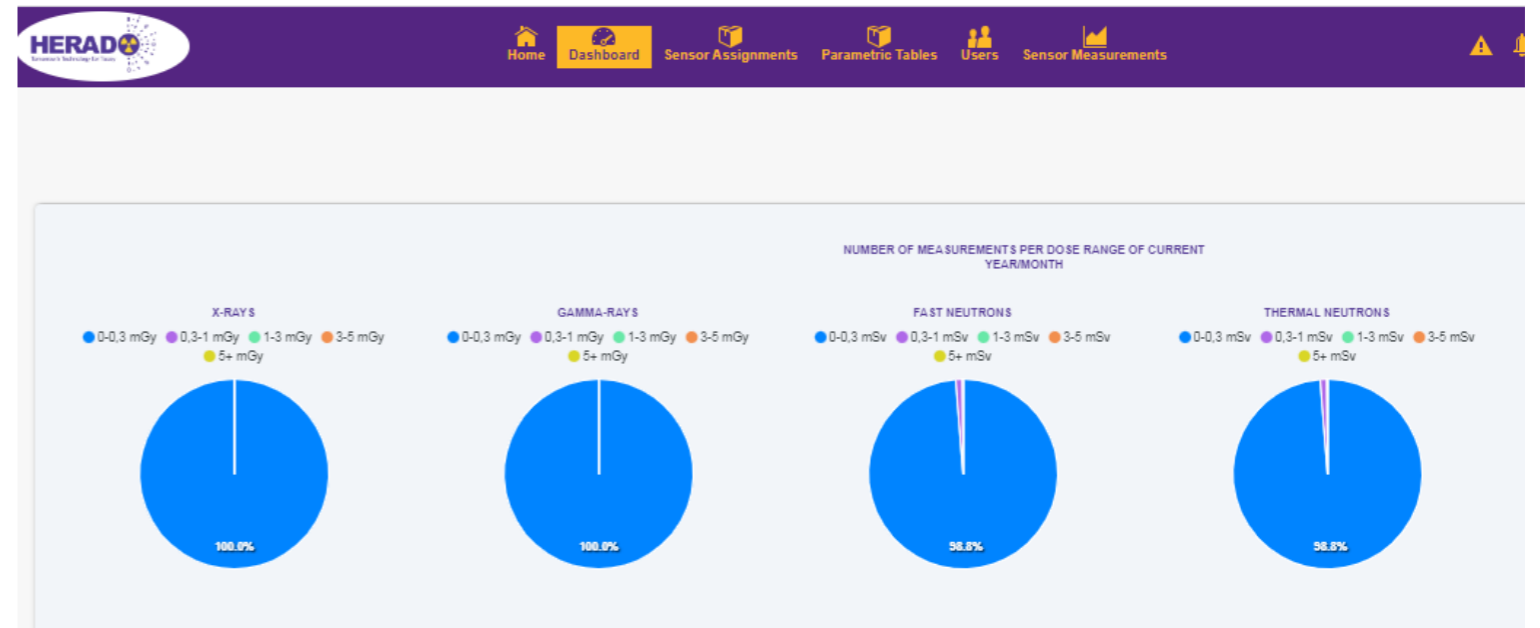


HERADO Monitoring Platform (HRDS)

HERADO Monitoring Platform (HRDS) - Measurements Table

Serial Number: 000010 | User: [Select value] | Date from: 29/08/2022 00:00 | Date to: 06/09/2022 10:00

Serial Number	Creation Date	GammaRays (mGy)	GammaRays (mGy)(BTF)	GammaRays (mGy)(BTFC)	XRays (mGy)	XRays (mGy)(BTF)	XRays (mGy)(BTFC)	Fast Neutrons (mSv)	Fast Neutrons (mSv)(B...)	Fast Neutrons (mSv)(B...)	Temperature...	Battery (m...)	Thermal Neutrons (mSv)	Thermal Neutrons
000010	06/09/2022 19:11	0.00065	1	23597	0.00065	1	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:10	0.00000	0	23596	0.00000	0	23596	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:09	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:08	0.00065	1	23597	0.00065	1	23597	0.00000	1	23742	25.25	3650.00		
000010	06/09/2022 19:07	0.00000	0	23596	0.00000	0	23596	0.00000	0	23741	25.25	3650.00		
000010	06/09/2022 19:06	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:05	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:04	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:03	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		
000010	06/09/2022 19:02	0.00000	0	23597	0.00000	0	23597	0.00000	0	23742	25.25	3650.00		



EDF-2022-RA-MCBRN-HICP: Diagnostics, Treatment, Transport and Monitoring of Highly Contagious, Injured and /or Contaminated Personnel (R)

HERADO developing high innovative portable **devices** for **detection** and **monitoring** **different types of radiation (x-rays, gamma rays, neutrons, heavy ions)**. We support in this topic the Research, development, detection, and monitoring of ultra-portable telemedicine devices and diagnostics sensors, For Radiological and Nuclear (CBRN) containment systems, 'porter' or load- carrying Unmanned Vehicles (UVs) and battlefield casualty extraction devices. We make research in order to developed custom solutions according to the needs of the call even with very small dimensions.



Artemis-1 HERADO detectors



Artemis-1 HERADO detectors ALMAR preliminary results

BOX 1	
Detector 34	D (mSv)
	10,27 ± 1,02

BOX 1	
Detector 33	D (mSv)
	118,95 ± 11,895

BOX 1	
Detector 13	D (mSv)
	10,27 ± 1,03

BOX 1	
Detector 36	D (mSv)
	89,368 ± 8,936

Artemis-1 HERADO detectors ALMAR preliminary results

Helga

BOX 2	
Detector 38	D (mSv)
	38,935 ± 3,89

BOX 2	
Detector 25	D (mSv)
	42,325 ± 4,23

Zohar

BOX 2	
Detector 35	D (mSv)
	7,956 ± 0,794

BOX 2	
Detector 28	D (mSv)
	11,05 ± 1.1

Artemis-1 HERADO detectors ALMAR preliminary results

BOX 3	
Detector 32	D (mSv)
	11,837 ± 1,183

BOX 3	
Detector 9	D (mSv)
	11,87 ± 1,18

Contact and Disclaimer

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Continued focus on ESG

Lower power consumption, rechargeable batteries



Portfolio evolution

towards higher-growth end markets, mitigating business risks



Enhance returns to shareholders

Continuous investment in organic and inorganic growth



Accelerated growth in line with global megatrends

IoT clever device, Digital AI healthcare protocol

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