

PEMS solutions for Space Applications



A Leading Provider of Smart, Connected and Secure Embedded Control Solutions

ALTER | esa

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2025

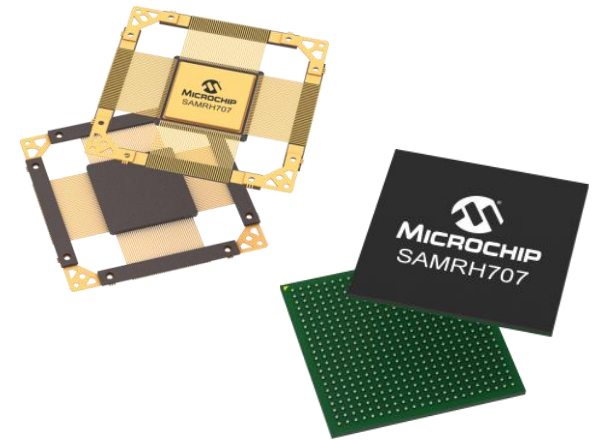
Seville - Spain
25 to 27th March



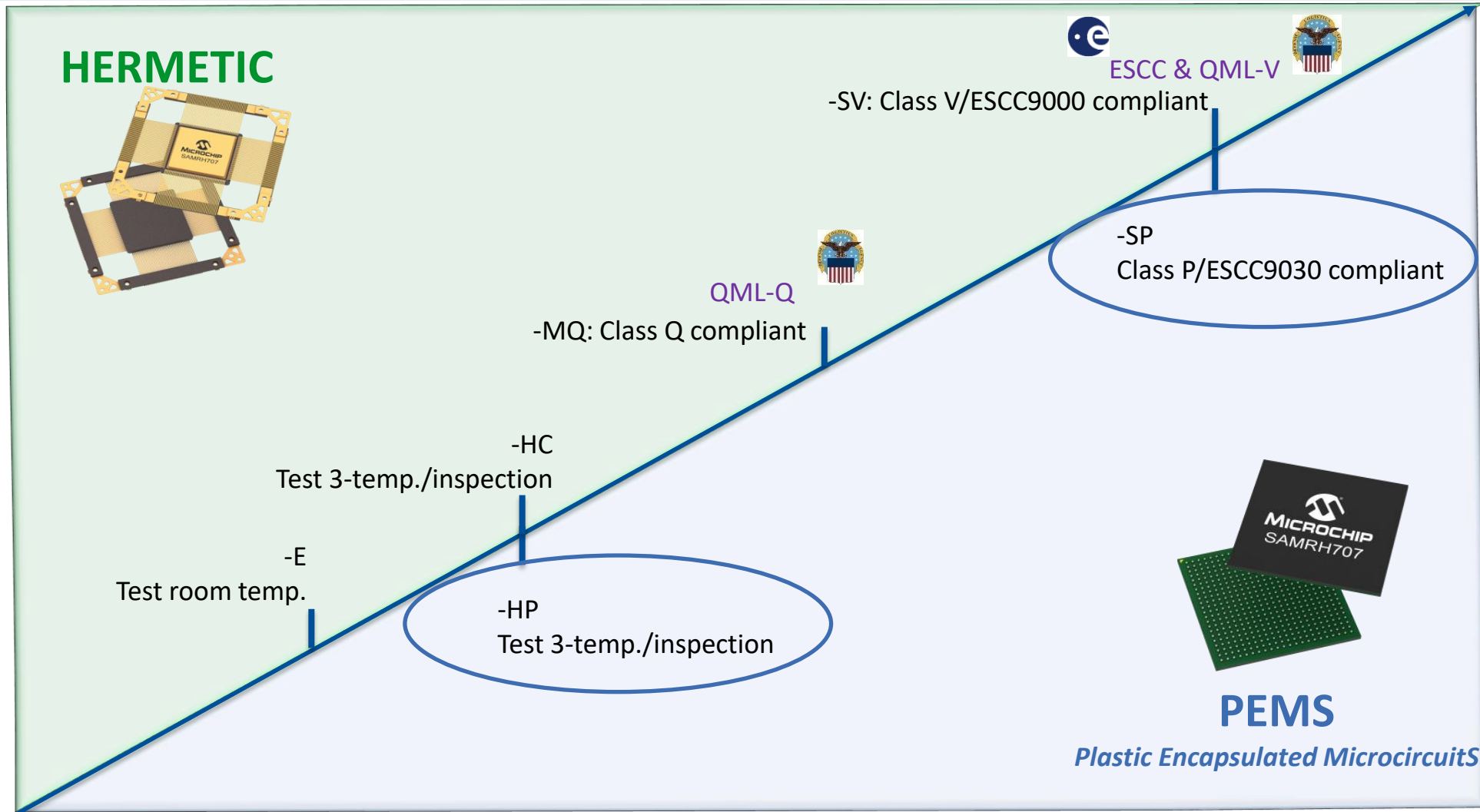
Aerospace & Defense Group, France

The Aerospace & defense Group in France is:

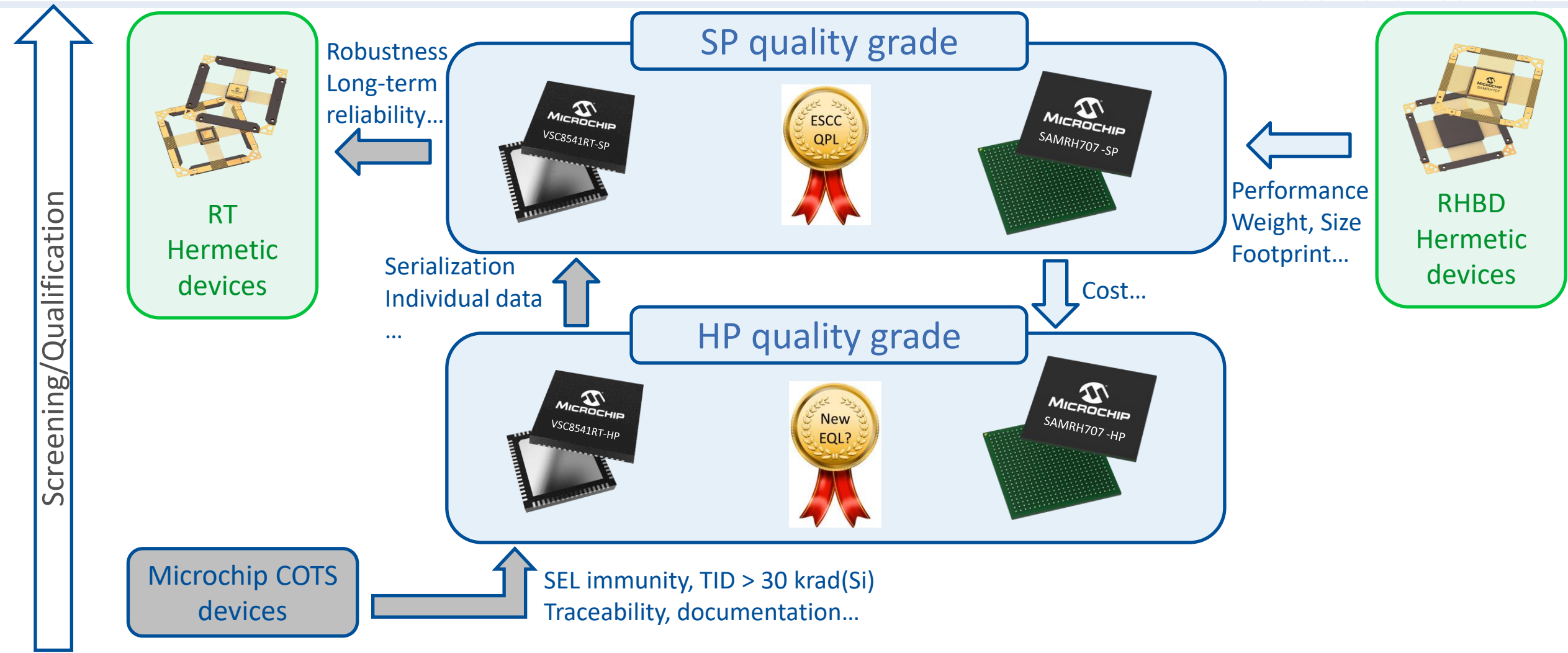
- ❖ Dedicated engineering teams (~ 60 people) located in France: Design, Engineering, Marketing, Quality, Application labs, Radiation tests & simulations...
- ❖ A strong flight heritage, delivering aerospace ICs for more than 30 years
- ❖ A set of RHBD/RT products under France export control: microprocessors, microcontrollers, memories, communication interfaces...
- ❖ A Quality Management System complying with both ESCC and MIL-PRF-38535 requirements
- ❖ ESCC certified technology flows with a dedicated electrical test/burn-in and qualification area in Nantes



ADG Quality grades



ADG PEMS Quality grades – RHBD and RT devices



ADG PEMS Quality grades – Key values

SP devices, for Class 1 space projects, complies with ESCC2269030/9030 requirements when HP devices, for “new” space projects, follows ADG internal requirements.

Key values for both SP and HP devices are presented over several topics:



Controls and management



Screening



Lot acceptance



Qualification monitor and Initial Qualification



Traceability and Documentation

ADG PEMS Quality grades – Key values

Controls & Management



SP devices are managed, all along their lifetime, by ADG TRB with the same requirements than QML/ESCC certified hermetic devices.

	Policy and Controls	Supply chain	Product availability	Change/Obsolescence	Production control	Customer support
-SP Class1 projects	Managed by ADG TRB. Space Agency annual survey	Single controlled manufacturing Baseline.	Extended product availability (15+ years)	TRB management Extended PCN program	TRB management Lot acceptance process Extended process monitors	Dedicated support from ADG-Nantes

Similar rules apply for HP devices

-HP “New” space projects	Managed by ADG TRB.	Single controlled manufacturing Baseline.	Extended product availability (15+ years)	TRB management Extended PCN program	TRB management Extended process monitors	Dedicated support from ADG-Nantes
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ADG PEMS Quality grades – Key values

Lot acceptance



	WLA/SEM inspection	“PRECAP” inspection
-SP Class1 projects	Each wafer lot	Each assembly lot

RESTRICTION

Our PEMS are assembled in high-volume Far East assembly lines.

→ Not feasible to train inspectors to perform “precap inspection” adapted from ESCC21002. Then, our Precap inspections are replaced by construction analysis on samples randomly chosen from the assembly lot.

	External visual inspection	Opening – Internal visual (and SEM) inspection	Package sectioning – Visual (and SEM) inspection	Material EDX analysis	Bond pull test	Bond ball shear test
-SP	5#	4#	1#	1#	4# - 25% of wires on each part	4# - 25% of wires on each part

ADG PEMS Quality grades – Key values

Traceability and Documentation



SP devices offer a full traceability from wafer lot up to each serialized part

	Traceability	Documentation for each product	Documentation with each delivery
-SP Class1 projects	Wafer lot Trace code Serialization	Qualification report Radiation report	Data-package: full manufacturing/ screening traceability, electrical and QCI/TCI data... CoC

For HP, a single wafer lot per assembly lot/tracecode is guaranteed

-HP “New” space projects	Wafer lot Trace code	Qualification report Radiation report	CoC
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ADG PEMS Quality grades – Key values

Chart F3 - Screening



SP devices comply with ESCC9030 requirements.

	Inspections	Electrical tests	Thermal cycling	Burn-in Drift - PDA applied
-SP Class1 projects	100% Die inspections X-rays External visual C-SAM, by sampling	100% -55/125°C	100% -55/125°C, 20 cycles	100% Static 144hrs, 125°C Dynamic 240 hrs, 125°C

RESTRICTION

Die Inspection, compliant MIL-STD-883 TM2010A, is done at wafer level in Nantes, by certified inspectors

-HP "New" space projects	External visual	100% -55/125°C	--	--
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ADG PEMS Quality grades – Key values

Chart F4 – Qualification monitor



SP devices comply with ESCC9030 requirements.

	Electrical control (Grp A)	Assembly capability (Grp B - ESCC SbGr3)	Life test (Grp C - ESCC SubGr2)	Environmental stress (Grp D - ESCC SubGr1)
-SP Class1 projects	Each assembly lot	Each assembly lot <i>With 4#: Bond pull/Ball shear Solderability test Internal visual Inspection</i>	Each wafer lot <i>With 45# 1000 hrs, 125°C Electrical tests</i>	6-months period <i>With ~50# Dimensions check Terminal integrity test Adhesion of terminal finish Thermal cycling -55/125°C, 500 cyc^(*) HAST 110°C/85% RH, 264 hrs^(*) UFAST 110°C/85% RH, 264 hrs^(*)</i>

(*): Stress applied after pre-conditioning and followed by a 100% C-SAM inspection and electrical tests

-HP “New” space projects	--	Each assembly lot <i>With 4#: Bond pull/Ball shear Solderability test</i>	Each wafer lot	<i>Assembly lines monitoring</i>
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ADG PEMS Quality grades – Key values

Initial Qualification



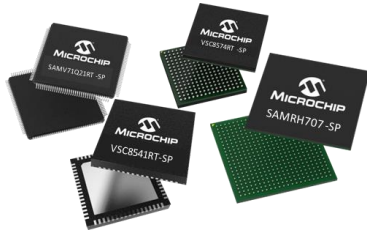
In addition to ESCC9030 requirements, ADG PEMS initial qualification includes

Wafer Level Reliability data	EM, SM, HCI, TDDB... With life time estimation over -55/125°C
Extended Life test	Up to 4000 hrs, 125°C
Extended Environmental tests	Thermal cycling -55/125°C, up to 1500 cyc ^(*) HAST 110°C/85% RH, up to 2*264 hrs ^(*) UHAST 110°C/85% RH, up to 2*264 hrs ^(*)
Construction Analysis	Internal visual inspection: optical and SEM views Glassivation integrity test Package sectioning: optical and SEM views Material analysis
Characterizations	HBM/CDM ESD – Electrical Latch up Molding Outgassing test Molding Glass Transition temperature Thermal resistance Junction-to-Case in vacuum env.
Radiation hardness tests	TID, SEE...

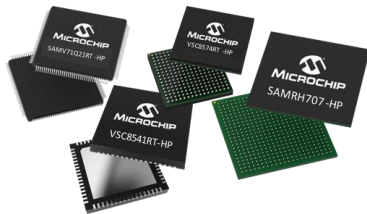
(): Stress applied after pre-conditioning and followed by a 100% C-SAM inspection and electrical tests*

To conclude...

Depending on the specific requirements of the space project,



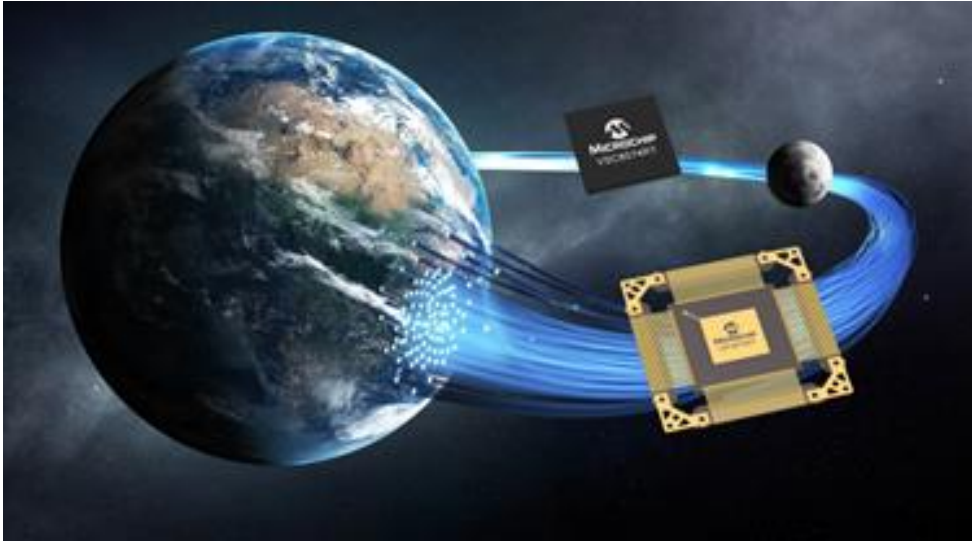
Our –SP’s can serve as an alternative to traditional solutions



Our –HP’s can offer a reliable turnkey solution as an alternative... to COTS !

...Without forgetting that the proven hermetic versions are still alive!





Thank You!
