

### Environmental Test Report on GAIA Converter DC/DC Module



#### **1 – Scope**

This report presents the environmental tests conducted on GAIA Converter DC/DC modules and the different results obtained during the various test campaigns that have taken place in 1997, 1998 and 1999.

Complete reports are available under request to GAIA Converter.

- Test Report n°ECE/96103/SC/11541.13/CI (March, 1997)
- Test Report n°ECE/97103/SC/11944.0101 (January, 1998)
- Test Report n° 99014/CELAR/TECN/64030.01/CI (April, 1999)

This work has been ordered by the French MOD, Systems Evaluation and Test Directorate to qualify GAIA Converter DC/DC modules for Aerospace/Military applications.

#### **2 – DGA and CELAR Presentation**

The Systems Evaluation and Test Directorate of the French MOD is dedicated to provide expertise and qualification from complete military programs to weapon sub systems up to components evaluation. This directorate regroups 12.000 personnels and 23 test centers, throughout France.

Among those centers, the "Centre Electronique de l'Armement" (CELAR) is dedicated to be the Technical Defense Center for Information Warfare.

Set up in Brittany, near Rennes, its activities cover 5 areas :

- weapons systems electronic warfare,
- information systems
- telecommunication systems,
- information system security,
- electronic components.

CELAR draws on the skills of 750 personnel, including experts in mathematics, electronics, data processing and simulations. Certain observers consider that the powerful resources available to Celar are unique in Europe.

For the field of electronic components, CELAR provide the necessary expertise for functional evaluation and fine electrical characterizations, technological analyses and simulation of environmental conditions.

CELAR is certified ISO 9001 for technical assistance in the field of information systems security since 1998.

Because reliability of a whole system depends on the reliability of each component included in that system, the “TEChnology and Normalisation” (TECN) division of CELAR can provide a wide range of evaluations on different kinds of electronic and electromechanical devices, such as :

- connecting technologies and cables,
- analog components, mixed components, power devices,
- digital integrated circuits,
- microwave components,
- voltage controlled oscillators,
- opto-electronic components .

The “ Analog and Mixed signal circuits and Power devices ” laboratory (AME) provide valuable characterizations on smart power components. Specific test benches have been developed for DC/DC converter testing, up to 400 watts per output, and input voltage from 5V to 330VDC. The main features of these benches are :

- Active loads (from 0 to 3 x 400 watts),
- HP300 bus controller,
- Power supplies (0V to 500V),
- Transient responses measurements,
- Temperature conditioning system : HERAEUS (from Tamb.= -70°C to +190°C)
- 200,000 points voltmeters.

The laboratory is often asked to define screening tests in order to evaluate the electrical performance and reliability of the “ state-of-the-art ” converters.



### **3 – Test Results**

The following table summarizes the different tests performed on GAIA Converter DC/DC modules low power range

Those tests have been conducted in March 1997, January 1998 and April 1999.

## Environmental Test Results

Test Type	Characteristics	Test Procedure	Test Parameters	Test Level	DC/DC Family Applied	Test Result
General Environment	Visual Inspection	MIL-STD-883E	/	/	4W, 10W, 30W	OK
	Solder Resistability	NFC 20720	Temperature Method	260°C 1A	30W	OK
	Soldering	NFC 20720	Temperature Method	235°C 1	30W	OK
	Pin Resistance	EN 60068-2-21	Traction Thrust	20N 4N	30W	OK
	Marking Resistance	EN 600069-2-45 Method 1	Force Solvant	5 N R113	10W	OK
Mechanical Environment	Vibration (Sinusoidal)	NFC 20706	Number of cycle Frequency Amplitude /acceleration	10 cycles in each axis 10 to 60 Hz/ 60 to 2000 Hz 0.7 mm/10 g	10W	OK
	Vibration (Random)	DO-160C	Number of cycle Frequency Amplitude /acceleration	1 hour per axis fig. 8.1 8g rms	30W	OK
	Shock (Half sinus)	NFC 20727	Number of shocks Peak acceleration Duration	3 shocks in each axis 100 g 6 ms	10W	OK
	Bump (Half sinus)	NFC 20729	Number of bumps Duration Peak acceleration	2000 Bumps in each axis 6 ms 40 g	10W	OK
Climatic Environment	Storage (High temperature)	NFC 42801	Temperature Duration	125°C 1000 Hours	10W, 30W	OK
	Storage (Low temperature)	NFC 42801	Temperature Duration	-55°C 1000 Hours	10W	OK
	Backing	NFC 42801	Temperature Duration Power On	105°C case 1000 Hours 100% load	10W, 30W	OK
	Altitude	MIL-STD-810E Procedure 500.3	Altitude level Climb up rate Climb up stabilisation	40.000 ft, unit functioning 1.000 ft per min 70.000 ft, unit functioning	4W, 10W	OK
	Altitude	GAM EG13B Class 1B, 1A, 1	Altitude/temperature Altitude/temperature	70.000 ft, -55°C pwr on 50.000 ft, +55°C pwr on	30W	OK
	Humidity (Cyclic)	MIL-STD-810E Procedure 507.3	Temperature Humidity Duration	31°C to 41°C 88 % to 60% relative humidity Cycle I : 240 Hrs	10W	OK
	Humidity (Contineous)	NFC 20703	Temperature Humidity Duration	40°C 93% relative humidity 56 days	10W	OK
	Salt Atmosphere	NFC 20711	Temperature Duration Cocentration Nacl	35°C 48 Hrs 5%	10W, 30W	OK
	Thermal Chock	NFC 20714 Procedure Na	Temperature Transfert time Stabilization time	-40°C/+105°C <10 secondes 30 minutes	4W, 10W, 30W	OK
	Thermal cycle	Power On (Test completed at GAIA Converter)	Low temperature High temperature Stabilization duration Transfert duration Number of cycles	-40°C +85°C 20 min. 40 min. 200	4W, 10W, 20W, 25W, 30W	OK
	Life Test	Life test Power On	Temperature Load Duration	60°C 100% load 2000 hours	4W, 10W	OK

### List of standards

- NFC 20702 : "Essais Fondamentaux Climatiques et de robustesse mécanique"  
Essais b : chaleur sèche
- NFC 20703 : "Essais Fondamentaux Climatiques et de robustesse mécanique"  
Essais Ca : continue chaleur humide
- NFC 20706 : "Essais Fondamentaux Climatiques et de robustesse mécanique"  
Essais Fc : vibrations sinusoïdales
- NFC 20714 : "Essais Fondamentaux Climatiques et de robustesse mécanique"  
Essais N : variations de températures
- NFC 20720 : "Essais Fondamentaux Climatiques et de robustesse mécanique"  
Essais T : brasabilité
- NFC 20729 : "Essais Fondamentaux climatiques et de robustesse mécanique"  
Essais Eb : secousses
- NFC 42801 : "Alimentation d 'Equipement Electrique et Electronique. Prescription Générale"
- GAM EG 13B : "Essais de compatibilité à l 'environnement climatique, mécanique, électrique, électromagnétique et spécial des matériels aéronautiques"
- EN 60068-2-2 : "Essais d 'environnement"  
Essais b : Chaleur sèche
- EN 60068-2-21 : "Essais d 'environnement"  
Essais U : Robustesse des sorties et dispositif de fixation
- EN 60068-2-27 : "Essais d 'environnement"  
Essais Ea : chocs
- EN 60068-2-45 : "Essais d 'environnement"  
Essais Xa : immersion solvant de nettoyage
- MIL-STD-810E : "Essais d 'environnement"  
Environnement test
- MIL-STD -883E : "Test method standard microcircuit"
- DO 160C : "Environmental Conditions and Test Procedures for Airborne Equipmen



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