

Environmental test experience for an antenna application at HENSOLDT

The device under test is a hybrid of an AM structure (bare metal) with a printed electronic AME structure inlay, in order to combine mechanical robustness and electronic performance.



Figure 1: 3D-AME structure inlay

The hybrid structure is tested with extracts of the standard RTCA/DO-160F and RTCA/DO-160G for airborne equipment.

The following chapters shall give an overview about exercised tests to show the potential of additively manufactured samples in operational test conditions.

1. Contamination Test on 3D-AME structure with Fluids

The Tests are performed with:

- Hydraulic fluid (H544H544Synthetic)
- De-Icing fluid (Aviform L50 and Killfrost ABC)
- Cleaning + solving (isopropanol)

The 3D-AME structure was able to withstand the contamination test without loss of performance.

2. Climate Test on hybrid DUT AM bare metal and 3D-AME

Severe Humidity Environment:

Humidity Test

- Temperature range +38°C/+65°C
- Humidity 85% RH / 95%
- Duration 10 cycles / 24 hours per cycle

The tested hybrid structure was able to withstand without deterioration or damage.

Temperature Variation

- Temperatures
 - o ground survival low temperature -55°C
 - o high operational temperature +55°C
 - o ground survival high temperature +85°C
- Temperature change rate
 - o 10°C/min
- Duration
 - o 2 cycles/12 hours per cycle

The tested hybrid structure was able to withstand without deterioration or damage.

Performance of Normal Salt Fog:

Salt Fog Test

- Temperature +35°C
- Salt Solution 5%
- Duration 2 cycles / 24 hours per cycle
- Drying room temperature 2 cycles / 24 hours per cycle

The tested AME structure inlay showed no degradation.

3. Mechanical Test on hybrid DUT AM bare metal and 3D-AME

Standard Random Vibration

Standard Random Vibration Test Curves for Equipment Installed in Fixed Wing Aircraft with Turbojet or Turbofan Engines

A visual inspection of the tested hybrid structure did not show any defects.

Robust Vibration

Robust Vibration Test Curves for Equipment Installed in Fixed Wing Aircraft with Turbojet or Turbofan Engines

A visual inspection of the tested hybrid structure did not show any defects.

Shock

- | | |
|------------------------|-------------------------|
| - Acceleration | 6g, 20g, 40g |
| - Duration of shock | 11ms |
| - Number of shocks | 54, 18 per axis |
| - Number of axis | 3, (X,Y,Z) |
| - Number of directions | 6, (+X,-X, +Y,-Y,+Z,-Z) |
| - Test category | non-operational test |

A visual inspection of the tested hybrid structure did not show any defects.

4. Summary Test-Matrix for hybrid AM-structure with AME-structure

RTCA/DO-160F			
Contamination Test			
	Fluids		
		Hydraulic fluid	✓
		De-Icing fluid	✓
		Cleaning + solving	✓
Climate Test			
	Severe Humidity Environment		
		Humidity	✓
		Temperature Variation	✓
	Normal Salt Fog		✓
RTCA/DO-160G			
Mechanical Test			
	Standard Random Vibration		✓
	Robust Vibration		✓
	Shock		✓



About HENSOLDT

Areas of activity

HENSOLDT is a leading supplier for platform independent offerings deployed across the domains air, sea, land and security for armed and security forces worldwide. As a German champion and the largest European pure-play defence and security electronics house, we contribute significantly to the protection of soldiers and the operational capability of the German Bundeswehr and the wider NATO.

HENSOLDT's portfolio includes various sensor technologies, which, when combined, allow detection capabilities to be improved substantially. Our main areas of activity include the protection of borders and critical infrastructures, air defence, mission management and platform self-protection, force protection, signal intelligence and data links, as well as night vision devices, laser rangefinders and optronic targeting equipment. In addition, our portfolio also comprises of mission avionics such as avionics computers, mission planning systems and autopilots.

With our wide product range, we cover all types of applications in air, sea, land and security missions and enable our customers to maintain superiority when it comes to monitoring the electromagnetic spectrum. **Our solutions are deployed on various platforms, including helicopters, aircraft, unmanned aerial vehicles, ships and submarines, armoured vehicles as well as satellites.**

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