Institute of Space Systems

Mechanics and Thermal Systems

Test Facilities

Date: 18.12.2017

DLR

Content

1 Contact

Head of Department:

Tom Sproewitz
DLR – Institute of Space Systems
Robert-Hooke-Str. 7
28359 BREMEN
Germany

Phone: +49 421 24420 1237
Fax: +49 421 24420 1120
Email: tom.sproewitz@dlr.de

Facility Manager:

Nauka Melnik
DLR – Institute of Space Systems
Robert-Hooke-Str. 7
28359 BREMEN
Germany

Phone: +49 421 24420 1263
Fax: +49 421 24420 1120
Email: nauka.melnik@dlr.de

2 Test Portfolio

Mechanical-dynamical Testing

- Sinusoidal vibration[1]
- Random vibration[1]
- Half-sine shock pulse[1]
- All tests under differing temperatures for small equipment (on costumer request)
- Pyroshock[1]
- Modal Parameter Identification

Thermal-Vacuum Tests

- Thermal Cycling with/without artificial sun[1]
- Thermal Balancing with/without artificial sun[1]
- Venting
- Deployment in thermal-vacuum environment (on costumer request)

Climate Chamber Tests

- Ambient pressure climate tests[1]
- Dry Heat Microbial Reduction (DHMR)

Contamination Test / Degradation Test

- Material outgassing according to ECSS-Q-ST-70-02C[1]
- Components outgassing[1]
- Thermo-optical properties of surfaces

Radiation Testing

- Electromagnetic radiation: VUV, UV, visible light, IR
- Particle radiation: Protons, Electrons

Electro-magnetic Compatibility Testing

- electromagnetic compatibility according to ECSS-E-ST-20-07C
    - conducted emission
    - radiated emission
    - conducted susceptibility
    - conducted susceptibility
- error/disturbance detection
- error/disturbance localization
- DC magnetic field emission
- DC magnet moment[1]

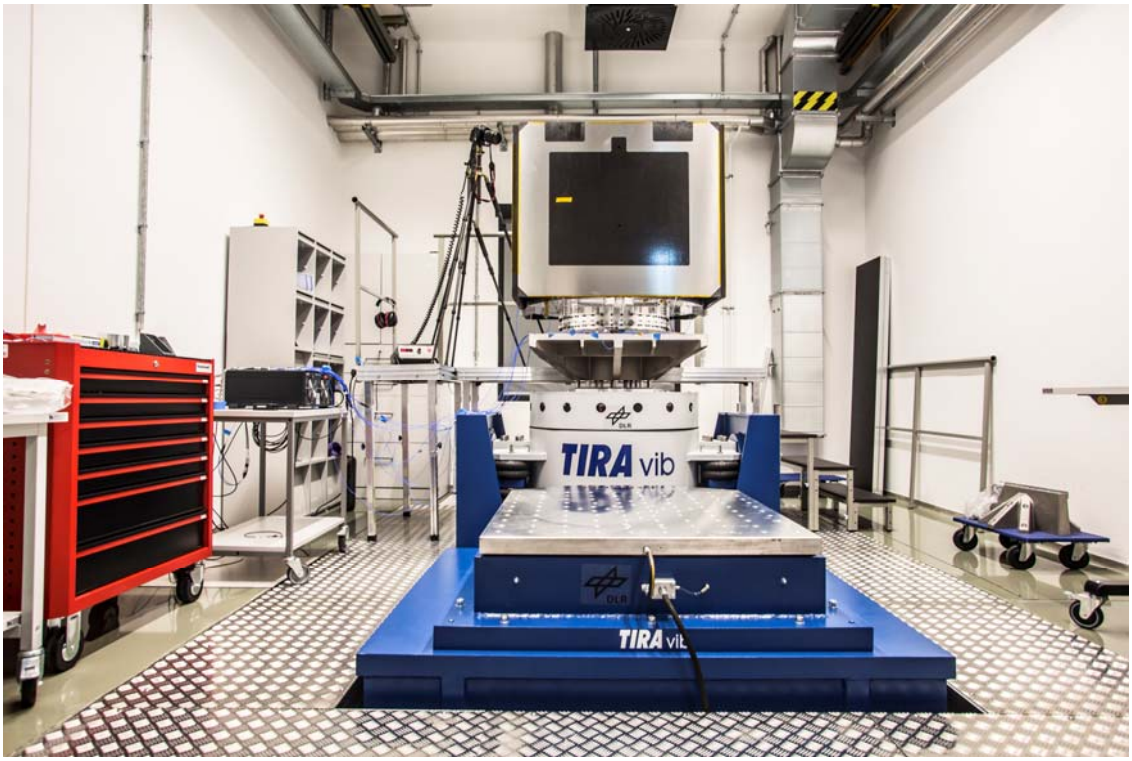
[1] Accredited according to DIN EN ISO/IEC 17025:2005

3 11 kN Vibration Test Facility

Purpose: Sine Vibration, Random Vibration, Half-sine Shock

Type:	TIRAVIB 51010/LS with slip table TGT-MO-24
Technical Parameters:	Sinus / Random
Nominal force	11000 N
Max. acceleration	97 g
Max. velocity	1.8 m/s
Max. stroke	51 mm
Max. test specimen weight	150 kg on armature / 500 kg on slip table
Frequency band	2 Hz – 5000 Hz
Cleanliness:	ISO 8
Accreditation:	DIN EN ISO/IEC 17025:2005

4 89 kN Vibration Test Facility



Purpose: Sine Vibration, Random Vibration, Half-sine Shock

Type:	TIRAvib 59389 / AIT-440 with slip table TGT MOH 39
Technical Parameters:	Sine / Random / Shock
Nominal force	89 / 89 / 267 kN
Max. acceleration	100 g / 90_{RMS} / 250 g
Max. velocity	2 / 2 / 3.5 m/s
Max. stroke (peak to peak)	63.5 / 63.5 / 76.2 mm
Max. test specimen weight	970 kg on armature / 2200 kg on slip table
Frequency band	5 Hz – 2400 Hz
Cleanliness:	ISO 8
Accreditation	DIN EN ISO/IEC 17025:2005

5 Pyroshock Test Facility

Purpose: Pyrotechnic Shock, Modal Parameter identification

Mounting:	Aluminium ringing plate or tuned beam
Excitation:	nail gun on metal target, handheld or pendulum hammer
SRS Adjustment:	
Metal target	variation of mounting location
Test specimen	variation of mounting location
Damping	usage of different damping materials
SRS Levels:	up to 26 000 g in SRS
Specimen Weight:	≤ 30 kg
Accreditation:	DIN EN ISO/IEC 17025:2005

6 Space Simulation Chamber

Purpose: Thermal Cycling with/without artificial sun, Thermal Balancing with/without artificial sun, Venting

Recipient:

Volume	ca. 17 m³
Test volume length	3.5 m
Test volume diameter	2.1 m
Test volume height above cold plate	1.6 m
Pressure	$<10^{-6}$ mbar
Temperature range	90 K – 390 K
Temperature control	electrical and lN_2

Sun Simulator:

Heat	0.5 – 1.4 kW/m²
Illuminated diameter	ca. 1 m
Spectrum	0.2 – 2.5 µm
Collimation angle	±2°

Data Acquisition:

Temperature Measurement Channels	80
Thermocouples	PT100
Customer feedthrough	3x SUB-D 37PIN, 2x SUB-D 25PIN 2x SUB-D 15PIN, 2x SUB-D 9PIN

Cleanliness: ISO 8

7 Sun Simulation Chamber

Purpose: Thermal Cycling with/without artificial sun, Thermal Balancing with/without artificial sun, Venting

Recipient:

Volume	0.80 m³
Overall length	0.8 m
Usable diameter	0.45 m
Pressure	10^{-7} mbar - 10^{-6} mbar
Temperature range	-180 C – 120 C
Temperature control	Electrical, thermostat and lN_2

Sun Simulator:

Heat flux	0.9 – 1.4 kW/m²
Illuminated diameter	ca. 100 mm
Spectrum	0.2 – 2.5 µm

Data Acquisition:

Temperature Measurement Channels	80
Thermo-couples	PT100

Cleanliness: ISO 8

Accreditation: DIN EN ISO/IEC 17025:2005

8 Climate Chamber

Purpose: Ambient pressure climate tests

Technical Parameters:

Usable volume	600 l
Dimensions (L/W/H)	800 mm / 760 mm / 950 mm
Max. specimen weight	160 kg
Temperature range	-70°C – 180 C
Maximum temperature change	
Cooling	2.5 K min^{-1}
Heating	4.0 K min^{-1}
Relative humidity	1% - 98% (gN_2 <10%)
Atmosphere	Air, gaseous Nitrogen
Feedthroughs	1 x ø125 mm, 1 x ø50 mm
Cleanliness:	ISO 8
Accreditation:	DIN EN ISO/IEC 17025:2005

9 EMC Test Facility

Purpose: electromagnetic compatibility according ECSS-E-ST-20-07C, error/disturbance detection, error/disturbance localization, DC magnetic field emission, DC magnet moment

Technical Parameters and practicable tests according ECSS-E-ST-20-07C	
Chambers Dimension	5.22 m x 5.5 m x 3.3 m
Conducted Emissions/Susceptibility	30 Hz to 200 MHz
Conducted Susceptibility Transients	0,15 µs / 10 µs
Radiated Emission	10 kHz to 40 GHz
Radiated Susceptibility	30 MHz to 80 MHz @ 10 V/m 80 MHz to 6 GHz @ 20 V/m
ESD	up to 15 kV
Measurement of	in-rush current bonding resistors isolation resistors/capacitance

10 Micro VCM Test Facility

Purpose: Material outgassing Measurements according to ECSS-Q-ST-70-02C

Technical Parameters:

Volume	30 l
Vacuum	10^{-6} – 10^{-7} mbar
Outgasing temperature	125°C
Required sample amount	≈ 10 g/Material

Standard:

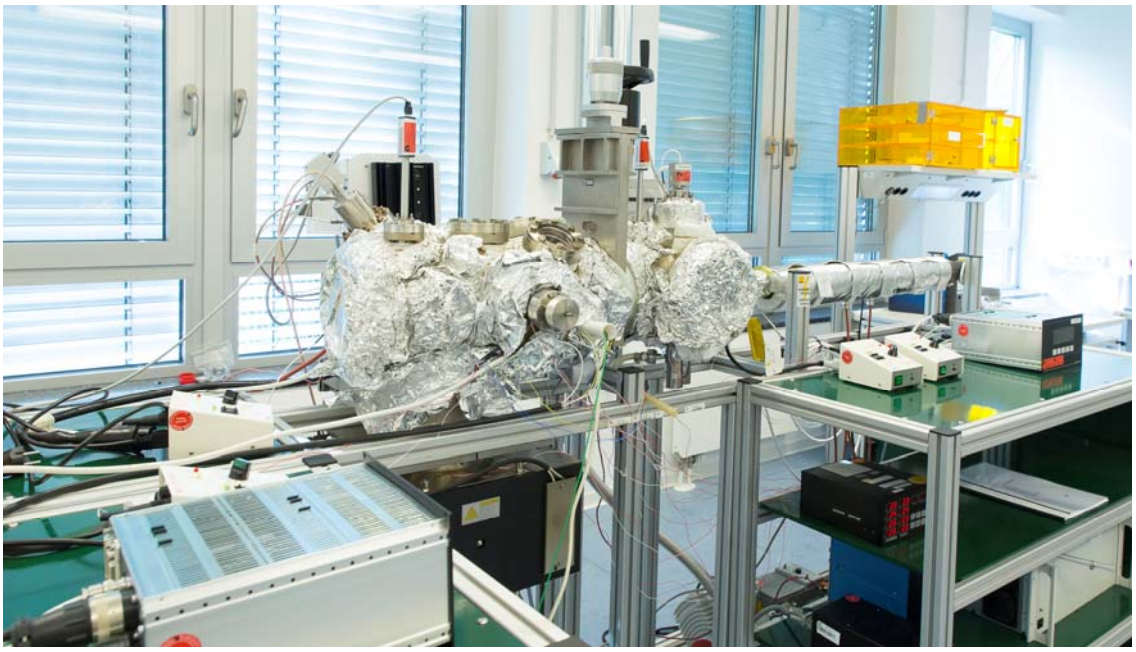
ECSS-Q-ST-70-02C	TML, RML, CVCM, WVR

Analysis of contaminants:

IR transmission measurement

Accreditation: DIN EN ISO/IEC 17025:2005

11 Ultra High Vacuum Test Facility



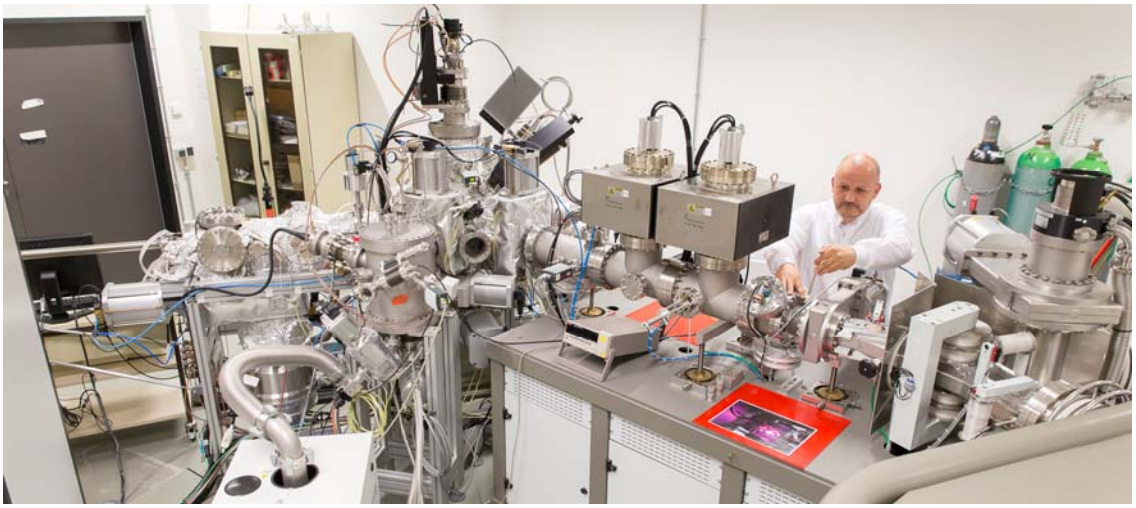
Purpose: Outgassing of material, mechanical parts and EEE components

Technical Parameters:

Test chamber volume	12 l
Vacuum lock volume	7 l
Pressure (empty chamber)	$5 \cdot 10^{-10}$ mbar
Mass range	1 – 510 amu
Temperature range	RT – 250°C
Residual gas analyzer	Quadrupol mass spectrometer

Accreditation: DIN EN ISO/IEC 17025:2005

12 Complex Irradiation Facility (CIF)



Purpose: Material surface electromagnetic and corpuscular radiation

Recipient:

Volume	0.035 m³ (400 mm diameter)
Pressure	$<10^{-8}$ mbar without VUV-simulator $<10^{-6}$ mbar with VUV-simulator
Irradiated diameter	80 mm

Light Sources:

Sun simulator	200 – 2150 nm (4.5kW/m²)
Deuterium VUV source	112 – 400 nm (1.65 W/m²)
Argon VUV source	40 – 410 nm (58 mW/m²)

Proton, Electron Source:

Current at lower Energy Range (1 – 10 keV)	1 – 100 nA
Current at higher Energy Range (10 – 100 keV)	0.1 – 100 µA

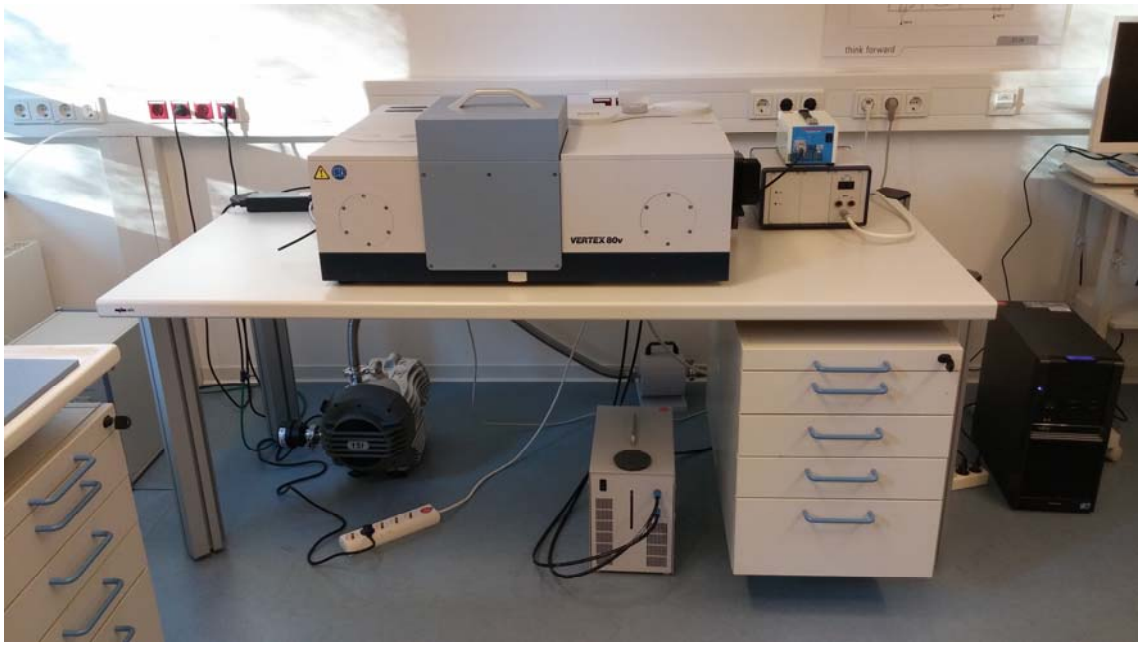
Specimen Temperature Control:

Heating	Halogen emitter (600 W, 600 K)
Cooling	Liquid Nitrogen (lN_2, 80 K)

Data Acquisition:

In situ measurement	Reflectivity and Absorptivity (planned)
Quadrupole mass spectrometer	
Radiation, Temperature, Pressure	

13 Bruker Vertex 80v FT-IR Spectrometer



Purpose: Measurements of solar absorptance α_S, hemispherical thermal emittance ε_h, specular reflectance, and transmittance

Technical Parameters:

Wavelength range α_S	250 – 2500 nm
Wavelength range ε_h	3 – 25 µm
Working pressure	2 mbar
Spectral resolution	Better than 0.2 cm^{-1}
Test Sample Size	50 mm x 50 mm

Standard:

ECSS-Q-ST-70-09C	solar absorptance α_S, thermal emittance ε