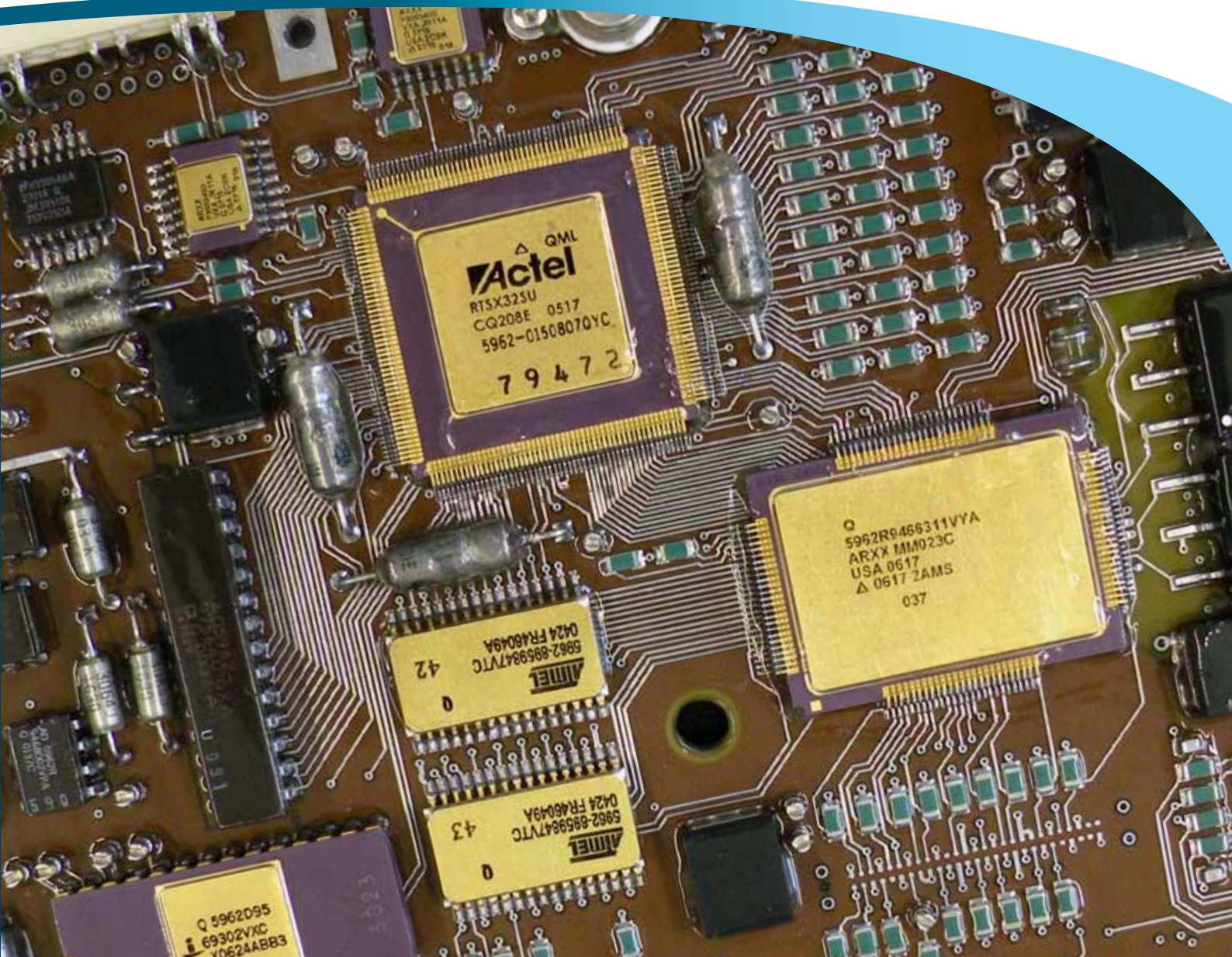


We. Create. Space.



SPACE SYSTEMS

# ELECTRONICS DESIGN & MANUFACTURING



# OVERVIEW

## ELECTRONICS DESIGN & MANUFACTURING

### Introduction

OHB System AG is specialized in the production of high-quality, high-complexity and low to mid volume electronic assemblies for space, military and industrial applications. OHB designs, manufactures, integrates and tests electronics and avionics systems which cover the full range of discrete printed circuit boards up to system-level units — always based on a fully customer-oriented approach.

OHB has earned its reputation as a service-oriented design and manufacturing company which offers particular experience in data communication systems based on Mixed Signal ASICs (using RF design tools like ADS System Tool), FPGA designs (using HDL Designer & Modelsim), Front-End Electronics (FEE) for electro-optical applications, security units, power supplies, payload data and video acquisition systems etc.

OHB maintains a full range of functional and performance test equipment for low to mid volume production tests. Environmental test facilities are operated in-house, used e.g. for burn-in, temperature cycling, and thermal vacuum testing.

With a flight heritage of more than 90 electronics units performing flawlessly in space, OHB was and is contributing to a large number of ambitious space missions. Until today, the in-orbit time of OHB equipment accumulates to more than 600 years of success.



### Heritage & Key Competences

Starting as a small company with a scientific focus it has always been the OHB approach to find robust and efficient solutions for technical challenges. With this mindset OHB has been equipping a variety of scientific instruments and satellite missions successfully with complex electronics.

The bandwidth of OHB's electronics covers a wide range: power supply and distribution systems (fuse boxes, power distribution units, DC/DC converters), analogue and electro-optical designs (high-speed sensor acquisition, discrete satellite telemetry acquisition including optical interrogation of temperatures, autonomous camera systems and read-out electronics for optical image sensors), digital designs (on-board computers and high speed crypto units) as well as RF designs (atomic clock frequency comparison, 30/20 GHz down-conversion and 11 GHz local oscillator chips). Due to the complex interactions of harness with several other disciplines, harness design activities are a must for OHB.

To ensure optimized solutions already in the specification phase, OHB electronics engineers are as a matter of principle

embedded in the systems engineering teams which is also a key asset for efficient processing of all customer specifications. Dedicated electronic development and tests are conducted in a number of electronic labs with a total space of approx. 1000m². The labs are equipped with leading edge test and measurement equipment. In addition EMC facilities and thermal-vacuum chambers are available, allowing a flexible testing of key environmental parameters in-house. All these development tasks are supported by EEE engineering resources ensuring the selection of the best-suited components during the design phase, considering their match to the required quality levels and the environmental needs.

The OHB manufacturing capabilities range from payload and satellite harness to PCB assemblies and full integration of electronic boxes. In combination with EEE engineering, standardized manufacturing document generation ensures the qualified assembly of electronic components. This service also allows external customers to produce their space-grade electronic assemblies through the OHB manufacturing lines.





# ELECTRONICS DESIGN

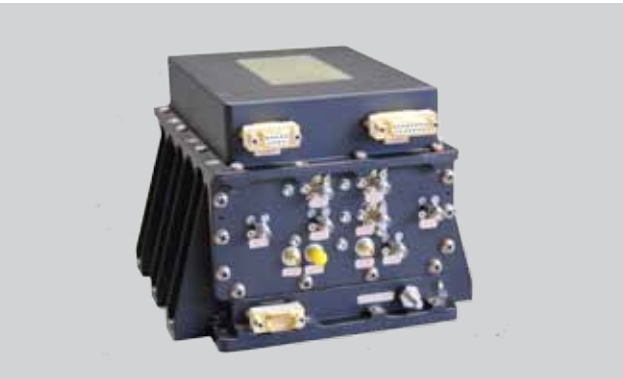
## HIGH-SPEED & DIGITAL DESIGN



- Satellite Security Units**
- Protection of satellite TM/TC data links
  - Application in LEO, MEO and GEO
  - Lowest emissions (TEMPEST)
  - Wide range of standard and customer specific encryption algorithms.



- Real-time Data Processing & Coding Units**
- Data processing rates of several Gbps
  - Real-time processing and encryption of payload data
  - Reed-Solomon encoding
  - CCSDS data packet formatting
  - Output data randomization.



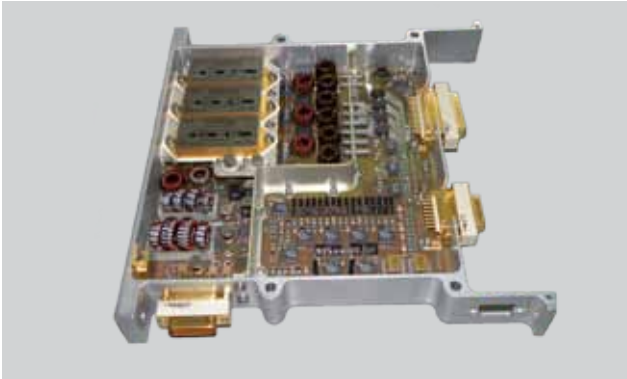
- Frequency Comparison & Distribution Packages**
- Acquisition and comparison of frequency and phase of several (up to eight) ultra-stable 100 MHz signals
  - Phase, frequency and phase noise are calculated for scientific analysis, e.g. of atomic clocks
  - FPGA based implementation enables parallel execution of independent algorithms and direct control of external hardware in realtime.



- Satellite Management Units (with OHB Italy)**
- Control and command of on-board data handling, power conditioning and distribution, AOCs
  - TC decryption and authentication
  - Radiation tolerant DSP processor TSC21020
  - Maximum integration and miniaturization by extensive use of FPGA components
  - Serial interfaces (RS422 and IEEE1355) as well as a range of discrete interfaces (analogue, bi-level pulsed and digital).

# ELECTRONICS DESIGN

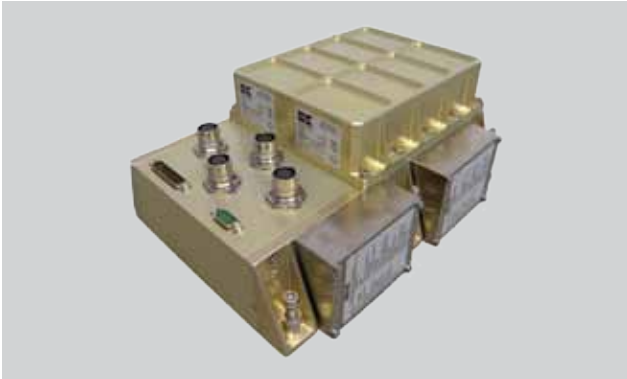
## ANALOGUE, MIXED SIGNAL & RF DESIGN



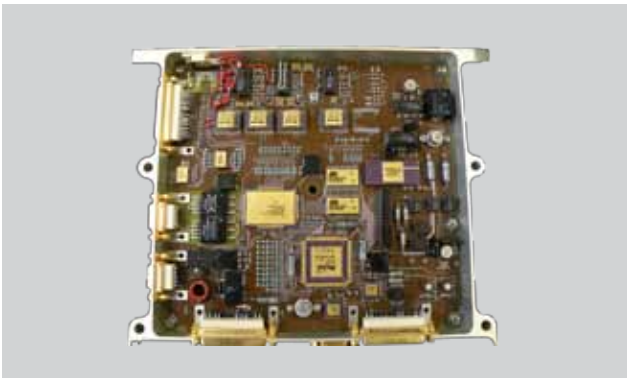
- Power Supply Modules**
- High reliability and redundant power supplies
  - Nominal input voltages between 28 and 120V
  - Large range of output voltages between 5 and 28V
  - Accurate and low noise power supply lines
  - Multiple and galvanically isolated output voltages to supply digital and sensitive analogue electronics.



- Hybrid Sensor & Telemetry Acquisition**
- Modular temperature measurement system for combined electrical and fiber-optical sensor bus networks
  - Selectable MIL-Bus/CAN/SpaceWire interfaces
  - Fiber-optic Interrogator Analog Front End.



- Video Compression & Telemetry Acquisition**
- JPGE 2000 image compression standard based on wavelet compression algorithm
  - Compression rate adaptable to TM transmission data rate
  - Optionally: camera heads and/or illumination modules included
  - Two serial asynchronous / synchronous interfaces and analogue housekeeping signal acquisition for TM or payload data transmission.

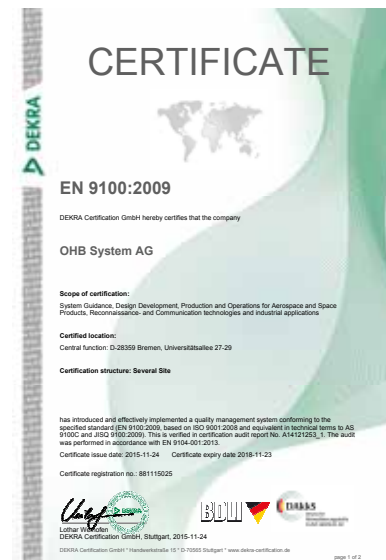


- Front-End Electronic Units**
- Low noise read-out and signal conditioning electronics for avalanche and other photo diodes as well as for CCD and CMOS sensors
  - High-speed VHDL circuit design based on tailored FPGA and ADC (16bit) detection chains
  - Integrated sensor power supply with high spectral purity and low noise.



# ELECTRONICS MANUFACTURING

## PCB ASSEMBLIES, BOX INTEGRATION, HARNESS



### Overview

OHB offers the full service of electronic flight hardware manufacturing and assembly by certified staff members:

- Automated surface mount and plated through-hole assemblies
- Manual soldering
- Vapour phase soldering and rework processes
- Cable and harness manufacturing and automatic testing
- Crimping and wire wraps
- Electromechanical assembly of flight units
- Optical inspection
- Conformal coating
- EMC and thermal-vacuum testing
- Burn-in capabilities at assembly, module and box level
- System level board testing capabilities.

### Production & Test Equipment

OHB's electronic production chain makes use of the following main equipments and tools:

- Automated pick and place machines JUKI PM 570 and DIMA HP 100
- Semi automatic screen printer DEK 248 for solder paste
- Vapour phase solder machine ASSCON VP 1000-53
- Repair station for fine pitch flat packs and ball grid arrays
- Soldering station under N2 protected atmosphere
- Cable tester ADAPTRONIC NT 730
- Dispenser DIMA DOTMASTER SMDU 5000.

### Satellite & Payload Harnesses

Based on growing customer requirements in harness design and manufacturing complexity for satellites, instruments and payloads, OHB managed a continuous project evolution of satellite harnesses for more than ten years, e.g.:

- SVM (AVM) harness for Herschel/Planck
- SMOS payload harness
- ADM Aeolus satellite harness
- SAR-Lupe satellite harness
- Galileo IOV and FOC platform harness
- Hispasat AG1 satellite harness.

In the frame of this evolution we have established a seamless process for harness design, development and manufacturing including full-scale test and integration:

- Concurrent harness design in line with accommodation and integration planning
- Analysis (worst case, derating, voltage drop, thermal)
- Mock-up and bracket design and manufacturing
- Harness production, assembly and integration.

### Workmanship Standards & Leadership

Certified according to EN 9100:2009 and AQAP 2110/2210 and workmanship standards in compliance with following agencies:

- European Space Agency (ESA)
- Deutsches Zentrum für Luft- und Raumfahrt (DLR).

Manufacturing leadership:

- SMD manufacturing certified according to PSS-01-738 since 1998
- Complete manufacturing areas according to cleanroom class ISO8 (> 300m<sup>2</sup>)
- Quality Assurance (QA) according to ECSS-Q-ST-20C
- Hand soldering according to IPC 600 and ECSS-Q-ST-70-08C (ESA certified soldering and inspection)
- Crimping according to ECSS-Q-ST-70-26C
- Ceramic Column Grid Array (CCGA) assembly line (CCGA 624 pin) according to ECSS
- Space qualified soldering according to ECSS-Q-ST-70-38C and repair according to ECSS-Q-ST-70-28C
- Procurement of PCBs according to ECSS-Q-ST-70-11C.



OHB has a long tradition of producing electronic boards, modules and equipments. Ever since the company was founded, components were mounted on PCBs and cables were manufactured which then have been integrated as modules at the corresponding integration site (either in-house or at the customer). Thanks to decades of

experience in the space and industrial sectors, stable production and qualification processes have been established and continuously improved in the areas of PCB production and harness manufacture. Valid soldering qualification status, compliant with ESA standards ECSS-ST-Q-70-08/38, has been available since 1998. The

electronics production areas are spanning over more than 300m<sup>2</sup> at both company sites (Bremen & Oberpfaffenhofen). All rooms are equipped in compliance with the ISO8 cleanliness standard. The room layout is flexible to serve the individual project needs. Each workplace is connected to a central supply of pressurised air and

nitrogen and has a soldering fume extractor. In summary, OHB's electronics production and test lines are able to serve all customer needs, both for space-grade printed circuit boards and harness assemblies as well as for complex electronic units, equipments and sub-systems.



**We. Create. Space.**

#### **About OHB System AG**

OHB System AG is one of the three leading space companies in Europe. It belongs to the listed high-tech group OHB SE, where around 2,400 specialists and system engineers work on key European space programs. With two strong sites in Bremen and Oberpfaffenhofen near Munich and more than 35 years of experience, OHB System AG specializes in high-tech solutions for space. These include small and medium-sized satellites for Earth observation, navigation, telecommunications, science and space exploration as well as systems for human space flight, aerial reconnaissance and process control systems.

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