



Systems & Projects

Mobile Calibration Van for the Belgian Air Force



Introduction

Rohde & Schwarz Belgium has realised a mobile calibration van for the Belgian Air Force. This van is used to calibrate all their available electronic measuring equipment.

The calibration trailer houses 3 main test systems consisting of 7 19" racks. Each test system takes care of specific EUT types, such as multimeters, oscilloscopes, LF and RF signal generators, function generators, counters, radiocommunication testers, RF attenuators, couplers, etc...

For each test system, a special calibration software has been developed by Rohde & Schwarz Belgium. It allows execution of full automatic test sequences. All controllers are connected via a network to the central administration controller, which takes care of data processing, statistical evaluation and reporting. Finally, the test results are transferred by modem to a central database in the head quarter.



Trailer

Van

The van is tailor-made and has been assembled according to the specifications of the Belgian Air Force. The mechanical construction has been realised based on the experience in mobile realisations of Rohde & Schwarz Belgium.

The trailer is built on a chassis with two directional wheel axis with ABS breaks, and air suspension. The EUTs can be entered in the van via calibration trolleys, which are placed on an elevator system below the door entrance. The operators have their entrance/exit via a staircase at the rear side of the van.

Two windows are foreseen. They can be covered if necessary.

The electrical installation comprises isolation transformers, proper earthing, surge protectors, converters, etc... offering a distribution of various DC and AC supply voltages through the van.

In case of fire, a smoke detection system will produce an alarm, and a fire extinguishing system (based on argonite gas) will be activated if necessary.

Air conditioning

The van has been equipped by two independent air conditioned channels. One for the operator area (± 13 kW), and one for the test systems in the racks (± 9 kW). They are controlled individually in order to guarantee operation within a specific temperature/humidity range, even at severe climatical conditions ($-20^{\circ}\text{C} \dots +40^{\circ}\text{C}$).

The air conditioning channel of the test systems flows through the racks. Air inlet ducts are located above the racks in the double ceiling. Exhaust is realised via air ducts below the operator workbenches.



Racks

The seven racks of the test systems are located on a long workbench at the same side of the van.

For maximum operator convenience, the racks can be turned and fixed at regular angles. They are mounted on shock mounts in the upper and lower parts. Below the workbench surface, sufficient drawers and storage shelves are available.

All internal RF and control cables are led through cable ducts which are also located in the double ceiling and below the workbenches. Patch panels offer flexible distribution of signals between the racks of different test systems, as well as a calibrated clock reference synchro signal.

Test Systems

Calibration system A

The purpose of this test system is to calibrate multimeters, oscilloscopes, etc... Therefore the system consists of :

- a Fluke calibrator 5500A.
- a Fluke multimeter 45.



The software is based on MET-CAL test environment :

- it contains over 300 ready-to-use test procedures for various instruments
- additionally, specific test procedures have been developed for the EUTs of the Belgian Air Force.

Calibration systems B and C

The test systems B and C are used to calibrate EUT types like LF and RF signal generators, function generators, counters, radiocommunication testers **CMS**, RF attenuators, couplers, etc...



Test system B consists of :

- a rubidium reference oscillator / counter 6681
- a RF signal generator **SMT02**
- an audio analyser **UPL**
- a digital storage oscilloscope TDS680B
- a function generator PM5138A
- a digital multimeter 8842B
- a true RMS voltmeter **URE3**
- a pulse generator 8116A

Test system C comprises :

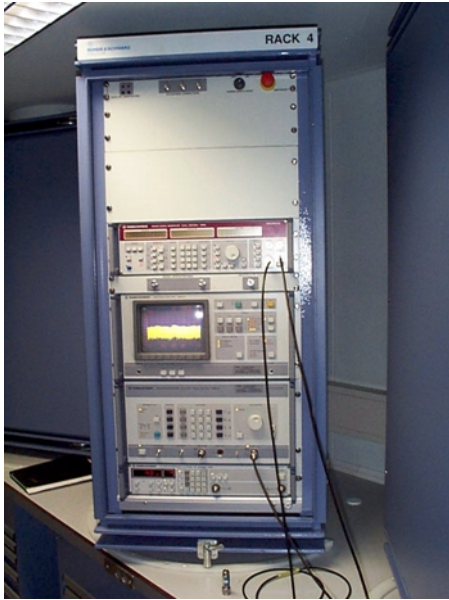
- a spectrum analyser **FSMS26**
- a precision step attenuator **RSM**
- a RF power signal generator **SMGL**
- a modulation analyser **FMB**
- a dual channel power meter **NRVD**
- a **customized RF switchbox**

Measurement quantities

In short, the following quantities can be measured with the installed measuring equipment:

- Voltage: 0-1000 V (DC & AC)
- True RMS voltage: ..30 MHz; .. 300V
- Sine, triangle, square, pulse,... signals 1 mHz - 50 MHz
- Current: 0 - 11A (DC & AC)
- Resistance: 0 - 330 Mohm
- RF-counter: 5 kHz - 1.5 GHz
- AM-demodulation: 0 - 100%
- FM-demodulation: up to 10 MHz
- Stereo-coder: 0.1 - 15 KHz
- RF-frequencies: 0 - 300 MHz
- RF-power probe: up to 50 W
- RF power: DC - 18 GHz; 200 uV - 100 V
- RF spectrum analysis up to 26.5 GHz
- SWR from 40 kHz - 18 GHz
- Audio signals 10 Hz - 110 KHz; low distortion
- Audio analysis 10 Hz - 110 kHz, 01. mV - 20 Vrms
- Multi-sine and sine burst analysis
- Audio FFT, THD, SINAD and DIST analysis
- signal view up to 1 GHz





Software

The software consists of the following modules :

- a set of **instrument drivers** for the measuring instruments of the test systems
- a set of **instrument drivers** for the EUTs
- a set of **measurement applications** (Application Libraries)
- a set of **universal routines** (Utility Libraries)
- a set of **verification and calibration procedures**, per EUT (several EUT Libraries)
- a user **interface module** to lead the user through the measurement procedures
- a **generic procedure** for the development of future EUT procedures
- a tool to define **measuring sequences** per EUT, with limit evaluation, reporting, and data storage.
- a license for **software development environment**

The software has been developed in Labwindows CVI. The verification or calibration procedure will call one or more measurement applications, which will call the required instrument drivers.

The Test Executive Toolkit calls all procedures required for a single EUT. These "applications" will show pop-up screens with test set-ups to the user, and will ask him for interaction when required. Of course, this man-machine interface is Windows-based, menu driven and mouse controlled.

Each test system is able to generate basic test reports on the network printer of the administrative computer. The layout of these reports is predefined, but can be changed easily.

The generic test procedure

For easy integration of future EUTs in the system, a generic test procedure has been provided.

- after filling in a so-called **recording sheet** (structured file), the software is able to execute a measurement sequence, guiding the user by pop-up screens
- measurement results are entered by the user via the controller keyboard
- the generic test procedure produces similar formatted files for measurement results and identification of the EUTs.

The administrative controller

The administrative controller is connected to the three test system controllers via an ethernet network. It is equipped with peripherals such as a printer, modem, CD-ROM reader/writer.

It takes care of :

- the statistical **processing of test results**
- **data storage**
- **reporting**
- follow up and **planning** of calibration jobs
- **data exchange** with external computers (logistic data management system of the Belgian Air Force)

The processed test results are finally printed by **Crystal Reports Professional**. This software module also allows export to other applications/workstations.



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