



Cellular Phone Production Test Platform TS7100

The new "ready to go" production tool

- One basic system platform
 - for all customary radio standards
 - for all production steps
 - board tests
 - functional tests
 - RF calibration
 - final tests incl. RF tests, acoustic tests, display tests and keyboard/pad tests
 - for multi-protocol and multiband testing with Radio Communication Tester CMU200, migration from CMD to CMU included
- One simple concept
 - Comprehensive modular test library for immediate use or easy customization
 - Generic system using versatile configuration based on Compact-PCI/PXI
 - Easy upgrade to 3rd generation products
- One cost effective tool
 - High throughput by real parallel testing using independent IEC/IEEE-bus systems
 - Flexible core system for either functional, final or other tests
 - Modular and versatile hardware and software, standard fixture interfaces
 - All hardware and software components based on industry standards



ROHDE & SCHWARZ

Mobile radio – a market with a future

For many years mobile communication has been showing an enormous growth worldwide. In particular, the mobile phone market is highly dynamic and is typified by ever-growing quantities, very short production cycles and diverse standards. Special development tools and standard chip sets of known manufacturers now facilitate the development of mobile phones also to newcomers, so that meanwhile a large number of companies are appearing on this market, offering cost-effective products. The competition is thus getting stiffer from day to day.

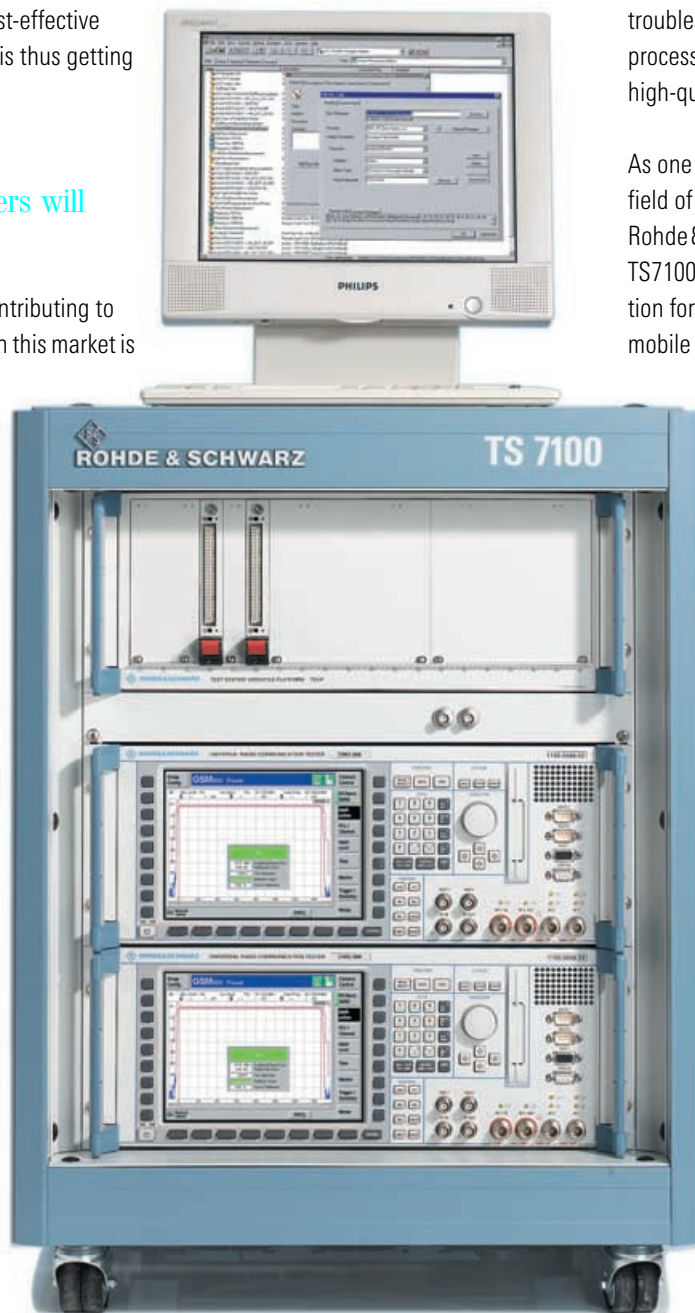
Only the fastest players will survive

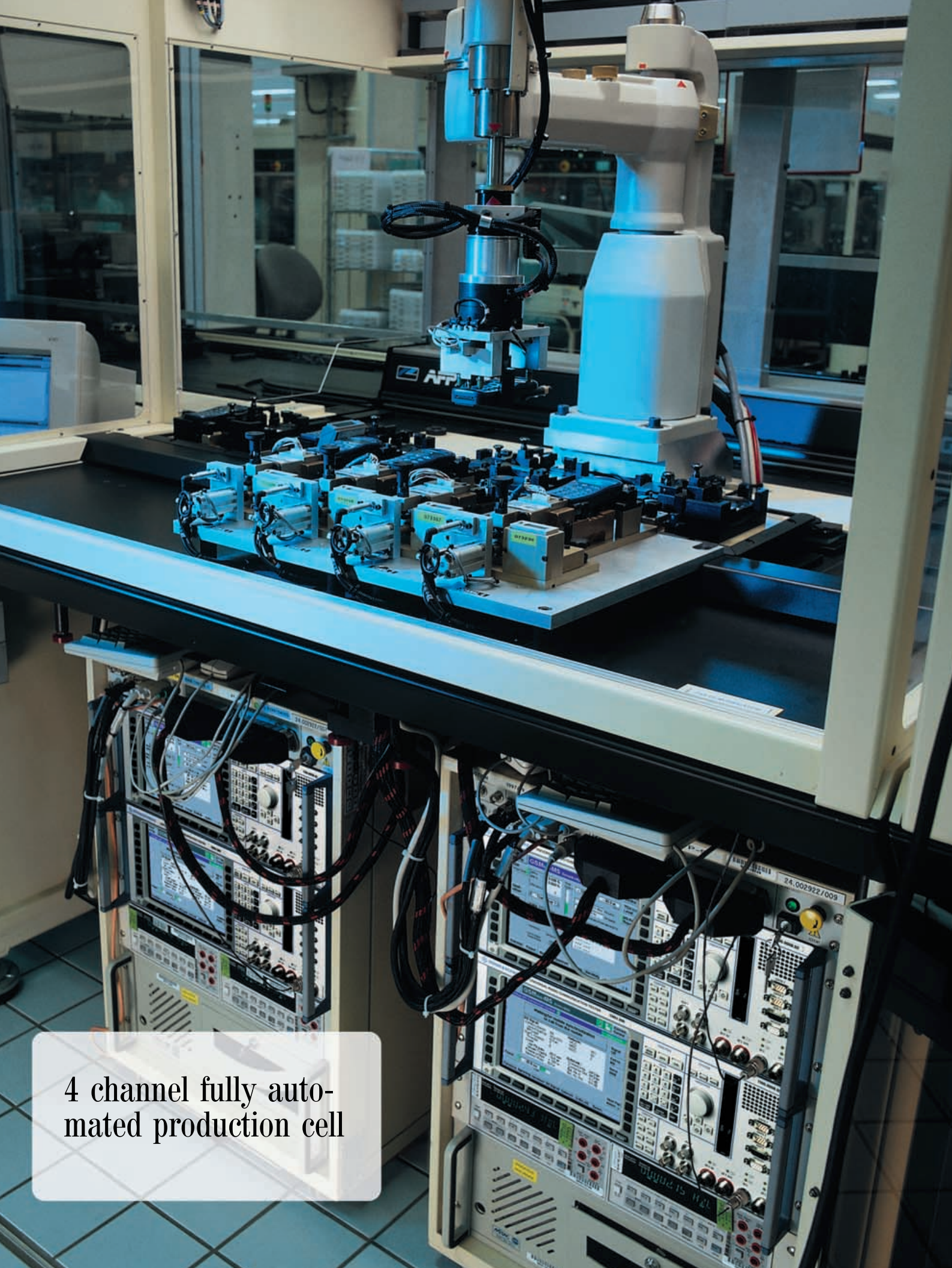
One of the main factors contributing to the success of a company in this market is the time required to get the next product generation to the market. Only those who succeed in developing new products according to the latest technologies in the quickest possible way and manufacturing them in large quantities fast in a cost-effective way and fault-free will be stand up to the numerous competitors. Only those who are able to keep up with pace and influence it measurably to leave their competitors far behind will be capable of surviving in this market.

The challenge spells "time-to-volume"

The crucial points are the fast transition from product development to series production and the capability to adapt production capacity very quickly to the demand. For this reason, the production should be geared up for high yields immediately. Test systems play a central role in this respect. They allow fast detection and troubleshooting in the manufacturing process, thus guaranteeing fault-free high-quality products.

As one of the leading companies in the field of communication test technology, Rohde & Schwarz has developed the TS7100 system which is an optimum solution for production testing all types of mobile phones. A turnkey solution for the functional board test, the RF calibration of mobile phones and the final test.





4 channel fully auto-
mated production cell

TS7100 – the test solution for mobile phone production

The manufacturing process of mobile phones is continuously monitored. For this purpose, the various manufacturing steps are followed by comprehensive tests which ensure that no faulty product is produced and each mobile phone complies with the relevant specifications and legal stipulations.

Rohde & Schwarz has developed the TS7100 system which is a tool-kit solution for the production test of mobile phones. The system can be used immediately and can be adapted and extended according to user requirements as a turnkey project. Since it is configured with standard components, it is cost-effective through measurement repeatability and reliability. The system is simple to operate and can be integrated into any production environment smoothly.

The system is backed up by a large number of services. We support our customers in the selection of the optimum test strategy and the configuration of the system to specific requirements. On request, we carry out the generation of test programs and the complete integration of the system into the manufacturing process. Of course, Rohde & Schwarz takes care of the maintenance and calibration of the system. Thus, we take all problems of production testing off your hands; you can rely on our partnership to support your production cycle with our test platform and to obtain excellent yield.

Fast in every respect

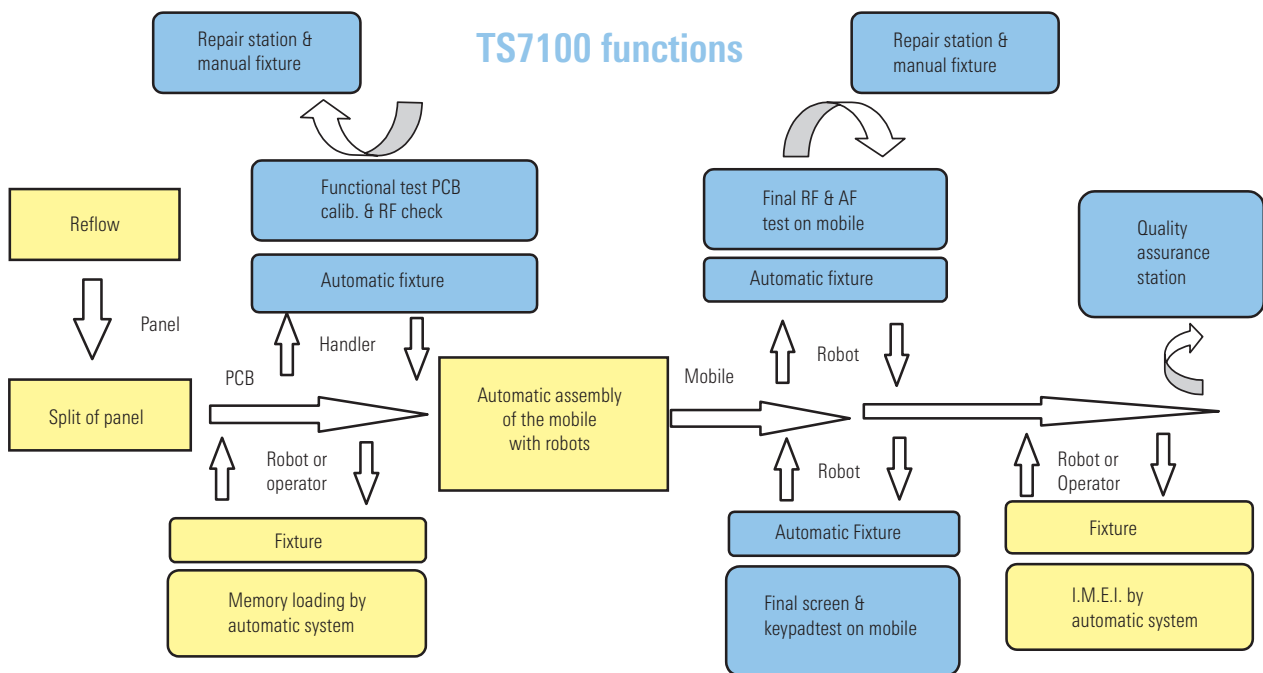
Thanks to extremely short measurement times, state-of-the-art test technology ensures a high throughput despite of the

large number of tests. In addition, the system can be easily equipped for the parallel test of mobile phones. This is in particular a quick and cost-effective way of increasing the forecasted throughput even more.

A system for all cases

The TS7100 system is a real all-in-one solution, however, there is the possibility of segmented application as well. It can be used equally in mobile phone board tests, RF calibrations and final testing. The system is suitable for the test of mobile phones complying with the major mobile radio standards. All critical parts are tested, mainly the audio section, the RF section, the keyboard and the display and the supply of the mobile phone. The TS7100 is "zero fault" orientated.

Example of Automatic Process in Mobile Production Lines



A standard but flexible system

The TS7100 system is an extremely compact, easy cabling overall solution designed for the test of mobile phones. Although the system has only a height of about 80 cm and fits below a conveyor belt, it includes all the essential components for the simultaneous testing of two mobile phones. And there is enough space left for future extensions. The essential components of a two-channel system are two radio communication testers, two special power supplies for the mobile phones as well as a CompactPCI/PXI rack with various plug-in boards. The different components were selected especially for high test throughput and simple enhanceability.

Rack configurations, special dimensions on request.



High Profile Rack



Low profile rack: components can be inserted on both sides.

CompactPCI/PXI – a compact and flexible standard

The TS7100 system contains the CompactPCI/PXI system platform TSVP (Test System Versatile Platform) which features up to 31 slots. The system controller, relay boards, digital I/O and measuring equipment which is not covered by the radio communication tester are combined in an instrument of 4 HU.

Universal module TS-PRL1 which accommodates the relay, power relay and digital I/O functionalities in a single module provides all the necessary basic functions for the mobile phone test including fixture control. Supplemental test equipment such as DMM or additional matrix boards can be implemented as required.

A standard but flexible system

Due to the unique wiring concept of the TSVP, the signals of the different test and stimulus units can be routed and switched within the TSVP. In this way, all signals are directly available at the fixture interface which allows simpler fixture and interface design.

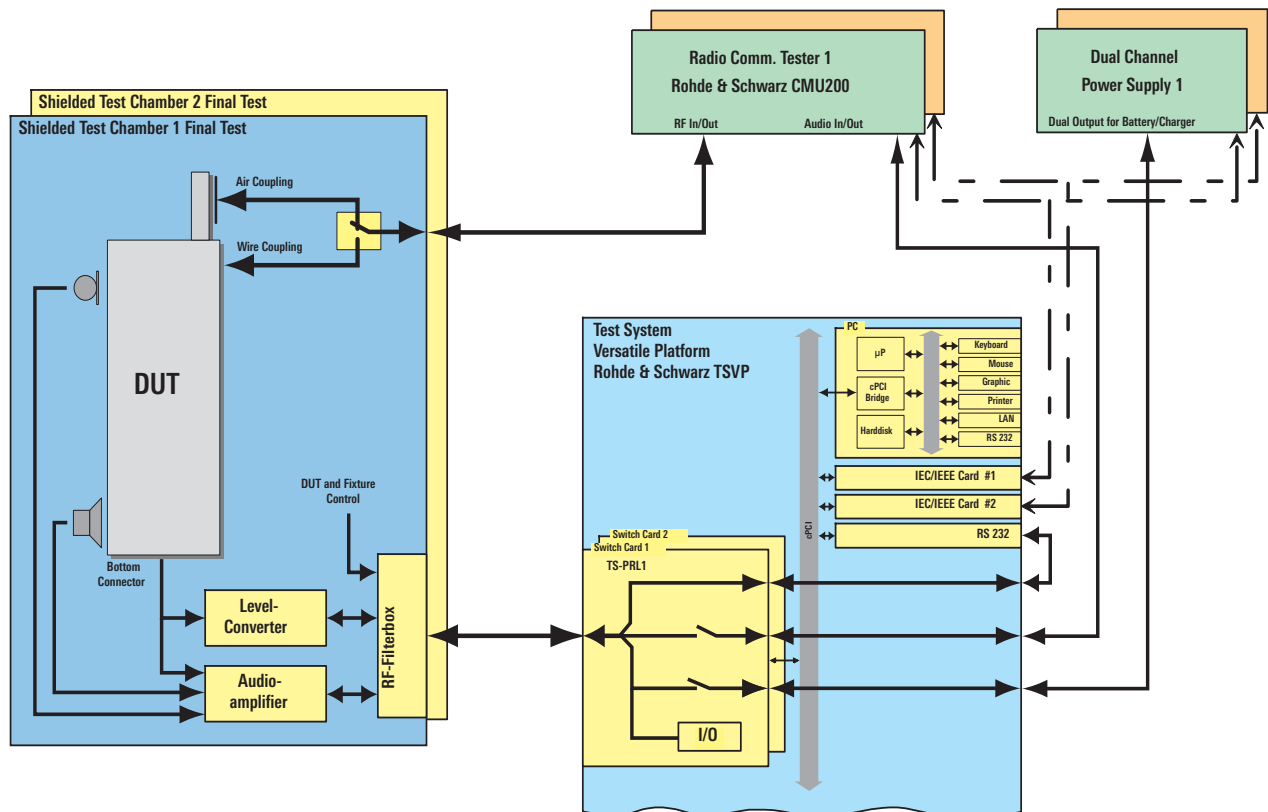
The PXI system architecture approved as industry standard was developed from the CompactPCI bus especially for T&M and sets a new standard in flexibility and compactness. A large number of different PXI modules are available on the market. CompactPCI boards can also be used. Like the VXI bus, the PXI bus has a variety of trigger functions and internal bus lines to transfer signals from one module to the other. When compared to the VXI bus, the PXI bus is far more compact, simpler to extend and up to 6 times faster with a data throughput up to 132 Mbyte/s.

CMU200 - fast and universal radio communication tester

Radio Communication Tester CMU200 offers most of the cellular phone tests such as audio tests, RF measurements, signalling and RF calibration of the cellular phone. CMU200 supports all customary mobile radio standards and is prepared for the standards of the 3rd generation. As such, CMU200 is best suited for testing dual or triple band as well as multimode cellular phones. Compared to the previous generation of mobile radio testers, CMU200 is up to ten times faster and up to three times more accurate.

Optimum throughput – no compromise in parallel tests

For simultaneously testing two cellular phones, all resources such as Radio Communication Tester CMU200, power supply and plug-in boards for the TSVP are doubled. There are also two IEC/IEEE busses to obtain optimum performance with ease of operation. Due to its high performance, it is not necessary to duplicate the TSVP, ie a system controller running under Windows NT drives the IEC/IEEE-bus instruments and plug-in boards simultaneously and in parallel in multi-tasking mode.



TS7100 Schematic diagram

The test program easy to compile

As for the TS7100 system software, particular attention was paid to obtaining ease of operation and generating the test programs quickly and without in-depth knowledge. The software is of modular design and comprises a test sequence control and a comprehensive library of tests for cellular phones of different

standards. The resource manager ensures assignment of test sequences to the corresponding hardware components and thus, for example, simplifies the parallel test of several mobile phones.

Everything well prepared

The Generic Test Software Library (GTSL) contains ready-to-run test cases for all important measurements and all customary mobile radio standards. Tests for all function blocks of the cellular phone such as audio and acoustic test, RF test and signalling test are included.

Extract from the comprehensive test library:

Non Signalling

Configuration

Trigger	GSM_NonSig_Conf_Trigger
Burst Analysis	GSM_NonSig_Conf_Burst_Analysis
Switch RF Generator ON OFF	GSM_NonSig_Conf_RF_Gen_OnOff

Measure

Mobile linked (UUT)	
Burst Analysis	GSM_NonSig_Meas_Burst_UUT
Frequency Error	GSM_NonSig_Meas_Freq_Error_UUT
Phase Error Peak	GSM_NonSig_Meas_Phase_Error_PK_UUT
Phase Error RMS	GSM_NonSig_Meas_Phase_Error_RMS_UUT
Power Average	GSM_NonSig_Meas_Power_AVG_UUT
Power Peak	GSM_NonSig_Meas_Power_PK_UUT
Power Time	GSM_NonSig_Meas_Power_Time_UUT
RSS	GSM_NonSig_Meas_RSS_UUT

Signalling

Call and Release

Mobile Linked

Call	GSM_Sig_Call_UUT
Release	GSM_Sig_Release_UUT

Configuration

Trigger	GSM_Sig_Conf_Trigger
BER Configuration	GSM_Sig_Conf_BER
BER power levels	GSM_Sig_Conf_BER_PowLev
BER sent frames	GSM_Sig_Conf_BER_SFframes
BS RF Parameters	GSM_Sig_Conf_BS_RF
BS Simulation Parameters	GSM_Sig_Conf_BS_Simulation_Param
Burst Analysis	GSM_Sig_Conf_Burst_Analysis
Location Update	GSM_Sig_Conf_Loc_Update
Modulation	GSM_Sig_Conf_Mod
Network Handover	GSM_Sig_Conf_Network_Handover
PCL, TCH and TS	GSM_Sig_Conf_PCL_TCH_TS
Power Base	GSM_Sig_Conf_Power_Base
Power	GSM_Sig_Conf_Pow
Power and Modulation	GSM_Sig_Conf_PowMod
Spectrum analysis	GSM_Sig_Conf_Spectrum

Fetch

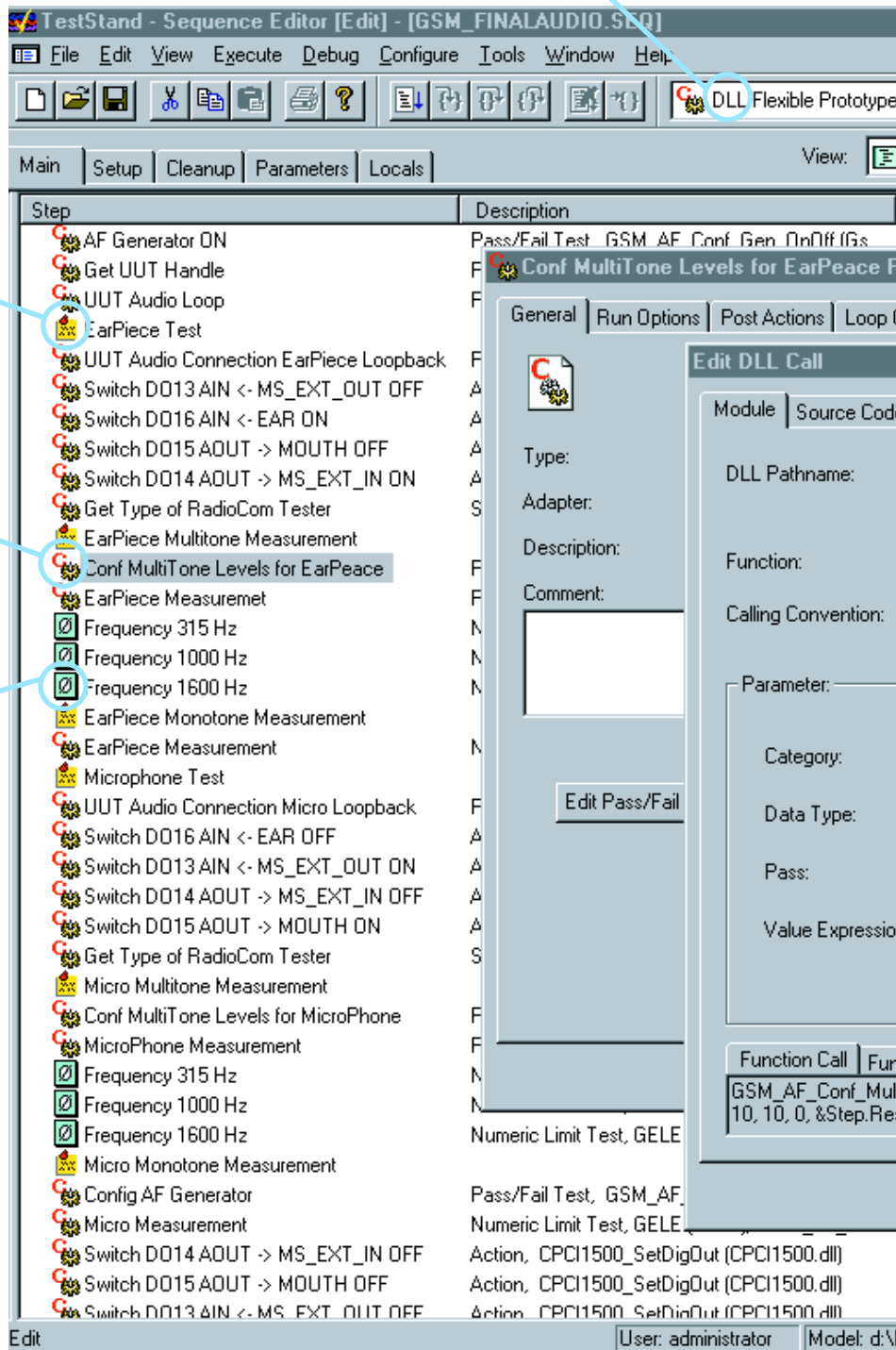
Average power	GSM_Sig_Fetch_Power_Avg
Frequency error	GSM_Sig_Fetch_Freq_Error
Phase error Peak	GSM_Sig_Fetch_Phase_Error_PK
Phase error RMS	GSM_Sig_Fetch_Phase_Error_RMS
Power time template matching	GSM_Sig_Fetch_Time_Template
Spect. due to swit. matching	GSM_Sig_Fetch_Spect_Switch_Match
Spect. due to mod. matching	GSM_Sig_Fetch_Spect_Mod_Match
BER	GSM_Sig_Fetch_BER
RBER	GSM_Sig_Fetch_RBER
Fast BER	GSM_Sig_Fetch_FBER

DLL Adapter for test step:
Step is performed by calling a function within a DLL

Label:
Can be destination of a GoTo cmd

Selected test step:
Configuration of multitone levels

Step to evaluate the result

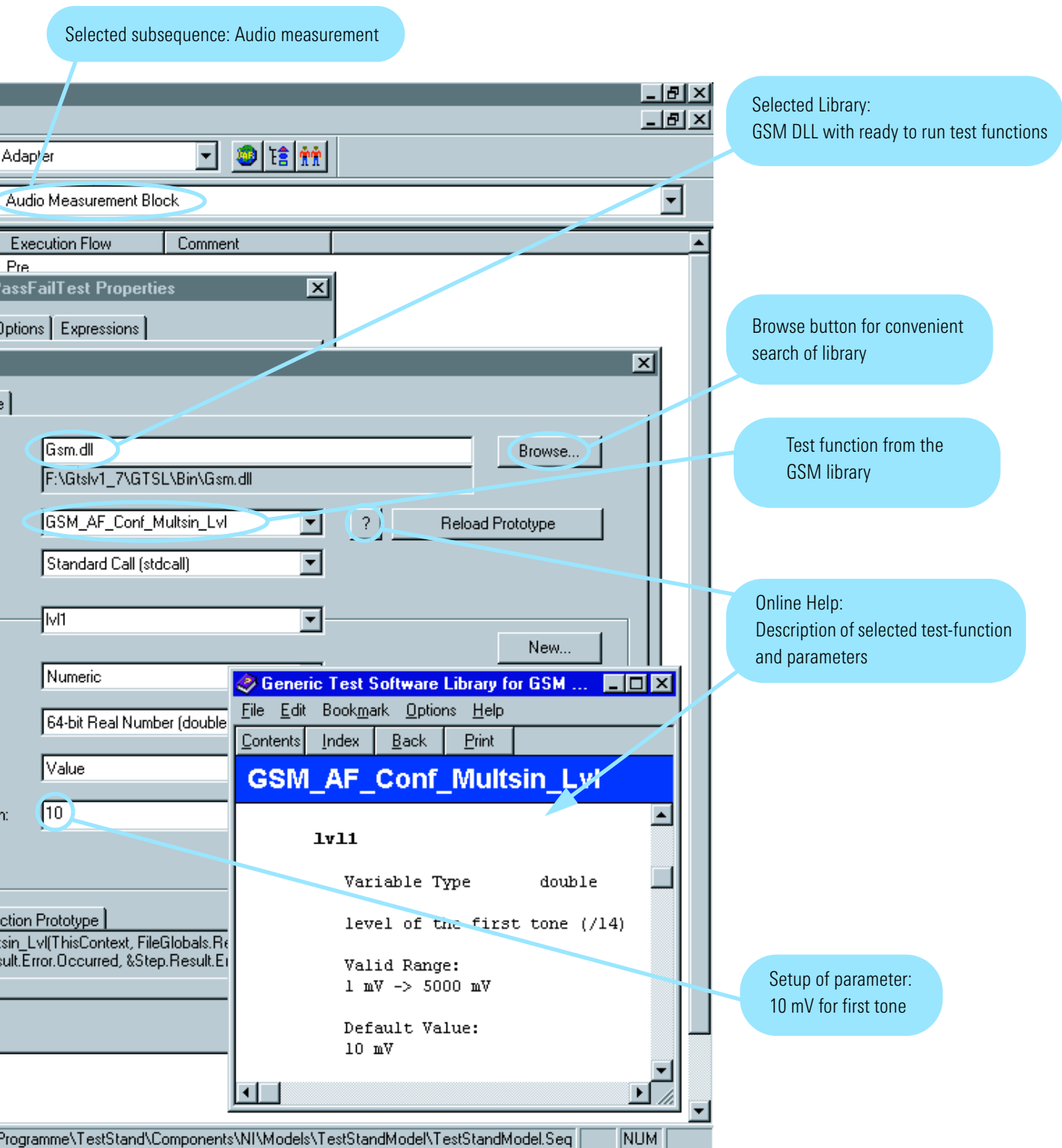


The different test cases are available as DLLs and can be customized under menu guidance. The associated limit values are compiled in an ASCII file. Modifications or adjustments of limit values can be performed easily and quickly using a standard editor.

Comprehensive functions for the production test

The Test Executive TestStand from National Instruments is used as test sequence control. This packet connects the test cases to form an executable test

sequence and adds all other functions important for the manufacturing process such as user administration, execution of several test sequences in multithreading or parallel mode, the collection and storage of relevant test results as well as report generation.

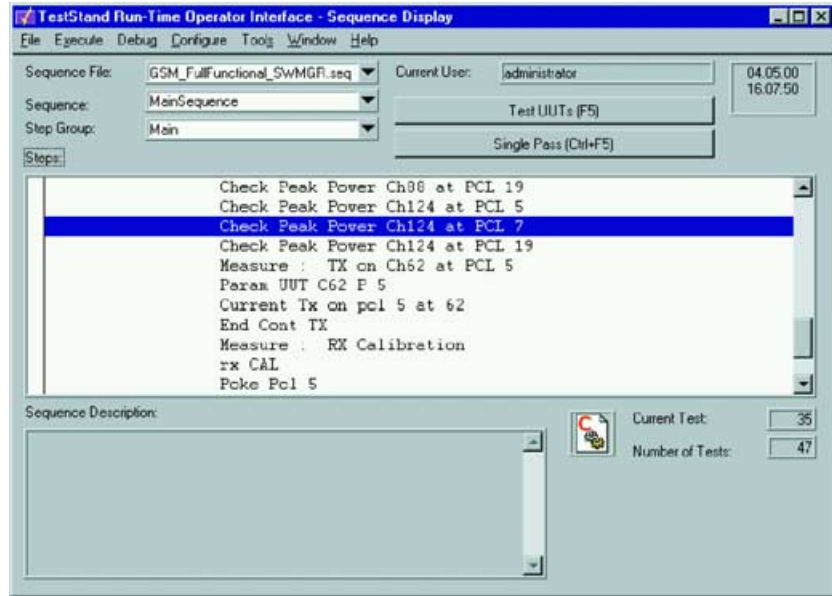


TestStand has an intuitive user interface and contains functions for the execution and debugging of test sequences. The integrated sequence editor serves to generate the test sequence simply by joining the different tests and to modify it any time. The measurement data obtained

during the test sequence are collected and can be used for the automatic creation of reports or simply be stored in a database for post-evaluation.

Testing mobile phones in-depth

The TS7100 system is equally suitable for the functional testing of boards, the calibration of mobile phones or final tests. Depending on the extent of tests required, different test cases can be combined from the test library to form a functional or final test. The test cases are sorted in the library according to mobile radio standards and each of them contains several functions. Each individual function can be assigned test parameters under menu guidance. With this hierarchical structure comprehensive test sequences can be configured easily and conveniently. Measurements can be also assigned result parameters as well as comparison operations for the conditional execution of actions. At the end of a test run, an individual test report can be automatically created from the results or the results can be stored in a database.



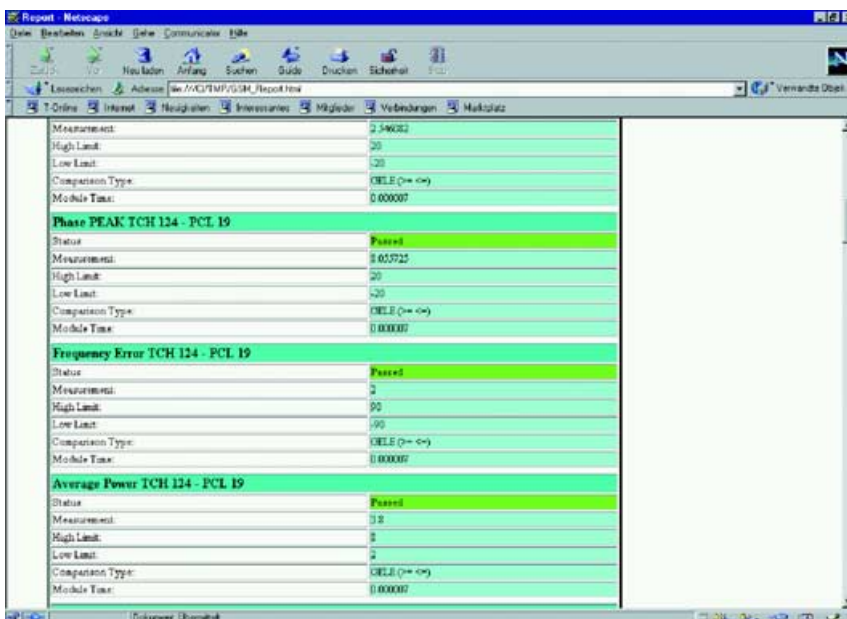
Operator panel

Example of a functional test sequence for GSM:

- General tests
 - Short-circuit test, current drain,...
- Transmitter
 - RF power, frequency and phase error, ...
- Receiver
 - AGC, RSSI, signal/noise ratio,...
- Oscillator
 - AFC, VCO calibration,...
- Audio
 - Frequency response, distortions,...
- Digital
 - Memory test, SIM interface,...

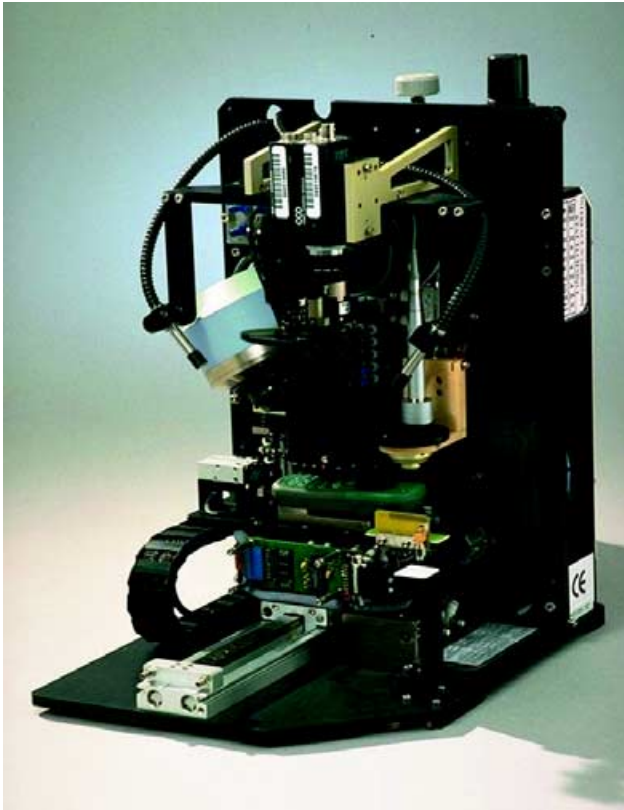
Example of a final test sequence for CDMA/AMPS

- Signalling
 - Location update, call setup,...
- RF test CDMA
 - Power level, modulation, FER,...
- Handoff for AMPS
- RF test AMPS
 - Power level, sensitivity,...
- Other tests
 - Audio test, keyboard, display, current drain,...



Testreport in HTML

From the standard system to the turnkey solution



Test adapter for automatic production line with display, keyboard and acoustic test

For a never-standstill production

Our regional integration centers with our R&S country support network are also your back-up partners for the maintenance, repair and calibration of the system as well as for the training of operators. On request, we offer customized maintenance contracts taking into account your specific requirements, we send you an expert to optimize your new processes, we follow you, if your production moves, etc.

Rohde & Schwarz, your long-term partnership counterpart

Rohde & Schwarz can look back on many years of experience in project management and the implementation of turnkey test and measurement systems for applications in telecommunications. In addition to measuring instruments for mobile radio, we also offer solutions for DECT, Bluetooth and other wireless communication standards.

As one of the world's leading T&M companies, Rohde & Schwarz has more than 5000 employees and is represented in over 70 countries.

Our regional integration centers shall be glad to assist you in selecting and setting up an optimum production process. Our high quality support comprises the configuration and integration of the system in the production line as well as servicing and maintenance after installation. Rohde & Schwarz offers you a complete spectrum of services for the production test of cellular phones, thus allowing extremely short time-to-volume, low test costs and comprehensive testing.

mechanical actuator for the keyboard test. For RF tests the fixtures are equipped with special antenna couplers and an RF connection to the test system (only 2 cables).

Test programs and fixtures

For the test of mobile phones, the complete package includes ready-to-run test programs and individual test cases as well as test fixtures for the manual and fully automatic use in automated production lines. Depending on the requirements, the fixtures are fitted with built-in shielding for acoustic and RF measurements, a camera for the display test and a



Fixture for manual use

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