# Protocol Tester PTW 60 for Bluetooth™ Solutions

## Platform for signalling tests in Bluetooth environments

### Main applications

- Protocol tests for the development of basic layers and profiles
- Protocol qualification (compliance testing) of layers and profiles by execution of TTCN test cases
- Reference implementation of baseband, LM and L2CAP in master and slave mode
- Test mode signalling (master) implemented
- Fully controlled by graphical user interface

### Main functions

- Simulation of one (optional two) *Bluetooth* piconets (baseband, LM and L2CAP)
- Automatic generation of ETCs (executable test cases) from the official SIG (*Bluetooth* Special Interest Group) ATSs (abstract test suites) by TTCN and C compiler
- Platform for the execution of all SIG protocol/profile tests for baseband, LM, L2CAP, GAP, SPP and SDAP

- Open programming interface with multiple possibilities for defining scenarios
- Message editor for easy generation of messages
- Connection of external layers via TCP/IP socket
- Extensive possibilities for analyzing incoming and outgoing messages

**ROHDE & SCHWARZ**

The Protocol Tester PTW60 for *Bluetooth Solutions* from Rohde & Schwarz has been developed for *Bluetooth* protocol and profile compliance testing of *Bluetooth* products. The tester is both a verified tool for *Bluetooth* protocol/profile qualification and an ideal R&D test and measurement instrument at all stages of *Bluetooth* product development.

The core of PTW60 is the *Bluetooth* real-time signalling unit that can simulate a *Bluetooth* piconet. The PTW60 runs the LynxOS (realtime UNIX) operating system which is also used by other protocol testers from Rohde & Schwarz. MGR is the graphical user interface.
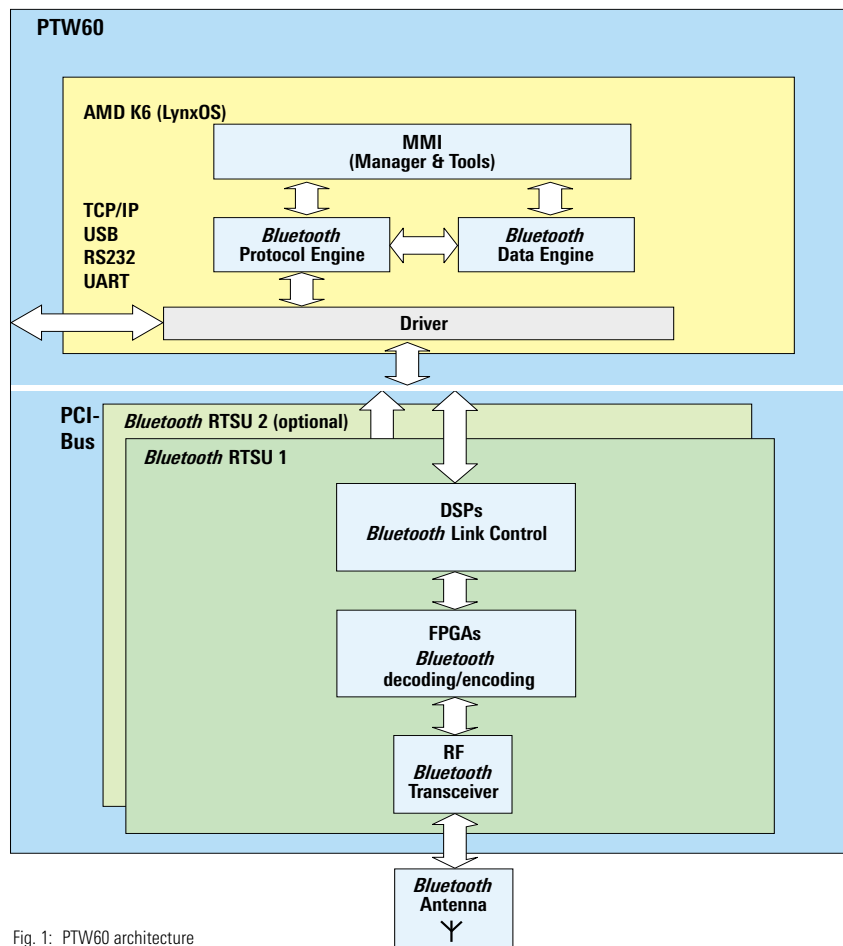


Fig. 1: PTW60 architecture

## Hardware

Hardware components at a glance:

- *Bluetooth* RTSU (realtime signalling unit) for simulating a *Bluetooth* piconet
- Wide variety of external interfaces which can also be operated as *Bluetooth* TCI (test controller interface):
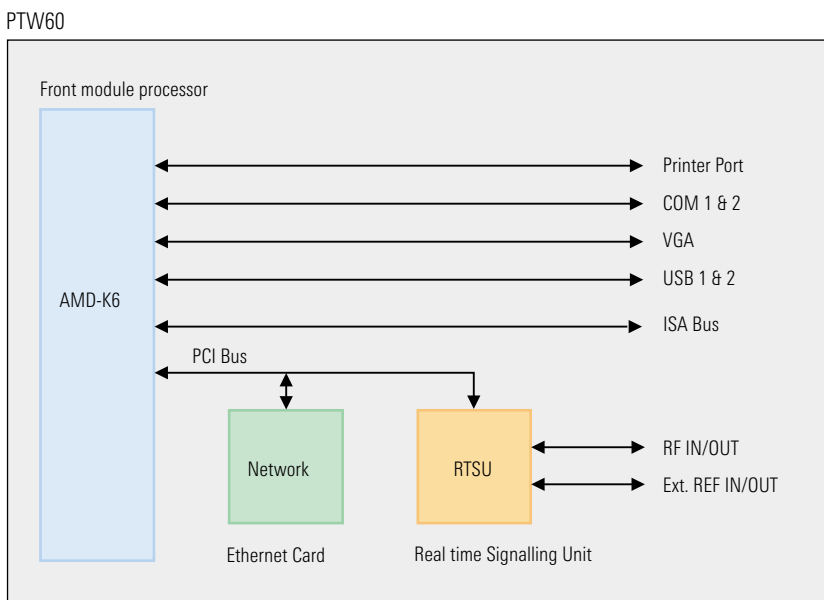  - USB
  - RS232/UART
  - Ethernet



Fig. 2: PTW60 hardware architecture

## Software

### Basic applications

The *Bluetooth* protocol tester can handle the following basic applications:

**1. Rohde & Schwarz TTCN toolbox and *Bluetooth* simulator libraries**

The TTCN toolbox comprises TTCN compiler, TTCN test case manager and PIXIT editor.

Simulator libraries for the automatic generation of executable test cases are being developed for the following *Bluetooth* TTCN test suites:

– Baseband
– Link manager
– Logical link control and adaptation protocol (L2CAP)
– Generic access profile (GAP)
– Serial Port Profile (SPP)
– Service discovery application profile (SDAP)

**2. Scenario manager**

By means of the scenario manager simulation scenarios can be run step by step.

A sequence of messages can thus be fed into a SAP (service access point) and sent. All required development options for simulation scenarios have been implemented in the PTW 60.

**3. Message editor**

*Bluetooth* messages can be compiled using the message editor. These messages are then fed into the different SAPs and sent.

### PTW60 *Bluetooth* protocol stack

The logical protocol data flow of the PTW 60 *Bluetooth* protocol stack can be displayed as shown in Fig. 3.

The baseband, LM and L2CAP layers are available on the PTW 60 as reference implementations. They can be started and stopped selectively and provide the SAPs for feeding data from the basic applications.

Fig. 3: PTW 60 protocol data flow
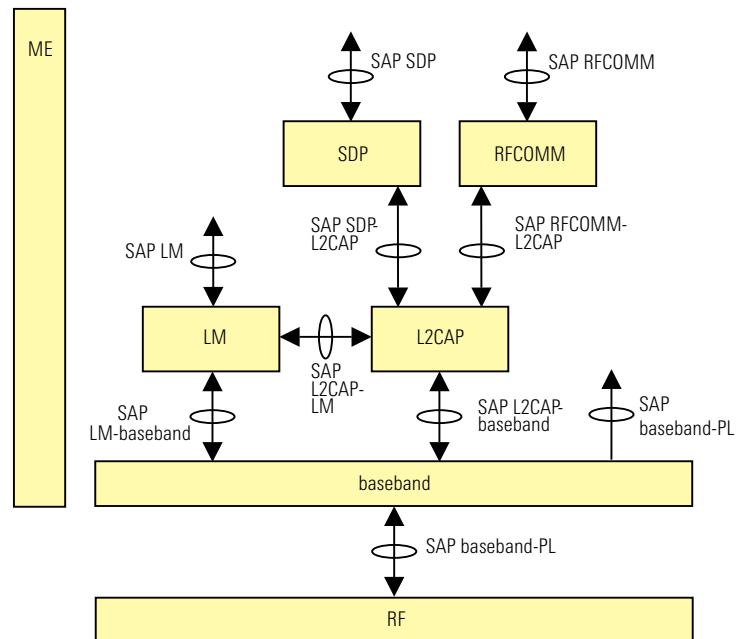


| AM_ADDR | Active Member Address |
| ASP | Abstract Service Primitive |
| ATS | Abstract Test Suite |
| BD_ADDR | *Bluetooth* Device Address |
| ETC | Executable Test Case |
| GAP | Generic Access Profile |
| L2CAP | Logical Link Control and Adaptation Protocol |
| LC | Link Control |
| LM | Link Manager |
| ME | Management Entity |
| MMI | Man Machine Interface |
| MSC | Message Sequence Chart |
| PCO | Point of Control and Observation |
| PDU | Protocol Data Unit |
| PIXIT | Protocol Implementation Extra Information for Testing |
| PL | Physical Layer |
| RFCOMM | Serial Cable Emulation Based on ETSI TS 07.10 |
| RSSI | Received Signal Strength Indication |
| RTSU | Realtime Signalling Unit |
| SAP | Service Access Point |
| SDAP | Service Discovery Application Profile |
| SDP | Service Discovery Protocol |
| SIG | Special Interest Group |
| SPP | Serial Port Profile |
| TCI | Test Controller Interface |
| TTCN | Tree and Tabular Combined Notation |

**Abbreviations**

**Protocol analysis tools**

The PTW 60 features various protocol analysis tools such as PCOs (points of control and observation), MSCs (message sequence charts) and TTCN trace analysis.

All ASPs (abstract service primitives) exchanged between the layers via SAPs (service access points) can be displayed and analyzed in PCOs. Each ASP is treated as a separate data packet and displayed in a line:
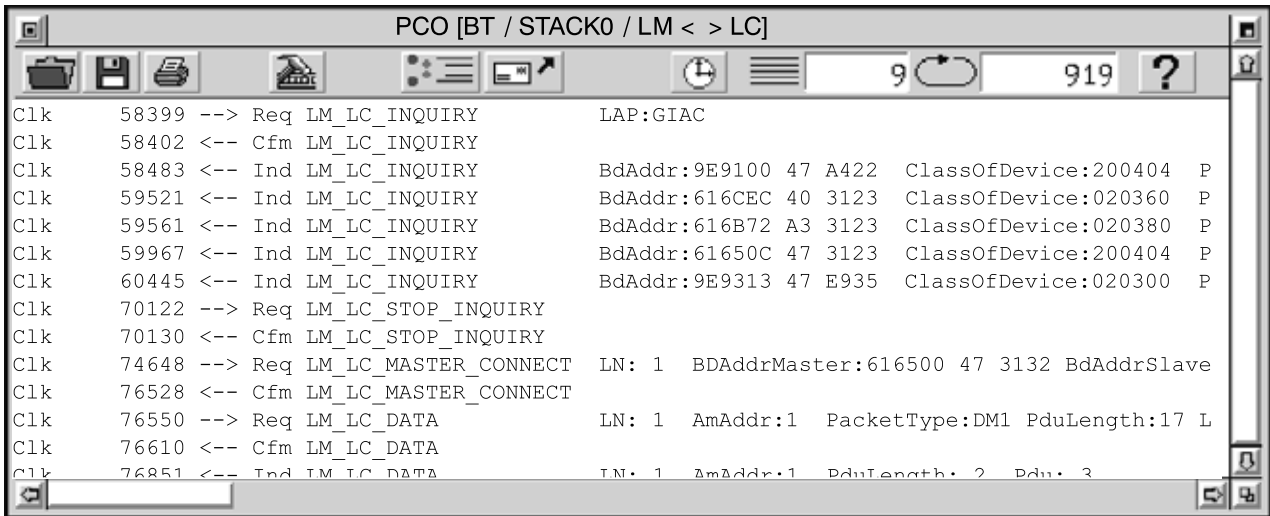
```
┌─────────────────────────────────────────────────────────────────────────┐
│ ▫         PCO [BT / STACK0 / LM < > LC]                             ▫  ⏚ │
├─────────────────────────────────────────────────────────────────────────┤
│ 🗁  💾  🖨    🏛     ⋮≡  ▭↗      🕐  ≡     9 ↻      919  ?           ⏚ │
├─────────────────────────────────────────────────────────────────────────┤
│ Clk     58399 --> Req LM_LC_INQUIRY        LAP:GIAC                       │
│ Clk     58402 <-- Cfm LM_LC_INQUIRY                                       │
│ Clk     58483 <-- Ind LM_LC_INQUIRY        BdAddr:9E9100 47 A422  ClassOfDevice:200404  P │
│ Clk     59521 <-- Ind LM_LC_INQUIRY        BdAddr:616CEC 40 3123  ClassOfDevice:020360  P │
│ Clk     59561 <-- Ind LM_LC_INQUIRY        BdAddr:616B72 A3 3123  ClassOfDevice:020380  P │
│ Clk     59967 <-- Ind LM_LC_INQUIRY        BdAddr:61650C 47 3123  ClassOfDevice:200404  P │
│ Clk     60445 <-- Ind LM_LC_INQUIRY        BdAddr:9E9313 47 E935  ClassOfDevice:020300  P │
│ Clk     70122 --> Req LM_LC_STOP_INQUIRY                                  │
│ Clk     70130 <-- Cfm LM_LC_STOP_INQUIRY                                  │
│ Clk     74648 --> Req LM_LC_MASTER_CONNECT LN: 1  BDAddrMaster:616500 47 3132 BdAddrSlave │
│ Clk     76528 <-- Cfm LM_LC_MASTER_CONNECT                               │
│ Clk     76550 --> Req LM_LC_DATA           LN: 1  AmAddr:1  PacketType:DM1 PduLength:17 L │
│ Clk     76610 <-- Cfm LM_LC_DATA                                         │
│ Clk     76851 <-- Ind LM_LC_DATA           LN: 1  AmAddr:1  PduLength: 2  Pdu: 3      ↓ │
│ ◁                                                                     ▷ ⊡ │
└─────────────────────────────────────────────────────────────────────────┘
```

Fig. 4:  PTW 60 PCO LM-baseband

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ▫         PCO [BT / STACK0 / LC < > PL]                             ▫  ⏚ │
├─────────────────────────────────────────────────────────────────────────┤
│ 🗁  💾  🖨    🏛     ⋮≡  ▭↗      🕐  ≡     9 ↻      919  ?           ⏚ │
├─────────────────────────────────────────────────────────────────────────┤
│ Clk    77824  ClkN   1275068416  --> Req LC_PL_DATA  f:20  LN: 0  Packet:ID-A  Pdu: 2E79 │
│ Clk    77825  ClkN   1275084800  --> Req LC_PL_DATA  f:35  LN: 0  Packet:ID-A  Pdu: 2632 │
│ Clk    77828  ClkN   1275133952  --> Req LC_PL_DATA  f:41  LN: 0  Packet:ID-A  Pdu: 2455 │
│ Clk    77829  ClkN   1275150336  --> Req LC_PL_DATA  f:16  LN: 0  Packet:ID-A  Pdu: 8963 │
│ Clk    77832  ClkN   1275199488  --> Req LC_PL_DATA  f:50  LN: 0  Packet:ID-B  Pdu: 2536 │
│ Clk    77833  ClkN   1275215872  --> Req LC_PL_DATA  f:57  LN: 0  Packet:ID-B  Pdu: 2144 │
│ Clk    77836  ClkN   1275265024  --> Req LC_PL_DATA  f: 3  LN: 0  Packet:ID-B  Pdu: 5336 │
│ Clk    77837  ClkN   1275281408  --> Req LC_PL_DATA  f:10  LN: 0  Packet:ID-B  Pdu: 5665 │
│ Clk    77838  ClkN   1275297792  <-- Ind LC_PL_DATA  f:17  LN: 0  Packet:ID   RSSI:-33d  │
│ Clk    77840  ClkN   1275330560  --> Req LC_PL_DATA  f:20  LN: 0  Packet:FHS  Pdu: 8566  │
│ Clk    77842  ClkN   1275363328  <-- Ind LC_PL_DATA  f:66  LN: 0  Packet:ID   RSSI:-34d  │
│ Clk    77844  ClkN   1275396096  --> Req LC_PL_DATA  f: 8  LN: 1  Packet:POLL Pdu: 5622  │
│ Clk    77846  ClkN   1275428864  <-- Ind LC_PL_DATA  f:70  LN: 1  Packet:NULL RSSI:-32d  │
│ Clk    77884  ClkN   1276051456  --> Req LC_PL_DATA  f:33  LN: 1  Packet:DM1  Pdu: 9657 ↓│
│ ◁                                                                     ▷ ⊡ │
└─────────────────────────────────────────────────────────────────────────┘
```
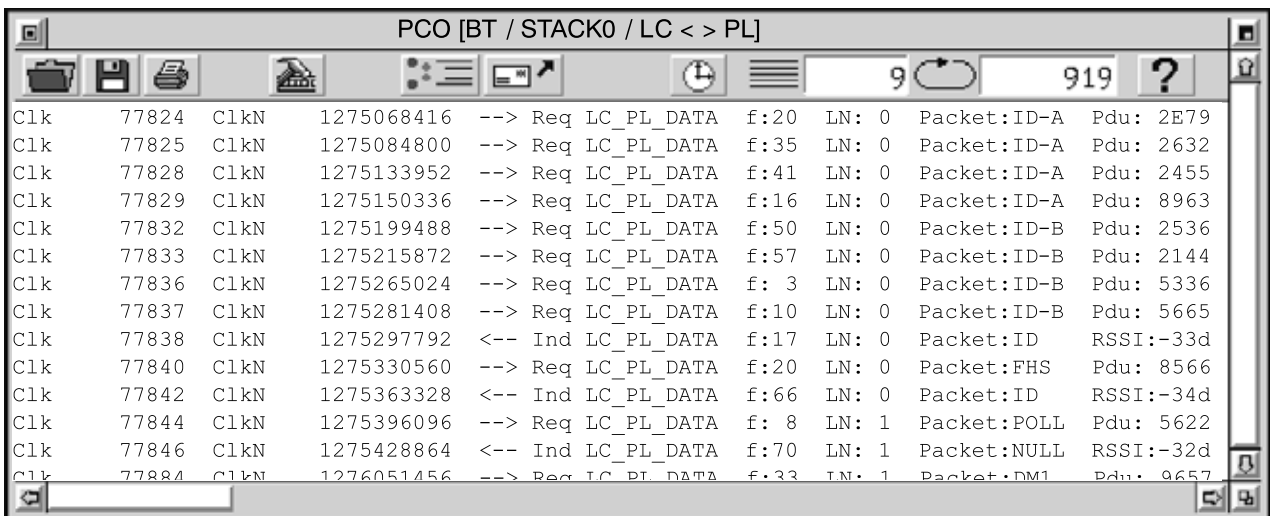
Fig. 5:  PTW 60 PCO baseband-PL

A wide range of elements per ASP is processed and displayed in a user-friendly way.

Some examples:

- Timestamp with a resolution of 312.5 µs or 1/32 µs at SAP baseband-PL
- Frequency of received/sent packet

- RSSI of received packet
- Bit error:
  - corrected bits in access code
  - corrected bits in header
  - corrected bits in payload
- PDU type
- BD_ADDR, AM_ADDR

etc

The PCOs offer a wide variety of filter options to enable the convenient analysis of the large amount of data.

MSCs represent the time-related compilation of different PCOs in columns.

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## Specifications

**RF data**

| | |
|---|---|
| TX frequency range | 2.402 GHz to 2.480 GHz |
| TX power range | −20 dBm to +18 dBm +/− 3 dB |
| RX frequency range | 2.402 GHz to 2.480 GHz |
| RX input power range | −70 dBm to −20 dBm |
| TX and RX impedance | 50 Ω |
| Modulation | GFSK with BxT = 0.5 |
| Carrier spacing | 1 MHz |
| Bit rate | 1 Mbps |

**RF interfaces**
- Split RF connectors for RX and TX path with N connectors at front panel
- External reference inputs/outputs with BNC connectors at rear panel

**Processor architecture**
- AMD-K6 processor with 233 MHz
- 4.3 GB IDE hard disk
- 64 MB RAM, can be upgraded to 128 MB
- 8.4" TFT colour LC display (640 x 480 dots)
- 3.5" floppy disk
- 3 PCI slots
- 3 ISA slots

**Digital interfaces**
- Printer port
- COM 1 with RS232 level
- COM 2 (600 to 19200 baud) with RS232 level or TLL (5 V) level, can be selected by means of microswitch
- Dual-port USB connector
- VGA connector for external monitor

**Environmental requirements**

| | |
|---|---|
| Rated temperature range | +15 °C to +35 °C |
| Operating temperature range | +5 °C to +40 °C |
| Storage temperature range | −25 °C to +60 °C |
| | standards met: DIN IEC 68-2-3 |
| Relative humidity | +40 °C  95% non condensing |
| | standards met: DIN IEC 68-2-3 |
| Mechanical resistance | |
| Vibration, sinusoidal | 5 Hz to 150 Hz |
| | standards met: DIN IEC 68-2-6 |
| Vibration, random | 5 Hz to 300 Hz |
| | standards met: DIN IEC 68-2-36 |
| Shock | 40 g shock spectrum |
| | standards met: DIN IEC 68-2-27 |

**General data**

| | |
|---|---|
| Power supply input range | 100 V to 240 V AC |
| Power supply input current | 1.3 A to 3.1 A |
| Power supply frequency range | 50 Hz to 400 Hz |

**Regulatory requirements**
Electromagnetic compatibility in line with EMC directive of EU

| | |
|---|---|
| − EMC | standards met: EN 50081-1 (1992) and 50082-2 (1995) |
| − Safety | standards met: EN 60950 (1992 + A1 2993 + A2 1993 + A3 1995) |

**Software**

| | |
|---|---|
| Operating system | LynxOS v3.0.1 |
| Graphical user interface | MGR v2.20b |

**Mechanical data**

| | |
|---|---|
| Dimensions (W x H x D) | 412 mm x 197 mm x 417 mm |
| Weight | 10 kg |

## Ordering information

| | | |
|---|---|---|
| Protocol Tester PTW60 for Bluetooth Solutions | PTW60 Basic System | 1133.3006.02 |
| PTW60BB | PTW60 Libraries for Compilation and Execution of Test Case Package; Baseband | 1133.3741.02 |
| PTW60GA | PTW60 Libraries for Compilation and Execution of Test Case Package; Generic Access Profile | 1133.4148.02 |
| PTW60LM | PTW60 Libraries for Compilation and Execution of Test Case Package; Link Manager | 1133.3841.02 |
| PTW60L2 | PTW60 Libraries for Compilation and Execution of Test Case Package; Logical Link Control and Adaptation Protocol | 1133.3793.02 |
| PTW60P1 | PTW60 Package: Basic System and PTW60 Libraries for Compilation and Execution of Test Case Package (BB, LM, L2CAP) | 1133.3893.02 |
| PTW60P2 | PTW60 Package: Basic System and PTW60 Libraries for Compilation and Execution of Test Case Package (GAP, SPP, SDAP) | 1133.3941.02 |
| PTW60P3 | PTW60 Package: Basic System and PTW60 Libraries for Compilation and Execution of Test Case Package (BB, LM, L2CAP, GAP, SPP, SDAP) | 1133.3993.02 |
| PTW60SD | PTW60 Libraries for Compilation and Execution of Test Case Package; Service Discovery Application Profile | 1133.4048.02 |
| PTW60SP | PTW60 Libraries for Compilation and Execution of Test Case Package; Serial Port Profile | 1133.4090.02 |
| PTW60EK | PTW60 encryption key length 128 bit (export licence required!) | 1133.4190.02 |
| PSP-Z2 | US keyboard with trackball | 1091.4100.02 |

## Fax Reply (Protocol Tester PTW 60 for Bluetooth™ Solutions)

❏        **Please send me an offer**

❏        **I would like a demo**

❏        **Please call me**

❏        **I would like to receive your free-of-charge CD-ROM catalogs**

Others:      _____
                  _____
                  _____

Name:                   _____

Company/Department:    _____

Position:                _____

Address:                _____

                       _____

                       _____

Country:               _____

Telephone:           _____

Fax:                       _____

E-mail:                 _____

Certified Environmental System
## ISO 14001
**REG. NO 1954**

Certified Quality System
## ISO 9001
**DQS REG. NO 1954-04**

## ROHDE & SCHWARZ