Test Receiver ESVD

for digital mobile radio networks

- For field-strength measurements in the planning stage and operation of mobile radio networks (GSM, PCN)
- For RFI measurements to European standards ENS5011 to 55022, ETS, FCC, VCCI and VDE 0871 to 0879
- In line with CISPR 16-1, VDE 0876 and ANSI C63.2

- Frequency range 20 to 1000 (2050) MHz
- Level measurement range -14 to +137 dBμV
- Frequency resolution 100 Hz, setting error <1-10^-7
- Field-strength measurements using test antennas
- Filter bandwidths for coverage measurements in cellular networks

- Programmable test receiver for selective voltage measurements in laboratory and test department
- Manual operation or control via internal or external controller
- Battery supply (int./ext.) or AC supply

ROHDE & SCHWARZ
Test Receiver ESVD is equally suitable for the measurement of signal strength and interference.

For planning and operation of mobile radio networks it is essential to know the propagation conditions in the area to be covered. Test Receiver ESVD features optimal bandwidths for mobile radio services as well as a high measurement rate so that it is ideal for fixed and mobile coverage measurements.

The number of measurements required to ensure electromagnetic compatibility is continuously increasing in the field of RFI measurements. Thanks to the built-in intelligence of Test Receiver ESVD, the time required for such measurements is reduced considerably. Being also a specialist for EMI measurements to CISPR, CENELEC, ETSI, FCC, VCCI and VDE standards, the ESVD can furnish results more rapidly and accurately than has been possible up to now.

**Description**

Test Receiver ESVD for digital mobile radio networks is a triple-conversion heterodyne receiver covering the frequency range from 20 to 1000 (2050) MHz. Its main features and facilities are:

- **RF attenuator switchable in 10-dB steps in the range 0 to 120 dB**
- **One preselector with fixed tuning and five tracking preselectors, option ESVD-B2 with four additional filters with fixed tuning**
- **Preamplifier with wide dynamic range, can be switched between preselector and 1st mixer**
- **Crystal-stabilized synthesizer as 1st LO, variable in 100-Hz steps, sweep mode for fast frequency scans; frequency accuracy complying with GSM recommendations**
- **High-level mixer ensuring high isolation of 1st LO for converting the input frequency to the first IF (1354.7 MHz or 394.7 MHz)**
- **High-level mixers for conversion to the second (74.7 MHz) and third (10.7 MHz) IF**
- **IF filters (10 kHz, 120 kHz, 300 kHz and 1 MHz) in the third IF stage with group-delay optimization**
- **Precise I/Q demodulator**
- **Highly linear envelope detector with more than 70 dB dynamic range**
- **Peak, average and quasi-peak detectors operating in parallel, which enables simultaneous measurements in different weighting modes**
- **Peak indication with IF bandwidth correction factors for measuring broadband interference (PK/MHz) automatically taken into account**
- **Measurement monitoring by means of automatic overload detection in the relevant ESVD stages and by the permanently activated peak detector**
• Logarithmic amplifier with more than 70 dB dynamic range
• 12-bit A/D converter with short conversion time
• Measurement time selectable between 1 ms and 100 s
• Flash EPROMs allowing convenient and fast firmware updating with the aid of a PC
• Digital level indication on LC display and analog level indication on moving-coil meter taking into account transducer factors and their units
• Automatic calibration at a keystroke with the aid of a high-precision built-in generator
• Demodulator circuits for FM, AM, and AO; built-in loudspeaker and headphones connector
• Automatic monitoring of all synthesizer loops and supply voltages during operation
• Detection of faulty modules by built-in selftest facilities

Design
The service-friendly modular design of ESVD ensures excellent results regarding RFI emission and immunity. A quiet, temperature-controlled blower minimizes self-heating of ESVD. Comprehensive built-in test functions allow any module requiring servicing to be easily identified and replaced independently of other modules.

Special features
• High measurement accuracy; error <1 dB
• Wide dynamic range: noise figure typ. 7 dB with preamplifier, 12 dB without preamplifier, third-order intercept point 20 dBm (without preamplifier)
• IF filter with optimum group delay ensuring fast frequency scanning and distortion-free demodulation of digitally modulated signals; correct averaging of pulse and sine signals
• Inphase and quadrature output for evaluating any modulated signal
• Frequency-dependent transducer factors are automatically taken into account
• Automatic level calibration
• Level shown on analog meter and digital display with 0.1-dB resolution
• Fast synthesizer, frequency resolution 100 Hz, any frequency step in <30 ms, sweep mode for fast frequency scanning
• Measurement of voltage, field strength, current and pulse spectral density with full indication of units
• 60-dB range also for quasi-peak and average indication; ESVD furnishes correct results at all times due to continuous level monitoring at all relevant stages of the signal path
• Parallel detectors for average, peak and quasi-peak indication
• Macros for automatic test runs
• Output of results as lists and diagrams on printer or plotter including limit lines and labelling
• Nonvolatile storage of 9 complete instrument setups and 22 transducer factors and limit lines

Functions
ESVD combines three classes of instruments in one:
- the system-compatible test receiver for GSM field-strength and EMI measurements
- the compact, manually tunable and battery-operated test receiver
- the automatic test receiver which performs EMI measurements and reports the results
Field-strength measurements in mobile radio networks

ESVD is ideal for propagation measurements in mobile radio networks thanks to its level-display accuracy, excellent frequency resolution and precision, high sensitivity as well as the 300-kHz bandwidth specially optimized for the GSM network.

The user-friendly operating concept and the easy-to-read LCDs for settings and test results make the ESVD a handy and convenient test instrument for manual operation. The internal or external battery – 12 or 24 Volt – makes the ESVD suitable for mobile use.

Within a mobile radio band the field strength can be recorded very fast on different frequencies with measurement rates of up to 2.5 ms per value. Thus, for example, field-strength statistics of several base stations in the GSM band are possible at normal speed of the test vehicle with a single receiver using the Lee method.

For additional evaluation of the signals received, the ESVD can be fitted with an I/Q demodulator (ESVD-B1). This most general type of demodulator is very important in digital communication systems as an interface between analog and digital signal processing. It allows processing of any kind of modulated signals. The characteristics of option ESVD-B1 closely follow the GSM and PCN specifications.

The frequency range of communication networks above 1 GHz is covered by the optional frequency extension to 2.05 GHz (ESVD-B2).

RFI field-strength and RFI power measurements

For solving complex EMC problems, manual measurement often is the most efficient way, as the operator can fully utilize his experience in identifying interference sources. ESVD features conventional test receiver operation with tuning knob, result indication on a meter and a built-in loudspeaker.

The results of a frequency scan are output on a printer with parallel interface or on a plotter with IEC/IEEE-bus interface. Time can be saved by the simultaneous printing of lists and plotting of graphs. Plotting is also possible during the frequency scan so that an overview of the interference spectrum can already be obtained during the measurements.

Any relevant information can be added to the test report either via a line editor or, more conveniently, via an MF2 keyboard. Information can be automatically added to the parameters known to the ESVD such as date, time and receiver settings.

Macros for semi-automatic test runs (ANALYSIS OPTIONS) match the ESVD to the specific configuration, device under test and measurement specification. Being thus prepared, the ESVD performs the following routines:

- Fast prescan measurement using the peak and/or average detector
- Determination of critical frequencies by means of limit lines with data reduction to shorten the measuring time
- Final measurement at critical frequencies using the average and/or quasi-peak detector
- Result documentation on plotter or printer

The minimum configuration consisting of ESVD, absorbing clamp and plotter is already a powerful and cost-effective test setup for RFI measurements.
Remote control

The IEC/IEEE-bus interface complies with the latest IEE Standard 488 Part 2. Measured values are output with a resolution of 0.01 dB. Up to 5000 measured values per second can be output via the IEC/IEEE bus when the ESVD is triggered externally.

Interfaces

For further signal evaluation and for driving or feeding add-on units, the ESVD is provided with the following interfaces:

- Coding and supply socket (ANTENNA CODE) for active antennas and for transducer factor coding
- 74.7-MHz IF output for a panoramic display
- 10.7-MHz IF output for evaluating the IF signal eg with an oscilloscope
- Regulated inphase and quadrature output for evaluating any modulated signal (option ESVD-B1)
- Envelope detector output (VIDEO OUTPUT) for evaluating the detected IF signal eg with an oscilloscope
- User interface with
  - 6 TTL ports for driving external devices
  - inputs for external trigger signals
  - outputs for the analog display voltage with and without meter simulation
  - RS-232 interface for updating the firmware by reprogramming the built-in flash EPROMs via an IBM-compatible PC
  - Parallel interface (PRINTER INTERFACE) for connecting a printer
  - IEC/IEEE-bus interface
  - Connector for an MF2-compatible keyboard for text entry
  - Output for internal crystal reference frequency (10 MHz)
  - Input for external battery (11 to 33 V) for battery-powered operation, eg in vehicles
Specifications

**Frequency range**
- 20 to 1000 MHz
- 20 to 2050 MHz

**Oscillator recallation at RF Input (0-dB RF attenuation)**
- 20 to 1000 MHz
- 1000 to 2000 MHz
- 20 to 2050 MHz

**Image frequency rejection, nonlinearities**

**Interference rejection**
- 20 to 1000 MHz
- 1000 to 2000 MHz
- 20 to 2050 MHz

**Preselcer**
- 20 to 1000 MHz
- 1 fixed-tuned filter
- 4 fixed-tuned filters
- 1000 to 2050 MHz

**Maximum input level**
- DC voltage: 7 V
- 130 dBm
- 97 dBm
- 7 V
- 137 dBm
- 150 V
- 1 mW

**RF shielding**
- Voltage indication of a field strength of 10 V/m with 0 dB RF attenuation (Fsf)
- Additional error in quasi-peak indication range at 10 V/m

**Intermediate frequencies**
- 1st IF: 20 to 1000 MHz
- 2nd IF: 1000 to 2050 MHz
- 3rd IF: 74.7 MHz

**IF bandwidths**
- Nominal bandwidth (±20%)
- Shape factor (±10%)

**Noise indication**
- Off
- Preamplifier
- On

**Voltage measurement range**
- Lower limit (additional error caused by inherent noise <1 dB)

**Level indication**
- Digital
- Analog

**Operating ranges**
- Detectors
- Measuring times
<table>
<thead>
<tr>
<th>Measurement error (AV for S/N = 16 dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 1000 MHz</td>
</tr>
<tr>
<td>0 to 55°C</td>
</tr>
<tr>
<td>-10 to 0°C</td>
</tr>
<tr>
<td>-10 to 55°C</td>
</tr>
<tr>
<td>1000 to 2050 MHz</td>
</tr>
<tr>
<td>Level calibration</td>
</tr>
<tr>
<td>Demodulation modes</td>
</tr>
<tr>
<td>Date, time of day</td>
</tr>
<tr>
<td>Connectors and interfaces</td>
</tr>
<tr>
<td>Remote control</td>
</tr>
<tr>
<td>Interface to IEC 625-2 (IEEE 488)</td>
</tr>
<tr>
<td>24-contact Amphenol connector, female</td>
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<tr>
<td>EIA interface</td>
</tr>
<tr>
<td>Printer connection</td>
</tr>
<tr>
<td>[13-contact Cannon connector, female]</td>
</tr>
<tr>
<td>Frontpanel outputs</td>
</tr>
<tr>
<td>Supply and coding connector</td>
</tr>
<tr>
<td>For antennas etc</td>
</tr>
<tr>
<td>AF output</td>
</tr>
<tr>
<td>Rearpanel outputs</td>
</tr>
<tr>
<td>Gain ref to RF input</td>
</tr>
<tr>
<td>RF attenuation 0 dB</td>
</tr>
<tr>
<td>IF 10.7 MHz</td>
</tr>
<tr>
<td>IF 10.7 MHz</td>
</tr>
<tr>
<td>BPM in range of analog level display</td>
</tr>
<tr>
<td>for unmodulated sine wave signal,</td>
</tr>
<tr>
<td>bandwidth = IF bandwidth,</td>
</tr>
<tr>
<td>operating range 30 dB</td>
</tr>
<tr>
<td>60 dB</td>
</tr>
<tr>
<td>Envelope detector output</td>
</tr>
<tr>
<td>BPM in range of analog</td>
</tr>
<tr>
<td>level display, operating range 30 dB</td>
</tr>
<tr>
<td>60 dB</td>
</tr>
<tr>
<td>Inphase/quadrature demodulator outputs</td>
</tr>
<tr>
<td>(option ESVD-B)</td>
</tr>
<tr>
<td>EMF (peak value, regulated)</td>
</tr>
<tr>
<td>Bandwidth</td>
</tr>
<tr>
<td>Phase error between I and Q</td>
</tr>
<tr>
<td>for S/N = 40 dB</td>
</tr>
<tr>
<td>Output frequency</td>
</tr>
<tr>
<td>10 to 100 kHz</td>
</tr>
<tr>
<td>100 to 200 kHz</td>
</tr>
<tr>
<td>for signals to ISMA Rec. 5.0.4</td>
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<tr>
<td>1000 to 2000 kHz</td>
</tr>
<tr>
<td>Reference output</td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>3 x 3 m, 7&quot; peak</td>
</tr>
<tr>
<td>BPM connector, female</td>
</tr>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>AC supply</td>
</tr>
<tr>
<td>Battery</td>
</tr>
<tr>
<td>Internal</td>
</tr>
<tr>
<td>Operating time</td>
</tr>
<tr>
<td>External</td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
</tr>
<tr>
<td>Weight without options</td>
</tr>
<tr>
<td>Other accessories</td>
</tr>
<tr>
<td>6V lead-acid storage battery 10 Ah</td>
</tr>
<tr>
<td>(2 required)</td>
</tr>
<tr>
<td>Keyboard (English)</td>
</tr>
<tr>
<td>Headphones</td>
</tr>
<tr>
<td>Service manual</td>
</tr>
<tr>
<td>Service Kit</td>
</tr>
<tr>
<td>19&quot; Rack Adapter with front handles</td>
</tr>
<tr>
<td>without front handles</td>
</tr>
<tr>
<td>Set of Front Handles</td>
</tr>
<tr>
<td>Trolley</td>
</tr>
<tr>
<td>Printer Cable</td>
</tr>
<tr>
<td>IEC Bus Connecting Cable, 1 m</td>
</tr>
<tr>
<td>General data</td>
</tr>
<tr>
<td>Rated temperature range</td>
</tr>
<tr>
<td>Storage temperature range</td>
</tr>
<tr>
<td>Mechanical resistance</td>
</tr>
</tbody>
</table>

### RFI suppression

- 5 dB (digital display)
- 5 dB (digital display)
- 2 dB (analog display)
- 3 dB (analog display)

- A0 [zero beat]
- A3 [for ATE emissions]
- F3 [for FSE emissions]
- internal clock, permanently operated from internal battery

### Ordering information

- **Order designation:** Test Receiver ESVD 1026.9001.02
- **Power supply:** 1026.9006.10
- **Battery**
  - **Internal:** 12 V, 10 Ah
  - **External:** approx. 2 h
  - **Dimensions:** 455 mm x 236 mm x 460 mm
  - **Weight without options:** 26 kg with / 23 kg w/o battery

### Recommended extras

- **Interference measurements:**
  - **Current Probe:** EZ-17 816.2063.02
  - **VHF Current Probe:** EZ-17 816.2063.03
  - **Antenna Radiator:** ESVDZ 353.7091.02
  - **Absorbing Clamp:** MDS-21 194.0100.50
  - **Tram Radiator:** HUZ-1 350.0125.22
  - **Triax Radiator:** HUZ-1 400.0752.02
  - **Biconical Antenna:** HUZ-1 350.0125.22
  - **Other accessories:**
    - **6V lead-acid storage battery 10 Ah** (2 required)
      - **PSA** 1009.1000.42
      - **Headphones** 1102.2509.02
      - **Service manual** 1016.2578.24
      - **Service Kit** 816.1067.02
      - **Front Handles** ZZA-95 396.4911.00
      - **Set of Front Handles** ZZA-95 396.9488.00
      - **Transit Case** ZZA-95 396.5176.00
      - **Trolley** ZZA-95 1013.3989.00
      - **Printer Cable** ZZA-95 1014.0105.00
      - **IEC Bus Connecting Cable, 1 m**
      - **IEC Bus Connecting Cable, 2 m** PCK 292.2013.10
      - **IEC Bus Connecting Cable, 2 m** PCK 292.2013.20

### Certified Quality System

ISO 9001