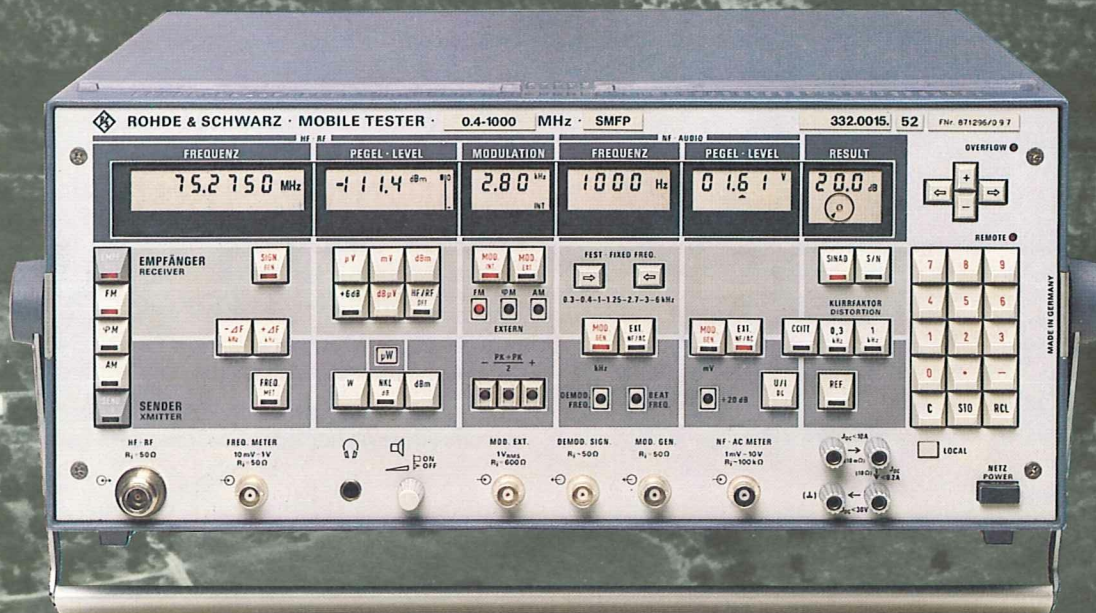


MOBILE TESTERS SMFP and SMFS

0.4 to 1000 MHz



IEC 625 Bus

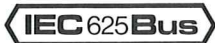
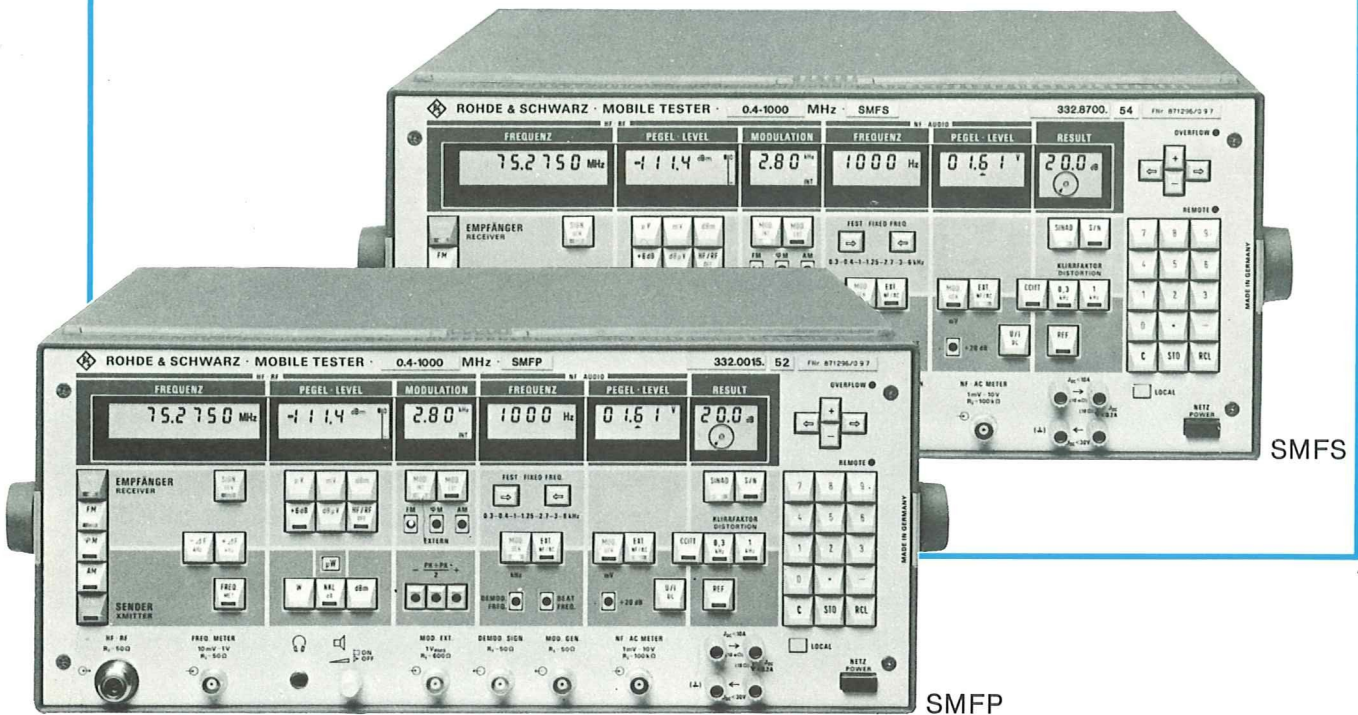
SMFP: Transceiver test set with IEC-bus interface
for fully automated measurements

SMFS: Manual transceiver test set with intelligent measurement routines

GENERAL

Mobile Testers SMFP and SMFS

◆ 0.4 to 1000 MHz



SMFP/SMFS features

- Compact testers for AM, FM and ϕ M radiotelephones
- Manual operation and semi-automatic or fully automatic measurements, depending on type and configuration

Both test sets contain all measurement capabilities required for transceiver testing; see next page.

Other common features:

- High measurement accuracy and high test rate
- Use in servicing, production and development
- Easy-to-grasp front-panel configuration and microprocessor-controlled key interlocking together with semi-automatic measurement routines for easy operation
- Many automatic settings and test routines - e.g. 6-dB bandwidth, acknowledgement signal
- Compact, handy unit requiring little bench space and suitable for battery operation
- Options available to extend the range of applications

Additional SMFP features

Basic unit for the following test systems:

- Self-contained semi-automatic transceiver test set for servicing in the field as well as in lab conditions
- Extended test assembly for servicing and batch testing - fully automatic, flexible and easy to operate thanks to the Process Controller PPC or PUC
- Test system for large-scale production testing, backed by controller and minicomputer (and data bank)

Differences between SMFP and SMFS

The two test sets embody the same basic design and offer the same measurement capabilities; they differ only in

- measuring convenience
 - SMFP:** IEC-bus compatible, can be built into fully automatic computer-controlled test assemblies
 - SMFS:** manual operation with semi-automatic measurement routines
- modulation generator
 - SMFP:** continuous tuning from 10 Hz to 25 kHz, crystal reference, synthesizer; 7 fixed frequencies
 - SMFS:** 12 fixed frequencies from 0.1 to 10 kHz, with option same as SMFP

CHARACTERISTICS, OPERATION

Characteristics, uses, configurations

With the Mobile Testers SMFP and SMFS, integrated test systems for **all transceiver measurements** are available for the first time. Manual and automatic operation, mobile and stationary use, universal measuring capabilities and high measuring speed together with high technical performance are just some of the advantages of these versatile systems for use in development, test departments, final test and servicing.

Both testers contain all the facilities required for precision measurements on transceivers (see listing below). While the SMFS is exclusively designed for manual operation, **all test parameters and measurements can be programmed for the SMFP with the aid of a controller**, simple IEC-bus instructions and basic software ensuring fast programming.

Measuring and control devices in SMFP and SMFS		Receiver test	Transmitter test
RF GENERATOR	0.4 to 520 MHz (to 1000 MHz with option)	●	
MODULATION GENERATOR		●	●
- SMFP:	continuous tuning plus 7 fixed frequencies		
- SMFS:	12 fixed frequencies (continuous tuning with option)		
RF FREQUENCY METER	1 to 520 MHz (to 1000 MHz with option)		●
POWER METER	up to 30 W		●
SINAD METER	switch-selected CCITT weighting filter	●	
S/N METER	switch-selected CCITT weighting filter	●	●
MODULATION METER	for AM, FM and φM		●
- Switch selection of positive, negative or mean peak value			
	switch-selected CCITT weighting filter		
SPURIOUS-MODULATION METER			●
- true rms meter			
	switch-selected CCITT weighting filter		
AF VOLTMETER	switch-selected CCITT weighting filter	●	
DISTORTION METER	switch-selected CCITT weighting	●	●
AF FREQUENCY METER	20 Hz to 1 MHz	●	●
BEAT-FREQUENCY METER			●
- with loudspeaker and connector for headphones			
DC VOLTMETER and AMMETER		●	●
ADJACENT-CHANNEL POWER METER (option)			●
CONTROL DEVICE	for transceiver (optional with SMFS)	●	●
- 12 TTL control lines and relay matrix			
AURAL MONITORING	with loudspeaker and headphones	●	●
ANALOG DISPLAY	(option)	●	●
- with oscilloscope and analog indicators			

Operation, measurement routines, indication

The controls of the SMFP and SMFS are arranged in different sections of different colours according to the measurement mode (transmitter or receiver) and the setting or the parameter to be measured. This **logical organization of the front panel** ensures errorfree operation without any training and fast access to the automatic routines. Moreover, illuminated keys for data setting and the readout of measurements in progress prevent erroneous interpretation of the measured values. By switching to receiver test or transmitter test the SMFP or SMSF is completely preset for the particular measurement.

Measurement routines. The possibility of choosing manual operation or calling up automatic measurement routines makes for versatile use of the test set on the one hand and speedy and errorfree measurement of repetitive standard values on the other.

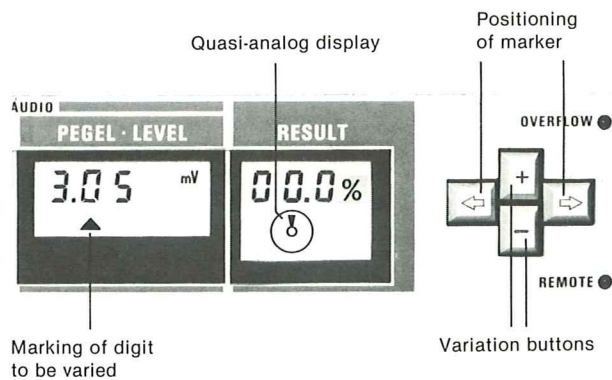
Indication. Six LCDs **simultaneously** read out virtually **all the test results**, eliminating reading errors and enabling the interdependence of individual parameters to be determined. A **quasi-analog display** which can be assigned to virtually any desired digit of the LCDs simplifies adjustments and indicates tendencies.

DESCRIPTION

Parameter setting

Automatic settings and automatic routines in both the SMFP and the SMFS, assigned to particular modes for receiver and transmitter testing, spare the user the repetitive settings which are otherwise needed over and over again in day-to-day measurements (a summary of the main automatic settings is given on page 6). Special buttons and the keypad further permit all the additional measurements required for a complete check of a transceiver.

Parameters that differ from the automatic test routines can be altered **with the keypad**. With the four buttons arranged to the right of the displays any frequency or level value of the AF and RF generators as well as the modulation can also be varied continuously (illustration below). Two buttons designated with arrows shift a marker beneath the display until it indicates the digit to be varied. The other two buttons (“+” and “-”) then permit this digit to be varied in steps or, if kept depressed, in a fast sequence. Since the carry of the digit varied is also considered automatically, the test set offers the user, besides the digital entry via the keypad, quasi-analog tuning with selectable resolution. It is also possible to vary the frequency of the RF generator in steps of any desired size (e. g. from channel to channel) with the two keys “+ Δf ” and “- Δf ”.

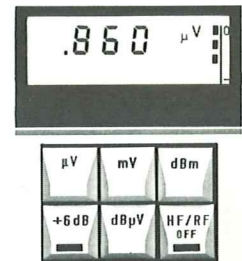


Buttons on mobile test set for varying any desired digit of level and frequency of RF and AF generators as well as modulation

RF generator

The output voltage of the RF generator is entered in μV , mV, dB μV or dBm. Conversion from one physical unit to another is initiated at the push of a button without cutting off or changing the RF level. The output voltage can also be reduced by up to 10 dB with an electronic attenuator without cutting off the level, as is necessary, for example, for an exact determination of squelch hysteresis. The setting of the attenuator is read out on the RF-level display and is a

reliable indication of whether the range of variation is likely to be exceeded (see illustration). The keys RF OFF and +6 dB permit fast variation of the RF level.



SMFP/SMFS output-level display combined with readout of electronic-attenuator setting plus keys for entry and conversion of physical units

AF generator

Seven (SMFP) or twelve (SMFS) standard frequencies of the modulation generator can be called up at the push of a button and varied proceeding in either direction. These cover all of the important modulation frequencies for transceiver testing. In the SMFP - or the SMFS with option - all other frequencies in the AF range can be set with crystal accuracy and high resolution via the keypad or the variation buttons. In both cases it is possible to increase the output-level setting by 20 dB with the aid of a special key, thus simplifying overmodulation measurements, which are an absolute necessity when testing modulation limiters for instance.

Transmitter test/receiver test selection

The two main modes of operation - **transmitter test** and **receiver test** - are selected automatically according to the power arriving from the transceiver. The switchover can moreover be initiated or inhibited by pressing a button so that parts of each test may be combined. For example, the SINAD ratio of a receiver can be checked during a transmitter test to determine the useful-signal transfer in duplex operation.

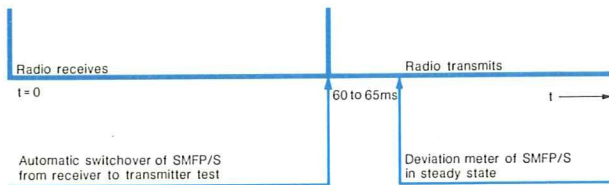
On switching from transmitter to receiver test, the **frequency of the RF generator** is set automatically **either**

- to a frequency entered over the keypad **or**
- to the transmit frequency of the transceiver measured **or**
- to the duplex pair frequency in the upper or lower band.

When the operating mode is switched over, **all test parameters** are **stored** and - provided the operator does not alter them in the meantime - automatically reset upon recalling. So no new entries are required even with repeated switchover.

MEASUREMENT CAPABILITIES

When the transmit frequency of the transceiver is entered via the keypad and the deviation meter is on, the mobile test set switches within 70 ms from receiver to transmitter test. This makes it possible to measure transceivers that send an acknowledgement signal.



Chronological sequence for testing transceivers that send an acknowledgement signal

Transmitter test

In transmitter testing the SMFP/SMFS measures automatically

- the **transmit frequency** of the transceiver with 10 Hz resolution,
- the **transmitter power** in W or dBm and
- the **modulation** with high resolution (using the self-tuning demodulators).

At the push of a key the test set increases or decreases the level of the modulation generator until the modulation entered over the keypad is reached. If no modulation has been entered, the test set adjusts to the modulation value last entered for the receiver test. The level of the modulation generator then represents

the modulation sensitivity

for the entered modulation, which is read out as a true measured value on the MODULATION display.

By simply selecting the modulation-generator frequencies one after the other,

the **modulation frequency response** of the transceiver can be determined rapidly. On the SMFP, for example, a relative value in dB – referred to any measured or keyed-in value – can be displayed in addition to the absolute value.

For measurements on **selective calling equipment** the test sets can be preset to ensure quick response of the demodulators. The tone sequence can be applied from a front-panel output to a selective-call evaluation unit.

Also at the push of a key the test set determines

the modulation distortion in %

or, by switching the modulation voltage cyclically on and off,

the signal-to-noise ratio in dB

of the transceiver; the result is read out on the RESULT display.

Fitted with the

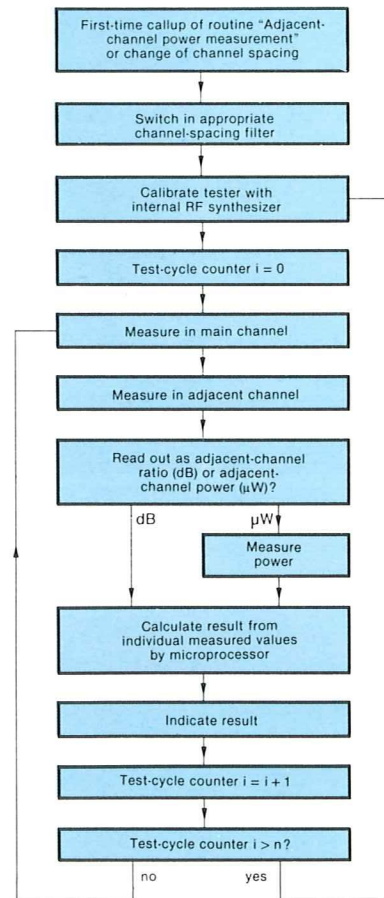
Adjacent-channel Power Meter option (SMFP-B6)

the SMFP or SMFS measures the transceiver radiation in the adjacent channels. For this the channel spacing and the nominal transmit frequency of the transceiver must simply be entered over the keypad. Readout of the adjacent-channel power ratio in dB relative to the carrier power or direct readout of the absolute value of the adjacent-channel power in μW can be selected.

The additional AF generator with 1-kHz fixed frequency in conjunction with the modulation generator permits **double-tone modulation of radiotelephone**. Resulting intermodulation products that lie in the adjacent channel can be measured directly with the adjacent-channel power meter.

If the modulation is switched off during transmitter measurement, the test set indicates the spurious modulation of the radiotelephone, broadband or CCITT weighting being selectable.

After attenuation by 30 dB the decoupled transmitter signal is available on the rear panel of the test set for checking purposes using an oscilloscope or a spectrum analyzer.



Comprehensive automatic internal test routines (see page 6) offer extreme operating ease combined with high accuracy: simplified flow chart for automatic test routines for adjacent-channel power measurement

MEASUREMENT CAPABILITIES

Receiver test

In receiver testing, the test parameters such as frequency, RF level, modulation and modulation frequency are preset and the SMFP/SMFS measures, in addition to the level of the transceiver AF output signal, either the **SINAD ratio** or, with the modulation cyclically switched on and off, the **signal-to-noise ratio** with or without CCITT weighting. If a certain SINAD or S/N ratio is entered over the keypad, the test set will automatically increase or decrease the RF level until the entered value is obtained. The RF level obtained represents the **sensitivity** of the transceiver and is indicated on the LEVEL display; the corresponding SINAD or S/N ratio appears on the RESULT display as a true measured value. The RF OFF key facilitates rapid testing of the squelch function and electronic level fine adjustment without interruption of the level permits an accurate determination of **squelch hysteresis**.

The SMFP/SMFS measures

the 6-dB bandwidth

with a single keystroke and indicates either bandwidth or bandwidth plus frequency offset. By varying the modulation frequency or selecting several one after the other,

the AF frequency response of the receiver

can readily be determined. As in transmitter measurement, it is possible to read out the absolute level or the relative value in dB referred to any measured or keyed-in value.

The built-in distortion meter permits checking

the AF distortion

of the transceiver and the 1-kHz fixed-frequency oscillator allows simultaneous frequency and amplitude modulation of the carrier for

checking AM suppression.

If the 1-kHz signal is used for the FM, the built-in distortion meter can be used for this test.

Main automatic settings

Transmitter test	Measurement of frequency, power and modulation
Receiver test	Measurement of AF level
Transmitter test/receiver test selection	Switchover controlled by arriving/missing radio transmitter power with automatic setup of the tester
Receiver test frequency	Use of the transmitter frequency as receiver test frequency (in the case of duplex operation with + or - offset)
Fast deviation measurement	With preset $f_{\text{transmit}} - 200$ kHz output of the demodulated signal immediately upon transmitter switch-on
Acknowledgement signal test	Switchover from receiver to transmitter test within 70 ms (transient time of deviation meter) after transmitter switch-on
SINAD ratio measurement	Setting of 1-kHz modulation frequency
Distortion measurement	Setting of appropriate AF frequency

Main automatic test routines

Routine	Function	Display
Sensitivity, SINAD or S/N ratio	Variation of RF level until entered value is reached	SINAD or S/N ratio and corresponding RF level
Frequency response	Measurement with instantaneous measured value or programmable value as reference value	+ dB or - dB
6-dB bandwidth	Determination by variation of RF level and RF frequency	Bandwidth and centre-frequency error
Modulation sensitivity	Variation of modulation level until entered modulation is reached	Modulation and AF level
Adjacent-channel power ratio	Determination of power in upper or lower adjacent channel	Relative in dB or absolute value in μW

MEASUREMENT CAPABILITIES

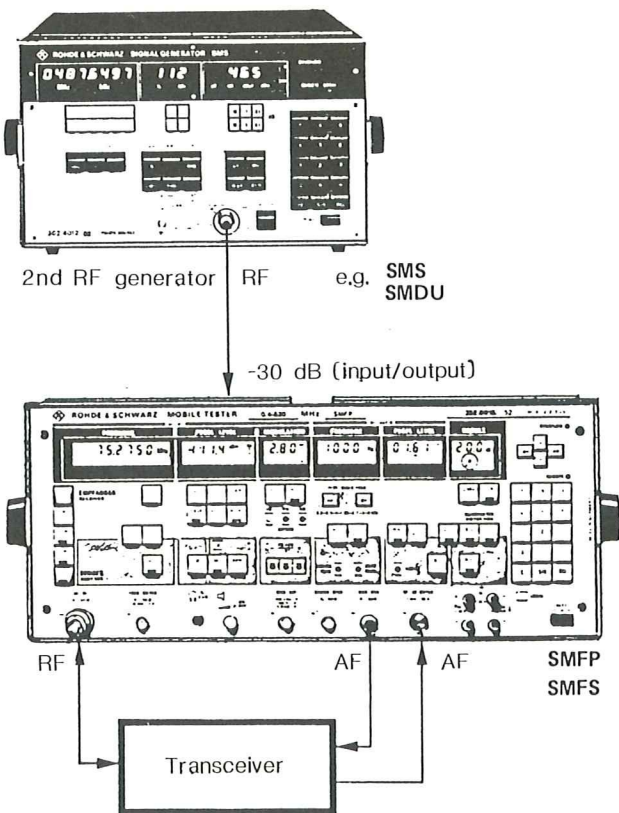
Two-signal measurements

For receiver measurements requiring two signal generators, the SMFP/SMFS has a rear RF input/output isolated by 30 dB from the main RF input/output on the front panel. All two-signal measurements, e. g. of

- adjacent-channel selectivity,
- intermodulation and cross-modulation,
- blocking,

can thus be performed without further accessories (attenuators, power distributors, etc.).

For very exacting two-signal measurements – e. g. for determining adjacent-channel selectivity – the second signal source should be an extremely low-noise type. The R&S Signal Generator SMDU is very well suited for this purpose.

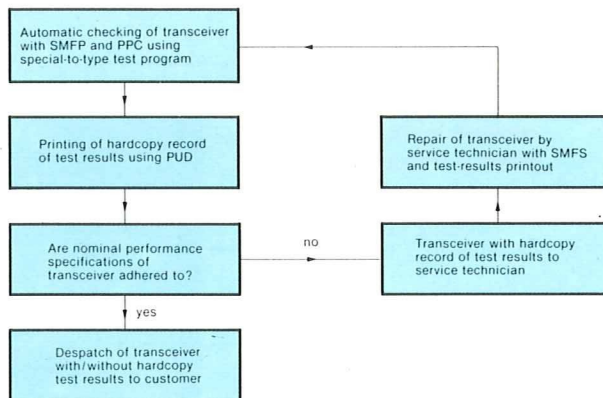


Test setup for two-signal measurements and measurements on repeaters

To perform measurements on repeaters, a second signal can again be fed into the RF path via the RF input/output on the rear to drive the repeater while the Mobile Tester measures the transmit signal from the repeater.

Application areas

Servicing. The TR test sets SMFP and SMFS contain all test facilities required for servicing and repair and thus offer an extremely cost-effective solution. In addition to automatic checking of the performance specifications of the transceiver in inwards repairs or checkout of the repaired transceiver the automatic firmware test routines provided in the SMFP and SMFS as well as device presetting for transmit



Example of organization of radio service workshop using Mobile Test Set SMFP/SMFS, Process Controller PPC or PUC and Universal Printer PUD

ter and receiver tests are of particular advantage. The SMFP and SMFS also permit reliable manual performance checking of the transceiver. Moreover, thanks to their small size, light weight and battery powering capability they are ideal for mobile use.

Test department. The SMFS and SMFP are used to advantage wherever automatic, semi-automatic and manual measurements are to be carried out in parallel, such as in the test department where test programs are many times interrupted by necessary adjustments or repairs. Their small size allows them to be fitted into every work bench. If a process controller is used for setting up the SMFP and calling up the test routines the test set can even be completely covered up in the work bench. As a dialog partner there will then be only the process controller.

Final check. The SMFP contains all test and control devices required for transceiver testing. By combining it with a process controller and a programmable power supply (e.g. NGPU from R&S) an automatic test set for checkout can be formed which can readily be accommodated thanks to the little space it requires.

The test results can be output to a printer, for example via a parallel interface of the process controller used.

MOBILE TESTER SMFP

Blue: receiver measurement
Red: transmitter measurement
Italics: receiver and transmitter measurement

RF level display
 Level ($\mu\text{V}/\text{mV}/\text{dBm}/\text{dB}\mu\text{V}$)
 and fine adjustment
 Level for entered S/N or SINAD ratio
 Transmitted power (W/dBm)
 Adjacent-channel power (dB/ μW)

Modulation display
 Modulation in kHz,
 % or rad
 Pos./neg./mean modulation in kHz,
 % or rad
 FM or ϕM from input RF frequency meter

RF frequency display
 Test frequency
 Frequency offset (for bandwidth measurement)
 Transmit frequency
 Nominal frequency (for adjacent-channel power measurement)
 External RF frequency

Setting of the entered RF frequency

Receiver test

Type of transceiver
 Internal modulation
 Type of demodulation

Transmitter test

Variation in steps of channel spacing entered

RF Output
 RF Input

Frequency meter and deviation meter
 RF external (remote measurement)

Setting of the entered RF level and increase by 6 dB

RF signal cut-off

Adjacent-channel power measurement

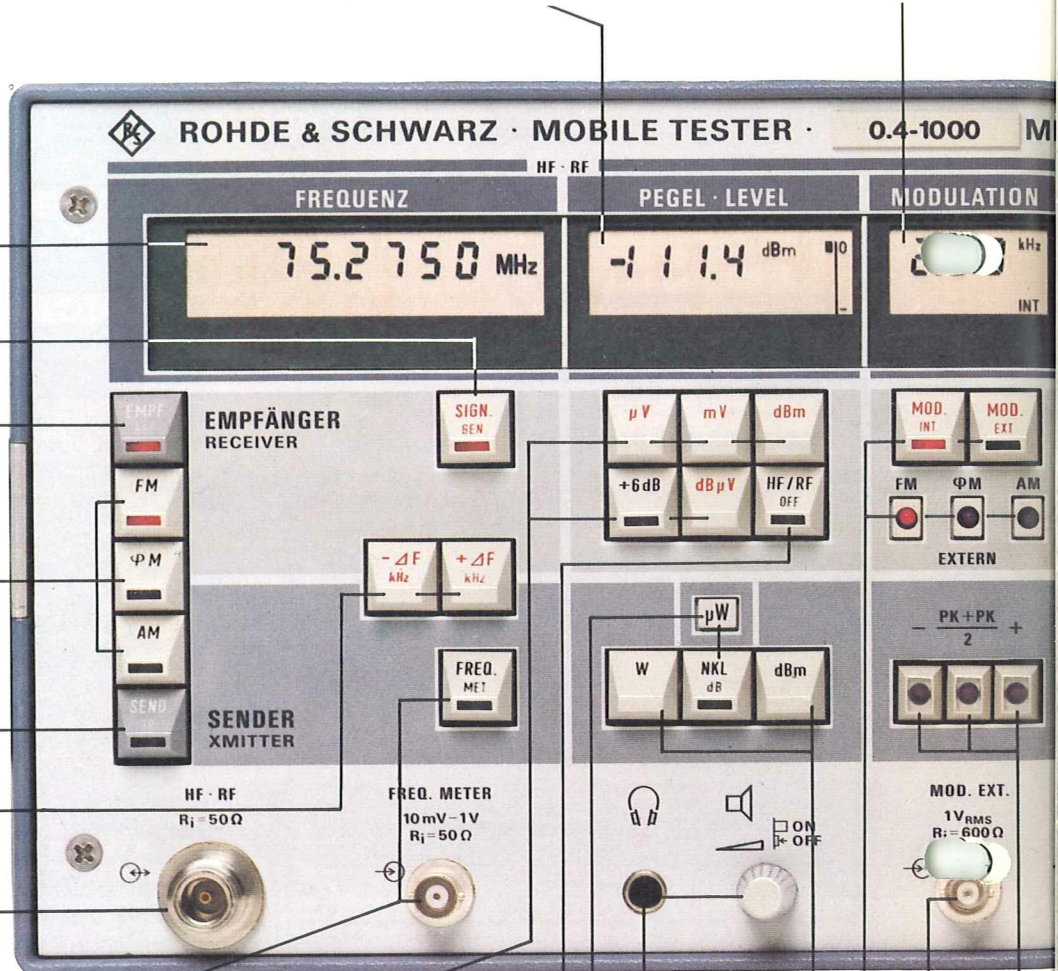
ON/OFF volume
 loudspeaker
 Headphones socket

Power measurement

Input Modulation signal

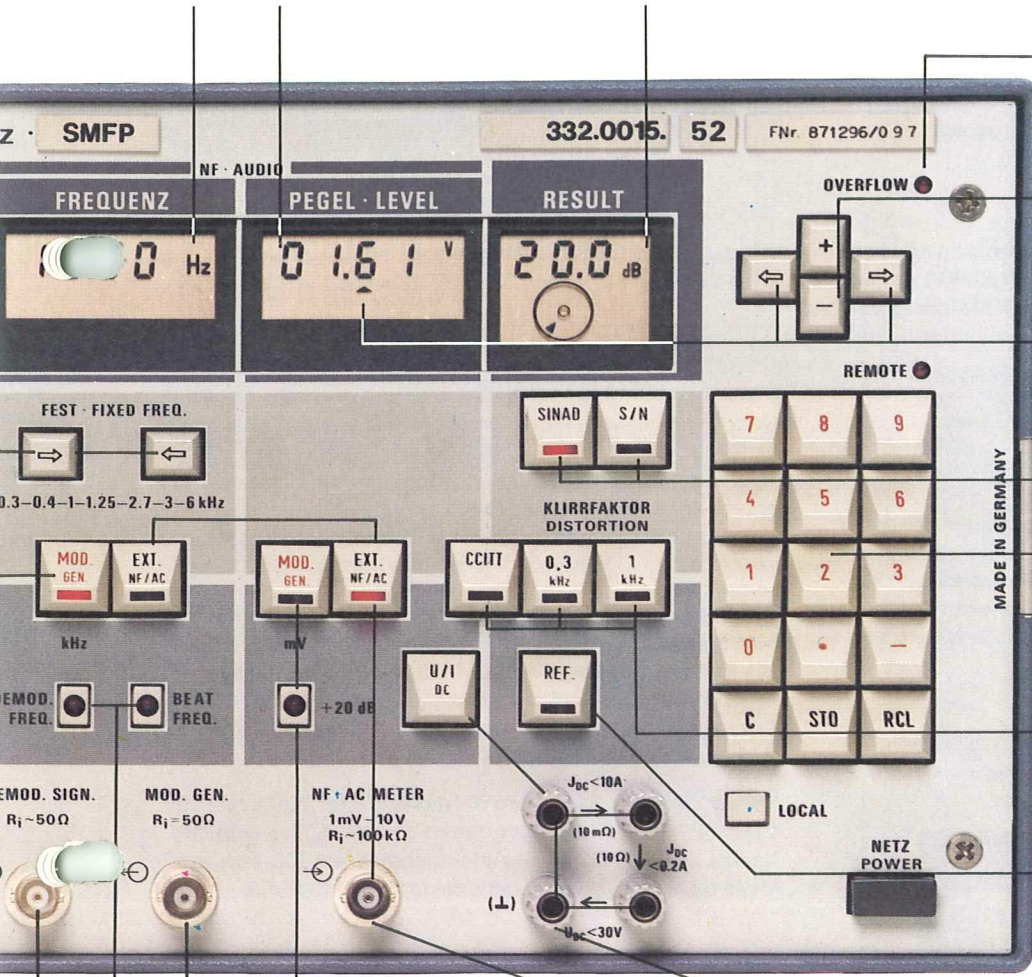
Selection of type of modulation and setting of entered data

Measurement of positive mean modulation



FRONT PANEL DETAILS

Frequency display
 Mod. frequency internal
 bandwidth
 Mod. generator frequency
 Demodulated AF
 External AF
 AF level display
 AF level
 Level mod. generator
 External DC currents
 and voltages
 Result display
 digital:
 S/N or SINAD ratio
 Distortion (input
 AF voltmeter)
 AF level (in dB above
 reference value)
 analog (tendency):
 AF voltage, distortion,
 S/N or SINAD ratio
 digital:
 Distortion
 S/N ratio
 analog (tendency):
 Modulation
 Distortion
 S/N ratio



Overflow indication
 (illegal entry,
 out-of-range)
 Variation of
 parameters selected
 with the cursor
 Cursor shift
 REMOTE
 Sensitivity measurement
 (SINAD, S/N)
 Test parameter entry
 Recall of automatic
 routines and settings
 CCITT filter and
 distortion meter
 Call of special
 functions, routines
 and settings
 DC ammeter
 and voltmeter

Output
 Demodulated
 signal
 Modulation
 frequency and
 setting of
 fixed/entered
 frequencies
 Frequency
 measurement
 of demodu-
 lated signal
 and beat
 Output
 Modula-
 tion
 generator
 Setting of
 modulation
 level and
 increase
 by 20 dB
 Frequency
 and level
 meter
 AF external

Blue: receiver measurement
Red: transmitter measurement
Italics: receiver and transmitter measurement

RF level display
 Level ($\mu\text{V}/\text{mV}/\text{dBm}/\text{dB}\mu\text{V}$)
 and fine adjustment
 Level for entered S/N or SINAD ratio
 Transmitted power (W/dBm)
 Adjacent-channel power (dB/ μW)

Modulation display
 Modulation in kHz,
 % or rad
 Pos./neg./mean modulation in kHz,
 % or rad
 FM or ϕM from input RF frequency meter

AF frequency display
 Mod. frequency internal
 Bandwidth
 AF generator frequency
 Demodulated AF
 External AF

AF level display
 AF level
 Level mod. generator
 External DC currents and voltages

Result display
 digital:
 S/N or SINAD ratio
 Distortion (input AF voltmeter)
 AF level (in dB above reference value)
 analog (tendency):
 AF voltage, distortion, S/N or SINAD ratio

digital:
 Distortion
 S/N ratio
 analog (tendency)
 Modulation
 Distortion
 S/N ratio

RF frequency display
 Test frequency
 Frequency offset (for bandwidth measurement)
 Transmit frequency
 Nominal frequency (for adjacent-channel power measurement)
 External RF frequency

Setting of the entered RF frequency

Receiver test

Type of transceiver
 Internal modulation
 Type of demodulation

Transmitter test

Variation in steps of channel spacing entered

RF Output
 RF Input

Frequency meter and deviation meter
 RF external (remote measurement)

Setting of the entered RF level and increase by 6 dB

Adjacent-channel power measurement

ON/OFF volume
 loudspeaker
 Headphones socket

Power measurement

Selection of type of modulation and setting of entered data

Measurement of pos./neg. mean modulation

Modulation frequency and setting of fixed/entered frequencies

Output Demodulated signal

Frequency measurement of demodulated signal and beat

Output Modulation generator
 Setting of modulation level and increase by 20 dB

Overflow indication (illegal entry, out-of-range)

Variation of parameters selected with the cursor

Cursor shift

Sensitivity measurement (SINAD, S/N)

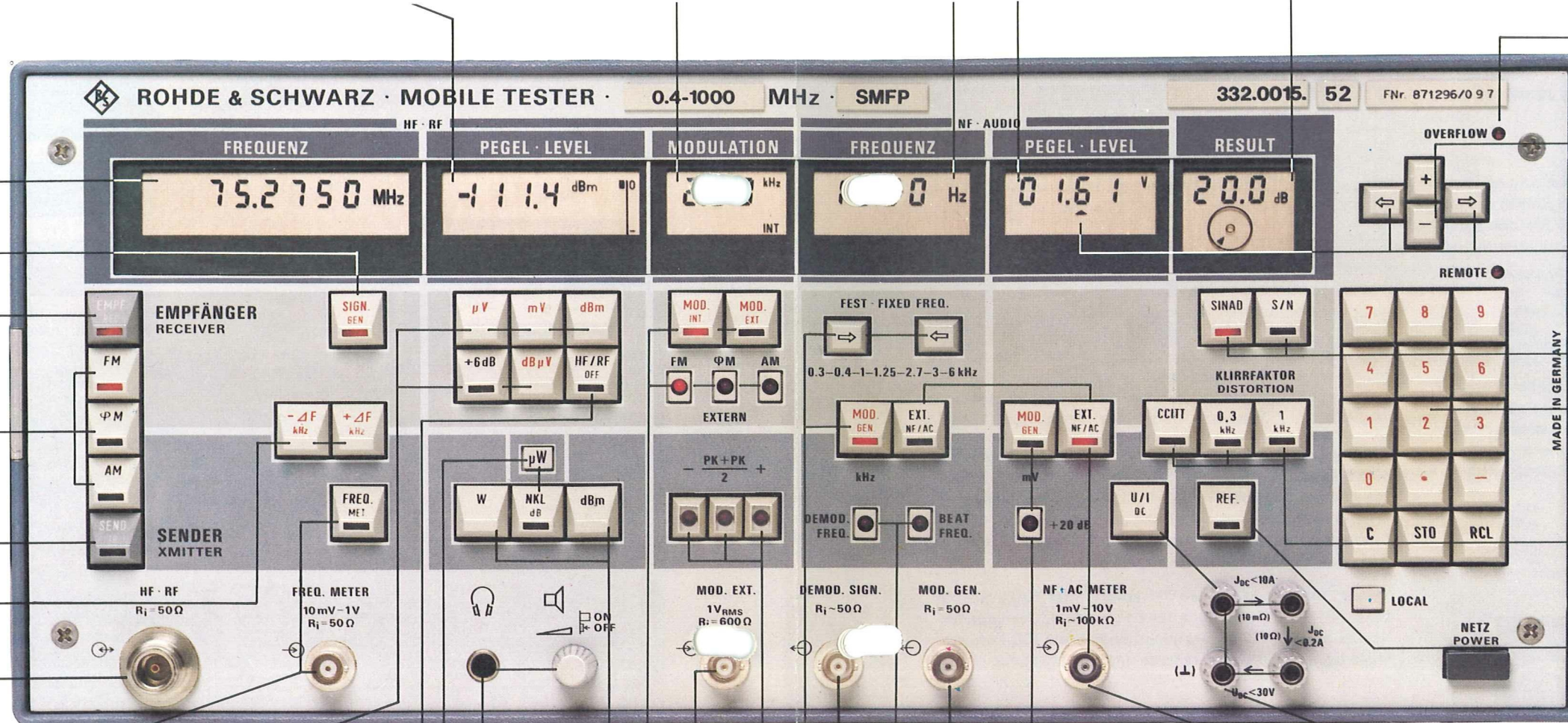
Test parameter entry
 Recall of automatic routines and settings

CCITT filter and distortion meter

Call of special functions, routines and settings

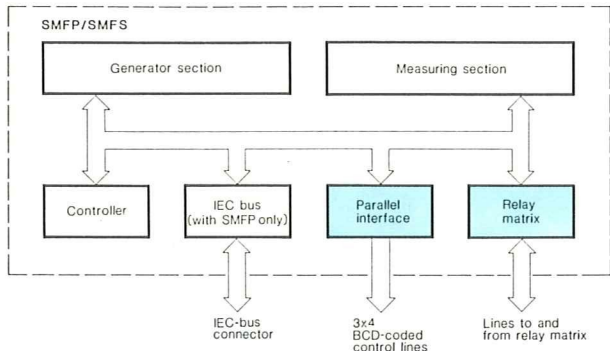
DC ammeter and voltmeter

Frequency and level meter
 AF external



AUTOMATIC OPERATION

Interface for Remote Control SMFS-B5 (option with SMFS)

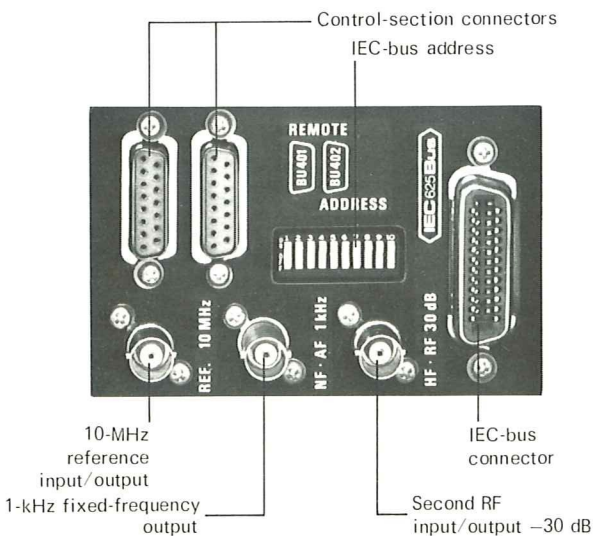


Basic diagram of SMFP and SMFS subdivided into generator, measuring and control sections;
blue: standard with SMFP, optional with SMFS

3x4 programmable BCD-coded control lines and an AF relay matrix (standard with SMFP, optional with SMFS) permit **automatic setting of the transceiver** from the computer (SMFP) or over the keypad (SMFP, SMFS) both prior to and during the measurement. For example,

- channel selection,
- transmitter/receiver switchover,
- loudspeaker on/off
- squelch on/off

and the control of non-IEC-bus-compatible accessory equipment can be programmed. The relay matrix can also be used as a signal scanner. An additional relay is coupled with the transmitter/receiver switchover, so the transceiver mode can be switched simultaneously when the mode is switched on the front panel of the test set.



Rear panel of SMFP/SMFS

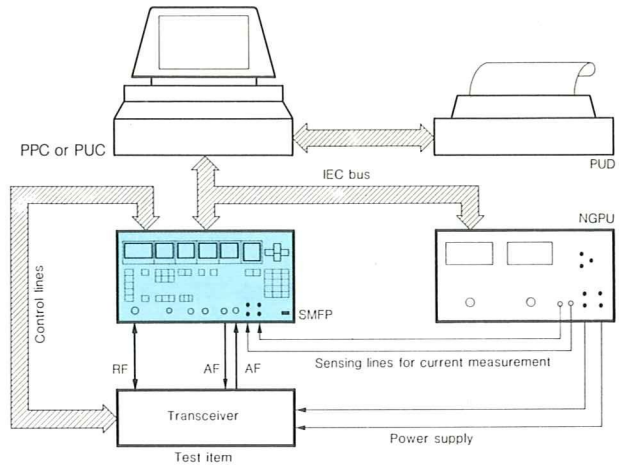
Fully automatic operation with SMFP

Extension possibilities

In conjunction with a controller the SMFP forms a fully automatic transceiver test assembly. The control section

contained in the SMFP (see diagram left) takes charge of setting the transceiver during the test, so no additional interfaces are required.

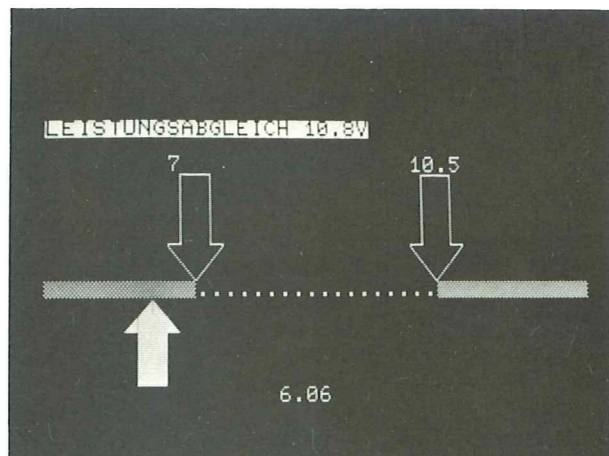
Simple **IEC-bus instructions** combinable with internal **test routines** and an elaborate **basic software** (SMFP-K1; page 11) facilitate rapid program writing.



Fully automatic transceiver test assembly with Mobile Tester SMFP, Process Controller PPC or PUC, Universal Printer PUD and Programmable Power Supply NGPU

Controller. For extending the SMFP to form a fully automatic transceiver test assembly (illustration above), use of the **Process Controller PPC or PUC** with built-in floppy-disk drive is recommended, permitting program and data output in seconds and providing a large screen for good readability and neat display of program and measured data.

Printer. The new, low-priced **Universal Printer PUD** available for the PPC and PUC, which can be connected to a separate socket on the PPC/PUC without loading the IEC bus, provides hardcopy program records and test printouts.



Example of display of transceiver adjustment on screen of Process Controller PUC (power adjustment with tolerance limits and actual value) using basic-software routine 86

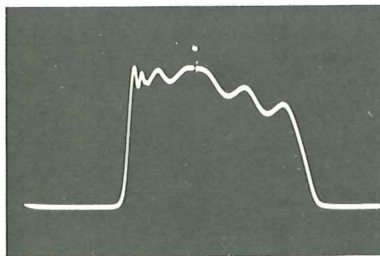
OPTIONS

Options for SMFP and SMFS

Analog Display SMFS-B9. The Analog Display option for the Mobile Testers SMFP and SMFS consists of an **AF oscilloscope** and two **bar displays** that can be assigned to the most varied measurements, thus offering additional checking capabilities and detectors with analog screen display, designed to match the specific requirements of **production testing and servicing**. With its automatic setting feature for the oscilloscope and the bar displays and the **AUTO LEVEL** button which does away with the need for readjustment during the tests, this option integrates easily with **automatic test systems**. When operating in the internal mode, the **oscilloscope** displays the signal demodulated by the SMFP or SMFS in a transmitter test or the AF signal delivered by the transceiver in a receiver test, with switch-selected time and amplitude resolution. The vertical deflection calibrated in V for AF, in kHz for FM, in % for AM and in rad for ϕ M ensures precise signal evaluation. By pressing a button, all signals can be displayed with constant amplitude, i.e. no adjustment on the oscilloscope is then required when test parameters such as modulation, modulation voltage and modulation frequency vary. When operating in the external mode, the oscilloscope displays the signal that is applied through the BNC cable or measured by means of a probe, with switch-selected time and amplitude resolution. At the push of a button, AC or DC coupling can be selected.

The X-axis signal is available at a rear socket and can be applied to the MOD. EXT. input of the basic unit for **sweeping**. Its level matches the input sensitivity so that the sweep width can be entered directly in kHz via the keypad.

The frequency response curve is displayed directly on the screen of the SMFS-B9 with the aid of a demodulator probe.

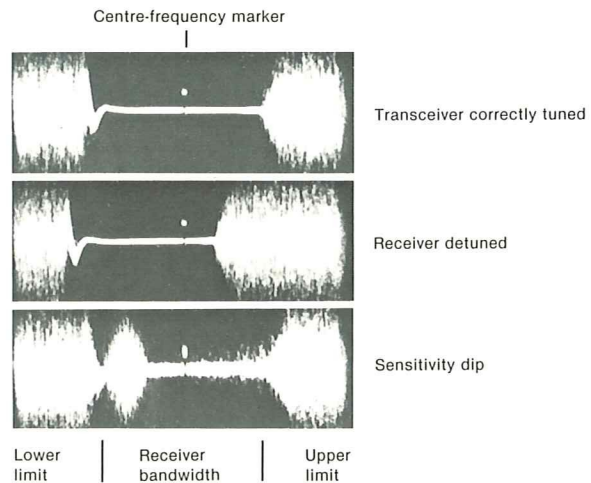


Swept-frequency measurement on a filter with frequency-response display and centre-frequency marker on screen of Analog Display

A marker can be added at the centre frequency at the push of a button. This cuts off automatic triggering. Using the parameter variation keys on the basic unit the centre sweep frequency can be shifted to find resonance frequencies, attenuation peaks or cutoff frequencies; the corresponding frequency can then be read directly on the RF frequency display on the basic unit. Input and output stages, IF amplifiers, filters, duplexers and resonant circuits can thus be measured with the aid of a demodulator probe (available as an accessory; can be completed with an adapter to form an insertion unit with or without 50- Ω termination).

Overall sweeping – from the RF input of the receiver to the AF output – offers a quick overview of bandwidth, centre frequency tuning and sensitivity within the receiver range. The switch-selected CCITT filter built into the basic unit ensures suppression of build-up or dying out transients in the transceiver.

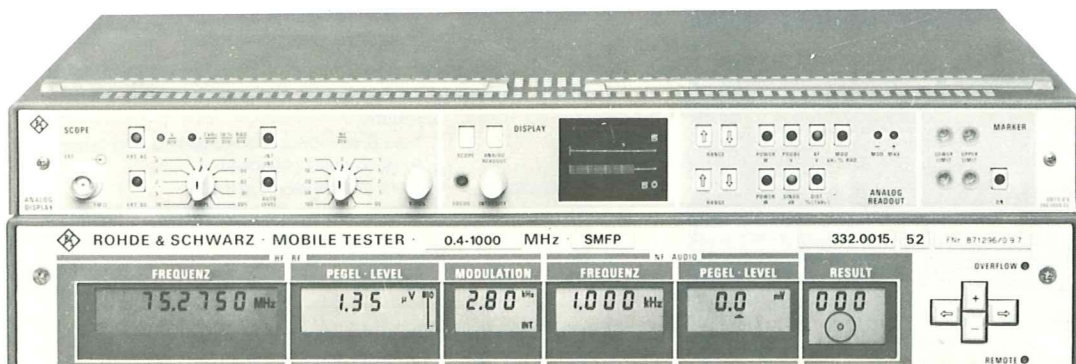
The superimposed centre-frequency marker also permits points of interest, such as the lower or upper band limit as



Swept-frequency measurement on a transceiver from the RF input to the AF output

well as dips to be checked; the corresponding frequency can then be read directly on the RF frequency display on the basic unit.

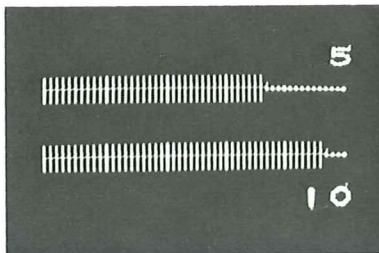
The simultaneous display of both band limits simplifies centre-frequency tuning of the receiver. All there is to do is to see to it that the upper and the lower band limit are at the same distance from the centre-frequency marker.



SMFS-B9
on
SMFP

Two **analog screen displays** are provided in the form of bars with bright-up scales. The scales, measurement ranges and time constant of the test points have been designed to suit the specific requirements of transceiver measurements.

The exact assignment of each scale division to a measured value, the different scales displayed depending on the measurement to be made, and the full-scale values displayed on the screen ensure unambiguous determination of the measured values and make for maximum clarity of presentation.



Analog screen displays with bright-up scales and indication of full-scale value

Interdependence of the test parameters is easily discernible since both displays can be observed at the same time.

The bars automatically display

SINAD ratio and AF level in receiver testing.

Power and positive or negative modulation, whichever is greater with additional LED display as an aid for symmetry adjustment in transmitter testing.

In addition, the following measured values can be displayed at the push of a button

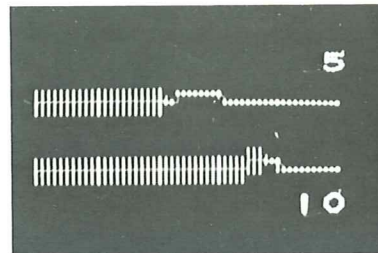
Distortion of AF output signal in receiver testing.

Modulation distortion in transmitter testing.

Measurement capabilities with analog display	Measurement ranges
AF	12.5/5/2.5/0.5 V
FM	25/10/5/1 kHz
AM	125/50/25/5 %
φM	12.5/5/2.5/0.5 rad
SINAD ratio	50/25 dB
Distortion	50/5 %
Power	50/10/2.5/0.5 W

The measurement capabilities can be combined with one another, for example simultaneous display of measured power and SINAD ratio when adjusting duplexers.

For adjustment to given nominal values it is also possible to display tolerances separately for each bar. Maximum and minimum values can be set by means of potentiometers.



Bars with displayed tolerances

Reference Oscillator SMS-B1 improves the frequency accuracy of the RF and AF generators and of the counter (aging $\leq 5 \times 10^{-8}$ /month, temperature effect $\leq \pm 1 \times 10^{-7}$).

1-GHz Frequency Extension SMFP-B2 extends the frequency range of the RF generator, the RF counter, the deviation meter and the adjacent-channel power meter to 1 GHz.

Adjacent-channel Power Meter SMFP-B6 measures the power components of the transmitter in the adjacent channel. The channel spacing and nominal transmitter frequency are entered via the keypad. The indication can be either in dB relative to the power in the main channel or absolute in μ W.

Options for SMFS

(incorporated in SMFP)

AF Synthesizer SMFS-B7 extends the frequency range of the modulation generator and permits crystal-referenced frequency setting throughout the AF range from 10 Hz to 25 kHz with high resolution.

Interface for Remote Control SMFS-B5 consists of 3×4 BCD-coded programmable control lines and a 9-relay matrix which permits the transceiver to be set from the front-panel keypad during the test.

Recommended extras for SMFP and SMFS

Protective Covers SMFP-Z8 for front and rear panels of the SMFP or SMFS without Analog Display SMFS-B9.

19" Adapter SMFP-Z9 permits incorporation of the SMFP or SMFS without Analog Display SMFS-B9 into 19" systems.

19" Adapter SMFS-Z10 permits incorporation of the SMFP or SMFS together with Analog Display SMFS-B9 into 19" systems.

SPECIFICATIONS

Specifications of SMFP and SMFS

Receiver measurement

- Test signals -

Signal-generator frequency range	. 0.4 to 520 MHz (to 1000 MHz with option)	
Frequency setting	via keypad	
Frequency indication	8-digit display	
Resolution	100 Hz	
Accuracy and drift	dependent on reference frequency (crystal)	
Reference oscillator	Standard	Option SMS-B1
Aging	< ±1 × 10 ⁻⁶ /month	< ±5 × 10 ⁻⁸ /month
Effect of temperature	< ±1 × 10 ⁻⁶ /°C	< ±1 × 10 ⁻⁷ over specified temperature range after 15 min warmup

Output level CW and FM	-137 to +13 dBm (0.032 μV to 1 V into 50 Ω)
AM	-137 to +7 dBm (0.032 μV to 0.5 V into 50 Ω)
Setting	via keypad
Fine level setting	0 to -10 dB with 0.1 dB resolution without interruption of output signal
Indication	in μV, mV, dBμV or dBm 3½-digit display
Resolution	0.1 dB
Error of output level	≤ ±1 dB + frequency-response error ¹⁾
Frequency response	flat ±0.5 dB (8 to 520 MHz) flat ±1 dB (0.4 to 8 MHz)
Output impedance	50 Ω, VSWR ≤ 1.2 (level ≤ -3 dBm) ¹⁾ connector: N female

Spectral purity

Harmonics	down ≥ 30 dBc ²⁾
Non-harmonic spurious signals	down ≥ 60 dBc ²⁾ (≥ 5 kHz from carrier)
Spurious FM, rms	0.3 to 3 kHz ≤ 4 Hz (weighted in accordance with CCITT)
Spurious AM, rms	0.03 to 20 kHz down ≥ 70 dBc ²⁾
Single-sideband phase noise	typ. down 120 dBc ²⁾ (test bandwidth 1 Hz, 20 kHz from carrier)
Single-sideband broadband noise	typ. down 145 dBc ³⁾ (test bandwidth 1 Hz, 2 MHz from carrier)

Modulation generator

	SMFP	SMFS
	AF synthesizer (continuous tuning)	with option as for SMFP, otherwise fixed frequencies only
Frequency range	10 Hz to 25 kHz	—
Resolution f < 1 kHz	0.1 Hz	—
< 10 kHz	1 Hz	—
> 10 kHz	10 Hz	—
Selectable fixed frequencies	0.3/0.4/1/1.25/2.7/3/6 kHz	0.1/0.3/0.4/0.6/1/1.25/2.7/3/4/6/8/10 kHz
Indication	4 digits	
Frequency error	f < 15 kHz < 1 × 10 ⁻⁶ ± 1 % f > 15 kHz < 1 × 10 ⁻⁵ ± 1 %	
Distortion	≤ 1 % ± 1 %	
Output EMF	0.1 mV to 4.995 V	0.1 mV to 4.995 V
Error limits at V _{out} > 1 mV	±(2% + 0.1 mV)	±(2% + 0.1 mV)
at V _{out} < 1 mV	typ. 2%	typ. 2%
Output impedance	50 Ω	50 Ω

Amplitude modulation

Frequency range; internal, external	50 Hz to 20 kHz (f > 8 MHz) 50 Hz to 5 kHz (f < 8 MHz)
Modulation depth	0 to 95%
Indication	3 digits
Resolution (0 to 9.95%)	0.05%
(10 to 95%)	0.5%
AM error (< 8 MHz)	≤ 7% of rdg ¹⁾ ± 1%
(8 to 520 MHz)	< 4% of rdg ¹⁾ ± 1%
Modulation distortion at 80% modulation	≤ 1.5% for f _{mod} ≤ 3 kHz ¹⁾ ≤ 5% for f _{mod} > 3 kHz ¹⁾
Input voltage requirements (rms) at AM ext.	1 V ± 1% (into 600 Ω)

Frequency modulation

Frequency range; internal, external	20 Hz to 20 kHz (3 dB points < 5 Hz to > 30 kHz typ.)
Frequency deviation	0 to 125 kHz
Indication	3 digits
Resolution	0 to 9.95 kHz 50 Hz 10 to 99.5 kHz 500 Hz 100 to 125 kHz 1 kHz
Error	≤ 5%

¹⁾ With fine level adjustment = 0 dB.

²⁾ dBc = relative level referred to carrier amplitude.

Modulation distortion of modulator

(5 kHz deviation)	≤ 1% for f _{mod} = 50 Hz to 3 kHz ≤ 5% for f _{mod} = 3 to 20 kHz
Input voltage requirement (rms) at FM ext.	1 V ± 1% (into 600 Ω)

Phase modulation

Frequency range; internal, external	100 Hz to 6 kHz
Phase deviation	0 to 10 rad
Indication	3 digits
Resolution	0.1 rad
Error	≤ ±5%
Input voltage requirement (rms) at φM ext.	1 V ± 1% (into 600 Ω)

Double modulation possible combinations AM int. + FM or φM ext., FM or φM int. + AM ext.

Receiver measurement

- Signal evaluation -

AF frequency meter

Frequency range	20 Hz to 999.9 kHz
Input level	10 mV to 10 V
Indication	4 digits
Resolution f < 10 kHz	1 Hz
< 100 kHz	10 Hz
< 1 MHz	100 Hz
Error	as for reference oscillator

AF level meter

Frequency range	50 Hz to 20 kHz
Measurement range	0.1 mV to 10 V
Indication	3½ digits
Resolution at V _{in} < 100 mV	0.1 V
at V _{in} < 1 V	1 mV
at V _{in} > 1 V	10 mV
Error limits (f > 100 Hz)	±(3% + 1 digit)
(f < 100 Hz)	±(4% + 1 digit)
Input impedance	≥ 100 kΩ

Distortion meter

Measurement frequencies	0.3/1 kHz ± 1%
Minimum input level	100 mV
Indication range	0.1 to 50%, 3 digits, resolution 0.1%
Intrinsic distortion, V _{in} > 200 mV	< 0.3%, 0.1% typ.
V _{in} < 200 mV	< 0.5%

Error limits

d < 10%	±(5% + 1 digit) + intrinsic distortion
d > 10%	±10% + intrinsic distortion

SINAD-ratio meter

Indication range	6 to 46 dB 3 digits, resolution 0.1 dB
Error limits	±1 dB
Minimum input level	100 mV

S/N meter

determines the S/N ratio by switching the modulation on/off	±1 dB
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If the wanted modulation is low the effect of inherent spurious modulation on the test results must be taken into account.

Transmitter measurement

RF frequency meter

Frequency range	1 to 520 MHz (to 999.99 MHz with option SMFP-B2)
Input level range	at transceiver connector 50 mW to 30 W at FREQU. METER input 10 mV to 1 V
Indication, resolution	8 digits, 10 Hz
Error	as for reference oscillator
Input impedance	50 Ω

Power meter

Frequency range	1 MHz to 1 GHz
Measurement range	10 mW to 30 W (10 to 45 dBm)
Error limits for P > 100 mW	20 to 500 MHz ±(5% + 1 digit) + frequency-response error 500 to 1000 MHz ±(10% + 1 digit) + frequency-response error
1 to 1000 MHz	±10% (typ.) + frequency-response error
Error limits for P < 100 mW	as above, but typ.
Frequency response	flat within ±4%

Frequency deviation meter

positive, negative or mean deviation	10 to 520 MHz (to 999.99 MHz with option SMFP-B2)
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Deviation measurement range	
peak weighting	100 Hz to 20 kHz
rms weighting	1 Hz to 100 Hz
Modulation-frequency range	
for display	100 Hz to 8 kHz or with CCITT weighting
for demod. signal output	< 5 Hz to 10 kHz (3 dB)
Input level range	
at transceiver connector	100 mW to 30 W
at FREQU. METER input	10 mV to 1 V
Indication, resolution	3 digits, 1/10/100 Hz
Error limits	±(3% of rdg + 1 digit) + residual FM
Spurious FM up to 500 MHz	< 5 Hz (CCITT weighting), typ. 2 Hz
above 500 MHz	< 10 Hz (CCITT weighting), typ. 4 Hz

Phase deviation meter

Frequency and input level	as for frequency deviation meter
Phase deviation measurement range	
peak weighting	0.1 to 5 rad
rms weighting	0.001 to 0.1 rad
Indication, resolution	3 digits, 0.001/0.01 rad
Modulation-frequency range	300 Hz to 3 kHz
Frequency-response error	± 2%

Modulation generator see receiver measurement

Modulation-depth meter

Frequency range	10 to 1000 MHz
Input level	100 mW to 30 W
AF frequency range	100 Hz to 10 kHz
Indication, resolution	3 digits, 0.1%
Error limits	
(modulation depth < 80%)	
300 Hz < f_{mod} < 3 kHz	±(5% + 1 digit)
100 Hz < f_{mod} < 10 kHz	±(10% + 1 digit)

DC voltmeter

Input resistance	≥ 100 kΩ
Voltage range	1 mV to 30 V
Resolution	
V < 0.3 V	1 mV
V < 1 V	3 mV
V < 3 V	10 mV
V < 10 V	30 mV
V < 30 V	100 mV
Indication	3 digits
Error limits	±(2% + 2 digits)

DC ammeter

Current range, resolution I	0.2 to 10 A, 10 mA
II	1 to 200 mA, 0.1 mA/1 mA
Indication	3½ digits
Error limits	±(3% + 3 digits)

Overvoltage protection

Response thresholds	< 1 W at RF, < 5 V at DC
Maximum permissible power	30 W

Remote control (SMFP only)

Interface	IEC 625-1 (Amphenol 24-way connector)
Functions	AH1, SH1, L2, T2, SR1, RL1, DC1
Parallel outputs	e. g. for test-item control (driven by IEC-bus commands) 12 outputs (open collector) 9 relays 100 V or 0.5 A (one relay coupled with transmitter/receiver switchover)

Specifications of options

1-GHz Frequency Extension SMFP-B2

Frequency range	0.4 to 1000 MHz
Changes in specifications as against basic unit for frequency range 520 to 1000 MHz:	
Resolution of frequency	200 Hz
Spurious FM	≤ 8 Hz (0.3 to 3 kHz, CCITT weighting)
Harmonics and subharmonics	down typ. 20 dB
Non-harmonic spurious signals	down ≥ 60 dB at > 200 kHz from carrier down ≥ 55 dB at > 5 kHz from carrier
Error of output level	± 1 dB + frequency-response error ¹⁾
Frequency response of output level	flat within ± 1 dB
Modulation depth	0 to 90%
Modulation distortion	
at 60% AM	≤ 5% for f_{mod} 100 Hz to 10 kHz ¹⁾ ≤ 10% for f_{mod} 10 to 20 kHz ¹⁾
AM indication error	≤ 7% of AM setting + 1% AM ¹⁾
Frequency range of	
frequency meter	1 to 999.9 MHz
deviation meter	10 to 999.9 MHz
adjacent-channel power meter (SMFP-B6)	10 to 999.0 MHz

Reference Oscillator SMS-B1 see preceding page

Adjacent-channel Power Meter SMFP-B6²⁾

Frequency range	10 to 519 MHz (to 999.0 MHz with option SMFP-B2)
Channel spacings	10/12.5/20/25 kHz (20/25 kHz with B2)
Input power range	0.1 to 30 W
Measurement range $f < 519$ MHz	down to 72 dB below carrier
$f \geq 519$ MHz	down to 66 dB below carrier
Indication	dB or μ W, mW, W, 3 digits
Resolution, error limits	
Indication in dB	0.1 dB, ± 3 dB
in μ W, mW, W	0.001 μ W/0.01 mW/0.01 W ±(3 dB + relative error of power meter)

AF Synthesizer SMFS-B7

(SMFS only; incorporated in SMFP) see preceding page

Interface for Remote Control SMFS-B5

(SMFS only; incorporated in SMFP)
Parallel outputs controllable via keypad,
3 decades BCD TTL (open collector)
9 relays 100 V or 0.5 A (one relay
coupled with T/R switchover)

Analog Display SMFS-B9

Oscilloscope	
Screen size	3 × 4 cm
Frequency range	
DC coupling	DC to 50 kHz
AC coupling	5 Hz to 50 kHz
Input impedance	1 MΩ
Timebase	0.05 to 100 ms/div with 1-2-5 stepping
Triggering	automatic
Y deflection	
EXT. mode	0.005 to 10 V/div with 1-2-5 stepping
INT. mode	FM: 10 Hz/div to 20 kHz/div AM: 0.05 to 100%/div ϕ M: 0.005 to 10 rad/div AF: 5 mV/div to 10 V/div with 1-2-5 stepping
INT. AUTO LEVEL mode	signal display with constant amplitude over practically entire level range
X output (sawtooth)	
Output voltage	1.41 V_0 into 600 Ω (matched to MOD. EXT. input on SMFP/SMFS)
Analog displays two bars with 50-division bright-up scales and superimposed full-scale values; 6-dB, 12-dB and 20-dB points of 25-dB SINAD ratio range are brightened	
Test parameters	
in receiver testing	SINAD ratio and AF level
pushbutton-selected	distortion of AF output level, power
Test parameters	
in transmitter testing	power and positive or negative modulation, whichever is greater with additional +/- LED display
pushbutton-selected	modulation distortion, SINAD ratio of demodulated signal
Measurement ranges	
AF	0.5/2.5/5/12.5 V
FM	1/5/10/25 kHz
AM	5/25/50/125%
ϕ M	0.5/2.5/5/12.5 rad
SINAD ratio	25/50 dB
Distortion	5/50%
Power ($P_{max} = 30$ W)	0.5/2.5/10/50 W
Resolution	2% of FS
Accuracy	same as basic unit ± resolution (only tendency indication for power < 0.5 W)

General data

Nominal temperature range	+ 5 to + 45 °C
Storage temperature range	- 40 to + 70 °C
Mechanical resistance	shockproof in accordance with DIN 40046, Part 7 (30 g, 11 ms); vibration test in accordance with DIN 40046, Part 8 (11 to 55 Hz, 2 g); corresponds to IEC Publications 68-2-27 and 68-2-6
Power supply, AC voltage	115 to 125 V/220 to 235 V, ± 10% (125 VA), 47 to 420 Hz, safety class I
battery	11 to 33 V (95 W)
Dimensions; weight	
SMFP/SMFS	470 mm × 198 mm × 485 mm; 24 kg
with SMFS-B9	470 mm × 246 mm × 485 mm; 28 kg

¹⁾ With fine level adjustment at 0 dB.

²⁾ Fitting SMS-B1 together with SMFP-B6 is recommended because of the required frequency accuracy.

ORDERING INFORMATION

Order designation	▶ Mobile Tester
SMFP	332.0015.52
SMFS	332.8700.54

Accessories supplied

50-Ω termination, adapter board, power cable, manual

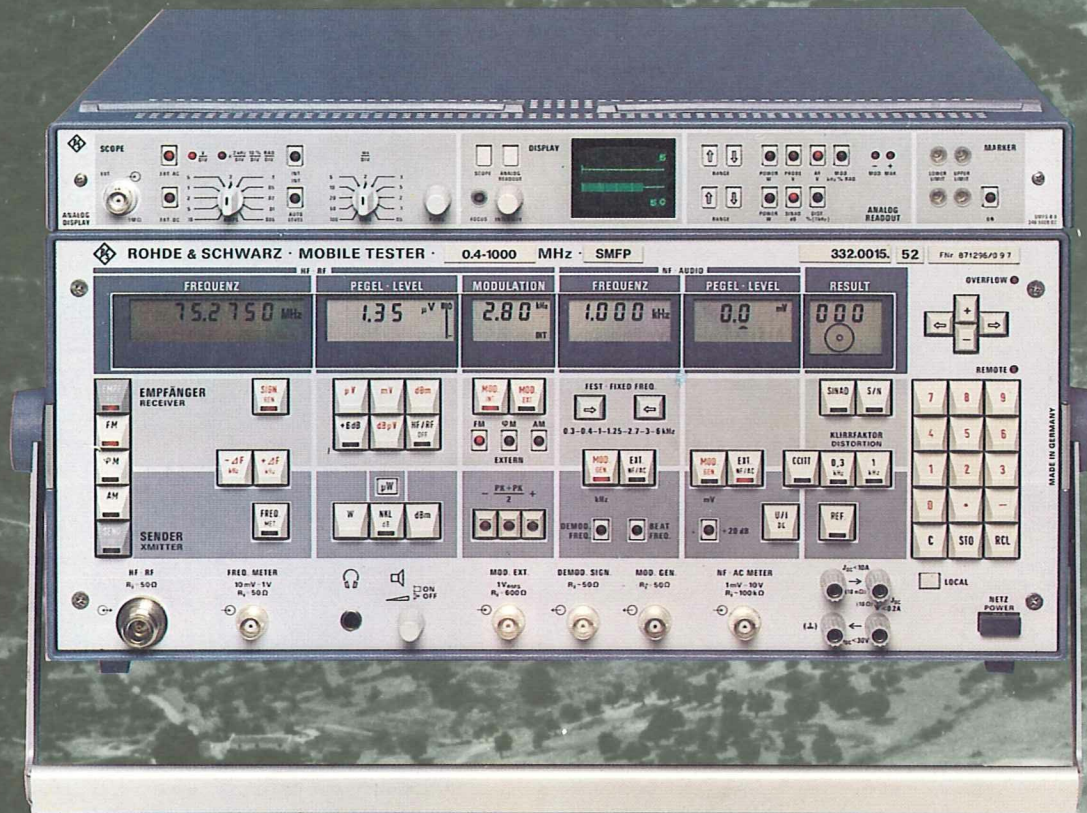
Options

Reference Oscillator	1-GHz Frequency	SMS-B1	302.8918.02
Extension	Adjacent-channel Power Meter ¹⁾	SMFP-B2	332.9706.50
AF Synthesizer	Interface for Remote Control	SMFP-B6	332.8000.02
SMFS-B7	SMFS-B5	332.9506.02	(for SMFS only)
SMFS-B9	SMFS-B9	332.9106.02	(for SMFS only)
	Analog Display	SMFS-B9	346.5008.02

Recommended extras

Basic Software	SMFP-K1	332.8600.02
Process Controller	PPC	343.3510.32
Process Controller	PUC	334.8900.04
IEC-bus Cable	PCK	292.2013.10 (1 m)
Protective Covers	SMFP-Z8	332.7890.02 (not with SMFS-B9)
19" Adapter (for Mobile Tester SMFP or SMFS; SMFS-B9 not included)	SMFP-Z9	332.7978.02
19" Adapter (for Mobile Tester SMFP or SMFS; SMFS-B9 included)	SMFS-Z10	346.6710.02
RF Probe	SWOB 3-Z	241.2116.00 (for SMFS-B9)
BNC Adapter	URV-Z	241.1110.02
Termination	RMF (BNC)	100.2927.50 (50 Ω)
		100.2927.70 (75 Ω)

¹⁾ Fitting SMS-B1 together with SMFP-B6 is recommended because of the required frequency accuracy.



Analog Display SMFS-B9 for Mobile Tester SMFP or SMFS (top); SMFP (bottom)