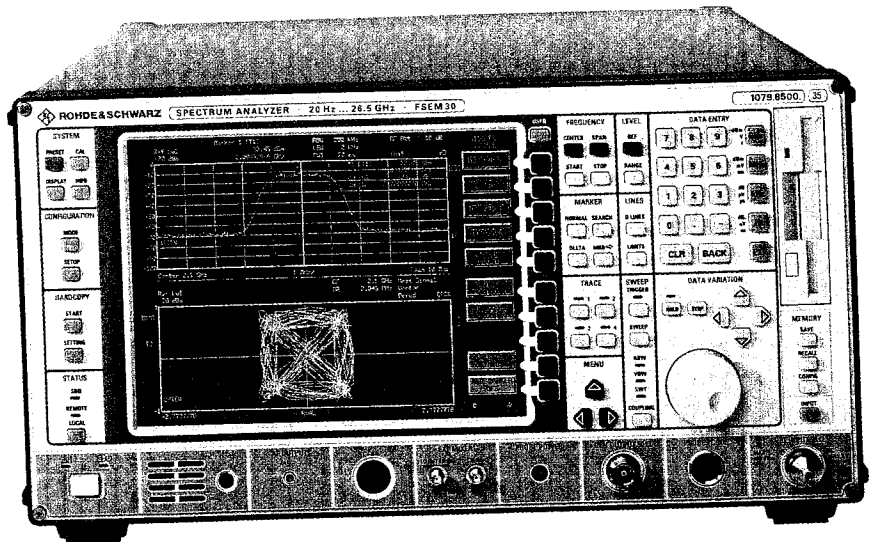


## Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

20 Hz to 40 GHz

High-performance analyzers for digital mobile radio and universal applications



FSEM30 (photo 43421-2)

## Brief description

FSEA, FSEB, FSEM and FSEK are advanced, high-speed and high-performance analyzers tailored to the requirements of modern digital communication systems. They can also be used as general-purpose analyzers for many applications. High measurement speed, modular design and excellent technical features make for an excellent price/performance ratio.

In addition to measurement functions for digital communication systems, such as 1  $\mu$ s sweep time in ZERO SPAN mode, pretrigger and trigger delay, gated sweep and adjacent-channel power measurement, these spectrum analyzers feature a wide dynamic range, a very low measurement uncertainty of 1 dB and a low-noise synthesizer.

FSE analyzers have low inherent noise and a wide dynamic range, so that for instance measurement of GSM power ramps is no problem.

An extremely wide intermodulation-free dynamic range of 105 dB (with 10 Hz resolution bandwidth) ensures reliable measurements on highly linear amplifiers as well as correct analysis of broadband complex signals. From the available frequency ranges, the basic models 20 and the high-performance models 30 the right instrument can be chosen for every application. Models 20 can easily be upgraded to give almost the full range of functions of models 30.

To ensure correct measurement of time variants or pulse-modulated signals, the FSE features digital resolution filters (1 Hz to 1 kHz) with a response corresponding to that of analog filters. It additionally provides FFT bandwidths from 1 Hz to 1 kHz (models 30 or models 20 + FSE-B5).

## Main features

- Resolution bandwidths 1 Hz (up to 10 MHz), adjustable in steps of 1/2/3/5
- Displayed noise floor down to  $-150$  dBm (FSEA, RBW 10 Hz)
- 3rd-order intercept point typ. +18 dBm (FSEA) 1 dB compression point of RF input +10 dBm
- Phase noise at 10 kHz from carrier: typ.  $-123$  dBc/Hz (FSEA)
- Intermodulation-free dynamic range 105 dB (RBW 10 Hz)
- Total measurement uncertainty up to 1 GHz:  $<1$  dB
- Headphones connector and built-in loudspeaker for AM/FM
- Internal RF trigger for GATED SWEEP measurements
- High speed:
  - FULL SPAN sweep time is 5 ms (for FSEA or FSEB) with a fully synchronized sweep – added speed is not at the expense of frequency accuracy but even enhances it
  - Shortest ZERO SPAN sweep time is 1  $\mu$ s (100 ns/div) – ideal for high-resolution measurements on pulse edges
  - More than 20 sweeps/s – an optimal prerequisite for fast alignments or applications in production

## Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

### From AF to microwave

FSEM/K 20/30 open up the microwave range through to 26.5/40 GHz and retain the excellent characteristics of the 3.5 GHz and 7 GHz basic models:

- Continuous full-span sweep
- Fundamental mixing, low noise floor as well as wide dynamic range up to 26.5 GHz
- Fully synchronized sweep with high frequency accuracy even for FULL SPAN (26.5/40 GHz)
- RF input adapters for N or PC 3.5-mm, or K connector (FSEM or FSEK)

Option FSE-B21 allows frequency range extension of FSEM and FSEK by means of external mixers. Mixers FS-Z60 (40 GHz to 60 GHz) and FS-Z75 (50 GHz to 75 GHz) are available as extras. Continuous automatic signal identification, which is used to suppress unwanted image frequency bands and mixture products, ensures fast and easy measurements. Due to the built-in diplexer, two-port as well as three-port mixers can be used.

### Measurement functions

- Up to 8 markers
- Marker functions for the direct measurement of
  - phase noise and phase power density
  - NEXT MIN/PEAK, NEXT MIN/PEAK RIGHT, NEXT MIN/PEAK LEFT
- Frequency counter with selectable resolution
- LOW NOISE, NORMAL and LOW DISTORTION modes to cater for low-intermodulation and low-noise operation
- Measuring curves printout in background operation or file saving in standard graphic formats
- Simultaneous display of four traces
- Selectable colour setup
- Numerous level and frequency lines
- Split-screen display with independent windows
- Frequency zoom
- Limit lines
- User-configurable menu and keyboard macros
- Adjacent-channel power measurement for up to 7 channels
- RMS detector

### FSE works as a Controller

The optional Controller FSE-B15 provides a further VGA card, a memory extension to 64 Mbyte, a serial mouse and a keyboard. With this option, Windows®-NT applications, eg statistics programs or spreadsheet analysis, can be installed on FSE. FSE can even be linked to a network using the optional Ethernet Interface FSE-B16.

Complete setups, traces, limit lines and macros can be stored non-volatile on the internal harddisk or on diskette with the built-in 1.44-Mbyte drive.

### Operation

A combination of hardkeys and softkeys makes for extremely fast and easy operation. The operating convenience based on a wide variety of evaluation routines and marker functions can be accessed via the menus. There are no complicated tree structures by using menus of lateral structure and fixed control keys. Complete setups and traces, limit lines as well as macros can be stored on the hard disk or on floppy disks.

### Overview of configurations and options

The analyzers of the FSE family are of modular design throughout. In the table below the right solution tailored to the needs of the various applications can be found.

| Designation, characteristics (hardware)  | Type   | Order No.    | FSEA 20 | FSEA 30 | FSEB 20 | FSEB 30 | FSEM 20 | FSEM 30 | FSEK 20 | FSEK 30 |
|--|--------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>7 GHz Frequency Extension</b>   | FSE-B2 | 1073.5040.02 | ○       | ○       | -       | -       | -       | -       | -       | -       |
| <b>Low Phase Noise and OCXO:</b> Typ. phase noise only -123 dBc (BW = 1 Hz, at 10 kHz from carrier), ideal for measuring phase noise of oscillators or adjacent-channel power of radio equipment | FSE-B4 | 1073.5396.02 | ○       | ●       | ○       | ●       | ○       | ●       | ○       | ●       |
| <b>FFT Filter</b> (1 Hz to 1 kHz)  | FSE-B5 | 1073.5544.02 | ○       | ●       | ○       | ●       | ○       | ●       | ○       | ●       |

Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

| Designation, characteristics (hardware)   | Type                  | Order No.    | FSEA 20 | FSEA 30 | FSEB 20 | FSEB 30 | FSEM 20 | FSEM 30 | FSEK 20 | FSEK 30 |
|---|-----------------------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>Vector Signal Analyzer:</b> Demodulation of digitally modulated signals          | FSE-B7                | 1066.4317.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>Tracking Generator</b> (9 kHz to 3.5 GHz)  | FSE-B8                | 1066.4469.02 | ○       | ○       | -       | -       | -       | -       | -       | -       |
| <b>Tracking Generator with I/Q Modulator</b> (9 kHz to 3.5 GHz)                     | FSE-B9                | 1066.4617.02 | ○       | ○       | -       | -       | -       | -       | -       | -       |
| <b>Tracking Generator</b> (9 kHz to 7 GHz)  | FSE-B10               | 1066.4769.02 | -       | -       | ○       | ○       | -       | -       | -       | ○       |
| <b>Tracking Generator with I/Q Modulator</b> (9 kHz to 7 GHz)                       | FSE-B11               | 1066.4917.02 | -       | -       | ○       | ○       | -       | -       | -       | ○       |
| <b>Switchable Attenuator for Tracking Generators FSE-B8/9/10/11</b> (0 dB to 70 dB) | FSE-B12               | 1066.5065.02 | ○       | ○       | ○       | ○       | -       | -       | -       | ○       |
| <b>1-dB Attenuator</b>  | FSE-B13 <sup>1)</sup> | 1119.6499.02 | ○       | ○       | ○       | ○       | -       | ○       | -       | ○       |
| <b>Controller</b> inclusive Mouse and Keyboard                                      | FSE-B15 <sup>3)</sup> | 1073.5696.06 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>Ethernet Interface</b>   | FSE-B16 <sup>2)</sup> | 1073.5973.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
|   |                       | 1073.5973.03 |         |         |         |         |         |         |         |         |
|   |                       | 1073.5973.04 |         |         |         |         |         |         |         |         |
| <b>2nd IEC/IEEE-Bus Interface</b>   | FSE-B17 <sup>2)</sup> | 1066.4017.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>Exchangeable Hard Disk</b>   | FSE-B18 <sup>3)</sup> | 1088.6993.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>2nd Hard Disk to FSE-B18</b> (Firmware included)                                 | FSE-B19               | 1088.7248.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>External Mixer</b>   | FSE-B21               | 1084.7243.02 | -       | -       | -       | -       | ○       | ○       | ○       | ○       |
| <b>Increased Level Accuracy up to 2 GHz</b>   | FSE-B22 <sup>3)</sup> | 1073.5544.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>Broadband Output 741,4 MHz</b>   | FSE-B23 <sup>3)</sup> | 1088.7348.02 | ○       | ○       | ○       | ○       | ○       | ○       | ○       | ○       |
| <b>44 GHz Frequency Range Extension for FSEK (factory-fitted only)</b>              | FSE-B24               | 1106.3680.02 | -       | -       | -       | -       | -       | -       | ○       | ○       |

- 1) Cannot be retrofitted in FSEM20/FSEK20, in conjunction with option FSE-B22 only factory-fitted.
- 2) Options FSE-B16 and FSE-B17 require option FSE-B15.
- 3) Factory-fitted only.

| Designation                      | Type                            | Use   | Functions   |
|----------------------------------|---------------------------------|---|---|
| Noise Measurement Software       | FS-K3                           | Noise figure measurements   | <ul style="list-style-type: none"> <li>• Measurement of noise figure and temperature to Y-factor method</li> <li>• Measurements on frequency converting devices</li> <li>• Frequency range same as basic unit, starting from 100 kHz</li> <li>• Editor for ENR tables</li> <li>• Runs under Windows®-NT on the internal controller (option) or on an external PC</li> </ul> |
| Phase Noise Measurement Software | FS-K4                           | Phase noise measurements  | <ul style="list-style-type: none"> <li>• Easy to use phase noise measurements</li> <li>• measurement of residual FM an PM</li> <li>• logarithmic plot over 8 decades</li> <li>• Runs under Windows®-NT on the internal controller (option) or on an external PC</li> </ul>  |
| Application Firmware             | FSE-K10, Mobile<br>FSE-K11, BTS | Mobile radio, transmitter measurements to GSM standards 11.10 and 11.20 | <ul style="list-style-type: none"> <li>• Power ramp and power template</li> <li>• Spectrum due to modulation/switching</li> <li>• Spurious emissions</li> <li>• Mean carrier power</li> <li>• Phase/frequency error (with option FSE-B7)</li> </ul>   |

- Fitted in basic model
- Option



## Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

### Model-dependent specifications in brief

| Frequency  | FSEA20   | FSEA30                          | FSEB20  | FSEB30                          | FSEM20  | FSEM30                          | FSEK20   | FSEK30                          |
|--|--|---------------------------------|---|---------------------------------|---|---------------------------------|--|---------------------------------|
| <b>Frequency range</b>   | 9 kHz to 3.5 GHz   | 20 Hz to 3.5 GHz                | 9 kHz to 7 GHz  | 20 Hz to 7 GHz                  | 9 kHz to 26.5 GHz   | 20 Hz to 26.5 GHz               | 9 kHz to 40 GHz  | 20 Hz to 40 GHz                 |
| Refer. frequency (aging)<br>With option FSE-B4   | 1 x 10 <sup>-6</sup> /year<br>2 x 10 <sup>-7</sup> /year   | 2 x 10 <sup>-7</sup> /year<br>— | 1 x 10 <sup>-6</sup> /year<br>2 x 10 <sup>-7</sup> /year    | 2 x 10 <sup>-7</sup> /year<br>— | 1 x 10 <sup>-6</sup> /year<br>2 x 10 <sup>-7</sup> /year  | 2 x 10 <sup>-7</sup> /year<br>— | 1 x 10 <sup>-6</sup> /year<br>2 x 10 <sup>-7</sup> /year | 2 x 10 <sup>-7</sup> /year<br>— |
| <b>Spectral purity</b>   |  |                                 |   |                                 |   |                                 |  |                                 |
| SSB phase noise, referred to 1 Hz bandwidth, f ≤ 500 MHz   |  |                                 |   |                                 |   |                                 |  |                                 |
| 100 Hz <sup>1)</sup>   | —  | <-87 dBc                        | —   | <-81 dBc                        | —   | <-81 dBc                        | —  | <-81 dBc                        |
| 1 kHz <sup>1)</sup>  | <-85 dBc   | <-107 dBc                       | <-79 dBc  | <-100 dBc                       | <-79 dBc  | <-100 dBc                       | <-79 dBc   | <-100 dBc                       |
| 10 kHz <sup>1)</sup>   | <-95 dBc   | <-120 dBc                       | <-90 dBc  | <-114 dBc                       | <-90 dBc  | <-114 dBc                       | <-90 dBc   | <-114 dBc                       |
| 100 kHz <sup>2)</sup>  | <-119 dBc  | <-119 dBc                       | <-113 dBc   | <-113 dBc                       | <-113 dBc   | <-113 dBc                       | <-113 dBc  | <-113 dBc                       |
| 1 MHz <sup>2)</sup>  | <-135 dBc  | <-138 dBc                       | <-129 dBc   | <-132 dBc                       | <-129 dBc   | <-132 dBc                       | <-129 dBc  | <-132 dBc                       |
| <b>Resolution bandwidths</b>   |  |                                 |   |                                 |   |                                 |  |                                 |
| 3 dB bandwidths  | 10 Hz to 10 MHz  | 1 Hz to 10 MHz                  | 10 Hz to 10 MHz   | 1 Hz to 10 MHz                  | 10 Hz to 10 MHz   | 1 Hz to 10 MHz                  | 10 Hz to 10 MHz  | 1 Hz to 10 MHz                  |
| Steps  | 1/2/3/5  | 1/2/3/5                         | 1/2/3/5   | 1/2/3/5                         | 1/2/3/5   | 1/2/3/5                         | 1/2/3/5  | 1/2/3/5                         |
| Shape factor 60 : 3 dB<br>(1 kHz to 2 MHz)   | <15  | <12                             | <15   | <12                             | <15   | <12                             | <15  | <12                             |
| Video bandwidths   | 1 Hz to 10 MHz   | 1 Hz to 10 MHz                  | 1 Hz to 10 MHz  | 1 Hz to 10 MHz                  | 1 Hz to 10 MHz  | 1 Hz to 10 MHz                  | 1 Hz to 10 MHz   | 1 Hz to 10 MHz                  |
| Steps  | 1/2/3/5  | 1/2/3/5                         | 1/2/3/5   | 1/2/3/5                         | 1/2/3/5   | 1/2/3/5                         | 1/2/3/5  | 1/2/3/5                         |
| <b>Level</b>   |  |                                 |   |                                 |   |                                 |  |                                 |
| <b>Displayed noise floor</b> , average level in dBm (10 Hz bandwidth, 0 dB RF attenuation, VBW = 1 Hz, no signal at RF input)      |  |                                 |   |                                 |   |                                 |  |                                 |
| 20 Hz  | —  | -80                             | —   | -74                             | —   | <-74                            | —  | <-74                            |
| 1 kHz  | —  | -110                            | —   | -104                            | —   | <-104                           | —  | <-104                           |
| 10 kHz   | -90  | -125                            | -84   | -119                            | <-84  | <-119                           | <-84   | <-119                           |
| 100 kHz  | -110   | -135                            | -104  | -129                            | <-104   | <-129                           | <-104  | <-129                           |
| 1 MHz  | <-130, typ. -135   | <-145, typ. -150                | <-125, typ. -130  | <-142, typ. -145                | <-124, typ. -129  | <-142, typ. -145                | <-124, typ. -129   | <-142, typ. -145                |
| 10 MHz to 3.5/6 GHz  | <-145, typ. -150   | <-145, typ. -150                | <-142, typ. -147  | <-142, typ. -147                | <-138, typ. -140  | <-138, typ. -140                | <-138, typ. -140   | <-138, typ. -140                |
| 6 GHz to 7 GHz   | —  | —                               | <-139   | <-139                           | <-135, typ. -138  | <-135, typ. -138                | <-135, typ. -138   | <-135, typ. -138                |
| 7 GHz to 18 GHz  | —  | —                               | —   | —                               | <-138, typ. -140  | <-138, typ. -140                | <-138, typ. -140   | <-138, typ. -140                |
| 18 GHz to 26.5 GHz   | —  | —                               | —   | —                               | <-135, typ. -138  | <-135, typ. -138                | <-135, typ. -138   | <-135, typ. -138                |
| 26.5 GHz to 30 GHz   | —  | —                               | —   | —                               | —   | —                               | <-120, typ. -125   | <-120, typ. -125                |
| 30 GHz to 40 GHz   | —  | —                               | —   | —                               | —   | —                               | <-116, typ. -122   | <-116, typ. -122                |
| <b>Max. dynamic range</b>  |  |                                 |   |                                 |   |                                 |  |                                 |
| Displayed noise floor at 1 dB compression  | 10 Hz bandwidth<br>155 dB                                  | 1 Hz bandwidth<br>165 dB        | 10 Hz bandwidth<br>152 dB                                   | 1 Hz bandwidth<br>162 dB        | 10 Hz bandwidth<br>150 dB   | 1 Hz bandwidth<br>160 dB        | 10 Hz bandwidth<br>150 dB                                | 1 Hz bandwidth<br>160 dB        |
| <b>Max. intermodulation-free range</b>   |  |                                 |   |                                 |   |                                 |  |                                 |
| 50 MHz to 3.5 GHz  | 105 dB   | 115 dB                          | —   | —                               | —   | —                               | —  | —                               |
| 100 MHz to 26.5 GHz  | —  | —                               | 105 dB  | 115 dB                          | 103 dB  | 112 dB                          | 103 dB   | 112 dB                          |
| <b>Total measurement uncertainty</b> (0 to 50 dB below reference level, span/RBW <100, rss 95% reliability)                        |  |                                 |   |                                 |   |                                 |  |                                 |
| <1 GHz   |  |                                 | <1 dB   |                                 |   |                                 |  |                                 |
| 1 GHz to 3.5/7 GHz   |  |                                 | <1.5 dB   |                                 |   |                                 |  |                                 |
| <b>Intermodulation</b>   |  |                                 |   |                                 |   |                                 |  |                                 |
| 3rd-order intermod., intermodulation-free dynamic range, level 2 x -20 dBm, Δf > 5 x RBW or 10 kHz, whichever is the greater value | >64 dBc for f > 50 MHz (T.O.I. > 12 dBm, typ. 18 dBm)      |                                 | >70 dBc for f > 150 MHz (T.O.I. ≥ 15 dBm, typ. 20 dBm)      |                                 | >74 dBc for f > 100 MHz >60 dBc for f > 7 GHz (T.O.I. ≥ 17 dBm, typ. 22 dBm; >10 dBm for f > 7 GHz) |                                 |  |                                 |
| Intermodulation-free range at -40 dBm mixer level  |  |                                 |   |                                 | 105 dB  |                                 |  |                                 |
| Intercept point k2 (dBm)   | >25, typ. >40 for f < 50 MHz, >45, typ. >50 for f > 50 MHz |                                 | >25 for f < 150 MHz, >35 typ. >40 for f > 150 MHz, >45 typ. |                                 |   |                                 |  |                                 |

1) Models 20: valid for span ≤ 50 kHz, RBW < 1 kHz.

2) Valid for span > 100 kHz.

Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

Common specifications in brief

Frequency

|                                 |   |
|---------------------------------|---|
| Frequency display               | with marker   |
| Resolution                      | 0.1 Hz to 10 kHz (depending on span)  |
| Frequency counter               | measures the marker frequency   |
| Resolution                      | 0.1 Hz to 10 kHz (selectable)   |
| Display range of frequency axis | 0 Hz, 10 Hz to full span  |
| Sweep time                      |   |
| Display range                   | 0 Hz <span style="float:right">1 μs to 2500 s</span><br>≥10 Hz <span style="float:right">5 ms to 16000 s</span> |
| Picture refresh rate            | >20 updates/s with 1 trace<br>>15 updates/s with 2 traces   |
| Sampling rate                   | 50 ns (20 MHz A/D converter)  |
| Sweep trigger                   | free run, single, line, video, gated, delayed, external   |
| Zero span                       | additionally pretrigger, posttrigger, trigger delay   |

Level

|   |  |
|---|--|
| Display range   | noise floor displayed to 30 dBm  |
| Max. input level                                      |  |
| RF attenuation 0 dB/≥10 dB                            |  |
| DC voltage  | 0 V  |
| CW RF power   | 20 dBm (= 0.1 W)/30 dBm (= 1 W)  |
| Pulse spectral density                                | 97 dBμV/MHz  |
| Max. pulse energy (10 μs)                             | 1 mWs/FSEM/K: 0.5 mWs<br>(RF attenuation ≥10 dB)   |
| Max. pulse voltage (RF attenuation ≥10 dB)            | FSEA/B: 150 V, FSEM/K: 50 V  |
| 1 dB compression of input mixer (0 dB RF attenuation) | +10 dBm nominal  |
| Max. harmonics suppression                            | 90 dB (f >50 MHz)  |
| Level display   |  |
| Trace   | 500 × 400 pixels (one diagram)   |
| Log level axis  | 10 to 200 dB in 10 dB steps  |
| Linear level axis                                     | 10% of reference level per level division, 10 divisions                                  |
| Setting range of reference level                      |  |
| Log level display                                     | -130 to +30 dBm in 0.1 dB steps  |
| Linear level display                                  | 7 nV to 7.07 V in 1% steps   |
| Units of level axis                                   | dBm, dBμV, dBμA, dBpW (log level display); mV, μV, mA, μA, pW, nW (linear level display) |
| Pulse amplitude accuracy (single pulses)              |  |
| Bandwidth <1 MHz                                      | 0.5 dB nominal   |
| ≥1 MHz  | 2 dB nominal   |

Trigger function

|                    |                                     |
|--------------------|-------------------------------------|
| Trigger            | free run, line, video, RF, external |
| Delayed sweep      |                                     |
| Trigger source     | free run, line, external, video     |
| Delay time         | 100 ns to 10 s, 1 μs                |
| Delayed sweep time | 2 μs to 1000 s                      |
| Gated sweep        |                                     |
| Trigger source     | external, RF level                  |
| Gate delay         | 1 μs to 100 s                       |
| Gate length        | 1 μs to 100 s, resolution 1 μs      |

Demodulation

|                  |                                   |
|------------------|-----------------------------------|
| Modulation modes | AM and FM                         |
| Audio output     | loudspeaker and headphones output |
| Marker stop time | 100 ms to 60 s                    |

1 dB Attenuator

|                                 |  |
|---------------------------------|--|
| Frequency range                 | FSE-B13<br>max. 7 GHz (stopp frequency ≤7 GHz) |
| Setting range of RF attenuation | 0 dB to 70 dB                                  |

|                                   |         |
|-----------------------------------|---------|
| Step width                        | 1 dB    |
| Additional attenuator uncertainty | <0.1 dB |

External Mixer FSE-B21

|                                  |                     |
|----------------------------------|---------------------|
| LO output/IF input (front panel) | SMA female, 50 Ω    |
| LO signal                        | 7.5 GHz to 15.2 GHz |
| Level                            | +15.5 dBm ±3 dB     |
| IF signal                        | 741.4 MHz           |
| Full level                       | -20 dBm             |
| Level measurement uncertainty    | <1 dB               |
| IF input (front panel)           | SMA female, 50 Ω    |
| Frequency                        | 741.4 MHz           |
| Full level                       | -20 dBm             |
| Level measurement uncertainty    | <1 dB               |

Inputs and outputs (front panel)

|   |  |
|---|--|
| RF input  | N female, 50 Ω (FSEA/FSEB), Micro-wave Adapter System (FSEM/K)                   |
| VSWR (RF attenuation >10 dB), f <3.5 GHz                          | <1.5   |
| Attenuator  | 0 to 70 dB, selectable in 10 dB steps  |
| Probe power   | +15 V/-12.6 V (DC) and ground, ≥150 mA   |
| Power supply and coding connector for antennas etc (antenna code) | 12-contact Tuchel connector  |
| Supply voltages   | ±10 V, max. 100 mA, ground jack, adjustable up to 1.5 V (Z <sub>in</sub> = 10 Ω) |
| AF output   |  |

Inputs and outputs (rear panel)

|                                      |  |
|--------------------------------------|--|
| IF 21.4 MHz                          | BNC female 50 Ω, bandwidth >1 kHz or resolution bandwidth 0 dBm at reference level, mixer level >-60 dBm |
| Level                                | BNC female 50 Ω, 0 to 1 V (open-circuit voltage)   |
| Video output                         |  |
| Reference frequency                  | BNC female 10 MHz, 10 dBm nominal  |
| Output, usable as input              | 1/.../16 MHz, >0 dBm into 50 Ω   |
| Input                                | BNC female, 0 to 10 V, proportional to displayed frequency   |
| Sweep output                         | BNC female, 0/28 V, switch-selected  |
| Noise source connector               | BNC, -5/+5 V, adjustable   |
| Ext. trigger/gate input              | interface to IEC625-2 (IEEE488.2), Command set SCPI 1994.0   |
| IEC/IEEE-bus control                 | RS-232 interface (COM1 and COM2), 9-contact female connectors  |
| Serial interface                     | PS/2-compatible  |
| Mouse interface                      | via IEC/IEEE bus or RS-232-C, HP-GL  |
| Plotter <sup>1)</sup>                | parallel (Centronics) or serial (RS-232-C)   |
| Printer interface                    | 5-contact female for MF2 keyboard  |
| Keyboard connector                   | 25-contact Cannon female   |
| User interface                       | 15-contact female  |
| Connector for external monitor (VGA) |  |

General data

|                              |   |
|------------------------------|---|
| Display (640 × 480)          | 24 cm colour LCD (9.5")   |
| Mass memory                  | 3½", 1.44 MByte; hard disk  |
| Power supply, AC             | 100 to 120 V: 50 Hz to 400 Hz<br>200 to 240 V: 50 Hz to 60 Hz<br>170 to 230 VA (depending on model) |
| Power consumption            |   |
| Dimensions (W × H × D; 5 HU) |   |
| Models 20                    | 435 mm × 236 mm × 460 mm  |
| Models 30                    | 435 mm × 236 mm × 570 mm  |
| Weight                       | 21.5 to 25.8 kg (depending on model)  |

## Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

### Ordering information

| Spectrum Analyzer  |                       |              |
|--|-----------------------|--------------|
| FSEA20   |                       | 1065.6000.25 |
| FSEA30   |                       | 1065.6000.35 |
| FSEB20   |                       | 1066.3010.25 |
| FSEB30   |                       | 1066.3010.35 |
| FSEM20   |                       | 1080.1505.25 |
| FSEM30   |                       | 1079.8500.35 |
| FSEK20   |                       | 1088.1491.25 |
| FSEK30   |                       | 1088.3494.35 |
| <b>Options</b>   |                       |              |
| 7 GHz Frequency Extension for FSEA (for models 20)         | FSE-B2                | 1073.5044.02 |
| Low Phase Noise and OCXO                                   |                       |              |
| FFT Filter 1 Hz to 1 kHz (for models 20)                   | FSE-B4                | 1073.5396.02 |
| Vector Signal Analyzer                                     | FSE-B5                | 1073.5544.02 |
| Tracking Generator 3.5 GHz                                 | FSE-B7                | 1066.4317.02 |
| Tracking Generator 3.5 GHz with I/Q Modulator              | FSE-B8                | 1066.4469.02 |
| Tracking Generator 7 GHz                                   | FSE-B9                | 1066.4617.02 |
| Tracking Generator 7 GHz with I/Q Modulator                | FSE-B10               | 1066.4769.02 |
| Switchable Attenuator for Tracking Generator               | FSE-B11               | 1066.4917.02 |
| 1 dB Attenuator  | FSE-B12               | 1066.5065.02 |
| Controller for FSE (mouse and keyboard included (English)) | FSE-B13 <sup>2)</sup> | 1119.6499.02 |
| Ethernet Interface   | FSE-B15 <sup>1)</sup> | 1073.5696.06 |
| 15-contact AUJ connector                                   | FSE-B16 <sup>2)</sup> | 1073.5973.02 |
| Thin-wire BNC connector                                    | FSE-B16 <sup>2)</sup> | 1073.5973.03 |
| RJ-45 connector  | FSE-B16 <sup>2)</sup> | 1073.5973.04 |
| 2nd IEC/IEEE-Bus Interface for FSE                         | FSE-B17 <sup>2)</sup> | 1066.4017.02 |
| Removable Hard Disk  | FSE-B18 <sup>2)</sup> | 1088.6993.02 |
| Second Hard Disk for FSE-B18 (firmware included)           | FSE-B19               | 1088.7248.02 |
| External Mixer   | FSE-B21               | 1084.7243.02 |
| Increased Level Accuracy up to 2 GHz                       | FSE-B22 <sup>3)</sup> | 1106.3480.02 |
| Broadband Output 741.4 MHz                                 | FSE-B23 <sup>3)</sup> | 1088.7348.02 |
| 44 GHz Frequency Range Extension for FSEK                  | FSE-B24 <sup>3)</sup> | 1106.3680.02 |
| <b>Software</b>  |                       |              |
| Noise Measurement Software, Windows                        | FS-K3                 | 1057.3028.02 |
| Phase Noise Measurement Software, Windows                  | FS-K4                 | 1108.0088.02 |
| GSM Application Firmware, Mobile                           | FSE-K10               | 1057.3092.02 |
| GSM Application Firmware, BTS                              | FSE-K11               | 1057.3392.02 |
| EDGE Application Firmware, Mobile                          | FSE-K20 <sup>4)</sup> | 1106.4086.02 |
| EDGE Application Firmware, BTS                             | FSE-K21 <sup>4)</sup> | 1106.4186.02 |

### Extras

|   |   |                                     |
|---|---|-------------------------------------|
| Service Kit   | FSE-Z1  | 1066.3862.02                        |
| DC Block, 5 MHz to 7000 MHz (Type N)                            | FSE-Z2  | 4010.3895.00                        |
| DC Block, 10 kHz to 18 GHz, Type N                              | FSE-Z4  | 1084.7443.02                        |
| 2.4-mm female (only for FSEK)                                   | FSE-Z5  | 1088.1627.02                        |
| Microwave Measurement Cable and Adapter Set for FSEM            | FS-Z15  | 1046.2002.02                        |
| Harmonics Mixer 40 GHz to 60 GHz                                | FS-Z60 <sup>5)</sup>  | 1089.0799.02                        |
| Harmonics Mixer 50 GHz to 75 GHz                                | FS-Z75 <sup>5)</sup>  | 1089.0847.02                        |
| Service Manual  | —   | 1065.6016.24                        |
| Headphones  | —   | 0708.9010.00                        |
| German Keyboard   | PSA-Z2  | 1007.3001.31                        |
| American Keyboard   | PSA-Z2  | 1007.3001.02                        |
| PS/2 Mouse  | FSE-Z2  | 1084.7043.02                        |
| Colour Monitor, 15", 230 V                                      | PMC3  | 1082.6004.02                        |
| IEC/IEEE-Bus Cable, 1 m   | PCK   | 0292.2013.10                        |
| IEC/IEEE-Bus Cable, 2 m   | PCK   | 0292.2013.20                        |
| 19" Rack Adapter with front handles                             | ZZA-95  | 0396.4911.00                        |
| Transit Case  | ZZK-954   | 1013.9395.00                        |
| Transit Case (FSEM 30 and FSEK 30 only)                         | ZZK-955   | 1013.9408.00                        |
| Matching Pads, 75 Ω   |   |                                     |
| L section   | RAM   | 0358.5414.02                        |
| Series resistor, 25 Ω   | RAZ   | 0358.5714.02                        |
| Accessories for current, voltage and field-strength measurement | see accessories for Test Receiver ESS, data sheet PD 756.9768 |                                     |
| SWR Bridge, 5 MHz to 3000 MHz                                   | ZRB2  | 0373.9017.52                        |
| SWR Bridge, 40 kHz to 4 GHz                                     | ZRC   | 1039.9492.52                        |
| High-Power Attenuators, 100 W, 3/6/10/20/30 dB                  | RBU 100   | 1073.8820.xx<br>(xx=03/06/10/20/30) |
| High-Power Attenuators, 50 W, 3/6/10/20/30 dB                   | RBU 50  | 1073.8895.xx<br>(xx=03/06/10/20/30) |
| Preamplifier, 20 MHz to 1000 MHz                                | ESV-Z3  | 0397.7014.52                        |
| For FSEM only:  |   |                                     |
| Test-Port Adapter, N (male)                                     | —   | 1021.0541.00                        |
| Test-Port Adapter, 3.5 mm (male)                                | —   | 1021.0529.00                        |
| For FSEK only:  |   |                                     |
| Test-Port Adapter, N (male)                                     | —   | 1036.4783.00                        |
| Test-Port Adapter, K (male)                                     | —   | 1036.4802.00                        |
| Test-Port Adapter, 2.4 mm (male)                                | FSE-Z5  | 1088.1627.02                        |

- 1) Plot function is not available, if FSE-B15 is fitted.
- 2) Options FSE-B16 and FSE-B17 require option FSE-B15.
- 3) Not retrofittable, factory-fitted only.
- 4) FSE-K10 or FSE-K11 required.
- 5) For all FSEM/FSEK, option FSE-B21 required.