### 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 µs 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 lownoise 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</li>
- 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 μs (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 or FSEK allow with option FSE-B21 frequency range extension by means of external mixers. 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, three-port as well as two-port mixers can be used.

The external mixer measurement function features great ease of operation:

- Definition of frequency range and harmonics by selection of a waveguide band
- Definition of all important parameters for each waveguide band separately
- Frequency-dependent consideration of mixer conversion loss
- Storage of parameters on hard disk

 Frequency range extension through external mixers up to 75 GHz with options FS-Z60 (40...60 GHz) and FS-Z75 (50...75 GHz)

#### **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 independ-

- ent windows
- Frequency zoom
- Limit lines
- User-configurable menu and keyboard macros
- Adjacent-channel power measurement for up to 7 channels
- RMS detector

### **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)	Туре	Order No.	FSEA 20	FSEA 30	FSEB 20	<b>FSEB 30</b>	<b>FSEM 20</b>	<b>FSEM 30</b>	FSEK 20	FSEK 30
7 GHz Frequency Extension	FSE-B2	1073.5040.02	0	0	•	•	-	-	-	-

# Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

Designation, characteristics (hardware)	Туре	Order No.	FSEA 20	FSEA 30	FSEB 20	FSEB 30	<b>FSEM 20</b>	<b>FSEM 30</b>	FSEK 20	<b>FSEK 30</b>
<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	0	•	0	•	0	•	0	•
FFT Filter (1 Hz to 1 kHz)	FSE-B5	1073.5544.02	0	•	0	•	0	•	0	•
Vector Signal Analyzer Demodulation of digitally modulated signals	FSE-B7	1066.4317.02	0	0	0	0	0	0	0	0
Tracking Generator (9 kHz to 3.5 GHz)	FSE-B8	1066.4469.02	0	0	-	-	-	-	-	-
Tracking Generator with I/Q Modulator (9 kHz to 3.5 GHz)	FSE-B9	1066.4617.02	0	0	-	-	-	-	-	-
Tracking Generator (9 kHz to 7 GHz)	FSE-B10	1066.4769.02	-	-	0	0	-	-	-	0
Tracking Generator with I/Q Modulator (9 kHz to 7 GHz)	FSE-B11	1066.4917.02	-	-	0	0	-	-	-	0
Switchable Attenuator for Tracking Generators FSE-B8/9/10/11 (0 to 70 dB)	FSE-B12	1066.5065.02	0	0	0	0	-	-	-	0
1-dB Attenuator	FSE-B13 <sup>1)</sup>	1119.6499.02	0	0	0	0	-	0	-	0
Controller inclusive Mouse and Keyboard	FSE-B15 <sup>3)</sup>	1073.5696.06	0	0	0	0	0	0	0	0
Ethernet Interface AUI connector, 15 poles Thin-wire connector, BNC RJ-45 connector (Twisted Pair)	FSE-B16 <sup>2)</sup>	1073.5973.02 1073.5973.03 1073.5973.04	0	0	0	0	0	0	0	0
2nd IEC/IEEE-Bus Interface	FSE-B17 <sup>2)</sup>	1066.4017.02	0	0	0	0	0	0	0	0
Exchangeable Hard Disk	FSE-B18 <sup>3</sup> )	1088.6993.02	0	0	0	0	0	0	0	0
2nd Hard Disk to FSE-B18 (Firmware included)	FSE-B19	1088.7248.02	0	0	0	0	0	0	0	0
External Mixer	FSE-B21	1084.7243.02	-	-	-	-	0	0	0	0
Increased Level Accuracy up to 2 GHz	FSE-B223)	1073.5544.02	0	0	0	0	0	0	0	0
Broadband Output 741,4 MHz	FSE-B23 <sup>3)</sup>	1088.7348.02	0	0	0	0	0	0	0	0

<sup>1)</sup> In conjunction with option FSE-B22 only factory-fitted.

<sup>3)</sup> Factory-fitted only.

Designation, characteristics (software)	Туре	Order No.	FSEA 20	FSEA 30	FSEB 20	FSEB 30	<b>FSEM 20</b>	<b>FSEM 30</b>	FSEK 20	FSEK 30
<b>Application Firmware</b> for mobile radio transmitter measurements to GSM900 specs 11.20 (mobiles), GSM1800 and GSM1900	FSE-K10	1057.3092.02	0	0	0	0	0	0	0	0
<b>Application firmware</b> for mobile radio transmitter measurements to GSM900 specs 11.20 (BTS), GSM1800 and GSM1900	FSE-K11	1057.3392.02	0	0	0	0	0	0	0	0
<b>Noise Measurement Software</b> Noise figure or noise temperature measurement (Y-factor method) from 100 kHz, 2nd-stage correction, measurements on frequency converters, editor for ENR tables, consideration of isolator/cable attenuation, runs under Windows	FS-K3	1057.3028.02	0	0	0	•	0	0	0	0
<b>Phase noise measurement software:</b> Easy to use phase noise measurements, measurement of residual FM an PM, logarithmic plot over 8 decades, runs under Windows	FSE-K4	1108.0088.02	0	0	0	0	0	0	0	0

<sup>2)</sup> Options FSE-B16 and FSE-B17 require option FSE-B15.

# $Spectrum\ Analyzers\ FSEA,\ FSEB,\ FSEM,\ FSEK$

# Model-dependent specifications in brief

Frequency	FSEA20	FSEA30	FSEB20	FSEB30	FSEM20	FSEM30	FSEK20	FSEK30
Frequency range	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) With option FSE-B4	1 x 10 <sup>-6</sup> /year 2 x 10 <sup>-7</sup> /year	2 x 10 <sup>-7</sup> /year —	1 x 10 <sup>-6</sup> /year 2 x 10 <sup>-7</sup> /year	2 x 10 <sup>-7</sup> /year —	1 x 10 <sup>-6</sup> /year 2 x 10 <sup>-7</sup> /year	2 x 10 <sup>-7</sup> /year —	1 x 10 <sup>-6</sup> /year 2 x 10 <sup>-7</sup> /year	
Spectral purity								
SSB phase noise, referre	d to 1 Hz bandw	ridth, f≤500 MF <–87 dBc	lz	م D م D م		<-81 dBc		. 01 dDa
1 kHz <sup>1)</sup>	_ <-85 dBc	<-07 dBc <-107 dBc	_ <-79 dBc	<-81 dBc <-100 dBc	_ <-79 dBc	<-01 abc <-100 dBc	_ <-79 dBc	<-81 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
Resolution bandwidths	1011	1.11	1011	1.11	10.11	1.11	1011	1.11
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	<15	<12	<15	<12	<15	<12	<15	<12
(1 kHz to 2 MHz)	1.11	111 .	1.11	1.11	1.11	1.11	1.11	1.11
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
Level								
	vorago lovol in dB	m (10 Hz band)	width OdB PE a	tonuation \/B\A/	_ 1 Hz no signa	al at PE input)		
<b>Displayed noise floor</b> , av 20 Hz	erage level in ab	–80	— — — — — — — — — — — — — — — — — — —	–74	= 1 Hz, no signo —	= 10 KF IIIpuij = -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, typ135	<-145, typ150	<-125, typ130	<-142 typ145	<-124, typ129	<-142, typ145	<-124, typ129	<-142, typ145
10 MHz to 3.5/6 GHz		<–145,	<-142,	<–142,	<-138,	<–138,	<–138,	<–138,
	typ150	typ. –150	typ147	typ147	typ140	typ140	typ140	typ140
6 GHz to 7 GHz	_	_	<-139	<-139	<-135,	<-135,	<-135,	<-135,
7 GHzto 18 GHz	_	_	_	_	typ. –138 <–138,	typ138 <-138,	typ. –138 <–138,	typ. –138 <–138,
7 011210 10 0112					typ. –140	typ. –140	typ. –140	typ. –140
18 GHz to 26.5 GHz	_	_	_	_	<−135,	<-135,	< <del>-</del> 135,	<-135,
24 5 CU- +- 20 CU-					typ. –138	typ. –138	typ. –138	typ. –138
26.5 GHz to 30 GHz	_	_	_	_	_	_	<–120, typ. –125	<-120, typ125
30 GHz to 40 GHz	_	_	_	_	_	_	<–116,	<–116,
							typ122	typ122
Max. dynamic range		n 1 Hz bandwidth		n 1 Hz bandwidth		n 1 Hz bandwidth	10 Hz bandwidth	n 1 Hz bandwidth
Displayed noise floor	155 dB	165 dB	152 dB	162 dB	150 dB	160 dB	150 dB	160 dB
at 1 dB compression								
Max. intermodulation-fre		115 dB						
50 MHz to 3.5/7 GHz 100 MHz to 26.5 GHz	—	—	_ 105 dB	_ 115 dB	_ 103 dB	_ 112 dB	_ 103 dB	_ 112 dB
Total measurement uncer		R below referen						
<1 GHz	idility (0 10 30 d	D Delow Telefelic	e level, spall/ Ki	<1 dB	78 reliability)			
1 GHz to 3,5/7 GHz				<1,5 dB				
Intermodulation								
3rd-order intermod.,		>50 MHz (T.O.I.		f >150 MHz			f >100 MHz	
intermodulation-free		dBm,	•	≥15 dBm,	/TO 1 > 1		orf>7 GHz	( . 7 CII )
dynamic range, level 2 > $-20 \text{ dBm}$ , $\Delta f > 5 \times RBW$	typ. I	8 dBm)	typ. 2	O dBm)	(1.0.1. ≥17	<sup>7</sup> dBm, typ. 22 c	IBm; > I U dBm fo	orf>/ GHz)
or 10 kHz, whichever is								
the greater value								
Intermodulation-free range	e			10	5 dB			
at -40 dBm mixer level Intercept point k2 (dBm)	>25 tvn >40	for f<50 MHz,			>25 for f < 150	) MHz, >35 typ.		
mercepi pomi kz (ubin)		for f >50 MHz				) MHz, >45 typ.		
	. /1					, , , , , , , ,		

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

<sup>2)</sup> Valid for span >100 kHz.

## Spectrum Analyzers FSEA, FSEB, FSEM, FSEK

### Common specifications in brief

Frequency

Frequency display Resolution Frequency counter Resolution

Display range of frequency axis

Sweep time Display range

Picture refresh rate

Sampling rate Sweep trigger

Zero span

Level Display range

Max. input level RF attenuation 0 dB/≥10 dB DC voltage CW RF power Pulse spectral density Max. pulse energy (10 μs)

Max. pulse voltage (RF attenuation ≥10 dB) 1 dB compression of input mixer (O dB RF attenuation)

Max. harmonics suppression Level display

Trace Log level axis Linear level axis

Setting range of reference level Log level display

Linear level display Units of level axis

Pulse amplitude accuracy (single pulses) Bandwidth < 1 MHz

≥1 MHz

Trigger function

Trigger Delayed sweep Trigger source Delay time Delayed sweep time Gated sweep

> Trigger source Gate delay Gate length

with marker

0.1 Hz to 10 kHz (depending on span) measures the marker frequency 0.1 Hz to 10 kHz (selectable) 0 Hz, 10 Hz to full span

1 μs to 2500 s >10 Hz 5 ms to 16000 s >20 updates/s with 1 trace >15 updates/s with 2 traces 50 ns (20 MHz A/D converter) free run, single, line, video, gated, delayed, external additionally pretrigger, posttrigger, trigger delay

noise floor displayed to 30 dBm

20 dBm (= 0.1 W)/30 dBm (= 1 W) 97 dBuV/MHz 1 mWs/FSEM/K: 0.5 mWs (RF attenuation ≥10 dB)

FSEA/B: 150 V. FSEM/K: 50 V

+10 dBm nominal 90 dB (f >50 MHz)

500 × 400 pixels (one diagram) 10 to 200 dB in 10 dB steps 10% of reference level per level division, 10 divisions

-130 to +30 dBm in 0.1 dB steps 7 nV to 7.07 V in 1% steps dBm, dBμV, dBμA, dBpW (log level display); mV, μV, mA, μA, pW, nW (linear level display)

0.5 dB nominal 2 dB nominal

free run, line, video, RF, external

free run, line, external, video 100 ns to 10 s, 1  $\mu$ s 2 µs to 1000 s

external, RF level 1 us to 100 s 1 μs to 100 s, resolution 1 μs **Demodulation** 

Modulation modes Audio output Marker stop time

External Mixer FSE-B21

LO output/IF input (front panel) LO signal Level IF signal

Level measurement uncertainty

Frequency Full level

Inputs and outputs (front panel) RF input

VSWR (RF attenuation >10 dB), f < 3.5 GHz Attenuator Probe power

Power supply and coding connector for antennas etc (antenna code)

Supply voltages AF output

Inputs and outputs (rear panel)

IF 21.4 MHz

Level

Video output

Reference frequency Output, usable as input

Input Sweep output

Noise source connector

Ext. trigger/gate input IEC/IEEE-bus control

Serial interface

Mouse interface Plotter 1) Printer interface Keyboard connector User interface

General data

Display  $(640 \times 480)$ Mass memory Power supply, AC

Power consumption Dimensions ( $\dot{W} \times H \times D$ ; 5 HU) Models 20 Models 30

Weight

AM and FM

SMA female, 50  $\Omega$ 

+15.5 dBm ±3 dB

SMA female,  $50 \Omega$ 

741.4 MHz

741.4 MHz

-20 dBm

<1 dB

-20 dBm

<1 dB

7.5 GHz to 15.2 GHz

loudspeaker and headphones output 100 ms to 60 s

Full level

IF input (front panel)

Level measurement uncertainty

N female, 50  $\Omega$  (FSEA/FSEB), Microwave Adapter System (FSEM/K)

0 to 70 dB, selectable in 10 dB steps +15 V/-12.6 V (DC) and ground, ≥150 mA

12-contact Tuchel connector ±10 V, max. 100 mA, ground jack, adjustable up to 1.5 V  $(Z_{in} = 10 \Omega)$ 

BNC female 50  $\Omega$ , bandwidth >1 kHz or resolution bandwidth O dBm at reference level, mixer level >-60 dBm BNC female 50  $\Omega$ , 0 to 1 V (open-circuit voltage)

BNC female 10 MHz, 10 dBm nominal 1/.../16 MHz, >0 dBm into 50  $\Omega$ BNC female, 0 to 10 V, proportional to displayed frequency BNC female, 0/28 V, switch-selected BNC, -5/+5 V, adjustable interface to IEC625-2 (IEEE488.2), Command set SCPI 1994.0 RS-232 interface (COM1 and COM2), 9-contact female connectors PS/2-compatible via IEC/IEEE bus or RS-232-C, HP-GL

parallel (Centronics) or serial (RS-232-C) 5-contact female for MF2 keyboard 25-contact Cannon female

Connector for external monitor (VGA) 15-contact female

24 cm colour LCD (9.5") 31/2", 1.44 MByte; hard disk 100 to 120 V: 50 Hz to 400 Hz 200 to 240 V: 50 Hz to 60 Hz 170 to 230 VA (depending on model)

 $435 \text{ mm} \times 236 \text{ mm} \times 460 \text{ mm}$  $435 \text{ mm} \times 236 \text{ mm} \times 570 \text{ mm}$ 21.5 to 25,8 kg (depending on model)

<sup>4)</sup> Plot function is not available, if FSE-B15 is fitted.

# $Spectrum\ Analyzers\ FSEA,\ FSEB,\ FSEM,\ FSEK$

## Ordering information

Spectrum Analyzer	FSEA 20 FSEA 30 FSEB 20 FSEB 30 FSEM 20 FSEK 20 FSEK 30	) ) ) )	1065.6000.25 1065.6000.35 1066.3010.25 1066.3010.35 1080.1505.25 1079.8500.35 1088.1491.25 1088.3494.35
Options 7 GHz Frequency Extension for FSEA Low Phase Noise and OCXO (for mo FFI Filter 1 Hz to 1 kHz (for models of the control of the contro	odels 20) 20) nnector nnector	FSE-B2 FSE-B4 FSE-B5 FSE-B7 FSE-B8 FSE-B10 FSE-B11 FSE-B13 <sup>2</sup> FSE-B15 <sup>2</sup> FSE-B16 <sup>1</sup> FSE-B16 <sup>1</sup> FSE-B16 <sup>1</sup> FSE-B16 <sup>1</sup> FSE-B16 <sup>1</sup> FSE-B17 FSE-B18 <sup>2</sup> FSE-B19 FSE-B21 FSE-B22 <sup>2</sup> FSE-B23 <sup>2</sup>	1073.5044.02 1073.5396.02 1073.5544.02 1066.4317.02 1066.4469.02 1066.4769.02 1066.4769.02 1066.5065.02 1119.6499.02 1073.5973.02 1073.5973.03 1073.5973.04 1066.4017.02 1088.6993.02 1088.7248.02 1084.7243.02 1084.7243.02
Software Noise Measurement Software, Wind Phase Noise Measurement Software Windows GSM Application Firmware, Mobile GSM Application Firmware, BTS		FS-K3 FSE-K4 FSE-K10 FSE-K11	1057.3028.02 1108.0088.02 1057.3092.02 1057.3392.02

Extras			
Service Kit		FSE-Z1	1066.3862.02
DC Block, 5 to 700	0 MHz (Type N)	FSE-Z3	4010.3895.00
DC Block, 10 kHz to			1084.7443.02
Microwave Measure			
Adapter Set for FSE		FS-Z15	1046.2002.02
Harmonics Mixer 40	to 60 GHz	FS-Z60 <sup>3)</sup>	1089.0799.02
Harmonics Mixer 50	) to 75GHz	FS-Z75 <sup>3)</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'		PMC3	1082.6004.02
IEC/IEEE-Bus Cable		PCK	0292.2013.10
IEC/IEEE-Bus Cable		PCK	0292.2013.20
19" Rack Adapter v	vith front handles		0396.4911.00
Transit Case		ZZK-954	1013.9395.00
Transit Case			
(FSEM 30 and FSEK		ZZK-955	1013.9408.00
Matching Pads, 75	Ω	D 4 4 4	0050 5414 00
L section	05.0	RAM	0358.5414.02
Series resistor		RAZ	0358.5714.02
Accessories for curre			: ( T .D : F66
and field-strength me	easurement	see accessor data sheet PI	ies for Test Receiver ESS,
CIA/D Datalana E AALI	- t- 2000 MIL-		
SWR Bridge, 5 MH:		ZRB2 ZRC	0373.9017.52 1039.9492.52
SWR Bridge, 40 kH High-Power Attenua		ZRC	1039.9492.32
3/6/10/20/30 dB		RBU 100	1073.8820.xx
3/0/10/20/30 db		KBO 100	(xx=03/06/10/20/30)
High-Power Attenua	tors 50 W		(xx=03/00/10/20/30)
3/6/10/20/30 dB		RBU 50	1073.8895.xx
3/0/10/20/30 db		KBO 30	(xx=03/06/10/20/30)
Preamplifier, 20 MH	17 to 1000 MHz	FSV-73	0397.7014.52
For FSEM only:	12 10 1000 7411 12	L3V-Z3	0377.7014.92
Test-Port Adapter,	N (male)	_	1021.0541.00
icali on Adapici,	3.5 mm (male)	_	1021.0529.00
For FSEK only:	o.o mm (maio)		1021.0027.00
Test-Port Adapter,	N (male)	_	1036.4783.00
	K (male)	_	1036.4802.00
	2.4 mm (male)	FSE-Z5	1088.1627.02
	()		

Options FSE-B16 and FSE-B17 require option FSE-B15.

<sup>2)</sup> Cannot be retrofitted, factory-fitted only.

<sup>3)</sup> For all FSEM/K, option FSE-B21 required