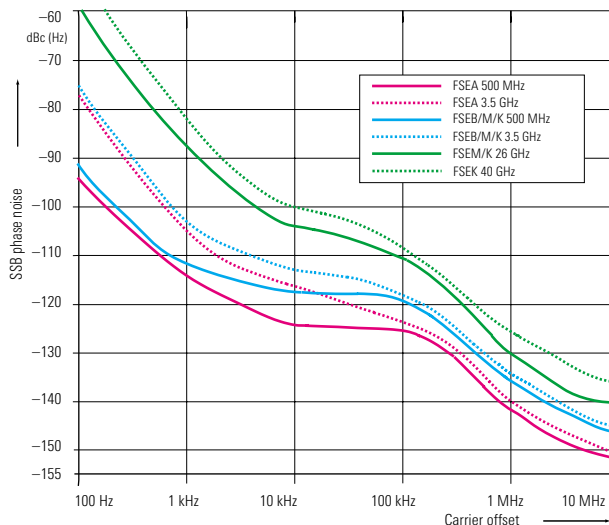


Specifications

	FSEA30	FSEB30	FSEM30	FSEK30
Specifications are guaranteed under the following conditions: 30 minutes warmup time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and total calibration performed. Data without tolerances: typical values only. Data designated "nominal" apply to design parameters and are not tested.				
Frequency				
Frequency range	20 Hz to 3.5 GHz	20 Hz to 7 GHz	20 Hz to 26.5 GHz	20 Hz to 40 GHz
Frequency resolution	0.01 Hz			
Internal reference frequency, nominal				
Aging per day ¹⁾	1 x 10 ⁻⁹			
Aging per year ¹⁾	2 x 10 ⁻⁷			
Temperature drift (0°C to +50°C)	5 x 10 ⁻⁸			
Total error limit (per year)	2.5 x 10 ⁻⁷			
External reference frequency				
Frequency display	10 MHz or n x 1 MHz, n = 1 to 16 with marker			
Resolution	0.1 Hz to 10 kHz (as a function of span)			
Error limit (sweep time > 3 x auto sweep time)	±(marker frequency x reference error + 0.5 % x span + 10 % x resolution bandwidth + 1/2 (last digit))			
Frequency counter				
Resolution	measures the marker frequency 0.1 Hz to 10 kHz (selectable)			
Count accuracy (S/N > 25 dB)	±(frequency x reference error + 1/2 (last digit))			
Display range for frequency axis				
Resolution/error limit of display range	0 Hz, 10 Hz to full span 0.1 Hz/1%			
Spectral purity (dBc (Hz))				
SSB phase noise, f ≤ 500 MHz for f > 500 MHz see diagram below				
Carrier offset	100 Hz	<-87		<-81
	1 kHz	<-107		<-100
	10 kHz	<-120		<-114
	100 kHz ²⁾	<-119		<-113
	1 MHz ²⁾	<-138		<-132
Sweep time				
Span = 0 Hz	1 μs to 2500 s in 5% steps			
Span ≥ 10 Hz	5 ms to 16 000 s in steps ≤ 10%			
Error limit	< 1%			
Picture refresh rate (span ≤ 7 GHz)	> 20 updates/s with 1 trace, > 15 updates/s with 2 traces			
Sampling rate	50 ns (20 MHz A/D converter)			
Number of pixels	500			
Time measurement	with marker and cursor lines			
Resolution	50 ns			
Sweep trigger	free run, single, line, video, gated, delayed, external			
Zero span	additionally pretrigger, posttrigger, trigger delay			
Resolution bandwidths				
3 dB bandwidths (in 1/2/3/5 steps)	1 Hz to 10 MHz			
FFT filter (in 1/2/3/5 steps) (see also page 16)	1 Hz to 1 kHz			



SSB phase noise (typical values)

Specifications

	FSEA30	FSEB30	FSEM30	FSEK30
Bandwidth error	≤3 MHz		<10%	
	5 MHz		<15%	
	10 MHz		+25%, -10%	
Shape factor 60:3 dB	<1 kHz		<6	
	1 kHz to 2 MHz		<12	
	>2 MHz		<7	
Video bandwidths			1 Hz to 10 MHz, 1/2/3/5 steps	
Level				
Display range				noise floor displayed to 30 dBm
Maximum input level				
RF attenuation 0 dB				
DC voltage			0 V	
CW RF power			20 dBm (=0.1 W)	
Pulse spectral density			97 dBμV (MHz)	
RF attenuation ≥10 dB				
DC voltage			0 V	
CW RF power			30 dBm (=1 W)	
Max. pulse voltage		150 V		50 V
Max. pulse energy (10 μs)		1 mWs		0.5 mWs
1 dB compression of input mixer (0 dB RF attenuation)				+10 dBm nominal
Displayed average noise floor	in dBm (0 dB RF attenuation, RBW 10 Hz, VBW 1 Hz, 20 averages, trace average, span 0 Hz, termination 50 Ω)			
Frequency	20 Hz	<-80		<-74
	1 kHz	<-110		<-104
	10 kHz	<-125		<-119
	100 kHz	<-135		<-129
	1 MHz	<-145, -150 typ.		<-142, typ. -145
	10 MHz to 3.5/6 GHz	<-145, -150 typ.	<-142, -147 typ.	<-138, -140 typ.
	6 GHz to 7 GHz	-	<-139	<-135, -138 typ.
	7 GHz to 18 GHz	-	-	<-138, -140 typ. <-134, -139 typ.
	18 GHz to 26.5 GHz	-	-	<-135, -138 typ. <-131, -136 typ.
	26.5 GHz to 30 GHz	-	-	- <-120, -125 typ.
	30 GHz to 40 GHz	-	-	- <-116, -122 typ.
Max. dynamic range, bandwidth 1 Hz				
Displayed noise floor to 1 dB compression	165 dB	162 dB		160 dB
Max. harmonics suppression, f >50 MHz				>90 dB
Max. intermodulation-free range				
50 MHz to 3.5 GHz (nominal)	115 dB	-		-
150 MHz to 7/26.5 GHz (nominal)	-	115 dB		112 dB
Intermodulation				
TOI, intermodulation-free dynamic range, level 2 × -30 dBm, Δf >5 × RBW or >10 kHz	>84 dBc for f >50 MHz (TOI >12 dBm, 18 dBm typ.)	>90 dBc for f >150 MHz (TOI >15 dBm, 20 dBm typ.)		>94 dBc for f >100 MHz >80 dBc for f >7 GHz, (TOI >17 dBm, 22 dBm typ.; >10 dBm for f >7 GHz)
Intermodulation-free range at -40 dBm mixer level				105 dB
Intercept point k2 (dBm)	>25, >40 typ. for f <50 MHz, >45, >50 typ. for f >50 MHz			>25 for f <150 MHz, >35 typ., >40 for f >150 MHz, >45 typ.
Immunity to interference				
Image frequency (dB)		>80, >90 typ.		>80, >90 typ. for f <22 GHz >75, >80 typ. for f >22 GHz
Intermediate frequency (dB)	>100 dB			>75 dB
Spurious response (f >1 MHz, without input signal, 0 dB attenuation)				
Span <30 MHz				<-110 dBm
Span ≥30 MHz				<-100 dBm
f _{in} = 25.06 MHz, 25.175 MHz, 5.7172 GHz				<-100 dBm
f _{in} = 60 MHz	<-110 dBm			<-100 dBm
f _{in} = 14.1894 GHz, 15.6722 GHz				
Span >10 MHz				-90 dBm
Other interfering signals (mixer level <-10 dBm)	<-80 dB ³⁾			<-75 dB ³⁾

Specifications

	FSEA30	FSEB30	FSEM30	FSEK30
Level display				
Measurement display	500 × 400 pixels (with one diagram displayed); max. 2 diagrams with independent settings			
Logarithmic level range	10 dB to 200 dB, in steps of 10 dB			
Linear level range	10% of reference level per division (10 divisions) or logarithmic scaling			
Traces	max. 4 per diagram (max. 2 if 2 diagrams are displayed) quasi-analog display of all results			
Trace detector	max peak, min peak, auto peak (normal), sample, rms, average			
Trace functions	clear/write, max hold, min hold, average			
Setting range of reference level				
Logarithmic level display	−130 dBm to 30 dBm, in steps of 0.1 dB			
Linear level range	7.0 nV to 7.07 V in steps of 1%			
Units of level axis	dBm, dBμV, dBmV, dBμA, dBpW (logarithmic and linear level display); mV, μV, mA, μA, pW, nW (linear level display)			
Level measurement uncertainty (−40 dBm, RF attenuation 20 dB, reference level −15 dB, RBW 5 kHz)	The values are guaranteed for bandwidths from 10 Hz to 30 kHz and 100 kHz to 10 MHz.			
Absolute error limit at 120 MHz	<0.3 dB			
Frequency response (10 dB RF attenuation)				
<1 GHz			<0.5 dB	
1 GHz to 3.5/7 GHz			<1 dB	
7 GHz to 18 GHz	–		<2 dB ⁴⁾	
18 GHz to 26.5 GHz	–		<2.5 dB ⁴⁾	
26.5 GHz to 40 GHz	–		–	<3 dB ⁴⁾
Attenuator error limit	<0.3 dB			
IF gain error	<0.2 dB (0.1 dB typ.)			
Display nonlinearity				
Logarithmic level display (RBW ≥1 kHz, analog)				
0 dB to −50 dB			<0.3 dB	
−50 dB to −70 dB			<0.5 dB	
−70 dB to −80 dB			–	
−70 dB to −95 dB			<1 dB	
Linear level display			5% of reference level	
Bandwidth switching error				
1 Hz to 30 kHz/100 to 500 kHz			<0.2 dB	
1 MHz to 10 MHz			<0.3 dB	
Total measurement uncertainty (0 dB 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	
7 GHz to 18 GHz	–		<2.5 dB ⁴⁾	
18 GHz to 26.5 GHz	–		<3 dB ⁴⁾	
26.5 GHz to 40 GHz	–		–	<3.5 dB ⁴⁾
Pulse amplitude error (single pulses)				
Bandwidth <1 MHz/≥1 MHz			<0.5 dB, nominal/<2 dB, nominal	
Trigger functions				
Trigger			free run, line, video, RF, external	
Delayed sweep				
Trigger source			free run, line, video, RF, external	
Delay time			100 ns to 10 s, resolution 1 μs min. or 1% of delay time	
Error of delay time			±(1 μs + (0.1% × delay time))	
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 min. 1 μs or 1% of gate length	
Error of gate length			±(1 μs + (0.05% × gate length))	
Gap sweep (span = 0 Hz)				
Trigger source			free run, line, video, RF, external	
Pretrigger			1 μs to 100 s, 50 ns resolution, dependent on sweep time	
Trigger to gap time			1 μs to 100 s, 50 ns resolution, dependent on sweep time	
Gap length			1 μs to 100 s, 50 ns resolution	

Specifications

	FSEA30	FSEB30	FSEM30	FSEK30
Audio demodulation				
AF demodulation types	AM and FM			
Audio output	loudspeaker and headphones output			
Marker stop time	100 ms to 60 s			
Inputs and outputs (front panel)				
RF input	N female, 50 Ω		adapter system, 50 Ω , N male and female, 3.5 mm male and female	adapter system, 50 Ω , N male and female, K male and female, 2.4 mm female
VSWR (RF attenuation ≥ 10 dB)				
f < 3.5 GHz	< 1.5			
f < 7 GHz	–		< 2.0	
f < 26.5 GHz	–	–	< 3	< 2.5
f < 37 GHz	–	–	–	< 2.5
f < 40 GHz	–	–	–	2.5 typ.
Attenuator	0 dB to 70 dB, selectable in 10 dB steps			
Probe power	+15 V DC, –12.6 V DC and ground, max. 150 mA			
Power supply and coding connector for antennas etc (antenna code)	12-contact Tuchel			
Supply voltages	± 10 V, max. 100 mA, ground			
AF output	$Z_{out} = 10 \Omega$, jack plug			
Open-circuit voltage	adjustable up to 1.5 V			
Inputs and outputs (rear panel)				
IF 21.4 MHz	$Z_{out} = 50 \Omega$, BNC female, bandwidth > 1 kHz or resolution bandwidth			
Level	0 dBm at reference level, mixer level > –60 dBm			
Video output	$Z_{out} = 50 \Omega$, BNC female			
Voltage (resolution bandwidth ≥ 1 kHz)	0 V to 1 V, full scale (open-circuit voltage); logarithmic scaling			
Reference frequency				
Output, usable as input	BNC female			
Output frequency	10 MHz			
Level	10 dBm nominal			
Input	1 MHz to 16 MHz, integer MHz			
Required level	> 0 dBm into 50 Ω			
Sweep output	BNC female, 0 V to 10 V in sweep range			
Power supply connector for noise source	BNC female, 0 V and 28 V, selectable			
External trigger/gate input	BNC female, > 10 k Ω			
Voltage	–5 V to +5 V, adjustable			
IEC/IEEE-bus control	interface to IEC625-2 (IEEE 488.2), command set: SCPI 1994.0			
Connector	24-contact Amphenol female			
Interface functions	SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C11			
Serial interface	RS-232-C (COM 1 and COM 2), 9-contact female connectors			
Mouse interface	PS/2 mouse compatible			
Plotter⁵⁾	via IEC/IEEE bus or RS-232-C; plotter language: HP-GL			
Printer interface	parallel (Centronics compatible) or serial (RS-232-C)			
Keyboard connector	5-contact DIN female for MF-2 keyboard			
User interface	25-contact Cannon female			
Connector for external monitor (VGA)	15-contact female			
General data				
Display	24 cm LC TFT colour display (9.5")			
Resolution	640 \times 480 pixels (VGA resolution)			
Pixel failure rate	< 2 $\times 10^{-5}$			
Mass memory	1.44 Mbyte 3 1/2" diskette drive, hard disk			
Operating temperature range				
Nominal temperature range	+5 $^{\circ}$ C to +40 $^{\circ}$ C			
Limit temperature range	0 $^{\circ}$ C to +50 $^{\circ}$ C			
Storage temperature range	–40 $^{\circ}$ C to +70 $^{\circ}$ C			
Humidity	+40 $^{\circ}$ C at 95 % relative humidity (IEC 68-2-3)			
Mechanical resistance				
Vibration, sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz; 55 Hz to 150 Hz, 0.5 g const. to IEC 68-2-6, IEC 68-2-3, IEC 1010-1, MIL-T-28800D, class 5			
Vibration, random	10 Hz to 300 Hz, acceleration 1.2 g (rms)			

Specifications

	FSEA30	FSEB30	FSEM30	FSEK30
Shock	40 g shock spectrum, to MIL-STD-810 D and MIL-T-28800 D, classes 3 and 5			
Recommended calibration interval	1 year (2 years for operation with external reference)			
RFI suppression	to EMC directive of EU (89/336/EEC) and German EMC legislation			
Power supply				
AC supply	200 V to 240 V: 50 Hz to 60 Hz, 100 V to 120 V: 50 Hz to 400 Hz, class of protection I to VDE 411			
Power consumption	180 VA	195 VA	230 VA	230 VA
Safety	to EN 61010-1, UL3111-1, CSA C22.2 No. 1010-1, IEC 1010-1			
Test mark	VDE, GS, UL, cUL			
Dimensions in mm (W x H x D)	435 x 236 x 460 (5 HU)		435 x 236 x 570	435 x 236 x 570
Weight in kg	22.7	23.2	25.2	25.8

- 1) After 30 days of operation.
- 2) Valid for span >100 kHz.
- 3) For models with option FSE-B23: <-50 dBm.
- 4) For frequencies >7 GHz: error after calling peaking function. For sweep times <10 ms/GHz: additional error 1.5 dB.
- 5) The plot function is not available if option FSE-B15 is installed.

Specifications

FFT filter

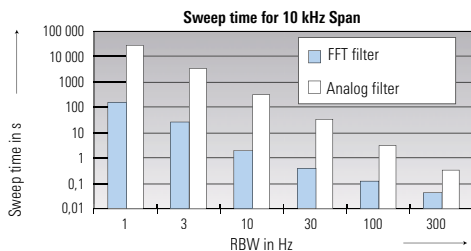
High frequency resolution due to very small shape factor of 2.5
Extremely short measurement time, up to 150 times faster than with conventional filters

Resolution bandwidths (RBW)

3 dB bandwidth
in 1/2/3/5 steps 1 Hz to 1 kHz
Bandwidth error 2%, nominal
Shape factor 60:3 dB 2.5, nominal

Display range for frequency axis

Min. span 25 x RBW
Max. span 100000 x RBW, max. 2 MHz



Level measurement error

Additional total level error,
referred to RBW 5 kHz <1 dB

Max. display range 100 dB

Immunity to interference

Spurious response ≤100 dBm

1 dB Attenuator FSE-B13

Frequency range max. 7 GHz (stop frequency ≤7 GHz)
Setting range of RF attenuation 0 dB to 70 dB
Step width 1 dB
Additional attenuator uncertainty <0.1 dB

External Mixing FSE-B21

LO output/IF input (front panel)	SMA female, 50 Ω
LO signal	7.5 GHz to 15.2 GHz
Amplitude	+15.5 dBm ±3 dB
IF signal	741.4 MHz
Full-scale level	-20 dBm
IF input (front panel)	SMA female, 50 Ω
IF signal	741.4 MHz
Full-scale level	-20 dBm
Level measurement error at IF inputs (IF level -30 dBm, reference level -20 dBm, RBW 30 kHz)	<1 dB

Increased Level Accuracy FSE-B22

Total level error	≤0.5 dB with 10 dB RF attenuation
	≤0.6 dB with 20/30/40 dB RF attenuation

Specifications are valid for:

Temperature range	-/+20°C to +30°C
Frequency range	10 MHz to 2 GHz
Resolution bandwidths	5 kHz to 30 kHz/300 kHz/1 MHz
Signal level	10 dB to 50 dB below reference level
Stop frequency	≤2 GHz
Sweep time	≥3 x auto sweep time

Broadband Output 741.4 MHz FSE-B23

FSE-B23 reduces the suppression of other interference signals to -50 dBm and must not be combined with FSE-K10/-K11.

	FSEA	FSEB	FSEM	FSEK
Gain from RF input to IF output (dB)	6	6	4	4
3 dB BW (MHz)	60	150	150 ¹⁾ 40 to 80 ²⁾	150 ¹⁾ 40 to 120 ³⁾

- 1) f <7 GHz.
- 2) 7 GHz to 26.5 GHz.
- 3) 7 GHz to 40 GHz.

Connector BNC
Impedance 50 Ω

For maximum bandwidth set instrument to 10 MHz RBW. The output level is a function of the mixer level, which equals the input signal level minus the set RF attenuation.

The typical loss between mixer level and IF output is 2 dB for FSEM/K, and 0 dB for FSEA/B.

44 GHz Frequency Extension for FSEK FSE-B24

Frequency range 20 Hz to 44 GHz

Level

Displayed average noise level (DANL)
(0 dB RF attenuation, RBW = 10 Hz, VBW = 1 Hz, 20 averages, trace average, span 0 Hz, 50 Ω termination)

40 GHz to 42 GHz <-112, -128 dBm typ.
42 GHz to 43 GHz <-108, -113 dBm typ.
43 GHz to 44 GHz <-105, -110 dBm typ.

Intermodulation

3rd-order intercept point (TOI) $\Delta f > 5 \times$ resolution bandwidth or > 10 kHz
>40 GHz +15 dBm typ.
2nd harmonic intercept point (SHI) >25 dBm for $f < 150$ MHz
>40 dBm for $f > 150$ MHz

Level measurement error

Frequency response (10 dB RF attenuation)
40 GHz to 44 GHz <4.0 dB¹⁾²⁾
Total measurement error
(0 dB to 50 dB below reference level)
40 GHz to 44 GHz <4.5 dB¹⁾²⁾

Inputs and outputs (front panel)

RF input adapter system, 50 Ω, N male und female, K male und female, 2.4 mm female
VSWR (RF attenuation >0 dB)
f >40 GHz <3.0:1 typ.

¹⁾ Error after running the preselector peaking function. For sweep <10 ms/GHz: additional error 1.5 dB.

²⁾ Temperature range 20°C to 35°C.

Ordering information

Order designation	Type	Order No.
Spectrum Analyzer 20 Hz to 3.5 GHz	FSEA30	1065.6000.35
Spectrum Analyzer 20 Hz to 7 GHz	FSEB30	1066.3010.35
Spectrum Analyzer 20 Hz to 26.5 GHz	FSEM30	1079.8500.35
Spectrum Analyzer 20 Hz to 40 GHz	FSEK30	1088.3494.35
Accessories supplied Power cable, operating manual, spare fuses; FSEM: test-port adapter 3.5 mm female (1021.0512.00) and N female (1021.0535.00) FSEK: test-port adapter K female (1036.4790.00) and N female (1036.4777.00)		
Options (see also fold-in page)		
7 GHz Frequency Extension for FSEA	FSE-B2	1073.5044.02
Vector Signal Analyzer	FSE-B7 ¹⁾	1066.4317.03
Tracking Generator 3.5 GHz	FSE-B8 ¹⁾	1066.4469.02
3.5 GHz with I/Q modulator	FSE-B9 ¹⁾	1066.4617.02
7 GHz	FSE-B10 ¹⁾	1066.4769.02
7 GHz with I/Q modulator	FSE-B11 ¹⁾	1066.4917.02
Switchable Attenuator for Tracking Generator	FSE-B12 ²⁾	1066.5065.02
1 dB Attenuator	FSE-B13 ²⁾³⁾	1119.6499.02
Controller for FSE (mouse and keyboard included)	FSE-B15 ⁴⁾	1073.5696.06
Ethernet Interface 15-contact AUI connector	FSE-B16 ⁵⁾	1073.5973.02
Thin-wire BNC connector	FSE-B16 ⁵⁾	1073.5973.03
RJ-45 connector (twisted pair)	FSE-B16 ⁵⁾	1073.5973.04
2nd IEC/IEEE-Bus Interface for FSE	FSE-B17 ⁵⁾	1066.4017.02

Order designation	Type	Order No.
Removable Hard Disk	FSE-B18 ⁴⁾	1088.6993.02
2nd Hard Disk for FSE-B18 (firmware included)	FSE-B19	1088.7248.02
External Mixing	FSE-B21	1084.7243.02
Increased Level Accuracy up to 2 GHz	FSE-B22 ⁴⁾	1106.3480.02
Broadband Output 741.4 MHz	FSE-B23 ⁴⁾	1088.7348.02
44 GHz Frequency Extension for FSEK	FSE-B24 ⁴⁾	1106.3680.02
Software		
Noise Measurement Software, Windows	FS-K3 ¹⁾	1057.3028.02
Phase Noise Measurement Software, Windows	FS-K4 ¹⁾	1108.0088.02
GSM Application Firmware	Mobile station FSE-K10 ¹⁾	1057.3092.02
	Base station FSE-K11 ¹⁾	1057.3392.02
EDGE Application Firmware	Mobile station FSE-K20 ¹⁾	1106.4086.02
	Base station FSE-K21 ¹⁾	1106.4186.02
Recommended extras		
Service Kit	FSE-Z1	1066.3862.02
DC Block	5 MHz to 7000 MHz (type N) FSE-Z3	4010.3895.00
	10 kHz to 18 GHz (type N) FSE-Z4	1084.7443.02
Microwave Measurement Cable and Adapter Set for FSEM	FSE-Z15	1046.2002.02
Harmonic Mixer	40 GHz to 60 GHz FS-Z60 ¹⁾	1089.0799.02
	50 GHz to 75 GHz FS-Z75 ¹⁾	1089.0847.02
	60 GHz to 90 GHz FS-Z90 ¹⁾	1089.0899.02
	75 GHz to 110 GHz FS-Z110 ¹⁾	1089.0976.00

Order designation	Type	Order No.
Service Manual	—	1065.6016.24
Headphones	—	0708.9010.00
Keyboard	German	PSA-Z2 1007.3001.31
	US	PSA-Z2 1007.3001.02
PS/2 Mouse	FSE-Z2	1084.7043.02
IEC/IEEE-Bus Cable	1 m	PCK 0292.2013.10
	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 (FSEM30 and FSEK30 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 and Spectrum Analyzers, data sheet PD 0756.4320	
SWR Bridge	5 MHz to 3000 MHz	ZRB2 0373.9017.52
	40 kHz to 4 GHz	ZRC 1039.9492.52

Order designation	Type	Order No.
High-Power Attenuators	100 W 50 W	RBU 100 RBU 50
Steps: 3/6/10/20/30 dB		1073.8820.xx 1073.8895.xx xx: 03/06/10/ 20/30
	ESV-Z3	0397.7014.52
For FSEM only: Test-Port Adapter	N male	—
	3.5 mm male	—
		1021.0541.00 1021.0529.00
For FSEK only: Test-Port Adapter	N male	—
	K male	—
	2.4 mm female	FSE-Z5
		1036.4783.00 1036.4802.00 1088.1627.02
Probe Power Connectors 3-contact	—	1065.9480.00

- 1) Extra data sheets available.
- 2) FSE-B12 and FSE-B13 cannot be fitted together.
- 3) In combination with FSE-B22 factory-fitted only.
- 4) Cannot be retrofitted, factory-fitted only.
- 5) FSE-B16 and FSE-B17 require option FSE-B15.



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