

# Modulation Analyzers FMA, FMAB, FMAV, FMB; Selective Modulation Analyzer FMAS

**FMA: 50 kHz to 1360 MHz**

**FMAB: FMA with built-in**

**FM stereo decoder**

**FMAS: FMA with receiver and**

**FM stereo decoder**

**FMAV: analysis for air navigation systems**

**FMB: extended frequency range up to 5.2 GHz**



FMAV (photo 40299-1)

## Overview of options

● Standard

FMA-B.. Option

Functions of individual models, options	FMA	FMAB	FMAS	FMAV	FMB
AM/FM/φM	●	●	●	●	●
Weighting filters (CCITT, CCIR), special filter	FMA-B1	●	●	FMA-B1	FMA-B1
SINAD/distortion meter 10 Hz to 100 kHz	FMA-B2	●	FMA-B2	FMA-B2	FMA-B2
Stereo decoder	FMA-B3	●	●	–	FMA-B3
Calibrator with AF and MPX generator	FMA-B4	FMA-B4	FMA-B4	–	FMA-B4
Calibrator with AF and VOR/ILS generator	–	–	–	FMA-B4	–
VOR/ILS measurements	–	–	–	●	–
ILS distortion meter	–	–	–	●	–
Selective AF analysis up to 45 kHz	–	–	–	●	–
Selective AF analysis up to 150 kHz	FMA-B8	FMA-B8	●	–	FMA-B8
RF/IF selection 5 to 1000 (400) MHz	FMA-B9	FMA-B9	●	(FMA-B9.57)	–
Reference oscillator (1 x 10 <sup>-7</sup> /year)	FMA-B10	FMA-B10	FMA-B10	●	FMA-B10
Frequency range up to 5 GHz	FMA-B12	FMA-B12	–	–	●

Designation and further functions of options	Option
<b>Filter:</b> lowpass filter 5 Hz, 4.2 kHz (high skirt selectivity), 30 kHz, 120 kHz (Bessel), special φM filter	FMA-B1
<b>DIST/SINAD Meter:</b> distortion measurable down to typically <0.005 %	FMA-B2
<b>Stereo Decoder:</b> precision instrument, built-in RDS demodulator with external evaluation facility	FMA-B3
<b>AM/FM Calibrator/AF Generator:</b> high-precision level calibration, FMA performance test, complete modulation test set for transmitters and transposers, VOR/ILS baseband signal generation/analysis	FMA-B4
<b>AF Analyzer/DSP Unit:</b> digital AF analyzer, true THD measurement, measurement of intermodulation products	FMA-B8
<b>RF/IF Selection:</b> can be switched on when required; tracking 4-section preselection, selectable IF filters	FMA-B9
<b>RF/IF Selection:</b> high-precision off-air measurement of VOR/ILS signals directly at the antenna (eg flight inspection systems)	FMA-B9.57
<b>5.2 GHz Frequency Extension:</b> enhanced power measurement accuracy	FMA-B12

## Brief description

### Modulation Analyzer FMA

FMA combines the functions of several measuring instruments all in one unit. It allows fast and accurate analysis of all parameters of modulated signals. Thanks to its versatility, it can also be used as an RF counter, power meter, voltmeter, psophometer, distortion meter and as an FM stereo decoder. FMA is suitable for measurements in the field of broadcasting (eg on AM and FM transmitters) as well as radio-telephony and in the calibration of signal generators. It can be upgraded for many other measurement tasks.

### Modulation Analyzer FMAB

FMAB has been especially designed for the analysis of FM stereo broadcast signals. Its measurement tasks include comprehensive analysis of VHF transmitters, channel transposers and VHF/baseband converters. The built-in stereo decoder with all its analysis functions can be separately used via the rear-panel input so that measurements on FM receivers and stereo coders are also possible.

### Selective Modulation Analyzer FMAS

FMAS combines the characteristics of a universal modulation analyzer with those of an FM stereo/TV dual-sound receiver:

- RF/IF selection for 5 to 1000 MHz can be switched on when required
- Selective audio analyzer

### Modulation Analyzer FMAV

FMAV features the versatile measurement functions of the basic model and special functions for the needs of air-traffic control authorities, airport operators as well as manufacturers of air-navigation airborne and test systems.

It measures with utmost precision all modulation parameters relevant in VOR and ILS air navigation systems. With its extremely low measurement error achieved by means of digital signal processing, FMAV meets the stringent requirements placed on measuring instruments for ILS systems of category III.

Its high accuracy makes FMAV also ideal for use as a calibrator for VOR and ILS signal generators like Radio-communication Service Monitor CMS 57 (page 12). With CMS 57 as a signal generator used in conjunction with FMAV as a demodulator, Rohde & Schwarz offers a complete, state-of-the-art test system for aeronautical radio.

### Modulation Analyzer FMB

FMB enables modulation analysis right into the lower microwave range. Its fields of application are especially in outside broadcasting, radio relay links as well as testing and calibration of microwave generators. The outstanding characteristics of the basic model are fully maintained in the extended frequency range up to 5.2 GHz. The power meter function of FMB differs from that of FMA in that it is individually calibrated as a function of frequency and level.

## Main features

- Fast, automatic frequency adjustment by direct frequency measurement
- Low-noise synthesizer with high frequency resolution
- Separate +PK and -PK detectors with extremely short response time
- True RMS detector
- Extremely high accuracy
- High-precision power measure-

ment (typ. error of FMA <0.5 dB, even smaller for FMB)

### Additional features of FMAS:

- Excellent static and dynamic selectivity and high sensitivity for direct measurements at the antenna
- Excellent transmission quality
- High overload capability to interfering signals
- Selective RF level measurement
- Low distortion due to phase-linear IF filters

### High measurement speed

- Two independent frequency counters for simultaneous RF and AF frequency measurements
- All measurement times can be adapted to the specific measurement problem, eg lowest measurement frequency or required counter resolution
- Measurement functions that are not required can be switched off
- FM demodulator with high bandwidth for analysis of digital modulators (eg mobile radio)

### Operation

- Menu-guided operation with softkeys
- Nonvolatile storage of up to 20 complete instrument setups
- Three displays for simultaneous readout of measurement results and indication of all important instrument settings
- Quasi-analog indication of high resolution with absolute or selective as well as MIN-MAX display
- IEC/IEEE-bus remote control to IEEE 488.2



## AM/FM Calibrator/AF Generator (option FMA-B4)

The data are tested at 23°C (73.4°F) and guaranteed by design in the range 23 ± 5°C (73.4 ± 9°F).

<b>AF</b> (single-tone and two-tone signals)	10 Hz to 100 kHz
Resolution	1 mHz
Accuracy	1 mHz + reference frequency drift
Level	1 mV to 7 V (max. 10 V pp)
Accuracy at 1 kHz	≤0.1% ±10 μV
Level resolution	0.02% (min. 10 μV)
Frequency response (at $Z_{in} = 20 \Omega$ , $C_L \leq 200$ pF), 10 Hz to 50 kHz	≤±0.1%
THD + N (level ≤6 V) 10 Hz to 20 kHz	≤0.02%
Difference-frequency distortion (two-tone signals, peak voltage ≤8 V)	≥74 dB (10 Hz to 20 kHz)

### Stereo MPX

Data determined by design, not tested individually. Generation of stereo multiplex signals L, R, R=L, R=-L including 19 kHz pilot tone (disconnectible) or 19 kHz pilot tone + 57 kHz subcarrier (without multiplex signal)

Linear distortion	
Preemphasis	50/75 μs, selectable
Frequency response (10 Hz to 53 kHz)	≤0.1%
Crosstalk attenuation	≥65 dB (30 Hz to 15 kHz)
Non-linear distortion and difference-frequency distortion	≥70 dB
Unweighted and weighted S/N ratio to CCIR 468-4	≥80 dB
Pilot tone	
Nominal frequency	19 kHz ±1 mHz + reference frequency drift
Phase versus carrier Setting range	≤0.1° ±10°
57 kHz subcarrier (only possible with multiplex signal switched off)	
Nominal frequency	57 kHz ±1 mHz + reference frequency drift
Phase versus pilot tone Setting range	≤0.1° ±30°

### VOR/ILS/TACAN (FMAV only)

Data determined by design, not tested individually.

VOR	
Deviation accuracy at 9.96 kHz subcarrier	≤±0.1% ±1 Hz
Setting range	0 to 700 Hz
Phase accuracy 30 Hz	≤±0.005°
ILS	
Frequency response 90 Hz/150 Hz	≤±0.02%
Additional gain difference error	≤0.1% x amplitude difference
Phase accuracy 90 Hz/150 Hz	≤±0.05°
TACAN	
Phase accuracy 15 Hz/135 Hz	≤±0.1°

### Outputs

	2 BNC female connectors on rear panel, unbalanced, same signal at both outputs (can be individually switched off) or 1 x balanced
Output impedance	20 Ω, 200 Ω, 600 Ω selectable
Tolerance	±1% ±2 Ω

### AM

Carrier frequency	10 MHz
Level	-10 dBm
Modulation depth	adjustable from 0 to 99%
Accuracy at $f_{mod} = 1$ kHz, 80% AM	≤0.1% of reading
Additional linearity error	≤0.1% (m = 10 to 95%)
Modulation frequency response	≤0.1% (15 Hz to 10 kHz)
Modulation distortion (THD + N, m = 80%)	≤0.1% (10 Hz to 20 kHz)
Incidental φM, m ≤80%	≤0.01 rad
Residual AM	typ. ≤0.02% (20 Hz to 23 kHz, RMS)

### AM VOR/ILS (FMAV only)

ILS	
DDM accuracy	
m = 18 to 22%	≤±0.00005 DDM ±0.001 x (DDM)
m = 32 to 48%	≤±0.0001 DDM ±0.001 x (DDM)
Phase accuracy 90 Hz/150 Hz	≤0.1°
VOR	
Deviation accuracy at 9.96 kHz subcarrier	≤±0.1% ±1 Hz
Setting range	0 to 700 Hz
Phase accuracy 30 Hz	≤0.01°
TACAN	
Phase accuracy 15 Hz/135 Hz	≤±0.25°

### FM

Carrier frequency	10 MHz
Level	-10 dBm
Deviation ( $f_{mod} = 1$ kHz, squarewave)	100 kHz
Accuracy	≤0.1%
Additional sinewave modulation	$f_{mod} = 10$ Hz to 100 kHz, deviation = 1 to 100 kHz
Residual FM (BW = 23 kHz, RMS)	≤10 Hz
Accuracy for 100 kHz deviation, $f_{mod} = 1$ kHz	≤0.2% + residual FM
Additional linearity error for $f_{mod} = 1$ kHz, dev. = 10 to 100 kHz	≤0.1%
Modulation frequency response	≤0.5% (10 Hz to 100 kHz)
Modulation distortion for 100 kHz deviation	≤0.1% ( $f_{mod} = 10$ Hz to 20 kHz)
Incidental AM for 50 kHz deviation	typ. ≤0.05% ( $f_{mod} = 1$ kHz, BW = 3 kHz)
Level	
Carrier frequency	10 MHz
Accuracy	same as reference frequency
Level range	-50 to -4 dBm
Accuracy	
-10 dBm	≤0.1 dB at
-40 dBm to -4 dBm	≤0.2 dB ±6 nW (
Output	BNC female on front panel (CAL), can be internally switched to RF input
VSWR at 10 MHz	≤1.05

## Specs in brief: FMAS receive mode

Instead of the optional DIST/SINAD Meter FMA-B2, the optional AF Analyzer/DSP Unit FMA-B8 is fitted in the FMAS.

### RF/IF Selection (option FMA-B9)

Frequency	
Frequency range	5 to 1000 MHz
FM wide	350 kHz
FM narrow/TV 2-sound	150 kHz
IF bandwidth (-3 dB)	3.4
Shape factor (-3/-60 dB)	3.7
RF level	
RF input level range	-87 to +30 dBm (10 μV to 7 V)
Overload protection	up to 5 W (15 V RMS), max. peak voltage 25 V
VSWR	≤2.7 (without attenuation)
Selective level measurement	≤1.4 (with ≥10 dB attenuation)
Measurement accuracy <sup>1)</sup>	peak measurement
5 to 500 MHz	±2 dB ± 3 μV
500 to 1000 MHz	±3 dB ± 3 μV

1) In temperature range 15 to 35°C; error doubles outside this range.

# Modulation Analyzers FMA, FMAB, FMAV, FMB; Selective Modulation Analyzer FMAS

## FM stereo

### Selectivity

Ratio of wanted to unwanted signal for a weighted S/N ratio of  $\geq 54$  dB, referred to a wanted signal of  $\Delta f = 40$  kHz,  $f_{\text{mod}} = 500$  Hz. Stereo measurements with 50  $\mu\text{s}$  deemphasis in stereo decoder. Specifications apply to input levels  $\geq 200$   $\mu\text{V}$  ( $-61$  dBm) for mono,  $\geq 2$  mV ( $-41$  dBm) for stereo.

Nearby selectivity, unwanted sig. modulated,  $f_{\text{mod}} = 500$  Hz,  $\Delta f = 75$  kHz

Frequency difference	stereo		mono	
	FM wide	FM narrow	FM wide	FM narrow
$\pm 100$ kHz	$\leq 64$ dB	$\leq 61$ dB	$\leq 7$ dB	$\leq 4$ dB
$\pm 200$ kHz	$\leq 25$ dB	$\leq 11$ dB	$\leq 7$ dB	$\leq 0$ dB
$\pm 300$ kHz	$\leq 5$ dB	$\leq -15$ dB	$\leq 4$ dB	$\leq -16$ dB
$\pm 600$ kHz	-	-	$\leq -26$ dB	$\leq -46$ dB

Far-off selectivity, unwanted signal modulated,  $f_{\text{mod}} = 500$  Hz,  $\Delta f = 75$  kHz,

Frequency difference $\geq 1.2$ MHz (except for image frequency and 1st IF)	FM wide	FM narrow
87.5 to 108 MHz	-	-
rest of range	-	-

### Linear distortion

Amplitude-frequency response, measured at MPX signal output,  $\Delta f = 40$  kHz, reference frequency 500 Hz

Frequency range	FM wide	FM narrow
40 Hz to 43 kHz	$\pm 0.1$ dB	$\pm 0.1$ dB
43 to 53 kHz	$\pm 0.1$ dB	$\pm 0.3$ dB
53 to 61 kHz	$\pm 0.2$ dB	$\pm 1$ dB
61 to 70 kHz	$\pm 0.5$ dB	$\pm 3$ dB
70 to 75 kHz	$\pm 1.5$ dB	$\pm 5$ dB

Stereo crosstalk L $\leftrightarrow$ R, measured via stereo decoder, without deemphasis

Frequency range	FM wide	FM narrow
40 Hz to 5 kHz	-50 dB	-37 dB
5 to 15 kHz	-44 dB	-31 dB

### Nonlinear distortion

THD measured at MPX signal output (mono)

Frequency range	$\Delta f = 75$ kHz		$\Delta f = 100$ kHz	
	wide	narrow	wide	narrow
40 Hz to 5 kHz	-	$\leq 0.5\%$	-	$\leq 1\%$
40 Hz to 15 kHz	$\leq 0.25\%$	-	$\leq 0.5\%$	-

Measured via stereo decoder

Frequency range	stereo		mono	
	wide	narrow	wide	narrow
40 Hz to 5 kHz	$\leq 0.3\%$	$\leq 0.8\%$	$\leq 0.25\%$	$\leq 0.5\%$
$\Delta f = 75$ kHz	$\leq 0.6\%$	$\leq 1.6\%$	$\leq 0.5\%$	$\leq 1\%$
$\Delta f = 100$ kHz				

### S/N ratio

To CCIR 468-4, deemphasis 50  $\mu\text{s}$ , referred to  $\Delta f = 40$  kHz,

$f_{\text{mod}} = 500$  Hz

S/N ratio (CCIR 468-4, weighted)

LOW NOISE<sup>1)</sup> mode

$f_{\text{in}}/\text{MHz}$ :	stereo				mono	
	5 to 130	130 to 470	470 to 1000	5 to 130	130 to 470	470 to 1000
Input voltage						
$\geq 200$ $\mu\text{V}$	-	-	-	$\geq 58$ dB	$\geq 58$ dB	$\geq 58$ dB
$\geq 2$ mV	$\geq 58$ dB	$\geq 58$ dB	$\geq 56$ dB	$\geq 76$ dB	$\geq 76$ dB	$\geq 74$ dB
$\geq 20$ mV	$\geq 70$ dB	$\geq 63$ dB	$\geq 60$ dB	$\geq 76$ dB	$\geq 76$ dB	$\geq 74$ dB

## TV dual sound

Input signal TV dual-sound signal, standard B/G, at IF or in bands I, II and IV, V with and without modulated vision carrier

Deviation measurement accuracy 30 Hz to 15 kHz,  $\Delta f \leq 70$  kHz  $\pm 1\%$  + residual FM  
 Difference accuracy with successive dev. measurement sound 1/sound 2, 30 Hz to 15 kHz  $\pm 0.3\%$  + residual FM

Nonlinear distortion	$\Delta f = 50$ kHz	$\Delta f = 70$ kHz
Distortion		
$f_{\text{mod}} = 30$ Hz to 5 kHz	$\leq 0.3\%$	0.5%
$f_{\text{mod}} = 5$ to 15 kHz	$\leq 0.5\%$	1%

S/N ratio

Quasi-peak measurement to CCIR 468-4, weighted and unweighted; deemphasis 50  $\mu\text{s}$ , ref. to wanted signal of  $\Delta f = 30$  kHz and  $f_{\text{mod}} = 500$  Hz

Input level (selective)	unweighted	weighted
$\geq 200$ $\mu\text{V}$	$\geq 53$ dB	$\geq 53$ dB
$\geq 2$ mV	$\geq 73$ dB	$\geq 73$ dB

Channel crosstalk, referred to  $\Delta f = 30$  kHz,  $f_{\text{mod}} = 500$  Hz, selective measurements, deemphasis 50  $\mu\text{s}$ , other sound carrier modulated with frequencies from 30 Hz to 15 kHz,  $\Delta f = 55$  kHz. Level (selective)  $\geq 5$  mV  $\geq 80$  dB

## AF Analyzer/DSP Unit (FMA-B8)

### Selective distortion measurement

Readout in % or dB  
 Display range 0.001 to 20%, -100 to -14 dB

Measurement of individual distortion  $d_i$  ( $i=2, 3, \dots, 10$ )

Meas. acc.	$10 \text{ Hz} \leq f_1 \leq 14 \text{ kHz}$	$f_1 \leq 50 \text{ kHz}$
$f_{\text{di}} \leq 42 \text{ kHz}$	$\pm 5\%$ of rdg $\pm 0.02\%$ absolute	$f_{\text{di}} \leq 150 \text{ kHz}$ $\pm 5\%$ of rdg $\pm 0.05\%$ absolute

THD measurement

Measurement of harmonic  $i = n$  ( $n = 2$  to 10 selectable)

Meas. acc.	$10 \text{ Hz} \leq f_1 \leq 14 \text{ kHz}$	$f_1 \leq 50 \text{ kHz}$
$f_{\text{dn}} \leq 42 \text{ kHz}$	$\pm 5\%$ of rdg $\pm 0.03\%$ absolute	$f_{\text{dn}} \leq 150 \text{ kHz}$ $\pm 5\%$ of rdg $\pm 0.1\%$ absolute

### Intermodulation measurement

Difference frequency distortion  $d_2, d_3$  to IEC 268-3

Readout in % or dB  
 Display range 0.001 to 20%, -100 to -14 dB

Meas. acc. ( $f_2 - f_1 \geq 30$  Hz)

$2 \times f_2 - f_1 \leq 42 \text{ kHz}$	$42 \text{ kHz} < 2 \times f_2 - f_1 \leq 150 \text{ kHz}$
$\pm 5\%$ of rdg $\pm 0.02\%$ absolute	$\pm 5\%$ of rdg $\pm 0.05\%$ absolute

### Selective modulation and voltage measurement

using special bandpass filter, in voltmeter, AM, FM and  $\phi\text{M}$  mode

Bandwidth ( $\text{BW}_{-3\text{dB}}$ ) at center frequency  $f_c$

$f_c$	$10 \text{ Hz to } \leq 1 \text{ kHz}$	$1 \text{ kHz to } \leq 20 \text{ kHz}$	$20 \text{ kHz to } \leq 150 \text{ kHz}$
$\text{BW}_{-3\text{dB}}$	2.3 Hz	6.8 Hz	68 Hz

Shape factor 3 dB/80 dB  $< 4$

Far-off selectivity 80 dB

Display range corresponding to display range of selected operating mode

Measurement uncertainty<sup>1)</sup>

with meas. frequency deviation from center frequency  $< \text{BW}_{-3\text{dB}}/4$  at center frequency  $f_c$

$10 \text{ Hz to } 100 \text{ kHz}$	$100 \text{ kHz to } 150 \text{ kHz}$
$\leq 2\%$	$\leq 5\%$

### Rear-panel outputs

Deflection for external oscilloscope

DSP1 Y deflection, 0 to 4 V, BNC female  
 DSP2 X deflection, 0 to 4 V, BNC female

Scale markers

Vertical 13 markers, 10 dB/div  
 Horizontal 10 markers, scaling can be called up via the information menu

1) Error of selective measurement in addition to error specified for selected voltmeter, AM, FM or  $\phi\text{M}$  mode.

# Specs in brief: FMAV, VOR/ILS measurement

## VOR/ILS/TACAN

Data are guaranteed within the frequency ranges specified ( $f_{in}$ ). They are typical values for all frequencies  $\geq 10$  MHz.

### VOR ( $f_{in} = 10$ MHz; 108 to 120 MHz)

Amplitude modulation measurement	accuracy for $m=10$ to 90%:
$f_{mod}=30$ Hz/9.96 kHz	$\pm 0.8\%$ of reading
$f_{mod}=300$ Hz to 4 kHz	$\pm 1.2\%$ of reading
Frequency modulation measurement	9.96 kHz carrier
Max. measurable deviation	700 Hz
Accuracy ( $f_{mod}=30$ Hz $\pm 1\%$ )	$\pm 0.5\% \pm 0.1$ Hz
Phase difference measurement at 30 Hz	
Measurement range	0 to $360^\circ$
Measurement accuracy	$\pm 0.03^\circ$
Resolution	$\leq 0.01^\circ$

### ILS ( $f_{in} = 10$ MHz; 108 to 120 MHz; 328 to 336 MHz)

Amplitude modulation measurement	$m = 10$ to 90%
Measurement accuracy	
90/150 Hz $\pm 2\%$	$\pm 0.5\%$ of reading
300 Hz to 4 kHz (identifier)	$\pm 1.2\%$ of reading
DDM measurement	
Measurement range	0 to $\pm 0.2$ DDM
$f_{mod}$	90/150 Hz $\pm 1\%$
Measurement accuracy	
$m = 18$ to 22%	$\pm 0.0002$ DDM $\pm 0.1\%$ of reading
$m = 32$ to 48%	$\pm 0.0005$ DDM $\pm 0.1\%$ of reading
Resolution	$\leq 0.0001$ DDM
Measurement of phase angle between 90 Hz and 150 Hz signals	
Measurement range	$\pm 60^\circ$
Measurement accuracy	$\pm 0.2^\circ$
Resolution	$\leq 0.01^\circ$

### TACAN ( $f_{in} = 10$ MHz; 950 to 1250 MHz)

Amplitude modulation measurement	$m = 10$ to 90%
Measurement accuracy at	
$f_{mod} = 15/135$ Hz $\pm 2\%$	$\pm 0.5\%$ of reading
Measurement of phase angle between 15 Hz and 135 Hz signals	
Measurement range	$\pm 180^\circ$ (135 Hz)
Measurement accuracy	$\pm 0.5^\circ$
Resolution	$\leq 0.01^\circ$
AF outputs DSP1, DSP2	max. 4 V into 600 $\Omega$
DC offset	$\leq 3$ mV

## RF/IF Selection (option FMA-B9.57)

Additional data of FMAV in receive mode

<b>Input frequency range</b>	5 to 400 MHz
<b>RF level</b>	
Input level range	$-87$ to $+30$ dBm (10 $\mu$ V to 7 V)
Overload protection	up to 5 W (15 V RMS), max. peak voltage 25 V
VSWR	$\leq 2.7$ (without attenuation) $\leq 1.4$ (with $\geq 10$ dB attenuation)

### Selective level measurement (peak measurement)

Measurement accuracy <sup>1)</sup>	$\pm 2$ dB $\pm 3$ $\mu$ V
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### Selectivity

IF bandwidth ( $-3$ dB)	17 kHz
Static selectivity	$\leq -60$ dB in $\pm 50$ kHz
Far-off selectivity	$\leq -60$ dB <sup>2)</sup>
Intermodulation distortion ( $d_3$ )	$\leq -60$ dB <sup>2)</sup>

### VOR/ILS-specific data

Unless stated otherwise, the specifications of FMAV are valid. Data differing from FMAV specs can be calibrated to FMAV accuracy using option FMA-B4.

## VOR

Accuracy of amplitude modulation measurement (% of reading) at $f_{mod}$	
30 Hz $\pm 1\%$	$\pm 0.8\%$ <sup>3)</sup>
1.02 kHz $\pm 2\%$	$\pm 2\%$ <sup>3)</sup>
9.96 kHz with $\Delta f=480$ Hz, $f_{mod}=30$ Hz (all tolerances $\pm 1\%$ )	$\pm 2\%$ <sup>4)</sup>
Accuracy <sup>1)</sup> of phase difference measurement at 30 Hz	$\pm 0.05^\circ$

## ILS

Amplitude modulation measurement	
Measurement accuracy <sup>3)</sup> (% of reading) at $f_{mod}$	
90 Hz $\pm 2\%$	$\pm 0.5\%$
150 Hz $\pm 2\%$	$\pm 0.5\%$
1.02 kHz $\pm 2\%$	$\pm 2\%$

## Ordering information

<b>Modulation Analyzer</b>	FMA	0852.8500.52
	FMAB	0856.4750.52
	FMAV	0856.4509.52
	FMB	0856.5005.52
<b>Selective Modulation Analyzer</b>	FMAS	0856.6001.52

### Options (possible configurations see pages 234)

Filter	FMA-B1	0855.2002.52
DIST/SINAD Meter	FMA-B2	0855.0000.52
Stereo Decoder	FMA-B3	0856.0003.52
AM/FM Calibrator/AF Generator	FMA-B4	0855.6008.52
AF Analyzer/DSP Unit	FMA-B8	0855.9007.55
RF/IF Selection 5 to 1000 MHz	FMA-B9	0856.6501.52
RF/IF Selection for FMAV	FMA-B9	0856.6501.57
Reference Oscillator	FMA-B10	0856.3502.52
5.2 GHz Frequency Extension	FMA-B12	0855.8500.52

### Extras

Service Kit	FMA-Z1	0856.4009.52
For FMAV:		
Log-Periodic Antenna	HL023A1	0577.8017.02
	HL023A2	0624.2815.02
High-Power Attenuator		
20 dB/50 W	RDL 50	1035.1700.52

- 1) In temperature range 20 to 30°C; error doubles in full temperature range.
- 2) Guaranteed data for frequencies from 108 to 120 MHz and 328 to 336 MHz, typical values for all other frequencies.
- 3) In temperature range 20 to 30°C, additional error  $\pm 0.3\%$  in full temperature range.
- 4) In temperature range 20 to 30°C.