# 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	FIMA-B Opti	on	
Functions of individual models, options	FMA	FMAB	FMAS	FMAV	FMB
ΑΜ/FM/φΜ	•	•	•	•	•
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 x10 <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
Filter: lowpass filter 5 Hz, 4.2 kHz (high skirt selectivity), 30 kHz, 120 kHz (Bessel), special $\phi$ M filter	FMA-B1
DIST/SINAD Meter: distortion measurable down to typically <0.005%	FMA-B2
Stereo Decoder: 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
AF Analyzer/DSP Unit: digital AF analyzer, true THD measurement, measurement of intermodulation products	FMA-B8
RF/IF Selection: 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
5.2 GHz Frequency Extension: enhanced power measurement accuracy	FMA-B12

# Overview of entions

# **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 radiotelephony 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 airtraffic control authorities, airport operators as well as manufacturers of airnavigation 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 Radiocommunication 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-ofthe-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

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

# Specifications in brief

#### Frequency

Frequency range FMA, FMAB, FMAV **FMAS** FMB as well as FMA and FMAB with option FMA-B12 Frequency tuning Display Resolution Reference oscillator Aging after 30 days of operation Warmup time External reference input/output

**RF** input Overload protection Maximum peak voltage VSWR (fin up to 1.36 GHz, attenuation  $\geq 20$  dB)

≤1.2

#### RF power measurement with calibration (FMA models)

Power measurement range Accuracy (P ≥0.1 mW)

±1 dB (typ. ±0.5 dB)

# RF power measurement (FMB)

Measurement range Accuracy (input level -10 to +5 dBm, f<sub>in</sub>=50 kHz to 1.36 GHz)

Amplitude modulation measurement

Modulation frequency range Resolution Accuracy Residual AM (fin up to 1.36 GHz, CCITT) Incidental AM in FM mode AF distortion

## Frequency modulation measurement

Modulation frequency range Max. measurable deviation for fin

Accuracy Resolution Residual FM for f<sub>in</sub>≤1.36 GHz, CCITT, RMS Stereo S/N ratio, weighted Stereo crosstalk attenuation AF distortion Incidental FM Deemphasis

#### Phase modulation measurement

Modulation frequency range Max. measurable deviation 300 kHz to 10 MHz ≥10 MHz Accuracy Residual oM (fin up to 1.36 GHz, CCITT) Resolution AF distortion

#### AF voltmeter

DC voltage measurement range Resolution Accuracy AC voltage measurement range Frequency range Resolution Accuracy (RMS, 30 Hz to 20 kHz) ±1%

50 kHz to 1.36 GHz 5 to 1000 (1360) MHz

50 kHz to 5.2 GHz automatic or manual 10-digit readout 0.1/1/10/100 Hz selectable standard option FMA-B10 2 x 10-6/year 1 x 10<sup>-7</sup>/year 1 x 10<sup>-9</sup>/day 15 min 15 min manual or remote-controlled

N connector, 50  $\Omega$ up to 5 W (15 V rms) 25 V (including DC)

# 0.18 $\mu$ W to 1 $\dot{W}$ (-37.5 to +30 dBm)

0.18 µW to 1 W (-37.5 to +30 dBm)

# ±0.3 dB

10 Hz to 200 kHz 0.1% of reading ±1% ≤0.01% ≤0.1% ≤0.2%

10 Hz to 200 kHz 50 to 0.3 to ≥10 MHz 300 kHz 10 MHz  $f_{in}/10$ 150 kHz 700 kHz ±1% better than 0.1% of reading <1 Hz

≥76 dB ≥56 dB (f<sub>mod</sub>=1 kHz) < 0.05% ≤10 Hz 50/75/750 µs selectable

200 Hz to 200 kHz

150 rad 700 rad ±2%

≤0.004 rad <0.1% (minimum 0.0001 rad) ≤0.1%

 $\pm 10 \ \mu V$  to  $20 \ V$ < 0.1% ±0.5% 30 µV to 20 V 10 Hz to 300 kHz 0.1% of reading

All AF measuring facilities such as detectors, filters, frequency counter and distortion meter can also be used in voltage measurements for weighting.

BNC, R<sub>in</sub>=100 kΩ ||80 pF

positive or negative peak

or their arithmetic mean

detector to CCIR Rec. 468-4

to peak for sinewave

468-4, unweighted;

100 kHz (4th order)

10 Hz to 300 kHz

±0.005% ±3 mHz ±1 digit

1 mHz to 10 Hz

for S/N ≥20 dB

0.005 to 50%

6 to 86 dB

≤0.1 dB

>80 dB

 $Z_{in} \ge 40 \ k\Omega$ 

≤0.2 dB

10 Hz to 100 kHz

±1 dB ±0.015% THD

≥60 dB (30 Hz to 15 kHz)

±0.1 dB (30 Hz to 15 kHz)

d<sub>2</sub> ≤0.05%, d<sub>3</sub> ≤0.1%

50 or 75 µs, selectable

≥50 dB (1 kHz < f ≤15 kHz)

-12 to +12.5 dBm into 600 Ω,

≤0.1% (THD, 30 Hz to 15 kHz)

bal., 3-cont. connector (DIN 41628)

bal., 3-cont. connectors (DIN 41628),

+6 dBm,  $Z_{out} \leq 30 \Omega$ ,  $Z_L \geq 300 \Omega$ 

unbalanced, BNC,  $Z_1 \ge 600 \Omega$ 

5 digits

DIN 41628

 $R_{in}$ = 600  $\Omega$ , 3-contact connectors,

readout as RMS value or converted

CCIR 468-4 (weighted), CCITT P53,

Cauer lowpass, special  $\phi M$  filter

5 Hz lowpass, 30 kHz and 120 kHz Bessel lowpass of 4th order, 4.2 kHz

#### Inputs . unbalanced balanced

AF detector Peak detector

**RMS** detector

Quasi-peak detector (with Filter option FMA-B1)

#### Weighting filters

Highpass filters (2nd/3rd/2nd order) 10/20/300 Hz Lowpass filters 3/23 kHz (4th order), combined with 20 Hz highpass filter meets CCIR

Filter option FMA-B1

#### AF frequency display

Frequency range Resolution Accuracy

#### Distortion measurement (option FMA-B2) in % or SINAD in dB

Readout Automatic adjustment Measurement range Display range THD SINAD Accuracy (20 Hz to 20 kHz)

#### Stereo decoder (option FMA-B3)

Crosstalk attenuation Frequency response Level difference between L and R Nonlinear distortion Difference-frequency distortion (DIN 45403) S/N ratio (CCIR, weighted, unweighted) Deemphasis External decoder input Common-mode rejection Input level range

Resolution of level setting Stereo decoder outputs L, R, M

S RDS decoder outputs Signals available

Measurement time Fast modulation measurement

## Outputs

IF output AM output FM/qM output

Distortion measurement output (with option FMA-B2) AF output

#### Remote control

9-contact Cannon connector data, clock, quality signal, TP information, 57 kHz carrier (TTL)

typ. 1 s ≤120 ms

max. 200 mV into 50  $\Omega$ max. 1 V into 600 Ω (can be DC-coupled) +6 dBm (1.545 V) at 40 kHz deviation/40 rad into 600  $\Omega$  (DC-coupled)

max. 1 V into 600  $\Omega$ 1 to 4 V into 600  $\Omega$ 

IEC 625-1/625-2 (IEEE 488.1/.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  $23 \pm 5$  °C (73.4  $\pm 9$  ° F).

$\boldsymbol{AF}$ (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 <sub>in</sub> = 20 Ω, C <sub>L</sub> ≤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

12.1.1.1.

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 mutiplex 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	≤0.1°
Setting range	±10°
57 kHz subcarrier (only possible	
with multiplex signal switched off)	
Nominal frequency	57 kHz ±1 mHz + reference frequency drift
Phase versus pilot tone	≤0.1°
Setting range	±30°
VOR/ILS/TACAN (FMAV only)	
Data determined by design, not teste	ed individually.

2 BNC female connectors on rear

panel, unbalanced, same signal at

both outputs (can be individually

20  $\Omega_{\rm r}$  200  $\Omega_{\rm r}$  600  $\Omega$  selectable

switched off) or 1 x balanced

adjustable from 0 to 99%

≤0.1% (m=10 to 95%)

≤0.1% (15 Hz to 10 kHz)

≤0.1% (10 Hz to 20 kHz)

typ. ≤0.02% (20 Hz to 23 kHz, RMS)

≤0.1% of reading

 $\pm 1\% \pm 2\Omega$ 

10 MHz

-10 dBm

< 0.01 rad

VOR

Deviation accuracy at 9.96 kHz subcarrier ≤±0.1% ±1 Hz 0 to 700 Hz Setting range ≤±0.005° Phase accuracy 30 Hz 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

Output impedance Tolerance

#### AM

Carrier frequency Level Modulation depth Accuracy at  $f_{mod} = 1$  kHz, 80% AM Additional linearity error Modulation frequency response Modulation distortion (THD + N, m = 80%) Incidental  $\phi$ M, m ≤80% Residual AM

# AM VOR/ILS (FMAV only)

DDM accuracy ≤±0.00005 DDM ±0.001 x (DDM) m=18 to 22% 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 (fmod = 1 kHz, squarewave) 100 kHz Accuracy < 0.1% Additional sinewave modulation  $f_{mod} = 10 \text{ Hz} \text{ to } 100 \text{ kHz}$ deviation =1 to 100 kHz Residual FM (BW = 23 kHz, RMS) ≤10 Hz Accuracy for 100 kHz deviation, ≤0.2% + residual FM

<0.1%

typ. ≤0.05%

10 MHz

≤0.1 dB at

≤1.05

-50 to -4 dBm

≤0.2 dB ±6 nW (

≤0.5% (10 Hz to 100 kHz)

 ${\leq}0.1\,\%$  (f\_{mod}{=}\,10 Hz to 20 kHz)

 $(f_{mod} = 1 \text{ kHz}, \text{BW} = 3 \text{ kHz})$ 

same as reference frequency

BNC female on front panel (CAL), can be internally switched to RF input

Actually for 100 kHz deviation,  $f_{mod} = 1$  kHz Additional linearity error for  $f_{mod} = 1$  kHz, dev. = 10 to 100 kHz Modulation frequency response Modulation distortion for 100 kHz deviation Incidental AM for 50 kHz deviation

Level Carrier frequency Accuracy Level range Accuracy -10 dBm -40 dBm to -4 dBm Output VSWR at 10 MHz

# 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 IF bandwidth (–3 dB) Shape factor (–3/–60 dB)

#### RF level

RF input level range Overload protection

#### VSWR

Selective level measurement Measurement accuracy<sup>1)</sup> 5 to 500 MHz 500 to 1000 MHz 5 to 1000 MHz FM wide FM narrow/TV 2-sound 350 kHz 150 kHz 3.4 3.7

 $\begin{array}{l} -87 \text{ to } +30 \text{ dBm } (10 \ \mu\text{V to } 7 \ \text{V}) \\ \text{up to } 5 \ \text{W} \ (15 \ \text{V RMS}), \ \text{max. peak voltage } 25 \ \text{V} \\ \leq 2.7 \ \text{(without attenuation)} \\ \leq 1.4 \ \text{(with } \geq 10 \ \text{dB attenuation)} \\ \text{peak measurement} \end{array}$ 

 $\begin{array}{c}\pm 2 \hspace{0.1cm} dB \pm 3 \hspace{0.1cm} \mu V \\ \pm 3 \hspace{0.1cm} dB \pm 3 \hspace{0.1cm} \mu V \end{array}$ 

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

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## 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<sub>mod</sub>=500 Hz. Stereo measurements with 50 µs deemphasis in stereo decoder. Specifications apply to input levels  $\geq$ 200 µV (–61 dBm) for mono,  $\geq$ 2 mV (–41 dBm) for stereo.

Nearby selectivity, unwanted sig. modulated, $f_{mod} = 500$ Hz, $\Delta f = 75$ kHz							
	stereo	mono					
	FM wide	FM narrow	FM	wide	FM r	arrow	
Frequency difference							
±100 kHz	≤64 dB	≤ 61 dB	$\leq$	7 dB	$\leq$	4 dB	
±200 kHz	≤25 dB	≤ 11 dB	$\leq$	7 dB	$\leq$	0 dB	
±300 kHz	$\leq$ 5 dB	≤–15 dB	$\leq$	4 dB	≤`	16 dB	
±600 kHz	-	-	≤-2	26 dB	≤-4	46 dB	

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

Frequency di	fference ≥1	.2 MHz	(except for	image fro	equency and	1st IF)
87.5 to 10	8 MHz	-	_		≤–54 dB	≤–54 dB
rest of rang	je	-	-	I	≤–40 dB	≤–40 dB

#### Linear distortion

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

	FM wide	FM narrow
40 Hz to 43 kHz	±0.1 dB	±0.1 dB
43 to 53 kHz	±0.1 dB	±0.3 dB
53 to 61 kHz	±0.2 dB	±1 dB
61 to 70 kHz	±0.5 dB	±3 dB
70 to 75 kHz	±1.5 dB	±5 dB
Stereo crosstalk L↔R, measu	red via stereo decoder,	without deemphasis
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)

-	$\Delta f = 75 \text{ kHz}$		∆f=100 kH	łz
FM	wide	narrow	wide	narrow
40 Hz to 5 kHz	-	≤0.5%	-	≤1%
40 Hz to 15 kHz	≤0.25%	-	≤0.5%	-
Measured via stereo decoder				
I	stereo	ĺ	mono	
FM	wide	narrow	wide	narrow
40 Hz to 5 kHz				
∆f=75 kHz	≤0.3%	≤0.8%	≤0.25%	≤0.5%
$\Delta f = 100 \text{ kHz}$	≤0.6%	≤1.6%	≤0.5%	≤1%

#### S/N ratio

To CCIR 468-4, deemphasis 50  $\mu s,$  referred to  $\Delta f\!=\!40$  kHz,  $f_{mod}\!=\!500$  Hz

. . . . . . .

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

LOW	NOISE1)	mode
-----	---------	------

	sterec	)		IIIUIIU	
f <sub>in</sub> /MHz: 5 t	o 130 t	o 470 te	o 5 to	130 to	o 470 to
13	0 470	1000	130	470	1000
Input voltage					
≥200 µV –	-	-	≥58 (	dB ≥58 d	B ≥58 dB
≥2 mV ≥5	8 dB ≥58 d	dB ≥56 d	lB ≥76 (	dB ≥76 d	B ≥74 dB
≥20 mV ≥7	0 dB ≥63 d	dB ≥60 d	lB ≥76 (	dB ≥76 d	B ≥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

Imono

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

	5	mou
Input level (selective)	unweighted	weighted
≥200 μV	≥53 dB	≥53 dB
≥2 mV	≥73 dB	≥73 dB
Channel crosstalk, referred	d to $\Delta f = 30 \text{ kHz}$ , $f_{mod} = 500$	Hz, selective measure

Channel crosstalk, referred to  $\Delta f$  = 30 kHz, f<sub>mod</sub> = 500 Hz, selective measurements, deemphasis 50 µs, other sound carrier modulated with frequencies from 30 Hz to15 kHz,  $\Delta f$  = 55 kHz. Level (selective)  $\geq$ 5 mV  $\geq$ 80 dB

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

#### Selective distortion measurement

Readout		in % c	or dB	
Display rang	y range 0.001 to 20%,			
		-100	to –14 dE	}
Measuremen	t of individual distor	rtion d <sub>i</sub> (i=2	, 3,10)	1
Meas. acc.	10 Hz ≤ f <sub>1</sub> ≤14 kH	Hz,	f <sub>1</sub> ≤50 kl	Hz
	f <sub>di</sub> ≤ 42 kHz		f <sub>di</sub> ≤150	kHz
	±5% of rdg ±0.02	2% absolute	±5% of r	dg ±0,05% absolute
THD measure	ement			
Measuremen	t of harmonic i = n	(n = 2  to  10)	) selectabl	e)
Meas. acc.	10 Hz ≤ f <sub>1</sub> ≤14 kH	Ηz	f <sub>1</sub> ≤50 kl	Hz
	f <sub>dn</sub> ≤42 kHz		f <sub>dn</sub> ≤150	kHz
	$\pm 5\%$ of rdg $\pm 0.03\%$	absolute	±5% of r	dg ±0.1% absolute
Intermodulat	ion measurement			
Difference ire	equency distortion a	$1_2, 0_3 \text{ IO IEC}$	√ 208-3	
Readoul		IN % C	Daer ab	
Display rang	e	100	. 10 20%, to 14 dE	, ,
Meas acc (f	ff, >30 Hz)	-100	10 – 14 UL	)
2 x f <sub>e</sub> =f.	. <42 kHz	L 42 kH	l7 < 2 y f.	_f. <150 kHz
+5% of	rda +0.02% absolu	ite +5% (	of rda $+0$	05% absolute
0	- ag _ 0.02 /0 absolu		51109 201	
Selective mod	dulation and voltage	e measurem	ent	
using special	bandpass filter, in	voltmeter, A	M, FM an	nd φM mode
Bandwidth (E	3W_3dB) at center fr	requency f <sub>c</sub>		
f <sub>c</sub>	10 Hz to ≤1 kHz	1 kHz to ≤	20 kHz 2	0 kHz to ≤150 kHz
₿_ <sub>3dB</sub>	2.3 Hz	6.8 Hz	6	8 Hz
Shape fact	or 3 dB/80 dB	<4		
Far-off sele	ctivity	80 dB	}	
Display rar	nge	corres	ponding t	o display range of
	- -	select	ed operat	ing mode
Measuremen	t uncertainty <sup>1</sup> )			
with meas.	frequency deviation	n from cente	er frequence	cy <bw<sub>-3dB/4</bw<sub>
at center fr	equency f <sub>c</sub>	10 Hz to 10	10 kHz	100 kHz to 150 kHz
		≤2%		≤5%
<b>.</b> .				
Rear-panel o	utputs r external oscillosco	no		

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

 Error of selective measurement in addition to error specified for selected voltmeter, AM, FM or φM 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 <sub>in</sub> = 10 MHz; 108 to 120 MHz	<u>z)</u>			
Amplitude modulation measurement	ent accuracy for m=10 to 90%:			
f <sub>mod</sub> =30 Hz/9.96 kHz	±0.8% of reading			
f <sub>mod</sub> =300 Hz to 4 kHz	±1.2% of reading			
Frequency modulation measurement	9.96 kHz carrier			
Max. measurable deviation	700 Hz			
Accuracy ( $f_{mod} = 30 \text{ Hz} \pm 1\%$ )	±0.5% ±0.1 Hz			
Phase difference measurement at 30 Hz				
Measurement range	0 to 360°			
Measurement accuracy	+0.03°			
Resolution	≤0.01°			
<b>ILS</b> ( $f_{in} = 10 \text{ MHz}$ ; 108 to 120 MHz;	;			
328 to 336 MHz)				
Amplitude modulation measurement	m = 10 to 90%			
Measurement accuracy				
90/150 Hz ±2%	±0.5% of reading			
300 Hz to 4 kHz (identifier)	±1.2% of reading			
DDM measurement				
Measurement range	0 to ±0.2 DDM			
f <sub>mod</sub>	90/150 Hz ±1%			
Measurement accuracy				
m=18 to 22%	±0.0002 DDM ±0.1% of reading			
m=32 to 48%	±0.0005 DDM ±0.1% of reading			
Resolution	≤0.0001 DDM			
Measurement of phase angle betwee	n			
90 Hz and 150 Hz signals				
Measurement range	±60°			
Measurement accuracy	±0.2°			
Resolution	≤0.01°			
IACAN (t <sub>in</sub> =10 MHz; 950 to 1250 M	VIHZ)			
Amplitude modulation measurement	m = 10 to 90%			
Measurement accuracy at				
f <sub>mod</sub> =15/135 Hz ±2%	±0.5% of reading			
Measurement of phase angle betwee	n			
15 Hz and 135 Hz signals				
Measurement range	±180° (135 Hz)			
Measurement accuracy	±0.5°			
Resolution	≤0.01°			
AF outputs DSP1, DSP2	max. 4 V into 600 Ω			

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

DC offset

Additional data of FMAV in receive mode

Input frequency range	5 to 400 MHz
RF level	
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
\/S\A/P	<2.7 (without attenuation)
VSVVK	$\leq 1.4$ (with $\geq 10$ dB attenuation)
Selective level measurement (pe	ak measurement)
Measurement accuracy <sup>1)</sup>	$\pm 2 \text{ dB} \pm 3 \mu \text{V}$
Selectivity	

≤3 mV

Selectivity	
IF bandwidth (-3 dB)	17 kHz
Static selectivity	≤-60 dB in ±50 kHz
Far-off selectivity	≤–60 dB <sup>2)</sup>
Intermodulation distortion (d <sub>3</sub> )	≤–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

VOK	
Accuracy of amplitude modulation	
measurement (% of reading) at fmod	
30 Hz ± 1%	±0.8% <sup>3)</sup>
1.02 kHz ± 2%	±2% <sup>3)</sup>
9.96 kHz with ∆f=480 Hz,	
f <sub>mod</sub> =30 Hz	
(all tolerances ±1%)	±2% <sup>4)</sup>
Accuracy <sup>1</sup> ) of phase difference	
measurement at 30 Hz	±0.05°

## ILS

# Ordering information

Modulation Analyzer Selective Modulation Analyzer	FMA FMAB FMAV FMB FMAS	0852.8500.52 0856.4750.52 0856.4509.52 0856.5005.52 0856.6001.52		
<b>Options</b> (possible configurations see pages 234)				
DIST/SINAD Meter	FMA-B1 FMA-B2	0855.2002.52		
Stereo Decoder	FMA-B3	0856.0003.52		
AM/FM Calibrator/AF Generator AF Analyzer/DSP Unit	FMA-B4 FMA-B8	0855.6008.52		
RF/IF Selection 5 to 1000 MHz	FMA-B9	0856.6501.52		
RE/IF Selection for EMAV Reference Oscillator	FMA-B9 FMA-B10	0856.6501.57		
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		
High-Power Attenuator	HLU23A2	0624.2815.02		
20 dB/50 W	RDL 50	1035.1700.52		

- 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.

<sup>1)</sup> In temperature range 20 to 30°C; error doubles in full temperature range.