STABILOCK 4031: Technical Data

Synthesizer

Spectral purity

• Phase noise (25-kHz offset)	
f < 500 MHz	< −121 dBc/Hz
f ≥ 500 MHz	< −115 dBc/Hz
• Residual FM	
f < 500 MHz	4 Hz (rms, CCITT-weighted)
f ≥ 500 MHz	8 Hz (rms, CCITT-weighted)
• Nonharmonic spurious signals > 500 Hz off carrier	< −55 dBc
• Harmonics	
Level < −15.1 dBm	< −25 dBc
Level ≥ −15.1 dBm	< −20 dBc
• Residual AM	< 0.02 % (rms, CCITT-weighted)

10-MHz reference oscillator

• Warmup time	< 3 min for frequency error < $5 \cdot 10^{-7}$ (T = 20 °C)
	< 10 min for frequency error < 10^{-7}
• Frequency error	< $1 \cdot 10^{-7}$ (T = 0 to 45 °C)
• Aging	< $5 \cdot 10^{-8}$/month
• Output level	approx. 0.4 V (into 50 Ω)
• Synchronization	10 MHz, V > 150 mV_{rms} (into 200 Ω)

Receiver test

Carrier frequency

• Frequency range	0.4 to 999.9999 MHz
• Resolution	
f < 500 MHz	50 Hz
f ≥ 500 MHz	100 Hz
• Frequency error	as reference oscillator

Output level

• RF socket	−142 to −7 dBm (max. −13 dBm with AM)
• RF DIRECT socket	−122 to +13 dBm (max. +7 dBm with AM)
• Resolution	0.1 dB
• Level error into 50 Ω	
RF socket	
Level ≥ −130 dBm	< 1.3 dB
Level > −15.0 dBm	< 2 dB
RF DIRECT socket	
Level ≥ −110 dBm	< 1.6 dB
Level > +5.0 dBm	< 2.5 dB
• VSWR (50 Ω) RF socket	< 1.1
• EMF setting range without interruption (not with AM)	0 to 20 dB
Additional level error	0.1 dB per dB

RX modulation

FM (AC-coupled)

• Frequency deviation	0 to 40 kHz
• Modulation frequency (int. and ext.)	30 Hz to 30 kHz
• Resolution	10 Hz
• Setting error	
f_{mod} = 300 Hz to 3 kHz	< 5 % + 3 digits
f_{mod} = 30 Hz to 20 kHz	< 10 % + 3 digits
• Distortion dev. < 10 kHz, f_{mod} = 300 Hz to 3 kHz	< 1 %
• Ext. mod. input	20 kHz FM = 0.707 V_{rms} into 600 Ω

FM (external DC-coupled)

• Frequency deviation	0 to 5 kHz
• Modulation frequency	0 to 30 kHz
• Centre-frequency error	< 100 Hz + frequency error of reference oscillator

ΦM

• Phase deviation	0 to 6 rad (f_{mod} · rad ≤ 20 kHz)
• Resolution	0.01 rad
• Modulation frequency	200 Hz to 6 kHz
• Setting error f_{mod} = 300 Hz to 3 kHz	< 6 % + 0.02 rad
• Distortion f_{mod} = 300 Hz to 3 kHz	< 1 %
• Ext. mod. input	20 rad ΦM = 0.707 V_{rms} into 600 Ω

AM

• Modulation depth	m = 0 to 99.9%
• Resolution	0.1 %
• Modulation frequency	30 Hz to 10 kHz
• Setting error for m ≤ 90 % f_{mod} = 30 Hz to 10 kHz	< 0.1 · m + 1 digit
• Distortion for m < 50 % f_{mod} = 300 Hz to 3 kHz	< 2 %
• Ext. mod. input	50 % AM = 0.707 V_{rms} into 600 Ω

Transmitter test

Frequency measurement

• Frequency range	2 to 999.9999 MHz
• Resolution	10 Hz
• Admissible input level	
on RF socket	0.1 mW to 125 W
• Measuring error	as reference oscillator + 10 Hz

Frequency-offset measurement

• Frequency range	2 to 999.9999 MHz
• Measuring range	0 to ±99.99 kHz
• Resolution	
f < 10 kHz	1 Hz
f ≥ 10 kHz	10 Hz
• Admissible input level	
on RF socket	2 µW to 125 W
on RF DIRECT socket	1 mV to 1 V (measuring range: 0 to ±15 kHz)
• Measuring error	as reference oscillator + 3 Hz (+ 1 digit for offset ≥ 10 kHz)

RF-power measurement (broadband)

• Frequency range	2 to 999.9999 MHz
• Measuring range	1 mW to 125 W (average)
• Resolution	
P < 1 W	1 mW
P < 10 W	10 mW
P ≥ 10 W	100 mW
• Measuring error (w/o modulation)	
P > 200 mW	< 10 % + 1 digit (f = 20 to 500 MHz)
	< 12 % + 1 digit (f = 6 to 999.9999 MHz)

RF-power measurement (bandwidth approx. 3 MHz)

• Frequency range	2 to 999.9999 MHz
• Measuring range	
RF socket	−45 to +37 dBm
RF DIRECT socket	−65 to +17 dBm
• Measuring error	< 3 dB
• Resolution	0.1 dBm

TX modulation measurement

FM measurement, RF socket (broadband)

• Frequency range	2 to 999.9999 MHz
• Input level	0.1 mW to 125 W
• Measuring range	0 to 25 kHz
• Resolution	10 Hz
• Measuring error (dev. < 10 kHz)	
f_{mod} = 300 Hz to 3 kHz	< 5 % + 1 digit + peak residual FM
f_{mod} = 100 Hz to 10 kHz	< 10 % + 1 digit + peak residual FM
• Demodulation distortion	
f_{mod} = 300 Hz to 3 kHz	< 0.5 %
• Peak residual FM	< 50 Hz or < 10 Hz/100 MHz

FM measurement, RF DIRECT socket (narrowband)

• Frequency range	2 to 999.9999 MHz
• Input level	−50 to −20 dBm
• Measuring range	0 to 10 kHz (f_{mod} · dev. < 10 kHz)
• Modulation frequency	f_{mod} = 0 to 6 kHz
• Resolution	10 Hz
• Sensitivity	better than 2 µV (3 kHz FM dev., 10 dB SINAD, CCITT-weighted)
• IF bandwidth	30 kHz

ΦM measurement, RF socket (broadband)

• Frequency range	2 to 999.9999 MHz
• Input level	0.1 mW to 125 W
• Measuring range	0 to 6 rad (FM dev. < 50 kHz)
• Resolution	0.01 rad
• Measuring error	
f_{mod} = 300 Hz to 3 kHz	< 6 % + 2 digits
f_{mod} = 200 Hz to 10 kHz	< 10 % + 2 digits
• Demodulation distortion	
f_{mod} = 300 Hz to 3 kHz	< 0.5 %

ΦM measurement, RF DIRECT socket (narrowband)

• Frequency range	2 to 999.9999 MHz
• Input level	−50 to −20 dBm
• Measuring range	0 to 3 rad (f_{mod} · ΦM dev. < 15 kHz)
• Modulation frequency	200 Hz to 6 kHz
• Sensitivity	better than 2 µV (3 rad ΦM dev., 10 dB SINAD, CCITT-weighted)
• IF bandwidth	30 kHz

AM measurement

• Frequency range	2 to 999.9999 MHz
• Measuring range	0 to 100 %
• Input level	
RF socket	1 mW to 125 W
RF DIRECT socket	0.01 mW to 0.5 W
• Resolution	0.1 %
• Measuring error (m ≥ 10 %)	
f_{mod} = 200 Hz to 10 kHz	< 10 % + 2 digits
• Demodulation distortion	
f_{mod} = 300 Hz to 3 kHz	< 1 %
• Modulation frequency	DC to 10 kHz

Spurious-modulation measurement

• Input level	
RF socket	1 mW to 125 W
RF DIRECT socket	20 mV to 1 V
• Measuring range	0 to −40 dB (CCITT-weighted) referred to 3 kHz FM dev., 3 rad ΦM dev. or 30 % AM
• Measuring error	< 1 dB

AF generator

Modulation generator GEN A

• Frequency range	30 Hz to 30 kHz
• Resolution	
f < 3 kHz	0.1 Hz
f ≥ 3 kHz	1 Hz
• Frequency error	< 0.01 %
• Level range (EMF)	0.1 mV_{rms} to 5 V_{rms}
• Resolution	
EMF ≤ 5 V	10 mV
EMF ≤ 1 V	1 mV
EMF ≤ 0.1 V	0.1 mV
EMF ≤ 10 mV	10 µV
• Level error	
f = 100 Hz to 10 kHz	< 3 %
f = 30 Hz to 30 kHz	< 10 %
• Distortion	
f = 30 Hz to 3 kHz	<0.5 %
f > 3 kHz	< 1 %
• Output impedance (balanced)	
f = 300 Hz to 3 kHz	< 10 Ω
f = 30 Hz to 30 kHz	< 40 Ω
• Output impedance (unbalanced)	600 Ω ±5 %
• Permissible load impedance	> 200 Ω

AF evaluation

AF voltmeter

• Frequency range	30 Hz to 30 kHz or to CCITT P 53A
• Measuring range	0.1 mV to 20 V
• Resolution	
Level < 0.1 V	0.1 mV
Level < 1 V	1 mV
Level < 10 V	10 mV
Level < 20 V	100 mV
• Measuring error	
f = 300 Hz to 3 kHz	< 3 %
f = 50 Hz to 15 kHz	< 6 %
• Source impedance	> 100 kΩ or 600 Ω ±3 %
• Input capacitance	20 pF

AF counter

• Frequency range	30 Hz to 30 kHz
• Input level	5 mV to 20 V
• Resolution	
f < 300 Hz	0.1 Hz
f < 10 kHz	1 Hz
f ≥ 10 kHz	10 Hz
• Measuring error	< 0.01 % + 1 digit

Distortion meter

• Input level	0.1 to 20 V
• Test frequency	1 kHz ±5 Hz
• Measuring range	0 to 99 %
• Resolution	0.1 %
• Measuring error d = 1 to 90 %	< 5 % of meas. value + 3 digits

SINAD meter

• Input level	0.1 to 20 V
• Measuring range	1 to 46 dB
• Resolution	
SINAD < 30 dB	0.1 dB
SINAD ≥ 30 dB	0.5 dB
• Measuring error for SINAD < 30 dB	< 0.8 dB + 1 digit

Scope & Analyzer

Spectrum analyzer

• Frequency range	2 to 999.9999 MHz
• Frequency accuracy	better than 2 % of sweep width
• Input-level range for measuring error < 3 dB in the frequency range $0.5 \cdot f_c \le f \le 2 \cdot f_c$	
RF socket	−70 to +47 dBm
RF DIRECT socket	−90 to +13 dBm
• Sweep width	200 kHz, 2 MHz, 10 MHz
• Sweep time	
Sweep width 2 MHz and 10 MHz	approx. 500 ms
Sweep width 200 kHz	approx. 2 s
• Evaluation bandwidth	
Sweep width 2 MHz and 10 MHz	30 kHz
Sweep width 200 kHz	6 kHz
• Inherent noise on RF DIRECT socket	
Sweep width 2 MHz and 10 MHz	−95 dBm
Sweep width 200 kHz	−105 dBm

Oscilloscope

• Inputs	
external	Z_i = 1 MΩ/40 pF (AC/DC)
internal	RX mod, TX demod, duplex demod, AF voltmeter, residual distortion
• Frequency range	DC (3 Hz) to 20 kHz
• Level error	< 10 % + 0.2 div
• Grating	6 x 10 div
• Horizontal deflection	100 µs/div to 500 ms/div
• Vertical deflection	2 mV/div to 10 V/div or 160 Hz/div to 8 kHz/div (FM); 0.16 rad/div to 8 rad/div (ΦM); 0.8 %/div to 40 %/div (AM)
• Trigger	± slope selectable trigger level
• Operating modes	auto, norm, one-shot, freeze, time measurement (max. resolution 2.5 µs)

Selective-call encoder and decoder

Standard tone sequences

• ZVEI 1	CCIR	VDEW
ZVEI 2	EEA	NATEL
EIA	EURO	CCITT

User-defined tone sequences

Sequence of up to 30 tones can be stored by user. Also double tones and underlying continuous tone (with GEN B option).

Encoder

Operating modes

- Single-tone sequence (max. 30 tones)
- Double-tone sequence (with GEN B option) (single-tone and double-tone sequences can be transmitted continously)
- Acknowledgement call (max. 15 double tones) from response time of < 100 ms acknowledgement call only possible with optional duplex FM/PhM stage
- Frequency error $1 \cdot 10^{-4}$ Hz

Setting ranges

With all standard and user-defined tone sequences it is possible to vary tones 1 to 15 in all parameters (tones 16 to 30: duration and pause can only be varied uniformly).

• Frequency	200 to 3000 Hz
• Resolution	0.1 Hz
• Tone duration	1 to 9999 ms at least 1 cycle
• Resolution	1 ms
• Pause duration	0 to 9999 ms
• Resolution	1 ms

Decoder

Decoding of each tone of tone sequences (max. 30 tones). Continuous decoding can be set.

Frequency measurement

• Measuring range	300 to 3000 Hz
• Resolution	0.1 Hz
• Measuring error *)	< 2 digits

Tone-duration measurement

• Measuring range	40 to 9999 ms
• Resolution	0.1 ms
• Measuring error *)	< 3 ms + 2 cycles of lowest frequency in tone sequence

Pause-duration measurement

• Measuring range	2 to 9999 ms
• Resolution	0.1 ms
• Measuring error *)	< 3 ms + 2 cycles of lowest frequency in tone sequence

*) Measuring errors referred to signal on VOLTM socket with level > 360 mV_{rms}

Receiving bandwidth

• Setting range	±0.1 to ±9.9 %
• Response-time measurement	2 to 9999 ms
• Resolution	1 ms

Options

HARDWARE OPTIONS

Duplex FM/ΦM stage

• Frequency range	27 to 999.9999 MHz
• Input level	1 mW to 125 W
• Measuring range	0 to 20 kHz 0 to 6 rad
• Measuring error	as for FM or ΦM measurement
• Peak residual FM	< 50 Hz or 15 Hz/100 MHz

All other values as for FM and ΦM measurement

Tracking

This permits frequency-dependent network analysis, eg the graphic display of filter curves (screen or printer).

• Frequency range	27 to 999.9999 MHz
• Min. window width	1 MHz
• Max. frequency resolution	5 kHz/pixel
• Displayed level dynamic range	70 dB

Modulation generator GEN B

Specifications as for GEN A

Control interface A

• Changeover relays *)	8
• TTL inputs	8 (electric strength: ±30 V)
• Trigger inputs	1

Control Interface C

• Changeover relays *)	24 (16 BCD-, BCD-inv.- or HEX-encodeable)
• TTL control outputs	20 (open collector)
• TTL inputs	8 (electric strength: ±30 V)
• TTL trigger inputs	2

*) I_{max} = 1 A, V_{max} = 30 V

RS-232/Centronics interface

• Baud rate	110/150/300/600/1200/2400/4800/9600 Bd
• Transmission protocol	7/8 bits, even/odd parity, 1/2 stop bits
• Socket connectors	25-way submin D

Keyboard

ASCII keyboard for writing Autorun programs and for interactive entries (eg adjustment instructions) in the course of a program.

Option card

The option card houses the optional modules.

Modules for option card

- DTMF device
  - Encoder/decoder
  - Tone/pause duration user-defined
- Network C expander
- DC voltmeter/ammeter
  - Voltmeter
    - Measuring range: 0 to ±42 V
    - Resolution: 100 µV to 100 mV
    - Measuring error: ≤ 1 % ±1 digit
  - Ammeter
    - Measuring range: 0 to ±15 A
    - Resolution: 1 to 100 mA
    - Measuring error: ≤ 4 % ±10 mA
- Variable notch filter 200 to 600 Hz
- 300-Hz highpass filter
- 300-Hz lowpass filter
- 3-kHz lowpass filter
- 4-kHz bandpass filter
- 6-kHz bandstop filter

Data module

For generating and decoding FFSK, NRZ and RZ signaling. The data module is the hardware requirement for testing cellular car telephones and radio-data systems with the software options.

VSWR test probe

• Frequency range	25 to 500 MHz
• Admissible forward power	1 to 50 W

Options

SSB stage

TX

• Frequency range	2 MHz to 999.9999 MHz
• RF power	1 mW to 125 W
• Measuring error	see standard unit
• Preselectable intermodulation for power measurement	0 to 45 dB
• Test tones/frequency	2 / freely selectable
• Frequency offset	±1 kHz
• AF bandwidth	10 Hz to 30 kHz
• Carrier suppression	0 to 60 dB for f = 1 kHz
• Opposite sideband suppression	0 to 60 dB for f = 1 kHz
• Measuring error	0 to 40 dB ± 1 dB 0 to 60 dB ± 2 dB
• AGC delay time	0 to 9999 ms selectable

RX

• Carrier-frequency range	0.4 MHz to 999.9999 MHz
• SSB modulation	0 to 30 kHz
• Resolution	10 Hz
• Accuracy	as reference oscillator
• Intermod. meas. range for intermodulation product	0 to 50 dB 2.3 kHz or 2.7 kHz
• Measuring error	±2 dB
• Measurable sensitivity	1 to 10 dB SINAD freely selectable
• Measuring error	see standard unit
• Max. RF level on RF DIRECT socket	+13 dBm
on RF socket	−7 dBm
• Max. RF level for intermod. measurement	−16 dBm
on RF DIRECT socket	−15,5 dBm
on RF socket	−36 dBm

ACPM

Adjacent-channel power meter

• Standard	CEPT T/R-27-01
• Frequency range	10 to 960 MHz
• Min. input level	> 100 mW on RF socket
• Measuring range	< −73 dBc for f < 492 MHz (typ. < −75 dBc) < −70 dBc for f ≥ 492 MHz (typ. < −72 dBc)
• Measuring error	< 3 dB
• Selectable channel spacing	10 / 12.5 / 20 / 25 kHz

SOFTWARE OPTIONS

Tests on car telephones and radio-data systems call for the appropriate software option on a memory card (see check-list) and the data module.

General data

Dimensions

• H x W x D	230 mm x 375 mm x 486 mm
• **Weight**	approx. 18.5 kg

Power supply

• AC	94 to 132 V or 187 to 264 V (47 to 450 Hz)
• DC	10.5 to 32 V
• P_{max}	approx. 110 W (incl. options)

Environment

• Operating temperature	0 to 45°C
• Storage temperature	−40 to +70°C
• Relative humidity	max. 90 %

Mechanical strength

(to DIN 40046)

• Shock	30 g
• Vibration	5 to 10 Hz for 10 mm amplitude 10 to 60 Hz, 2 g constant

• **RFI**	to VDE 0871 / class B corr. to PTT decree 1046/84
• **Damp tropical/ cold test**	to Def. Std. 66-31 issue 1/cat. 3
• **Safety**	to VDE 0411/IEC 348

IEEE-bus interface

• Standard	IEEE 488
• Connector	24-way
• Functions	AH1, SH1, L2, T1, SR1, RL1, DC1