

# STABILOCK 4031: Technical Data

## Synthesizer

Spectral purity		Nonharmonic spurious signals		10-MHz reference oscillator	
<ul style="list-style-type: none"> <li>Phase noise (25-kHz offset)</li> <li><math>f &lt; 500</math> MHz</li> <li><math>f \geq 500</math> MHz</li> <li>Residual FM</li> <li><math>f &lt; 500</math> MHz</li> <li><math>f \geq 500</math> MHz</li> </ul>	<ul style="list-style-type: none"> <li><math>&lt; -121</math> dBc/Hz</li> <li><math>&lt; -115</math> dBc/Hz</li> <li>4 Hz (rms, CCITT-weighted)</li> <li>8 Hz (rms, CCITT-weighted)</li> </ul>	<ul style="list-style-type: none"> <li><math>&gt; 500</math> Hz off carrier</li> <li>Level <math>&lt; -15.1</math> dBm</li> <li>Level <math>\geq -15.1</math> dBm</li> <li>Residual AM</li> </ul>	<ul style="list-style-type: none"> <li><math>&lt; -55</math> dBc</li> <li><math>&lt; -25</math> dBc</li> <li><math>&lt; -20</math> dBc</li> <li><math>&lt; 0.02</math> % (rms, CCITT-weighted)</li> </ul>	<ul style="list-style-type: none"> <li>Warmup time</li> <li>Frequency error</li> <li>Aging</li> <li>Output level</li> <li>Synchronization</li> </ul>	<ul style="list-style-type: none"> <li><math>&lt; 3</math> min for frequency error <math>&lt; 5 \cdot 10^{-7}</math> (<math>T = 20^\circ\text{C}</math>)</li> <li><math>&lt; 10</math> min for frequency error <math>&lt; 10^{-7}</math> (<math>T = 0</math> to <math>45^\circ\text{C}</math>)</li> <li><math>&lt; 5 \cdot 10^{-8}</math>/month approx. <math>0.4</math> V (into <math>50 \Omega</math>)</li> <li>10 MHz, <math>V &gt; 150</math> mV<sub>rms</sub> (into <math>200 \Omega</math>)</li> </ul>

## Receiver test

Carrier frequency		Output level		Level error into $50 \Omega$ RF socket	
<ul style="list-style-type: none"> <li>Frequency range</li> <li><math>f &lt; 500</math> MHz</li> <li><math>f \geq 500</math> MHz</li> <li>Frequency error</li> </ul>	<ul style="list-style-type: none"> <li>0.4 to 999.9999 MHz</li> <li>50 Hz</li> <li>100 Hz</li> <li>as reference oscillator</li> </ul>	<ul style="list-style-type: none"> <li>RF socket</li> <li>RF DIRECT socket</li> <li>Resolution</li> </ul>	<ul style="list-style-type: none"> <li>-142 to -7 dBm (max. -13 dBm with AM)</li> <li>-122 to +13 dBm (max. +7 dBm with AM)</li> <li>0.1 dB</li> </ul>	<ul style="list-style-type: none"> <li>Level <math>\geq -130</math> dBm</li> <li>Level <math>&gt; -15.0</math> dBm</li> <li>Level <math>\geq -110</math> dBm</li> <li>Level <math>&gt; +5.0</math> dBm</li> <li>VSWR (<math>50 \Omega</math>) RF socket</li> <li>EMF setting range without interruption (not with AM)</li> <li>Additional level error</li> </ul>	<ul style="list-style-type: none"> <li><math>&lt; 1.3</math> dB</li> <li><math>&lt; 2</math> dB</li> <li><math>&lt; 1.6</math> dB</li> <li><math>&lt; 2.5</math> dB</li> <li><math>&lt; 1.1</math></li> <li>0 to 20 dB</li> <li>0.1 dB per dB</li> </ul>

## RX modulation

FM (AC-coupled)		FM (external DC-coupled)		AM	
<ul style="list-style-type: none"> <li>Frequency deviation</li> <li>Modulation frequency (int. and ext.)</li> <li>Resolution</li> <li>Setting error</li> <li><math>f_{\text{mod}} = 300</math> Hz to 3 kHz</li> <li><math>f_{\text{mod}} = 30</math> Hz to 20 kHz</li> <li>Distortion dev. <math>&lt; 10</math> kHz, <math>f_{\text{mod}} = 300</math> Hz to 3 kHz</li> <li>Ext. mod. input</li> </ul>	<ul style="list-style-type: none"> <li>0 to 40 kHz</li> <li>30 Hz to 30 kHz</li> <li>10 Hz</li> <li><math>&lt; 5</math> % + 3 digits</li> <li><math>&lt; 10</math> % + 3 digits</li> <li><math>&lt; 1</math> %</li> <li>20 kHz FM = <math>0.707 V_{\text{rms}}</math> into <math>600 \Omega</math></li> </ul>	<ul style="list-style-type: none"> <li>Frequency deviation</li> <li>Modulation frequency</li> <li>Centre-frequency error</li> </ul>	<ul style="list-style-type: none"> <li>0 to 5 kHz</li> <li>0 to 30 kHz</li> <li><math>&lt; 100</math> Hz + frequency error of reference oscillator</li> </ul>	<ul style="list-style-type: none"> <li>Modulation depth</li> <li>Resolution</li> <li>Modulation frequency</li> <li>Setting error for <math>m \leq 90</math> %</li> <li>Distortion for <math>m &lt; 50</math> %</li> <li>Ext. mod. input</li> </ul>	<ul style="list-style-type: none"> <li><math>m = 0</math> to 99.9%</li> <li>0.1 %</li> <li>30 Hz to 10 kHz</li> <li><math>&lt; 0.1 \cdot m + 1</math> digit</li> <li><math>&lt; 2</math> %</li> <li>50 % AM = <math>0.707 V_{\text{rms}}</math> into <math>600 \Omega</math></li> </ul>
		<ul style="list-style-type: none"> <li>Resolution</li> <li>Modulation frequency</li> <li>Setting error</li> <li>Distortion</li> <li>Ext. mod. input</li> </ul>	<ul style="list-style-type: none"> <li>Phase deviation</li> <li>Resolution</li> <li>Modulation frequency</li> <li>Setting error</li> <li>Distortion</li> <li>Ext. mod. input</li> </ul>		

## 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

- Measuring error as reference oscillator + 3 Hz (+ 1 digit for offset  $\geq 10$  kHz)

### 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

### Frequency-offset measurement

- Frequency range 2 to 999.9999 MHz
- Measuring range 0 to  $\pm 99.99$  kHz
- Resolution  $f < 10$  kHz 1 Hz  
 $f \geq 10$  kHz 10 Hz
- Admissible input level on RF socket 2  $\mu$ W to 125 W  
on RF DIRECT socket 1 mV to 1 V (measuring range: 0 to  $\pm 15$  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  $\geq 10$  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)

## 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

### $\Phi$ M 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) 0.01 rad
- Resolution
- 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 %

### 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  $\geq 10$  %)  $f_{mod} = 200$  Hz to 10 kHz < 10 % + 2 digits
- Demodulation distortion  $f_{mod} = 300$  Hz to 3 kHz < 1 %
- Modulation frequency DC to 10 kHz

### 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  $\mu$ V (3 kHz FM dev., 10 dB SINAD, CCITT-weighted)
- IF bandwidth 30 kHz

### $\Phi$ M measurement, RF DIRECT socket (narrowband)

- Frequency range 2 to 999.9999 MHz
- Input level -50 to -20 dBm
- Measuring range 0 to 3 rad ( $f_{mod}$  dev. < 15 kHz)
- Modulation frequency 200 Hz to 6 kHz
- Sensitivity better than 2  $\mu$ V (3 rad  $\Phi$ M dev., 10 dB SINAD, CCITT-weighted)
- IF bandwidth 30 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  $\Phi$ M dev. or 30 % AM
- Measuring error < 1 dB

## AF generator

### Modulation generator GEN A

● Frequency range	30 Hz to 30 kHz
● Resolution	
$f < 3 \text{ kHz}$	0.1 Hz
$f \geq 3 \text{ kHz}$	1 Hz
● Frequency error	$< 0.01 \%$
● Level range (EMF)	0.1 mV <sub>rms</sub> to 5 V <sub>rms</sub>

● Resolution		
EMF $\leq 5 \text{ V}$	10 mV	
EMF $\leq 1 \text{ V}$	1 mV	
EMF $\leq 0.1 \text{ V}$	0.1 mV	
EMF $\leq 10 \text{ mV}$	10 $\mu\text{V}$	
● Level error		
$f = 100 \text{ Hz to } 10 \text{ kHz}$	$< 3 \%$	
$f = 30 \text{ Hz to } 30 \text{ kHz}$	$< 10 \%$	

● Distortion		
$f = 30 \text{ Hz to } 3 \text{ kHz}$	$< 0.5 \%$	
$f > 3 \text{ kHz}$	$< 1 \%$	
● Output impedance (balanced)		
$f = 300 \text{ Hz to } 3 \text{ kHz}$	$< 10 \Omega$	
$f = 30 \text{ Hz to } 30 \text{ kHz}$	$< 40 \Omega$	
● Output impedance (unbalanced)		600 $\Omega \pm 5 \%$
● Permissible load impedance		$> 200 \Omega$

## 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 $< 0.1 \text{ V}$	0.1 mV
Level $< 1 \text{ V}$	1 mV
Level $< 10 \text{ V}$	10 mV
Level $< 20 \text{ V}$	100 mV
● Measuring error	
$f = 300 \text{ Hz to } 3 \text{ kHz}$	$< 3 \%$
$f = 50 \text{ Hz to } 15 \text{ kHz}$	$< 6 \%$
● Source impedance	$> 100 \text{ k}\Omega$ or 600 $\Omega \pm 3 \%$
● Input capacitance	20 pF

### AF counter

● Frequency range	30 Hz to 30 kHz
● Input level	5 mV to 20 V
● Resolution	
$f < 300 \text{ Hz}$	0.1 Hz
$f < 10 \text{ kHz}$	1 Hz
$f \geq 10 \text{ kHz}$	10 Hz
● Measuring error	$< 0.01 \%$ + 1 digit

### Distortion meter

● Input level	0.1 to 20 V
● Test frequency	1 kHz $\pm 5 \text{ Hz}$
● 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 $< 30 \text{ dB}$	0.1 dB
SINAD $\geq 30 \text{ dB}$	0.5 dB
● Measuring error for SINAD $< 30 \text{ dB}$	$< 0.8 \text{ dB} + 1 \text{ digit}$

## 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 $< 3 \text{ dB}$ in the frequency range $0.5 \cdot f_c \leq f \leq 2 \cdot f_c$	
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	$Z_i = 1 \text{ M}\Omega / 40 \text{ pF}$ (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 $\mu\text{s/div}$ 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 ( $\Phi\text{M}$ ); 0.8 %/div to 40 %/div (AM) $\pm$ slope
● Trigger	selectable trigger level auto, norm, one-shot, freeze, time measurement (max. resolution 2.5 $\mu\text{s}$ )
● Operating modes	

## 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 continuously)
- 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 · 10<sup>-4</sup> 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<sub>max</sub>

### 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
- Measuring error 0 to 6 rad 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<sub>max</sub> = 1 A, V<sub>max</sub> = 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 Autoran 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
- 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  $\pm 1$  kHz
- Frequency offset 0 to 30 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  $\pm 1$  dB  
0 to 60 dB  $\pm 2$  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
- Measuring error 2,3 kHz or 2,7 kHz  $\pm 2$  dB
- Measurable sensitivity 1 to 10 dB SINAD freely selectable see standard unit
- Measuring error +13 dBm  
-7 dBm
- Max. RF level on RF DIRECT socket on RF socket
- Max. RF level for intermod. measurement on RF DIRECT socket on RF socket -16 dBm  
-15,5 dBm  
-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  $f \geq 492$  MHz (typ. < -72 dBc)  
< 3 dB
- Measuring error
- 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

- HxWxD 230 mm x 375 mm x 486 mm

### Weight

approx. 18,5 kg

### Power supply

- AC 94 to 132 V or 187 to 284 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 decrees 1046/84

### Damp tropical/ cold test

to Def. Std. 66-31 issue 1/cat. 3  
to VDE 0411/IEC 348

### Safety

### IEEE-bus interface

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