will′tek

Willtek
4032

STABILOCK® Communications
Test System

Built-in spectrum analyzer

AUTORUN

IEEE-488 interface

High-speed measurements

Reliability

In excess of 5000 STABILOCK 4032 radio test sets are currently in use worldwide. This success has been due to the versatile design, simple operation and wide variety of system tests which can be made with the "universal" test set.

Applications range from high-speed production tests and quality measurements to servicing and commissioning tests. The wide variety of hardware modules and software options covering frequency ranges up to 2.3 GHz, provide comprehensive capability of analog and digital cellular, cordless and two-way radio systems.

Additional capability includes base station measurements and paging tests.

Systems include TETRA Digital Trunked Radio, Tetrapol as well as CDMA base station testing at 800 MHz and 1900 MHz. The GSM Option of the STABILOCK 4032 now is also capable of testing dual-band mobiles.

Please refer to individual data sheets for further details of system performance.

Built-in spectrum analyzer

Detailed spectrum analysis from 2 MHz to 1 GHz (standard) or up to 2.3 GHz (optional). Additional option for high-speed sweep and a host of useful functions.

AUTORUN

Simple, BASIC-oriented programming language for fully automated tests. Ready-written programs are available for all popular mobile telephone systems.

IEEE-488 interface

Fitted as standard. Ensures remote control via controller or program downloads from LAN servers.

High-speed measurements

Special firmware for final testing during production cuts measuring times by around 30%.

Reliability

All subassemblies are burnt-in tested, with plug-in modules and SMD technology.

Typical performance is derived from the standard deviation of many hundreds of production units operating under normal environmental conditions of 20°C.

Generator (Typical Performance)		
Level error	(< –15 dBm, RF socket, f = 1 to 1000 MHz)	< 0.3 dB [≤1.3 dB]
Level error (FEX)	(< –20 dBm, RF socket, f = 1000 to 2000 MHz)	< 0.3 dB [≤1.3 dB]
Analzyer (Typical Performance)		
RF power measuring error	(20 to 500 MHz, broadband)	≤ 4% [< 10%]
RF power measuring error	(800 to 920 MHz, broadband)	≤ 5% [< 12%]
Audio Generator and Analyzer (Typical Performance)		
AF generator distortion	(f > 3kHz)	< 0.6% [< 1.0%]
AF volmeter measuring error	(f = 300 Hz to 3 kHz)	< 1% [< 3.0%]

Specifications below apply for the basic 4032 up to 999.99 MHz. When the FEX (Frequency Extension) option is fitted please see ∗ section at the end. Please refer to individual data sheets for performance of options.

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 accuracy (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 accuracy	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 Analyzer

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 accuracy	
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 accuracy	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 accuracy	
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 accuracy 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 accuracy 3 dB	
in the frequency range 0.5 × f_c ≤ f ≤ 2 × 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)
Inputs 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 μs/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 continuously).
Acknowledgement call (max. 15 double tones) from response time of < 100 ms acknowledgement call only possible with optional duplex FM/ΦM stage

Frequency error	1 × 10^{-4} Hz

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

General data

Dimensions and weight

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)
P$_{max.}$	approx. 110 W (incl. options)

Environment

Operating temperature	+5°C to +45°C
Storage temperature	–40°C to +70°C
Relative humidity	max. 90%

Mechanical strength

Shock	25 g
Vibration	5 to 10 Hz for 10 mm amplitude
	10 to 60 Hz, 2 g constant
EMC conformity	EN 55022: 1999/05; Class B
	EN 61000-4-2: 1996/03; test level 1
	EN 61000-4-3: 1999/06; test level 2
	EN 61000-4-4: 1996/03; test level 3
	EN 61000-4-2/A1: 1998/10
	EN 61000-4-2/A3: 1999/07 draft
Safety	EN 61010-1: 1994/03
	EN 61010-1, correction 1: 1998/11
	EN 61010-1/A2: 1996/05
	EN 61010-1/A2, correction 1: 1998/11

IEEE–bus interface

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

* Frequency Extension

The following specifications apply to the FEX option:

RF Generator

Carrier Frequency

Frequency range	1.0 to 2.3 GHz
Resolution	1 kHz

Output level

RF socket	–142 to –20 dBm
RF DIRECT socket	–122 to 0 dBm
Level error into 50 Ω (1.0 to 2.0 GHz)	
RF socket	1.5 dB (over range –110 to –20 dBm)
VSWR (50 Ω) RF socket	< 1.2

RF Analyzer

Frequency measurement

RF frequency range	1.0 to 2.3 GHz
Minimum level	–5 dBm (over range 1.0 to 2.0 GHz)

RF power measurement, RF socket (broadband)

RF frequency range	1.0 to 2.0 GHz
Measurement accuracy	14% ±1 digit
	(over range 200 mW to 10 W)

Ordering information

Accessories supplied

2 miniature fuses 3.15 A	M 849 037
Power cable	M 880 606
2 protective caps, black	M 787 095
TNC/BNC adapter	M 886 255
TNC terminator cap	M 886 247
Protective front panel cover	M 501 350
Headphones jack plug	M 884 123
1 memory card (blank, 256 KByte)	M 897 053
Operating manual	M 290 288

Recommended extras

Telescopic antenna	M 248 120
Carrying bag	M 378 258
Transport container	M 300 692
Protective back panel cover	M 501 350
19-inch adapter	M 378 257
Connector set	M 300 690
N/BNC adapter	
2 x 1 m cable BNC/BNC	
1 x 1 m cable N/N	
1 x 1 m cable BNC/banana	
Memory card (256 KByte)	M 897 053
Carrying grip kit	M 378 256
1205 RF probe 20 dB	M 248 640
Service manual	M 291 288
50-way D connector for control interface	
	M 300 643
25-way connector for control interface	M 300 641
Protective edges	M 248 190
GSM/DCS 1800 SIM Card plug-in	M 860 188
Model 150 bridge (5 to 1000 MHZ)	
incl. cable set	M 886 086
Model 150 bridge (5 to 2000 MHZ)	
incl. cable set	M 886 100

Test Packages

STABILOCK 4032	M 108 802
RF Frequency extension 2.3 GHz (FEX)	M 248 295
TETRA/FEX BS Test Package	M 248 366
incl. TETRA module	
RF Frequency extension 2.3 GHz	
High-Speed Spectrum Analyzer	
TETRA BS test software	
TETRA/FEX MS Test Package	M 248 308
incl. TETRA module	
RF Frequency extension 2.3 GHz	
TETRA MS test software	

TETRA Base Station Testing

Specifications

Temperature range	+10°C to +45°C

TETRA Signal Generator

Frequency range

with TETRA/FEX	100 to 1000 MHz
Resolution	100 Hz

Output power

RF socket (N-type)	–130 to –20 dBm
RF DIRECT socket (TNC)	–95 to 0 dBm
with TETRA/FEX	–110 to 0 dBm
Resolution	0.1 dB
Accuracy	
(N-type socket, P > –115 dBm)	1.5 dB

Modulation

$\pi/4$ differential quadrature phase shift keying (DQPSK)	
Roll-off factor α	0.35
Symbol rate	18 k symbols/s
RMS vector error	< 0.12
Generated patterns (bursted)	T1:TCH/7.2
	T1:SCH/F
Generated patterns (continuous)	PN–9
	various (0000, 1111, etc.)

TETRA Analyzer [1]

Frequency range

with TETRA/FEX	100 to 1000 MHz

Power measurement

(N-type connector only)	
Range	+15 to +45 dBm
Resolution	0.1 dB
Accuracy (P > 20 dBm)	1.0 dB
Indications	current/min./max./average

Frequency error measurement

Resolution	1 Hz
Accuracy	
(P > 15 dBm)	5 Hz + ref. osc. accuracy
Indications	current/min./max./average

Vector error measurement

Resolution	0.001
Accuracy (rms meas.)	0.03
Indications	current/min./max./average

Residual carrier measurement

Resolution	0.1%
Accuracy	0.3%
Indications	current/min./max./average

Constellation display

Display modes	dots/lines/statistics
	continuous/freeze

Additional measurements

power
RMS vector error
residual carrier power
frequency error

Burst power display

Reference	average power over burst
Template	user-definable
	with pass/fail indication
Horizontal range	350 symbols
Display modes	continuous/freeze
	TETRA-filtered/unfiltered

Modulation spectrum display

Reference	average power over burst
Display modes	TETRA-filtered/unfiltered
Additional measurements	
	absolute power over burst
	relative power at 0, $\pm$12.5, $\pm$25 kHz

TETRA Synchronisation

Software Synchronisation

Synchronises to Main Control Channel, reads MCC/MNC/BCC

Hardware Synchronisation

Synchronises to Frame or Multiframe TTL trigger signal

Manual timing adjustment	$\pm$510 symbols

[1] Analyzer specifications only valid for test signals on N-type socket with

Frequency error < 1 kHz
RF power 0 to 45 dBm
RMS vector error < 0.10
Residual carrier power < 10%
At least 20 symbol changes available

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

Warm-up time	< 3 min for frequency error
	< 5 × 10⁻⁷ (T = 20°C)
	< 10 min for frequency error, < 10⁻⁷
Frequency error	< 1 × 10⁻⁷ (T = 5 to 45°C)
Aging	< 5 × 10⁻⁸/month
Output level	approx. 0.4 V (into 50 Ω)
Synchronisation	10 MHz, V > 150 mV$_{rms}$
	(into 200 Ω)

RF Generator

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 15 dB, usable to 20 dB
Additional level error	0.1 dB per dB

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

RF Analyzer

Frequency measurement

Frequency range *	2 to 999.9999 MHz
Resolution	10 Hz
Admissible input level on RF socket	
	0.1 mW to 125 Ω
Measuring accuracy	as reference osc. ±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 mW to 125 W
on RF DIRECT socket	1 mV to 1 V
	(measuring range: 0 to ±15 kHz)
Measuring accuracy	as reference osc. ±3 Hz
	(+ 1 digit for offset ≥ 10 kHz)

RF–power measurement, RF socket (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 accuracy	3 dB
Resolution	0.1 dBm

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 accuracy (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 mV
	(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 accuracy	
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 mV
	(3 rad ΦM dev., 10 dB SINAD, CCITT–weighted)
IF bandwidth	30 kHz

TETRA MS Test

Specifications

Temperature range	+10°C to +45°C

TETRA Signal Generator

Frequency range

with TETRA/FEX	100 to 1000 MHz

Channel

Channel spacing	25 kHz
Channel numbering	0 to 9999
Duplex spacing	10 MHz
(TX selectable for upper/lower band)	

Output power

RF socket (N–type)	–130 to –20 dBm
RF DIRECT socket (TNC)	–95 to 0 dBm
Resolution	0.1 dB
Accuracy	
(N–type socket, P > –115 dBm)	1.5 dB

Modulation [2]

π/4 differential quadrature phase shift keying (DQPSK)

Roll-off factor α	0.35
Symbol rate	18 k symbols/s
Residual carrier power	< 3%

TETRA Analyzer [1]

Frequency range

with TETRA/FEX	100 to 1000 MHz

Power measurement

(N–type connector only)

Range	+15 to +45 dBm
Resolution	0.1 dB
Accuracy (P > 20 dBm)	1.0 dB
Indications	current/min./max./average

Frequency error measurement

Resolution	1 Hz
Accuracy	
(P > 15 dBm)	5 Hz + ref. osc. accuracy
Indications	current/min./max./average

Vector error measurement [2]

Resolution	0.001
Accuracy (rms meas.)	0.03
Indications	current/min./max./average

Residual carrier measurement [2]

Resolution	0.1%
Accuracy	0.3%
Indications	current/min./max./average

Timing measurement

Resolution	0.01 symbol period

Constellation display

Display modes	dots/lines/statistics
	continuous/freeze

Additional measurements

power
RMS vector error
residual carrier power
frequency error

Burst power display

Reference	average power over burst

Template

user-definable
with pass/fail indication

Horizontal range

Normal bursts	350 symbols
Control uplink bursts	175 symbols
Display modes	continuous/freeze
	TETRA-filtered/unfiltered

Additional measurements

Power

Modulation spectrum display

Reference	average power over burst
Horizontal range	±25 kHz
Vertical range	120 dB
Display modes	TETRA-filtered/unfiltered

Additional measurements

Absolute power over burst
Relative power at 0, ±12.5, ±25 kHz

[1] Analyzer specifications only valid for test signals on N–type socket with

Frequency error < 1 kHz
RF power 0 to 45 dBm
RMS vector error < 0.10
Residual carrier power < 10%
At least 20 symbol changes available

[2] Accuracy specified for average of 10 measurements

Other available options

Duplex FM/ΦM
Control interfaces
2nd Modulation generator
RS-232/Centronics interface
SSB kit
Adjacent Channel Power Meter (ACPM)
Fast Spectrum Analyzer
Option card
DTMF module
DC voltmeter/ammeter
Various highpass, lowpass, bandpass,
bandstop filters
Various notch filters
ARE Autorun Editor

NMT
AMPS, EAMPS, NAMPS
NATEL-C
Radiocom 2000 HD
FMS
VDEW direct dialing
VDEW digital
ZVEI binary
POCSAG (NRZ, FFSK)
Cityruf
Trunking (MPT 1327 / PAA 2424)
AT&T Microcell
US Signaling formats
LTR + US Signaling
Tracking

NADC (900 MHz, 450 MHz)
IS-136 DB (down-banded)
GSM Base Station Test

Not all of the options can be fitted into one 4032.
Some options can only be used in conjunction with
other options.

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