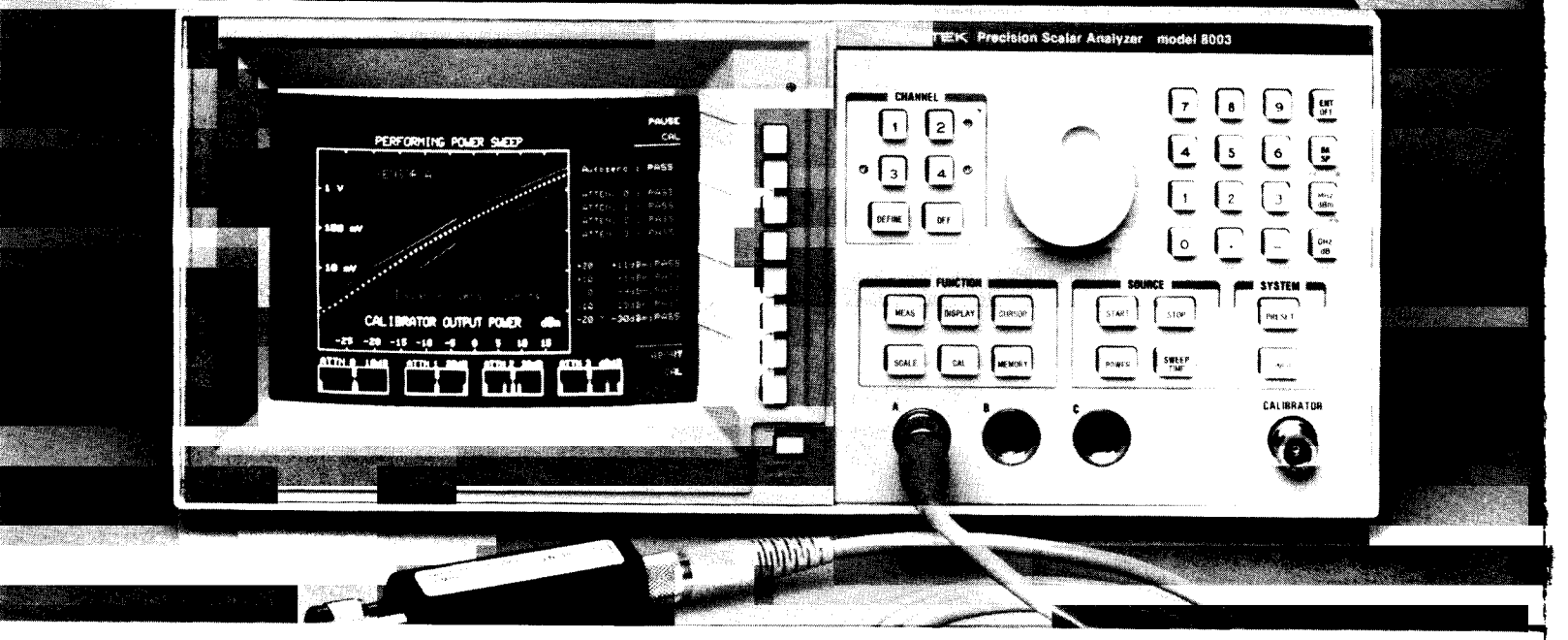


Precision Scalar Analyzer

- **10 MHz to 40 GHz Frequency Range**
- **±0.04 dB Linearity From +20 dBm to −70 dBm**
- **Full System Integration With Sweeper**
- **AC/DC Detection Modes**
- **Exceeds CW Power Meter Accuracy**

Overview
The 8003 Precision Scalar Analyzer is designed for making highly accurate transmission loss or gain, return loss, (SWR) and precise power measurements quickly and easily.

Frequency range is from 10 MHz to 40 GHz depending on the sweeper and power sensors selected. The 8003 can be used with a wide variety of sweepers depending on the performance required and budget available. There is a separate GPIB connector for interfacing to any of the firmware supported sweepers for total system integration.

A color display adds considerably to the overall ease of use designed into the 8003.

0.04 dB (1%) Linearity Over 90 dB Dynamic Range
Wavetek's unique power sweep calibration system results in linearity and absolute power measurement capabilities that exceeds modern CW power meters with thermocouple sensors. This capability is available in both the AC and DC detection modes for the first time in a Scalar Analyzer.

Powerful Measurements Using Cursors, Markers and Limit Lines
Power and frequency at any point on the display can be continuously displayed using the front panel CURSOR key together with the spin knob or via direct keypad entry.

Cursor MAX and MIN functions can be used to automatically place the cursor at the maximum or minimum values on the active trace and display the frequency and power level.

Ten built in markers, generated by the 8003, can be used for making measurements at defined frequencies.

Limit lines can be used to establish PASS/FAIL limits that make the most of Wavetek's lower measurement uncertainties. The limit lines for each channel can be displayed on the CRT. Traces that exceed the limits will result in a FAIL flag on the display. Limit test failed can also be detected over the GPIB.

Adaptive Path Calibration
Path calibration is used to improve accuracy by cancelling out frequency response variations due to the source, sensors and signal splitting devices. Path calibration data for the entire frequency range of the sweeper is stored in 4096 points for each input. Path calibration data is then automatically interpolated for any subsequent frequency range eliminating system frequency response variations.

Full Feature Power Meter Capabilities
High power meter versatility is achieved in the 8003 through 4 user defineable channels that display the power measured at the 3 inputs.

Power measurements can be absolute (Log or Lin) or relative (dBr or %). Offsets can be entered to compensate for external attenuators for example.

Digital averaging is available to reduce the effects of noise for making accurate measurements at low power levels.

Additional ease of use features include max-hold, min-hold and stored set-ups.

Total Sweeper Integration

The 8003 can be used with a wide variety of firmware supported sweepers over the private line GPIB with no operator intervention required. Sweeper control is from the front panel of the scalar analyzer adding considerably to ease-of-use.

Full Range of Power Sensors

Users can select from a family of power sensors depending on the frequency range and application. Power sensors are available with appropriate coax connectors to cover from 10 MHz to 40 GHz. Ultra low VSWR sensors are available for highly accurate transmission and power measurements. For applications such as compression measurements on amplifiers where the harmonic content will be substantial, there are true RMS power sensors. High power sensors measure up to 1 Watt.

Precision Return Loss Bridges

High performance bridges and a full line of accessories are available to complete the 8003 precision scalar analyzer system.

Buffered, Direct Digital Plots

Record keeping is as easy as pressing the PLOT soft key on the 8003. Simply connect one of the many compatible digital plotters and printers to the private line GPIB port and then continue using the 8003 while it downloads the display buffered in memory.

Product color plots with multi-pen plotters or the HP Paintjet. Use Laserjet, Inkjet or dot matrix printers for black and white records.

SYSTEM SPECIFICATIONS

Frequency Range: 10 MHz to 40 GHz in coax using Wavetek's 80300 Series power sensors and 80500 Series bridges and an appropriate sweeper.

Power Range: +30 dBm to −70 dBm in both AC and DC detection modes.

Inputs: Three inputs, A, B and C accept detected outputs from Wavetek's power sensors and bridges.

DISPLAY

CRT: Full color display. Each channel can be assigned a different color. Graticule color is selectable (default green). Menus for soft keys use color.

Display resolution: 608 x 430 points for each channel.

Channels: Four channels can be used to select and simultaneously display inputs from A, B, and C in single channel or ratio mode.

Display Modes

Graph/Readout: Graph mode displays swept frequency response on CRT. Readout mode displays power level at cursor frequency or CW power levels in digital format on CRT.

Graph Mode

Log

dBm: Single channel power measurement.

dB: Relative power measurement (ratio or relative to trace memory).

Readout Mode

Log:

dBm: Single channel measurement.

dB: Relative power measurement.

Lin:

nW, μW, mW and Watts: Single channel measurement.

%: Dual channel measurement.

% Rel: Dual channel measurement relative to a reference.

Autoscale: Automatically sets the scale factor, reference level and reference position to provide optimum display of active channel.

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces can be averaged to reduce effects of noise on measurement.

Smoothing: Provides a linear moving average of adjacent data points. The smoothing aperture defines the trace width (number of data points) to be averaged. The smoothing aperture can be set from 0.1% to 25% of the trace width.

Adaptive Path Calibration (Normalization): Traces are stored and normalized with the highest resolution, independent of display scale/division or offset. 4096 points for each trace are stored over the full frequency range of the sweeper or any user selected frequency range. Normalizaton data is automatically interpolated for ranges within the original normalized range.

Trace Memory: Ten traces can be stored and recalled. Trace differences can be displayed.

Settings Store/Recall: Allows up to nine full front panel setups, plus power down state to be stored and recalled from non-volatile memory.

Sequence: Step through 10 stored setups. Sequence order is user definable.

Alternate Sweep: Displays alternate sweeps between the current front panel setup and any of nine stored setups.

Limit Lines: Two lines for each trace can be set as go/no-go data limits. Complex limit lines can be entered through the GPIB interface.

CURSOR AND MARKERS

Cursor: The cursor can be positioned with the tuning knob or via the numeric keypad. The frequency and amplitude of test data at the cursor on all active channels is digitally displayed.

Cursor Delta: Displays differences in dB and frequency between the reference cursor and the main cursor.

Cursor Min/Max: Automatically moves the cursor to the minimum or maximum value of test data.

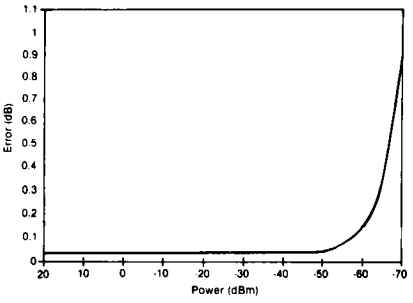
Cursor "x" dB: Automatically moves the cursor to the point on the trace equal to the value of "x" in dB or dBm.

Cursor "x" Bandwidth: Automatically displays cursors to the right and left of the cursor at the frequencies where the test data is equal to the value of "x" dB. The bandwidth between the cursors is displayed.

Markers: Displays up to 10 markers which are generated by the 8003. The cursor can be moved directly to any marker or moved sequentially through the markers.

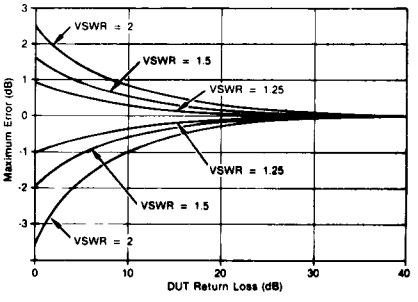
ACCURACY

Transmission Loss or Gain Measurement: Transmission loss or gain measurements are made relative to a 0 dB reference point established during calibration. Therefore, frequency response errors of the source, sensors, and signal splitting device are removed. The remaining elements of uncertainty are instrument linearity and noise uncertainty (see graph) and mismatch error.

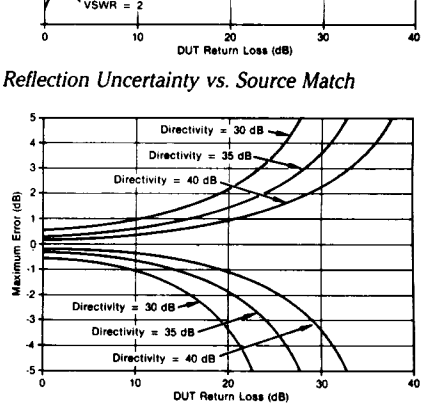


Linearity Plus Noise vs. Input Power

Reflection Measurement Accuracy: When measuring devices with high return loss (>10 dB), reflection accuracy is typically dominated by the effective system directivity, instrument linearity errors, and noise uncertainty. With low return loss devices (<10 dB), reflection accuracy is typically dominated by source match, see following graphs. Calibration with an open and short effectively remove uncertainties due to frequency response of the source, sensors, and signal splitting device. Reflection Accuracy = Scalar Accuracy + Reflection Bridge Accuracy.



Reflection Uncertainty vs. Source Match



Reflection Uncertainty vs. Directivity

MICROWAVE SCALAR ANALYZERS

MODEL 8003

Absolute Power Measurement Accuracy: The absolute power measurement accuracy is determined by a number of factors including calibrator accuracy, noise, sensor calibration factor error, and the mismatch uncertainty between sensor and device under test.

Calibrator: Provides a 50 MHz calibration signal at 51 very accurately controlled levels from +20 to −30 dBm to dynamically linearize the sensors.

Frequency: 50 MHz nominal.

Connector: Type N(f) precision connector, 50Ω. (Adapters available for calibrating sensors with other connector types.)

Accuracy: ±0.7% at 0 dBm, traceable to the National Bureau of Standards.

VSWR: <1.05 (Return Loss >37 dB).

Instrument Linearity:
±0.02 dB (±0.5%) over any 20 dB range.
±0.04 dB (±1.0%) from +20 to −70 dBm.

Temperature Coefficient of Linearity: <0.1%/°C temperature change after calibration.

Zeroing Accuracy
(CW Mode, Averaging Factor =32).
Zero Set: ±25 picowatts.
Zero Drift: Typically <±100 picowatts in 1 hour at constant temperature after a 24 hour warmup.

Noise Uncertainty: Typically <25 picowatts, at constant temperature, measured over a 1 minute interval, two standard deviations)

GPIB

Interface: Operates according to IEEE-488 interface standard. A private line GPIB is used to connect the analyzer to firmware supported sweepers. Pass through commands allow control of the signal source using a controller other than the analyzer.

Programmable Functions: All front panel functions, except power on/off are programmable.

Interrupts: SRQ's are generated for the following conditions: Front panel key pressed, Operation complete, Illegal command, Instrument self-test error, and Limit test failed.

REAR PANEL INPUTS/OUTPUTS

Sweep Voltage Requirements (Sweep In): (BNC connector). 0 to +10V nominal.

Blanking Input: (BNC connector). Used to blank the sweep oscillator band switching points on the 8003 display.

Voltage Level:
Blanked >2V typical.
Unblanked <0.8V typical.

VccF Input: (BNC connector). Allows direct entry of frequency from RF power sources equipped with a VccF output. Used to apply a Cal Factor correction for absolute power measurements.

Input 1: (BNC connector). Used with some sweepers to provide synchronization.

AC Modulation Output: (BNC connector). Provides drive to modulation input on sweeper or external modulator for use in AC detection mode.

DAC Output: (BNC connector). Used to supply V prop. F signal to drive a microwave generator or tracking filter.
Current Compliance: ±2 mA maximum.
Minimum Load: 5 KΩ.

Bias Output: (BNC connector). Programmable output voltage used to display family of curves.
Voltage Range: ±10V.
Current Compliance: Source or sink 150 mA maximum.

User GPIB: (GPIB connector). Used to connect 8003 to GPIB system controller.

Instrument GPIB: (GPIB connector). Used to connect 8003 to dedicated signal source, plotter or printer.

NS200 Port: Used to connect 8003 to Wavetek NS200 Series RF modules.

RS232 Port: Serial Communications Interface for driving Laserjet, Paintjet, plus serial printers and plotters.

Floppy Disk Port: Not currently used.

SIGNAL SOURCES

System Integrated: The 8003 can be system integrated (total sweeper control using the 8003) with the following sweepers:
- Wavetek NS200 Series Source Modules
- HP8350B with an RF plug-in (HP83500 Series or HP86200 Series with HP11869A Adapter)
- HP8340A/B or HP8341A/B Synthesized Sweeper
- Gigatronics 610 and 910 Series Synthesized Sweepers

Operator Integrated: The 8003 is compatible with any signal source that meets the following requirements:
Horizontal Ramp: Provides a 0V to +10V nominal ramp signal.
Blanking Signal: Provides +5V during retrace and bandswitching.

Modulation
AC Detection Mode: A square wave is provided by the analyzer to modulate the signal source.
DC Detection Mode: When retrace zero mode is enabled, the analyzer zeros its sensors during the retrace time of the sweep. The signal source must turn off its RF output (blank) during sweep retrace.
RF Off Level: <−80 dBm during retrace.

POWER SENSOR SELECTION GUIDE

Model No. (Application)	Frequency Range	Power Range	Maximum Power	Maximum VSWR	RF Connector	Dimensions		
						Length	Diameter	Weight
80301 (Standard)	10 MHz to 18 GHz	−70 to +20 dBm (100 pW to 100 mW)	+23 dBm (200 mW)	10 MHz-2 GHz; 1.12 2 GHz-18 GHz; 1.22	N(m) 50Ω	11.45 cm (4.5 lb.)	3.2 cm (1.25 lb.)	0.18 kg (0.4 lb.)
80302 (Standard)	10 MHz to 18 GHz	−70 to +20 dBm (100 pW to 100 mW)	+23 dBm (200 mW)	10 MHz-2 GHz; 1.12 2 GHz-18 GHz; 1.22	APC-7 50Ω	11.45 cm (4.5 lb.)	3.2 cm (1.25 lb.)	0.18 kg (0.4 lb.)
80303 (Standard)	10 MHz to 26.5 GHz	−70 to +20 dBm (100 pW to 100 mW)	+23 dBm (200 mW)	10 MHz-2 GHz; 1.12 2 GHz-18 GHz; 1.22 18 GHz-26.5 GHz; 1.43	APC-3.5(m) 50Ω	11.45 cm (4.5 in.)	3.2 cm (1.25 in.)	0.18 kg (0.4 in.)
80304 (Standard)	10 MHz to 40 GHz	−70 to +20 dBm (100 pW to 100 mW)	+23 dBm (200 mW)	10 MHz-2 GHz; 1.12 2 GHz-18 GHz; 1.22 18 GHz-26.5 GHz; 1.29 26.5 GHz-40 GHz; 1.67	K(m) 50Ω	11.45 cm (4.5 in.)	3.2 cm (1.25 in.)	0.23 kg (0.5 lb.)
80310 80313 80314 (Low VSWR)	10 MHz to 18 GHz 10 MHz to 26.5 GHz 10 MHz to 40 GHz	−64 to +26 dBm (400 pW to 400 mW)	+29 dBm (800 mW)	10 MHz-12 GHz; 1.12 12 GHz-18 GHz; 1.15 18 GHz-26.5 GHz;1.18 26 GHz- 40 GHz; 1.29	K(m) K(m) K(m) 50Ω	12.7 cm (5.0 in.)	3.2 cm (1.25 in.)	0.23 kg (0.5 lb.)
80320 80323 80324 (High Power)	10 MHz to 18 GHz 10 MHz to 26.5 GHz 10 MHz to 40 GHz	−60 to +30 dBm (1 nW to 1 W)	+33 dBm (2 W)	10 MHz-12 GHz; 1.12 12 GHz-18 GHz; 1.15 18 GHz-26.5 GHz; 1.18 26.5 GHz-40 GHz; 1.29	K(m) K(m) K(m)	12.7 cm (5.0 in.)	3.2 cm (1.25 in.)	0.23 kg (0.5 lb.)
80330 80333 80334 (True RMS)	10 MHz to 18 GHz 10 MHz to 26.5 GHz 10 MHz to 40 GHz	−30 to +20 dBm (1 μW to 100 mW)	+33 dBm (2 W)	10 MHz-12 GHz; 1.12 12 GHz-18 GHz; 1.15 18 GHz-26.5 GHz; 1.8 26.5 GHz-40 GHz; 1.29	K(m) K(m) K(m) 50Ω	15.25 cm (6.0 in.)	3.2 cm (1.25 in.)	0.27 kg (0.6 lb.)

MODEL 8003

POWER SENSOR CAL FACTOR UNCERTAINTIES

Freq. (GHz)		Sum of Uncertainties (%)[1]			Probable Uncertainties (%)[2]		
Lower	Upper	80301 80302	80303 80304	80310 Series 80320 Series 80330 Series	80301 80302	80303 80304	80210 Series 80320 Series 80330 Series
0.1	1	1.63	2.59	2.57	0.84	1.37	1.37
1	2	1.93	3.15	3.03	0.89	1.46	1.44
2	4	2.20	3.76	3.63	0.94	1.59	1.58
4	6	2.38	4.05	3.91	0.99	1.69	1.66
6	8	2.46	4.25	4.11	1.01	1.76	1.73
8	12.4	2.99	5.04	4.87	1.22	2.03	1.99
12.4	18	3.74	6.10	6.00	1.63	2.44	2.41
18	26.5	—	9.58	9.36	—	3.73	3.66
26.5	40	—	14.5	13.5	—	5.73	5.25

[1]Includes uncertainty of reference standard and ransfer uncertainty. Directly traceable to NBS.
[2]Square root of sum of the individual uncertainties squares (RSS).

GENERAL

Temperature: Operating 0° to 50°C, storage −40° to 70°C.
Power Requirements: 100/120/220/240V ±10%, 48 to 440 Hz, 200 VA typical.
Dimensions: 45.1 cm (17.76 in.) wide, 17.8 cm (7 in.) high, 48.3 cm (19 in.) deep.
Weight: 16.6 kg (36.5 lb.) net.

POWER SENSORS

The 80300 Series of Power Sensors are designed specifically for use with the 8003. The same detectors are used for both swept measurements and CW measurements. Both AC and DC detection modes can be used with any of the power sensors. Each sensor includes an EEPROM which has been programmed with Calibration Factor data for that sensor.

Accessories: Power sensors with APC-7, APC-3.5 and Type K connectors are supplied with an adapter to Type N (m) for connection to the 8003 calibrator.

DIRECTIONAL BRIDGES

The 80500 Series of Directional Bridges are designed specifically for use with the 8003 to measure the return loss of a test device. The bridges can be used in AC or DC detection mode. Each bridge includes an EEPROM which has been programmed with Calibration Factor data for that bridge.

Bridge Frequency Response: Return loss measurements using the 8003 are frequency compensated by reading Cal Factor data from an EEPROM located in the bridge.
Insertion Loss: 6.5 dB nominal from input port to test port.
Detector Polarity: Negative.
Maximum Input Power: +27 dBm (0.5 W).
Accessories: An Open/Short is included for establishing the 0 dB return loss reference during path calibration.

FACTORY/FOB

Sunnyvale, CA

PRICE

Model 8003	**$12,500**
Option 01 (Rack Mount)	**$150**
Standard Power Sensors	
Model 80301	**$1,000**
Model 80302	**$1,100**
Model 80303	**$1,250**
Model 80304	**$1,750**
Low VSWR Power Sensors	
Model 80310	**$1,250**
Model 80313	**$1,500**
Model 80314	**$1,950**
High Power, (1W), Power Sensors	
Model 80320	**$1,250**
Model 80323	**$1,500**
Model 80324	**$1,950**
True RMS, (−30 to +20 dBm input level), Power Sensors	
Model 80330	**$1,250**
Model 80333	**$1,500**
Model 80334	**$1,950**
Power Sensor Options	
Option 19548-001	**$75**
Option 19548-002	**$90**
Option 19548-003	**$125**
Option 19548-004	**$175**
Option 19548-005	**$225**
Directional Bridges	
Model 80501	**$2,500**
Model 80502	**$2,600**
Model 80503	**$3,400**
Model 80504	**$3,600**
Options for Directional Bridges	**Contact Factory**

DIRECTIONAL BRIDGE SELECTION GUIDE

Model No.	Frequency Range	Directivity (dB)	Input Connector	Test Point Connector	Test Port Match (SWR)
80501	0.01 to 18 GHz	38	N(f)	N(f)	0.01k-8 GHz: <1.17 8-18 GHz: <1.27
80502	0.01 to 18 GHz	40	N(f)	APC-7	0.01-8 GHz: <1.13 8-18 GHz: <1.22
80503	0.01 to 26.5 GHz	35	WSMA(f)	WSMA(f)	0.01-8 GHz: <1.22 8-18 GHz: <1.22 18-26.5 GHz: <1.27
80504	0.01 to 40 GHz	30	K(f)	K(f)	0.01-8 GHz: <1.35 8-18 GHz: <1.35 18-26.5 GHz: <1.35 26.5-40 GHz: <1.44

DIRECTIONAL BRIDGE CAL FACTOR UNCERTAINTIES

Freq. (GHz)		Sum of Uncertainties (%)[1]		Probable Uncertainties (%)[2]	
Lower	Upper	80501 80502	80503 80504	80501 80502	80503 80504
0.1	1	3.74	4.99	1.56	1.99
1	2	4.92	5.45	2.30	2.04
2	4	5.19	6.05	2.32	2.14
4	6	5.37	6.33	2.34	2.21
6	8	5.45	7.47	2.35	2.79
8	12.4	6.69	8.23	2.68	2.96
12.4	18	7.44	9.78	2.89	3.40
18	26.5	—	13.42	—	4.47
26.5	40	—	18.62	—	6.22

[1]Includes uncertainty of reference standard and ransfer uncertainty. Directly traceable to NBS.
[2]Square root of sum of the individual uncertainties squares (RSS).