Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

10039

Accredited to ISO/IEC 17025:2017

MCS Test Equipment Limited

Issue No: 010 **Issue date:** 23 July 2025

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Calibration performed at the above address only

Calibration and Measurement Capability (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column			
ELECTRICAL			
DC Voltage			
Generation	0 V to 330 mV 330 mV to 3.3 V 3.3 V to 33 V 33 V to 330 V 330 V to 1020 V	16 µV/V + 3.2 µV 9 µV/V + 15 µV 9 µV/V + 180 µV 14 µV/V + 2.4 mV 14 µV/V + 8.1 mV	These values can be generated for the calibration of measuring instruments
Measurement	0 V to 202 mV 202 mV to 2.02 V 2.02 V to 20.2 V 20.2 V to 202 V 202 V to 1050 V	0.41 µV 3.14 µV 7.80 µV 1.70 mV 2.0 mV	Outputs of instruments within these values can be measured to the listed uncertainties
Resistance			
Generation	0 Ω to 11 Ω 11 Ω to 33 Ω 33 Ω to 110 Ω 110 Ω to 330 Ω 330 Ω to 1.1 kΩ 1.1 kΩ to 3.3 kΩ 3.3 kΩ to 11 kΩ 11 kΩ to 33 kΩ 33 kΩ to 110 kΩ 110 kΩ to 330 kΩ 330 kΩ to 1.1 MΩ 1.1 MΩ to 3.3 MΩ 3.3 MΩ to 11 MΩ 11 MΩ to 33 MΩ 33 MΩ to 110 MΩ	46 µΩ/Ω + 5.6 mΩ 35 µΩ/Ω + 3.1 mΩ 33 µΩ/Ω + 3.7 mΩ 33 µΩ/Ω + 3.7 mΩ 33 µΩ/Ω + 470 mΩ 33 µΩ/Ω + 670 mΩ 33 µΩ/Ω + 430 mΩ 33 µΩ/Ω + 1.8 Ω 33 µΩ/Ω + 1.7 Ω 37 µΩ/Ω + 6.2 Ω 37 µΩ/Ω + 2.0 kΩ 70 µΩ/Ω + 5.7 kΩ 151 µΩ/Ω + 3.0 kΩ 290 µΩ/Ω + 7.3 kΩ 580 µΩ/Ω + 16 kΩ	These values can be generated for the calibration of measuring instruments

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Resistance (continued)			
Measurement	0 Ω to 2.02 Ω	14.6 µΩ	Outputs of instruments within these values can be measured to the listed uncertainties
	2.02 Ω to 20.2 Ω	38.3 µΩ	
	20.2 Ω to 202 Ω	216 µΩ	
	202 Ω to 2.02 kΩ	1.50 mΩ	
	2.02 kΩ to 20.2 kΩ	20.0 mΩ	
	20.2 kΩ to 202 kΩ	290 mΩ	
	202 kΩ to 2.02 MΩ	4.6 Ω	
	2.02 MΩ to 20.2 MΩ	80 Ω	
	20.2 MΩ to 202 MΩ	5.1 kΩ	
DC Current			
Generation	0 A to 330 µA	116 µA/A + 20 nA	These values can be generated for the calibration of measuring instruments
	330 µA to 3.3 mA	78 µA/A + 90 nA	
	3.3 mA to 33 mA	115 µA/A + 800 nA	
	33 mA to 330 mA	80 µA/A + 8 µA	
	330 mA to 3.3 A	290 µA/A + 251 µA	
	3.3 A to 11 A	400 µA/A + 1.0 mA	
	11 A to 20 A	0.12 % + 2.5 mA	
Measurement	0 A to 1,0 mA	0.30 nA	Outputs of instruments within these values can be measured to the listed uncertainties
	1.0 mA to 10 mA	12.0 nA	
	10 mA to 100 mA	55.0 nA	
	100 mA to 1.0 A	1.3 µA	
	1.0 A to 3.0 A	201 µA	
	3.0 A to 10.0 A	496 µA	
	10.0 A to 30.0 A	649 µA	
AC Voltage			
Generation	*10 Hz to 45 Hz*		These values can be generated for the calibration of measuring instruments
	30 µV to 33 mV	0.060 % + 5.3 µV	
	33 mV to 330 mV	0.023 % + 14 µV	
	330 mV to 3.3 V	0.020 % + 103 µV	
	3.3 V to 33 V	0.020 % + 1.3 mV	
	45 Hz to 1 kHz		
	33 V to 330 V	0.015 % + 12 mV	
	330 V to 1 kV	0.023 % + 30 mV	
	45 Hz to 10 kHz		
	30 µV to 33 mV	0.010 % + 5.2 µV	
	33 mV to 330 mV	0.011 % + 12 µV	
	330 mV to 3.3 V	0.012% +132 µV	
	3.3 V to 33 V	0.012 % + 1.5 mV	
	1 kHz to 10 kHz		
	33 V to 330 V	0.015 % + 11 mV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Voltage (continued)	*10 kHz to 20 kHz*	*10 kHz to 20 kHz*	These values can be generated from the calibration of measuring instruments
	30 µV to 33 mV	*30 µV to 33 mV*	
	33 mV to 330 mV	33 mV to 330 mV	0.025 % + 5.2 µV
	330 mV to 3.3 V	330 mV to 3.3 V	0.012 % + 1 µV
	3.3 V to 33 V	3.3 V to 33 V	0.015 % +100 µV
	33 V to 330 V	33 V to 330 V	0.020 % + 1.1 mV
			0.020 % + 10 mV
	20 kHz to 50 kHz	*20 kHz to 50 kHz*	
	30 µV to 33 mV	*30 µV to 33 mV*	0.080 % + 6.4 µV
	33 mV to 330 mV	33 mV to 330 mV	0.030 % + 11 µV
	330 mV to 3.3 V	330 mV to 3.3 V	0.023 % +96 µV
	3.3 V to 33 V	3.3 V to 33 V	0.027 % + 1.0 mV
	33 V to 330 V	33 V to 330 V	0.023 % + 10 mV
	50 kHz to 100 kHz	*50 kHz to 100 kHz*	
	30 µV to 33 mV	*30 µV to 33 mV*	0.27 % + 10 µV
	33 mV to 330 mV	33 mV to 330 mV	0.062 % + 27 µV
	330 mV to 3.3 V	330 mV to 3.3 V	0.054 % + 0.13 mV
	3.3 V to 33 V	3.3 V to 33 V	0.070 % + 1.7 mV
	33 V to 330 V	33 V to 330 V	0.15 % + 41 mV
	100 kHz to 500 kHz	*100 kHz to 500 kHz*	
	30 µV to 33 mV	*30 µV to 33 mV*	0.62 % + 39 µV
	33 mV to 330 mV	33 mV to 330 mV	0.15 % + 60 µV
	330 mV to 3.3 V	330 mV to 3.3 V	0.19 % + 0.55 mV
AC Voltage Measurement	*1Hz to 1 kHz*		Outputs of instruments within these values can be measured to the listed uncertainties
	30 µV to 10 mV	2.2 µV	
	10 mV to 100 mV	2.5 µV	
	100 mV to 1.0 V	67 µV	
	1.0 V to 10 V	182 µV	
	10 V to 100 V	2.0 mV	
	1 kHz to 30 kHz		
	30 µV to 10 mV	2.2 µV	
	10 mV to 100 mV	2.7 µV	
	100 mV to 1.0 V	211 µV	
	1.0 V to 10 V	283 mV	
	30 kHz to 60 kHz		
	100 mV to 1 V	554 µV	
	1 V to 10 V	844 µV	
	60 kHz to 100 kHz		
	100 mV to 1 V	565.2 µV	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Current			
Generation	*45 Hz to 1 kHz*		These values can be generated for the calibration of measuring instruments
	30 µA to 3.3 mA	0.140 % + 700 nA	
	3.3 mA to 33 mA	0.06 % + 3.3 µA	
	33 mA to 330 mA	0.06 % + 27 µA	
	330 mA to 1.1 A	0.08 % + 0.17 mA	
	1.1 A to 3.3 A	0.24 % + 0.20 mA	
	1 kHz to 5 kHz		
	30 µA to 3.3 mA	0.29 % + 3.3 µA	
	3.3 mA to 33 mA	0.12 % + 2.8 µA	
	33 mA to 330 mA	0.14 % + 60 µA	
	330 mA to 1.1 A	0.15 % + 230 µA	
	1.1 A to 3.3 A	0.87 % + 1.2 mA	
	5 kHz to 10 kHz		
	30 µA to 3.3 mA	0.72 % + 3.2 µA	
	3.3 mA to 33 mA	0.30 % + 5.8 µA	
	33 mA to 330 mA	0.30 % + 0.13 mA	
	330 mA to 1.1 A	3.6 % + 6.0 mA	
	1.1 A to 3.3 A	3.6 % + 6.0 mA	
	10 kHz to 30 kHz		
	30 µA to 3.3 mA	1.5 % + 4.0 µA	
	3.3 mA to 33 mA	0.60 % + 6.6 µA	
	33 mA to 330 mA	0.60 % + 240 µA	
	330 mA to 1.1 A	3.5 % + 6.0 mA	
	3.3 A to 11 A		
	45 Hz to 100 Hz	0.087 % + 3.7 mA	
	100 Hz to 1 kHz	0.15 % + 3.8 mA	
	1 kHz to 5 kHz	4.3 % + 4.6 mA	
	11 A to 20.5 A		
	45 Hz to 100 Hz	0.17 % + 8.3 mA	
	100 Hz to 1 kHz	0.22 % + 8.4 mA	
	1 kHz to 5 kHz	4.4 % + 8.4 mA	
AC Current Measurement	*10 Hz to 1 kHz*		Outputs of instruments within these values can be measured to the listed uncertainties
	10 mA to 100 mA	7.0 µA	
	100 mA to 1 A	361 µA	
	1 kHz to 5 kHz		
	10 mA to 100 mA	7.0 µA	
	100 mA to 1 A	608	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
AC Power			
Unity PF to 0.25 PF			
	45 Hz to 65 Hz 10 mV to 1 kV		
	3.3 mA to 20.5 A	0.50 %	
Capacitance			
Sourcing by simulation	1.1 nF to 3.3 nF	0.39 % + 8 pF	These values can be simulated for the calibration of measuring instruments
	3.3 nF to 11 nF	0.19 % + 12 pF	
	11 nF to 33 nF	0.19 % + 82 pF	
	33 nF to 110 nF	0.19 % + 112 pF	
	110 nF to 330 nF	0.29 % + 0.40 nF	
	330 nF to 1.1 µF	0.19 % + 1.0 nF	
	1.1 µF to 3.3 µF	0.19 % + 3.3 nF	
	3.3 µF to 11 µF	0.19 % + 12 nF	
	11 µF to 33 µF	0.31 % + 48 nF	
	33 µF to 110 µF	0.35 % + 127 nF	
	110 µF to 330 µF	0.35 % + 0.25 µF	
	330 µF to 1.1 mF	0.35 % + 0.80 µF	
	1.1 mF to 3.3 mF	0.35 % + 2.5 µF	
	3.3 mF to 11 mF	0.52 % + 12 µF	
	11 mF to 33 mF	0.58 % + 25 µF	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Oscilloscope Calibration			
Vertical deflection as a Voltage			
	0 V to 25 mV	0.040 % + 31 µV	
	25 mV to 110 mV	0.039 % + 31 µV	Into 1 MΩ
	110 mV to 2.2 V	0.039 % + 120 µV	
	2.2 V to 11 V	0.039 % + 200 µV	
	11 V to 130 V	0.039 % + 2.0 mV	
	0 V to 25 mV	0.19 % + 31 µV	
	25 mV to 110 mV	0.19 % + 33 µV	Into 50 Ω
	110 mV to 2.2 V	0.19 % + 26 µV	
	2.2 V to 6 V	0.19 % + 26 mV	
Square wave peak to peak			
	0 V to 25 mV	0.19 % + 62 µV	
	25 mV to 110 mV	0.19 % + 224 µV	Into 50 Ω
	110 mV to 2.2 V	0.19 % + 4.4 mV	
	2.2 V to 6 V	0.19 % + 9.8 mV	
Sine wave level flatness referenced to set point	Ref set point 5 mV to 5.5 V		
	50 kHz to 300 MHz	3.9 %	
	100 kHz to 600 MHz	3.9 %	
Rise time	250 ps 5 mV to 2.5 V peak	78 ps	
Resistance	40 Ω to 60 Ω	0.077 % + 10 m Ω	
	500 k Ω to 1.5 M Ω	0.077 % + 100 m Ω	
Time markers			
	2 ns to 5 ns	11 fs	
	5 ns to 20 ns	44 fs	
	20 ns to 50 ns	110 fs	
	50 ns to 20 ms	44 ns	
	20 ms to 100 ms	12 µs	
	100 ms to 1 s	0.80 ms	
	1 s to 5 s	19 ms	
Capacitance	5 pF to 50 pF	3.9 % + 0.47 pF	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Insulation Testers			
Continuity	0 Ω to 100 mΩ 100 mΩ to 500 mΩ 0.5 Ω to 1 Ω 1 Ω to 5 Ω 5 Ω to 200 Ω 200 Ω to 10 kΩ	4.5 mΩ 6.5 mΩ 8.0 mΩ 25 mΩ 0.80 Ω 8.0 Ω	
High Resistance	10 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 1 GΩ 1 GΩ to 10 GΩ	0.20 % 0.30 % 0.65 % 1.0 %	Uncertainty Increases by 0.10 % per 200 V above 500 V
Test Voltage Measurement	0 V to 2 kV DC *10 kΩ to 1 MΩ* *1 MΩ to 10 GΩ*	 0.8 % + 2.6 V 0.8 % + 4.5 V	
Line / Loop Impedance Testers			
Resistance Nominal values	25 mΩ 50 mΩ 100 mΩ 330 mΩ 500 mΩ 1 Ω 1.8 Ω 5 Ω 10 Ω 18 Ω 50 Ω 100 Ω 180 Ω 500 Ω 1 kΩ 1.8 kΩ	4.0 mΩ 4.5 mΩ 4.0 mΩ 5.5 mΩ 6.5 mΩ 8.0 mΩ 15.5 mΩ 25 mΩ 50 mΩ 80 mΩ 0.25 Ω 0.40 Ω 0.80 Ω 2.0 Ω 4.0 Ω 8.0 Ω	
	0.05 A 0.5 A 3.2 A 10 A 20 A	1.2 % + 2.0 mA 1.2 % + 11 mA 1.2 % + 55 mA 1.2 % + 0.16 A 1.2 % + 0.30 A	Outputs of instruments within these values can be measured to the listed uncertainties

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RCD Testers			
Timing	10 ms to 5 s	0.02 % + 2.7 ms	
Current			
0.5 x I and 1 x I Mode	3 mA to 30 mA 30 mA to 300 mA 300 mA to 3000 mA	0.80 % + 60 µA 0.80 % + 0.60 mA 0.80 % + 6.0 mA	
1.4 x I and 2 x I Mode	3 mA to 30 mA 30 mA to 300 mA 300 mA to 1500 mA	1.6 % + 60 µA 1.6 % + 0.60 mA 1.6 % + 6.0 mA	
5 x I Mode	3 mA to 30 mA 30 mA to 300 mA 300 mA to 600 mA	4.0 % + 60 µA 4.0 % + 0.60 mA 4.0 % + 6.0 mA	
Leakage Testers			
Current			
Passive/Differential/Substitute Modes	0.1 mA to 30 mA	0.30 % + 2 µA (ac + dc) rms	
Active Mode	0.1 mA to 30 mA	0.30 % + 1.3 µA (ac + dc) rms	
Touch Voltage	250 V Range	5.0 % + 3.0 V	
Portable Appliance Testers			
Earth / Ground Bond Resistance. Nominal values At 50 Hz to 60 Hz	25 mΩ 50 mΩ 100 mΩ 330 mΩ 500 mΩ 1 Ω 1.8 Ω 5 Ω 10 Ω 18 Ω 50 Ω 100 Ω 180 Ω 500 Ω 1 kΩ 1.8 kΩ	4.0 mΩ 4.5 mΩ 4.0 mΩ 5.5 mΩ 6.5 mΩ 8.0 mΩ 16 mΩ 25 mΩ 47 mΩ 80 mΩ 0.25 Ω 0.40 Ω 0.80 Ω 2.0 Ω 4.0 Ω 8.0 Ω	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
Earth / Ground Bonding Current At 50 Hz to 60 Hz	0.05 A 0.5 A 3.2 A 10 A 20 A	1.2 % + 1.7 mA 1.2 % + 11 mA 1.2 % + 55 mA 1.2 % + 0.12 A 1.2 % + 0.28 A	
Insulation Resistance	10 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 1 GΩ 1 GΩ to 10 GΩ	0.16 % 0.27 % 0.62 % 0.95 %	Uncertainty Increases by 0.10 % per 200 V above 500 V
Test Voltage	0 V to 2 kV DC *10 kΩ to 1 MΩ* *1 MΩ to 10 GΩ*	 0.80 % + 2.6 V 0.80 % + 4.5 V	
Continuity	100 mΩ to 500 mΩ 0.5 Ω to 1 Ω 1 Ω to 5 Ω 5 Ω to 200 Ω 200 Ω to 10 kΩ	6.5 mΩ 8.0 mΩ 25 mΩ 0.78 Ω 7.8 Ω	
HIPOT/HV TESTERS			
HVDC Voltage	0.1 kV to 1.0 kV	0.23 % + 4.5 V	
HVAC Peak Voltage	*50 Hz to 60 Hz* 0.1 kV to 1.0 kV	 0.40 % + 4 V	
DC Leakage Current	0 A to 300 µA 0.3 mA to 3 mA 3 mA to 30 mA 30 mA to 300 mA	0.23 % + 0.20 µA 0.16 % + 1.3 µA 0.16 % + 12 µA 0.16 % + 120 µA	
AC Leakage Current	*20 Hz to 400 Hz* 0 A to 300 µA 0.3 mA to 3 mA 3 mA to 30 mA 30 mA to 300 mA	 0.23 % + 0.34 µA 0.16 % + 1.5 µA 0.16 % + 18 µA 0.16 % + 130 µA	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RF MEASUREMENTS			All RF measurements are for a well matched 50 Ω source or load unless otherwise stated.
Voltage Reflection Coefficient	1.0 to 0.1 *10 MHz to 6 GHz* *6 GHz to 15 GHz* *15 GHz to 18 GHz*	 0.020 0.030 0.040	Uncertainties apply to precision connectors.
Frequency Generation			May be reported as time (1/f) for repetitive events.
Specific Value	10 MHz	6.0 in 10^{12}	GPS Time and frequency Reference Receiver
Measurement			
Specific Value	10 MHz	6.9 in 10^{12}	
Other Values	1 Hz to 10 Hz 10 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 10 kHz 10 kHz to 100 kHz 100 MHz to 160 MHz 160 MHz to 1.3 GHz 1.3 GHz to 10 GHz 10 GHz to 18 GHz 18 GHz to 26.5 GHz	2.2 in 10^{7} 1.4 in 10^{7} 1.5 in 10^{8} 3.8 in 10^{8} 3.5 in 10^{9} 1.0 in 10^{10} 3.0 in 10^{10} 7.5 in 10^{10} 1.4 in 10^{9} 4.7 in 10^{9}	
Power			
I mW reference	1 mW at 50 MHz	0.004 mW	
Ranges	*9 kHz to 6 GHz* 200 pW to 40 µW 20 nW to 4 mW 2 µW to 200 mW *10 MHz to 18 GHz* 2 nW to 40 µW 200 nW to 40 mW 2 µW to 2 W	 1.5 % 1.4 % 1.4 % 5.3 % 2.2 % 2.4 %	
Attenuation	0 dB to 90 dB *50 MHz to 18 GHz*	 0.10 dB	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks
RF MEASUREMENTS Continued			
Calibration Factor	75 % to 110 % 9 kHz 1MHz 1 MHz to 1 GHz 1 GHz to 6 GHz	 0.62 % (Cal Factor) 0.64 % 0.84 %	 For power sensor range of 9 kHz to 6KHz
	75 % to 110 % 10 MHz to 1 GHz 1 GHz to 6 GHz 6 GHz to 12 GHz 12 GHZ to 18 GHz	 0.66 % 0.85 % 0.98 % 1.5 %	 For power sensor range of 10 MHz to 18 GHz
Amplitude Modulation (AM)	*10 Hz to 10 kHz* 150 kHz to 10 MHz	 2.4 % of reading	
	50 Hz to 50 kHz 10 MHz to 1300 MHz	 1.4 % of reading	
AM Distortion	*10 Hz to 50 kHz* 150 kHz to 1300 MHz	 0.50 %	
Frequency Modulation (FM)	*20 Hz to 10 kHz* 250 kHz to 10 MHz	 2.4 % + 40 Hz	Frequency Modulation - Carrier frequency range 10 MHz to 1300 MHz Modulation frequency range 10 Hz to 100 kHz
	50 Hz to 100 kHz 10 MHz to 1300 MHz	 1.2 % + 17 Hz	
FM Distortion	*20 Hz to 100 kHz* 150 kHz to 1300 MHz	 0.20 %	
Harmonic Content	Carrier Frequency 1 MHz to 13 GHz Harmonic Frequency 2 MHz to 26 GHz	 0.62 dB	Maximum CW amplitude +15 dBm; minimum harmonic level -80 dBc
END			

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest measurement uncertainty that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The measurement uncertainty is calculated according to the procedures given in the GUM and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published measurement uncertainty in certificates issued under its accreditation.

Expression of CMCs - symbols and units

It should be noted that the percentage symbol (%) represents the number 0.01. In cases where the measurement uncertainty is stated as a percentage, this is to be interpreted as meaning percentage of the measurand.
Thus, for example, a measurement uncertainty of 1.5 % means $1.5 \times 0.01 \times q$, where q is the quantity value.

The notation Q[a, b] stands for the root-sum-square of the terms between brackets: $Q[a, b] = [a^2 + b^2]^{1/2}$