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Keysight Technologies UK Ltd

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Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details	Activity	Location code
Address The Calibration House Halesfield 7 Telford Shropshire TF7 4QL **Local contact** Mr R A Jones	Electrical and Dimensional calibrations	P

Site activities performed away from the locations listed above:

Location details	Activity	Location code
Customers' sites or premises The customers' site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer **Local contact** Mr R A Jones	Dimensional calibrations	S

CALIBRATION AND MEASUREMENT CAPABILITY (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DC RESISTANCE				P
Specific values	1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ	3.9 μΩ/Ω 2.4 μΩ/Ω 1.2 μΩ/Ω 1.3 μΩ/Ω 1.5 μΩ/Ω 2.2 μΩ/Ω 2.2 μΩ/Ω 6.1 μΩ/Ω	Standard resistors available for application to resistance measuring instruments, in a 2-wire or 4-wire configuration as appropriate. Calibration of resistors by comparison with these standards can also be undertaken.	
Other Values	0 Ω to 0.5 Ω 0.5 Ω to 5 Ω 5 Ω to 50 Ω 50 Ω to 500 Ω 500 Ω to 5 kΩ 5 kΩ to 50 kΩ 50 kΩ to 500 kΩ 500 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 10 GΩ 10 GΩ to 100 GΩ 100 GΩ to 1 TΩ	7.5 μΩ/Ω + 0.25 μΩ 7.4 μΩ/Ω 5.4 μΩ/Ω 5.4 μΩ/Ω 5.4 μΩ/Ω 5.4 μΩ/Ω 5.4 μΩ/Ω 5.4 μΩ/Ω 7.2 μΩ/Ω 25 μΩ/Ω 33 μΩ/Ω 73 μΩ/Ω 400 μΩ/Ω	Using voltage / current method.	
DC VOLTAGE	0 V to 11 V 11 V to 110 V 110 V to 1100 V	2.8 μV/V + 0.30 μV 2.8 μV/V 3.2 μV/V	Known voltages for application to voltage measuring instruments. Measurements of the output voltages from sources may also be undertaken.	P
	1 kV to 70 kV	0.14 %	Using high voltage divider.	
DC CURRENT	100 nA to 10 μA 10 μA to 1 A 1 A to 2 A 2 A to 100 A	13 μA/A + 5.0 pA 10 μA/A 23 μA/A 10 μA/A	Known currents for application to current measuring instruments. Measurements of the output currents from sources may also be undertaken.	P
	10 mA to 5 A 5 A to 100 A 100 A to 2500 A	0.30 % + 1.0 mA 0.12 % + 20 mA 0.47 % + 0.52 A	For the calibration of clamp-on ammeters and similar devices using multi-turn coil method.	P

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE				P
Generation	1 mV to 2.2 mV		Known voltages for application to voltage measuring instruments, using multi-function calibrator.	
	10 Hz to 100 kHz	0.12 % + 5.0 µV		
	100 kHz to 300 kHz	0.21 % + 10 µV		
	300 kHz to 500 kHz	0.40 % + 20 µV		
	500 kHz to 1 MHz	0.61 % + 20 µV		
	2.2 mV to 22 mV			
	10 Hz to 50 kHz	0.027 % + 4.0 µV		
	50 kHz to 100 kHz	0.053 % + 5.0 µV		
	100 kHz to 300 kHz	0.11 % + 10 µV		
	300 kHz to 500 kHz	0.15 % + 20 µV		
	500 kHz to 1.0 MHz	0.31 % + 20 µV		
	22 mV to 220 mV			
	10 Hz to 20 Hz	0.025 % + 12 µV		
	20 Hz to 20 kHz	0.010 % + 7.0 µV		
	20 kHz to 50 kHz	0.013 % + 7.0 µV		
	50 kHz to 100 kHz	0.032 % + 17 µV		
	100 kHz to 300 kHz	0.067 % + 20 µV		
	300 kHz to 500 kHz	0.14 % + 25 µV		
	500 kHz to 1 MHz	0.28 % + 45 µV		
	220 mV to 2.2 V			
	10 Hz to 20 Hz	0.025 % + 40 µV		
	20 Hz to 40 Hz	0.010 % + 15 µV		
	40 Hz to 20 kHz	0.005 % + 8.1 µV		
	20 kHz to 50 kHz	0.007 % + 10 µV		
	50 kHz to 100 kHz	0.010 % + 30 µV		
	100 kHz to 300 kHz	0.035 % + 80 µV		
	300 kHz to 500 kHz	0.10 % + 0.20 mV		
	500 kHz to 1 MHz	0.19 % + 0.30 mV		
	2.2 V to 22 V			
	10 Hz to 20 Hz	0.025 % + 0.40 mV		
	20 Hz to 40 Hz	0.010 % + 0.15 mV		
	40 Hz to 20 kHz	0.005 % + 0.051 mV		
	20 kHz to 50 kHz	0.007 % + 0.10 mV		
	50 kHz to 100 kHz	0.010 % + 0.20 mV		
	100 kHz to 300 kHz	0.028 % + 0.60 mV		
	300 kHz to 500 kHz	0.10 % + 2.0 mV		
	500 kHz to 1 MHz	0.17 % + 3.2 mV		
	22 V to 220 V			
	10 Hz to 20 Hz	0.025 % + 4.0 mV		
	20 Hz to 40 Hz	0.010 % + 1.5 mV		
	40 Hz to 20 kHz	0.006 % + 0.60 mV		
	20 kHz to 50 kHz	0.009 % + 1.0 mV		
	50 kHz to 100 kHz	0.016 % + 2.5 mV		
	100 kHz to 300 kHz	0.091% + 16 mV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				P
Generation (continued)	220 V to 1100 V			
	15 Hz to 40 Hz	0.031 % + 16 mV		
	40 Hz to 1 kHz	0.010 % + 4.2 mV		
	1 kHz to 20 kHz	0.017 % + 6.1 mV		
	20 kHz to 30 kHz	0.060 % + 11 mV		
	220 V to 750 V			
	30 kHz to 50 kHz	0.061 % + 11 mV		
	50 kHz to 100 kHz	0.23 % + 45 mV		
	1 kV to 30 kV *50 Hz to 60 Hz*	0.42 %	Using high voltage divider.	P
AC VOLTAGE				
Measurement				
NOTE: Two systems are available for AC Voltage measurements. Both employ digital multimeters for the calibration of AC Voltage sources. As two multimeters are in general use, each resulting in different and overlapping CMCs, the capabilities for each multimeter are described in this section.				
SYSTEM 1 - using Model 3458A multimeter				P
	1 mV to 10 mV			
	40 Hz to 1 kHz	0.037 % + 1.3 µV		
	1 kHz to 20 kHz	0.046 % + 1.3 µV		
	20 kHz to 100 kHz	0.59 % + 1.3 µV		
	100 kHz to 300 kHz	4.7 % + 2.3 µV		
	10 mV to 100 mV			
	40 Hz to 1 kHz	0.011 % + 2.3 µV		
	1 kHz to 20 kHz	0.018 % + 2.3 µV		
	20 kHz to 100 kHz	0.10 % + 2.3 µV		
	100 kHz to 300 kHz	0.35 % + 12 µV		
	100 mV to 1 V			
	40 Hz to 1 kHz	0.010 % + 0.023 mV		
	1 kHz to 20 kHz	0.018 % + 0.023 mV		
	20 kHz to 50 kHz	0.037 % + 0.023 mV		
	50 kHz to 100 kHz	0.10 % + 0.023 mV		
	100 kHz to 300 kHz	0.35 % + 0.12 mV		
	300 kHz to 1 MHz	1.2 % + 0.12 mV		
	1 V to 10 V			
	40 Hz to 1 kHz	0.010 % + 0.23 mV		
	1 kHz to 20 kHz	0.018 % + 0.23 mV		
	20 kHz to 50 kHz	0.037 % + 0.23 mV		
	50 kHz to 100 kHz	0.094 % + 0.23 mV		
	100 kHz to 300 kHz	0.35 % + 1.2 mV		
	300 kHz to 1 MHz	1.2 % + 1.2 mV		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				P
SYTEM 1 - using Model 3458A multimeter (continued)	10 V to 100 V			
	40 Hz to 1 kHz	0.025 % + 2.3 mV		
	1 kHz to 20 kHz	0.027 % + 2.3 mV		
	20 kHz to 50 kHz	0.043 % + 2.3 mV		
	50 kHz to 100 kHz	0.14 % + 2.3 mV		
	100 V to 1000 V			
	40 Hz to 1 kHz	0.050 % + 23 mV		
SYSTEM 2 - using Model 8508A multimeter				P
	10 mV to 200 mV			
	20 Hz to 10 kHz	0.012 % + 4.0 µV		
	10 kHz to 30 kHz	0.030 % + 8.0 µV		
	30 kHz to 100 kHz	0.070 % + 20 µV		
	200 mV to 2 V			
	20 Hz to 40 Hz	0.010 % + 20 µV		
	40 Hz to 10 kHz	0.0083 % + 20 µV		
	10 kHz to 30 kHz	0.020 % + 40 µV		
	30 kHz to 100 kHz	0.050 % + 0.20 mV		
	100 kHz 300 kHz	0.30 % + 2.0 mV		
	300 kHz to 1 MHz	1.0 % + 20 mV		
	2 V to 20 V			
	20 Hz to 40 Hz	0.010 % + 0.20 mV		
	40 Hz to 10 kHz	0.0083 % + 0.20 mV		
	10 kHz to 30 kHz	0.020 % + 0.40 mV		
	30 kHz to 100 kHz	0.050 % + 2.0 mV		
	100 kHz to 300 kHz	0.30 % + 20 mV		
	300 kHz to 1 MHz	1.0 % + 0.20 V		
	20 V to 200 V			
	20 Hz to 40 Hz	0.011 % + 2.0 mV		
	40 Hz to 10 kHz	0.0090 % + 2.0 mV		
	10 kHz to 30 kHz	0.020 % + 4.0 mV		
	30 kHz to 100 kHz	0.050 % + 20 mV		
	200 V to 1000 V			
	55 Hz to 10 kHz	0.010 % + 21 mV		
	10 kHz to 30 kHz	0.021 % + 42 mV		
AC High Voltage measurements	1 kV to 30 kV			P
	50 Hz to 60 Hz	0.42 %	Using high voltage divider.	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC CURRENT				
Generation	20 µA to 220 µA		Known currents for application to current measuring instruments.	P
	10 Hz to 20 Hz	0.030 % + 0.016 µA		
	20 Hz to 40 Hz	0.016 % + 0.010 µA		
	40 Hz to 1 kHz	0.011 % + 0.0081 µA		
	1 kHz to 5 kHz	0.028 % + 0.012 µA		
	5 kHz to 10 kHz	0.11 % + 0.065 µA		
	220 µA to 2.2 mA			
	10 Hz to 20 Hz	0.031 % + 0.042 µA		
	20 Hz to 40 Hz	0.018 % + 0.037 µA		
	40 Hz to 1 kHz	0.011 % + 0.037 µA		
	1 kHz to 5 kHz	0.020 % + 0.11 µA		
	5 kHz to 10 kHz	0.11 % + 0.65 µA		
	2.2 mA to 22 mA			
	10 Hz to 20 Hz	0.030 % + 0.42 µA		
	20 Hz to 40 Hz	0.017 % + 0.37 µA		
	40 Hz to 1 kHz	0.011 % + 0.37 µA		
	1 kHz to 5 kHz	0.020 % + 0.56 µA		
	5 kHz to 10 kHz	0.11 % + 5.0 µA		
	22 mA to 220 mA			
	10 Hz to 20 Hz	0.030 % + 4.2 µA		
	20 Hz to 40 Hz	0.016 % + 43.7 µA		
	40 Hz to 1 kHz	0.011 % + 2.8 µA		
	1 kHz to 5 kHz	0.020 % + 3.7 µA		
	5 kHz to 10 kHz	0.11 % + 10 µA		
	220 mA to 2.2 A			
	20 Hz to 1 kHz	0.026 % + 37 µA		
	1 kHz to 5 kHz	0.045 % + 81 µA		
	5 kHz to 10 kHz	0.70 % + 160 µA		
	2.2 A to 11 A			
	40 Hz to 1 kHz	0.047 % + 0.21 mA		
	1 kHz to 5 kHz	0.095 % + 0.40 mA		
	5 kHz to 10 kHz	0.36 % + 0.76 mA		
	2 A to 100 A		Using transconductance amplifier	P
	50 Hz to 60 Hz	0.030 %		
	50Hz to 60 Hz		For the calibration of clamp-on ammeters and similar devices using multi-turn coil method.	P
	10 mA to 5 A	0.044 % + 0.58 mA		
	5 A to 100 A	0.052 % + 0.017 A		
	100 A to 2500 A	0.44 % + 0.52 A		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC CURRENT				P
Measurement				
NOTE: Two systems are available for AC Current measurements. Both employ digital multimeters for the calibration of AC Current sources. As two multimeters are in general use, each resulting in different and overlapping CMCs, the capabilities for each multimeter are described in this section.				
SYSTEM 1 - using Model 3458A multimeter				P
	45 Hz to 1 kHz			
	10 µA to 100 µA	0.083 % + 0.035 µA		
	100 µA to 1 mA	0.077 % + 0.23 µA		
	1 mA to 10 mA	0.072 % + 2.3 µA		
	10 mA to 100 mA	0.072 % + 23 µA		
	100 mA to 1 A	0.12 % + 0.23 mA		
SYSTEM 2 - using Model 8508A multimeter				P
	20 µA to 200 µA			
	55 Hz to 5 kHz	0.035 % + 20 nA		
	5 kHz to 10 kHz	0.047 % + 20 nA		
	200 µA to 2 mA			
	55 Hz to 10 kHz	0.027 % + 0.20 µA		
	2 mA to 20 mA			
	55Hz to 10 kHz	0.026 % + 2.0 µA		
	20 mA to 200 mA			
	55 Hz to 10 kHz	0.026 % + 20 µA		
	200 mA to 2 A			
	55 Hz to 2 kHz	0.060 % + 0.20 mA		
	2 kHz to 10 kHz	0.073 % + 0.20 mA		
	2 A to 20 A			
	10 Hz to 2 kHz	0.11 % + 2.0 mA		
	2 kHz to 10 kHz	0.33 % + 2.0 mA		
	50 Hz to 60 Hz			
	2 A to 100 A	0.030 %	Using transconductance amplifier	
	50Hz to 60 Hz		For the calibration of clamp-on ammeters and similar devices using multi-turn coil method.	
	20 mA to 5 A	0.044 % + 0.58 mA		
	5 A to 100 A	0.052 % + 0.017 A		
	100 A to 2500 A	0.44 % + 0.52 A		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC POWER	*50 Hz to 60 Hz* 50 mW to 4 kW 4 kW to 10 kW	 0.052 % 0.20 %	At unity power factor, using a phantom load technique. Measurements can also be made at power factors of 0.9, 0.5, 0.1 and 0.01 but the quoted uncertainties will be increased.	P
FREQUENCY				P
Specific value	10 MHz	1.0 in 10^{10}	By comparison with house standard.	
Other values	0.1 Hz to 1 Hz 1 Hz to 10 Hz 10 Hz to 100 Hz 100 Hz to 10 kHz	5.0 in 10^{4} 5.0 in 10^{5} 5.0 in 10^{6} 5.0 in 10^{7}	Multi-period measurement using counter timer.	
	10 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 10 MHz 10 MHz to 150 MHz 150 MHz to 1 GHz 1 GHz to 20 GHz	1.0 in 10^{6} 1.0 in 10^{7} 1.0 in 10^{8} 1.0 in 10^{9} 1.0 in 10^{9} 3.0 in 10^{10}	Frequency measurement using counter timer.	
PHASE ANGLE	*50 Hz to 10 kHz* 0° to 360°	 0.050°	Using digital phasemeter.	P
CAPACITANCE			Standard capacitors available for application to capacitance measuring instruments. Calibration of capacitors by comparison with these standards can also be undertaken.	P
Specific values and frequencies	*100 Hz* 1 nF 10 nF 100 nF 1 µF 10 µF 100 µF	 0.051 % 0.023 % 0.023 % 0.017 % 0.046 % 0.046 %		
	1 kHz 1 pF 10 pF 100 pF 1 nF 10 nF 100 nF 1 µF 10 µF 100 µF	 0.27 % 0.045 % 0.041 % 0.017 % 0.010 % 0.021 % 0.015 % 0.046 % 0.046 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
CAPACITANCE (continued)				P
	10 kHz			
	1 nF	0.017 %		
	10 nF	0.013 %		
	100 nF	0.028 %		
	1 µF	0.017 %		
	1 MHz			
	1 pF	0.27 %		
	10 pF	0.042 %		
	100 pF	0.041 %		
	1 nF	0.048 %		
Other Values and Frequencies	1 nF to 1 µF *100 Hz to 10 kHz*	0.11 %		
INDUCTANCE			Standard inductors available for application to inductance measuring instruments. Calibration of inductors by comparison with these standards can also be undertaken.	P
Specific values and frequencies	*100 Hz*			
	10 µH	0.41 %		
	100 µH	0.20 %		
	1 mH	0.11 %		
	10 mH	0.060 %		
	100 mH	0.11 %		
	1 H	0.020 %		
	1 kHz			
	1 µH	0.38 %		
	10 µH	0.18 %		
	100 µH	0.018 %		
	1 mH	0.020 %		
	10 mH	0.020 %		
	100 mH	0.021 %		
	1 H	0.020 %		
	10 kHz			
	1 µH	0.38 %		
	10 µH	0.18 %		
	100 µH	0.024 %		
	1 mH	0.020 %		
	10 mH	0.020 %		
	100 mH	0.030 %		
	1 H	0.80 %		
	100 Hz to 1 kHz			
	1 H	0.080 %		
	1 kHz to 10 kHz			
	10 µH	0.42 %		
	100 µH	0.18 %		
	1 mH to 100 mH	0.16 %		
	100 Hz to 1 kHz			
	1 H	0.080 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL SIMULATION OF TEMPERATURE				
Temperature indicator calibration			By electrical simulation.	
Base metal thermocouple indicators	-270 °C to 0 °C 0 °C to 1370 °C	0.24 °C 0.16 °C	Excluding cold junction compensation	P
	-270 °C to 0 °C 0 °C to 1370 °C	0.26 °C 0.20 °C	Including cold junction compensation	
Noble metal thermocouple indicators	0 °C to 200 °C 200 °C to 800 °C 800 °C to 1760 °C	0.51 °C 0.50 °C 1.0 °C	Excluding cold junction compensation.	P
	0 °C to 200 °C 200 °C to 800 °C 800 °C to 1760 °C	0.60 °C 0.50 °C 1.0 °C	Including cold junction compensation.	
Cold junction compensation	At ambient of 23 °C	0.10 °C	Temperature measurement at cold junction.	P
RF POWER	-70 dBm to -65 dBm *10 MHz to 50 MHz* *50 MHz to 3 GHz* *3 GHz to 6 GHz* *6 GHz to 10 GHz* *10 GHz to 14 GHz* *14 GHz to 18 GHz*	 16 % 15 % 15 % 19 % 18 % 15 %	Using RF power meter and sensor, in 50 Ω coaxial systems only.	P
	-65 dBm to -60 dBm *10 MHz to 50 MHz* *50 MHz to 3 GHz* *3 GHz to 6 GHz* *6 GHz to 10 GHz* *10 GHz to 14 GHz* *14 GHz to 18 GHz*	 7.3 % 5.8 % 7.6 % 8.1 % 7.8 % 9.0 %		
	-60 dBm to -50 dBm *10 MHz to 50 MHz* *50 MHz to 3 GHz* *3 GHz to 6 GHz* *6 GHz to 10 GHz* *10 GHz to 14 GHz* *14 GHz to 18 GHz*	 5.6 % 4.4 % 4.4 % 4.4 % 4.4 % 4.4 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
RF POWER (continued)	-50 dBm to -36 dBm			P
	10 MHz to 50 MHz	4.0 %		
	50 MHz to 3 GHz	4.0 %		
	3 GHz to 6 GHz	4.0 %		
	6 GHz to 10 GHz	4.0 %		
	10 GHz to 14 GHz	4.0 %		
	14 GHz to 18 GHz	4.2 %		
	-36 dBm to -14 dBm			P
	10 MHz to 50 MHz	2.1 %		
	50 MHz to 3 GHz	2.3 %		
	3 GHz to 6 GHz	2.2 %		
	6 GHz to 10 GHz	2.2 %		
	10 GHz to 14 GHz	2.5 %		
	14 GHz to 18 GHz	2.5 %		
	-14 dBm to +20 dBm			
	10 MHz to 50 MHz	2.8 %		
	50 MHz to 3 GHz	2.8 %		
	3 GHz to 6 GHz	2.8 %		
	6 GHz to 10 GHz	2.8 %		
	10 GHz to 14 GHz	3.0 %		
	14 GHz to 18 GHz	3.0 %		
	50 MHz at 0 dBm	1.7 %		
RF VOLTAGE	200 µV to 10 V		Using RF voltmeter, in 50 Ω coaxial systems only.	P
	9 kHz to 30 MHz	2.8 %		
	30 MHz to 100 MHz	2.5 %		
	100 MHz to 600 MHz	2.5 %		
	600 MHz to 1 GHz	2.1 %		
	1 GHz to 1.6 GHz	4.2 %		
	1.6 GHz to 2 GHz	6.8 %		
MODULATION MEASUREMENTS			Using modulation analyser.	P
Amplitude Modulation	20 % to 95 %	1.0 % of reading	f_c 50 kHz to 800 MHz f_{mod} 30 Hz to 100 kHz	
Frequency Modulation		1.4 %	f_c 50 kHz to 800 MHz f_{mod} 10 Hz to 200 kHz	
Phase Modulation	1 radian to 200 radian	1.7 %	f_c 50 kHz to 800 MHz f_{mod} 10 Hz to 200 kHz	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
VOLTAGE REFLECTION COEFFICIENT	*100 kHz to 1.3 GHz* 0.0 to 0.3 0.3 to 0.6 0.6 to 1.0 *1.3 GHz to 3 GHz* 0.0 to 0.3 0.3 to 0.6 0.6 to 1.0 *0.045 GHz to 2 GHz* 0.0 to 0.3 0.3 to 0.6 0.6 to 1.0 *2 GHz to 18 GHz* 0.0 to 0.3 0.3 to 0.6 0.6 to 1.0	 0.011 to 0.012 0.012 to 0.014 0.014 to 0.019 0.011 to 0.015 0.012 to 0.016 0.016 to 0.028 0.011 to 0.012 0.012 to 0.014 0.014 to 0.019 0.011 to 0.016 0.012 to 0.020 0.016 to 0.037	Using HP8753ES Type N connectors only. Results and uncertainties may also be quoted in terms of return loss (dB) or VSWR Using HP810C. Type N Connectors only. Results and uncertainties may also be quoted in terms of return loss (dB) or VSWR.	P
DIRECTIVITY *of VRC bridges and couplers*	16 dB to 50 dB *10 MHz to 2 GHz* *2 GHz to 18 GHz*	 0.017 to 0.0060 0.019 to 0.010	This capability is for the measurement of directivity of 50 Ω VRC bridges and similar devices with Type N connectors. The CMCs are given in linear quantities (VRC) where the range applies to the range of measured directivity. The values and uncertainties may be reported in dB terms, calculated from the linear values and uncertainties.	P
RF ATTENUATION	*100 kHz to 1.3 GHz* 0 dB to 30 dB 30 dB to 50 dB 50 dB to 70 dB 70 dB to 80 dB 80 dB to 84 dB *1.3 GHz to 3 GHz* 0 dB to 30 dB 30 dB to 50 dB 50 dB to 70 dB 70 dB to 80 dB 80 dB to 84 dB	 0.028 dB to 0.064 dB 0.064 dB to 0.13 dB 0.13 dB to 0.84 dB 0.77 dB to 2.6 dB 2.4 dB to 4.2 dB 0.036 dB to 0.068 dB 0.067 dB to 0.14 dB 0.13 dB to 0.95 dB 0.84 dB to 2.9 dB 2.6 dB to 4.7 dB	Using HP8753ES network analyser. The uncertainties quoted are for devices fitted with Type N connectors only and which present a near match to the 50 Ω measurement system. Measurement of devices presenting significant mismatch will attract larger uncertainties.	P

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
RF ATTENUATION (continued)	*45 MHz to 6 GHz* 0 dB to 30 dB 30 dB to 50 dB 50 dB to 70 dB 70 dB to 80 dB 80 dB to 84 dB *6 GHz to 12 GHz* 0 dB to 30 dB 30 dB to 50 dB 50 dB to 70 dB 70 dB to 80 dB 80 dB to 84 dB *12 GHz to 18 GHz* 0 dB to 30 dB 30 dB to 50 dB 50 dB to 70 dB 70 dB to 80 dB 80 dB to 84 dB	 0.040 dB to 0.069 dB 0.069 dB to 0.14 dB 0.12 dB to 0.99 dB 0.64 dB to 3.1 dB 2.0 dB to 4.9 dB 0.043 dB to 0.073 dB 0.072 dB to 0.18 dB 0.15 dB to 1.4 dB 0.99 dB to 4.4 dB 3.1 dB to 6.9 dB 0.056 dB to 0.081 dB 0.081 dB to 0.18 dB 0.18 dB to 1.4 dB 1.4 dB to 4.4 dB 4.4 dB to 6.9 dB	Using HP8510C network analyser. The uncertainties quoted are for devices fitted with Type N connectors only and which present a near match to the 50 Ω measurement system. Measurement of devices presenting significant mismatch will attract larger uncertainties.	P
DIMENSIONAL MEASUREMENTS	All units for dimensional measurements are presented in millimetres unless otherwise stated.	All Dimensional uncertainties are presented in micrometres unless otherwise stated.	NOTES 1 The uncertainty quoted is for the departure from flatness, straightness, or squareness, ie, the distance separating the two parallel planes which just enclose the surface under consideration.	
Length				P
Thread measuring cylinders	As BS 5590:1978 0.1 to 3 diameter 3 to 5	 0.60 0.90	Calibration as BS 5590:1978 using a length measuring machine	P
Plain plug gauges (parallel), cylindrical setting standards and rollers	0.1 to 3 diameter 3 to 100 100 to 150	0.60 1.0 1.5	Calibration using a length measuring machine	P
Length gauges (Flat and Spherical)	25 to 600 Measured length: Parallelism:	 1.0 + (5.0 x length in m) 0.52	Calibration using a length measuring machine	P

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DIMENSIONAL MEASUREMENTS (continued)				
Plain ring gauges (parallel)	2 to 25 25 to 50 50 to 100 100 to 150 150 to 200	1.0 1.2 1.7 2.3 2.9	Calibration using a length measuring machine	P
Angle				P
Squares	As BS 939:2007		See note 1.	
Blade type	50 to 450	5.0	Calibration as BS 939:2007	
Block	As BS 939:2007		Calibration as	
	50 to 450	5.0	BS 939:2007	
Angle plates and box angle plates	As BS 5535:1978 50 to 450	Squareness: 4.2 + (1.0 per 100 mm) Parallelism: 1.0 + (1.0 per 100 mm)	See note 1. Calibration as BS 5535:1978	P
Form				
Surface plates Granite and Cast Iron	BS 817:2008 160 x 100 to 4000 x 6000		See note 1. Calibration as BS 817:2008	P & S
	Flatness of working surface (Note 1):	1.7 + (0.8 x diagonal in m)		
	Local variation of working surface:	2.4		
Measuring machines and instruments			Instrument entries in this section of the schedule also cover digital and dial type gauges which are calibrated based on the quoted standards.	
Micrometers				P
External micrometer	BS 870:2008 0 to 450		Calibration as BS 870:2008	
	Heads:	2.0 between any two points		
	(Zero) Setting, 0 to 25:	1.0		
	(Zero) Setting, 25 to 1000:	1.0 + (7.0 x length in m)		
	Flatness of anvils:	0.44		
	Parallelism of anvils:	1.0		
	Spindle alignment:	7.0		
Internal	As BS 959:2008 0 to 450	Heads: 2.0 between any two points Setting and extension rods: 1.0 + (5.0 x length in m)	Calibration as BS 959:2008	
Depth	As BS 6468:2008 0 to 450	Heads: 2.0 between any two points Setting and extension rods: 1.0 + (5.0 x length in m)	Calibration as BS 6468:2008	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
DIMENSIONAL MEASUREMENTS (continued)				
Micrometer heads	As BS 1734:1951 0 to 100	1.3	Calibration as BS 1734:1951	P
Height setting micrometer	0 to 300	Heads: 2.0 between any two points Stepped column: 2.0 Overall performance: 3.0	By comparison with end standards	P
Riser blocks for above	150 300 600	1.3 2.3 4.3	By comparison with end standards	P
Vernier gauges				
Caliper	As BS 887:2008 0 to 1000	10 + (30 x length in m)	Calibration as BS 887:2008	P
Height	As BS 1643:2008 0 to 1000	10 + (30 x length in m)	Calibration as BS 1643:2008	
Depth	As BS 6365:2008 0 to 600 Overall performance: Flatness: Straightness: Parallelism:	 10 + (30 x length in m) 2.3 2.3 2.3	Calibration as BS 6365:2008	
Dial gauges and dial test indicators	As BS 907:2008 and BS 2795:1981 0 to 50	1.0	Calibration as BS 907:2008 and BS 2795:1981	P
Comparators (external)	As BS 1054:1975 250 to 10,000 magnification Scale accuracy: Flatness: Parallelism: Consistency of reading:	 1.0 % of range, Minimum 0.20 0.44 1.8 0.22	Calibration as BS 1054:1975	P
Feeler gauges	As BS 957:2008	3.0	Calibration as BS 957:2008	P
Steel rules	BS 4372:1968 0 to 1000 Straightness: Parallelism: Squareness:	 10.0 + (15 x length in m) 25 25 15	Calibration as BS 4372:1968	P

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 uncertainty of measurement 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 CIPM-ILAC definition of the CMC is as follows:

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 CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measurand.

Thus, for example, a measurement uncertainty of 1.5 % means $1.5 \cdot 0.01 \cdot q$, where q is the quantity value.

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