

Schedule of Accreditation

issued by

United Kingdom Accreditation Service


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

 0013 Accredited to ISO/IEC 17025:2005	Trescal Limited	
	Issue No: 096 Issue date: 27 September 2017	
	Saxony Way Blackbushe Business Park Yateley Hampshire GU46 6GT	Contact: Mr Matt Gypps Tel: +44 (0)1438 212500 Fax: +44 (0)1438 212555 E-Mail: ukcal@trescal.com Website: www.trescal.com
Calibration performed by the Organisation at the locations specified below		

Locations covered by the organisation and their relevant activities

Laboratory locations:


Location details	Activity	Location code
<p>Address Saxony Way Blackbushe Business Park Yateley Hampshire GU46 6GT</p> <p>Local contact Mr James Luff Tel: +44 (0)1252 533 300 Fax: +44 (0)1252 533 333 Email: jim.luff@trescal.com</p> <p>Mr Jeremy Struthers Tel: +44 (0)1252 533 300 Fax: +44 (0)1252 533 333 Email: jeremy.struthers@trescal.com</p>	<p>Electrical dc & lf Electrical rf Photometric</p> <p>Pressure Flow Temperature Humidity</p>	Yateley
<p>Park Gate Close Bredbury Park Way Bredbury Stockport SK6 2SL</p> <p>Mr Mark Brewer Tel: +44 (0)161 406 7878 Fax: +44 (0)161 406 7979 E-Mail: calibration.manchester@trescal.com</p>	<p>Electrical dc & lf High Voltage Accelerometry Acoustics Mass Force Torque Dimensional Pressure</p>	Manchester
<p>Ramsey Building Muirton Way Dunfermline Scotland KY11 9FZ</p> <p>Mr Ken Baxter Tel: +44 (0)1383 646464 Fax: +44 (0)1383 646468 E-Mail: calibration.scotland@trescal.com</p>	<p>Dimensional Electrical dc & lf Electrical rf High Voltage Torque Pressure Temperature Volume</p>	Donibristle

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Locations covered by the organisation and their relevant activities

Laboratory locations (continued):

Location details	Activity	Location code
<p>Sanders Building Gunnels Wood Road Stevenage SG1 2AU</p> <p>Mr John Brooks Tel: +44 (0)1438 212541 Fax: +44 (0) 1438 772203 E-Mail: calibration.stevenage@trescal.com</p>	<p>Electrical dc and lf Electrical rf Accelerometry Dimensional Torque</p>	Stevenage
<p>Activities at more than one of the above locations</p>	<p>Electrical dc & lf</p>	As specified overleaf

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Site activities performed away from the locations listed above:

Location details	Activity	Location code
<p>Customers' sites or premises</p> <p>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.</p>	Dimensional	Based at Manchester
	DC & LF Electrical Pressure Temperature Humidity	On site
	Electrical DC & LF (including 17th edition equipment) and RF Humidity Temperature Pressure Mass - weighing machines (non-automatic)	Mobile facility



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DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
Gauge blocks		Class (See Footnotes)	NOTES	Manchester
Inch (Steel and tungsten carbide)	BS 4311-1:2007 0 to 0.4 in 0.4 to 1 in 2 in 3 in 4 in	C D 3.0 μ m 4.0 μ m 4.0 μ m 5.0 μ m 5.0 μ m 7.0 μ m 6.0 μ m 8.0 μ m 7.0 μ m 10.0 μ m	1 In addition to the items listed above, other similar items, including parts of measuring instruments and machines, may be calibrated to the uncertainties stated. Where the item or part calibrated is of lower quality due to wear, errors in geometry (next paragraph should be attached to this paragraph). or form, or poor surface texture, or where any other factor adversely affects the measurement capability, greater uncertainties must be quoted.	
Millimetre (Steel and tungsten carbide)	BS EN ISO 3650:1999 0 to 10 10 to 25 30, 40, 50 60, 70, 75 80, 90, 100	C D 0.080 0.10 0.10 0.13 0.12 0.17 0.15 0.21 0.18 0.25	2 The uncertainty quoted if for the departure from flatness, straightness, or squareness, ie the distance separating the two parallel planes which just enclose the surface under consideration.	
Class C uncertainties apply to the measurement of length of steel and tungsten carbide gauges by comparison with grade K standards of length of a similar material. Class C uncertainties apply to new and used grade 0, 1 and 2 gauges to BS 4311:2007 and BS EN ISO 3650:1999. Class D uncertainties represent the best capability for the measurement of length of gauges by comparison with grade K standards of length of a dissimilar material.			3 Single start, symmetrical thread forms only.	
Gauge block accessories	BS 4311:Part 2:2009 0.1 to 12.5	0.30	4 Includes use of check plugs for screw rings from 1 mm to 14 mm diameter	
Gauge block comparators	0 to 100	0.050 + (0.50 \times L in m)	5 Functional test for size using setting plugs calibrated with a CMC of 3.0 μ m	
Length bar accessories	BS 1790:1961 and BS5317:1976	0.30	6 Simple height gauges - vernier, dial and digital instruments designed only for measuring distances parallel to the beam.	
Precision scales (linear)	0 to 400	1.0 + (3.0 \times L in m)	7 Conformance statements cannot be made against specifications whose magnitudes are smaller than the specified CMC values	
Stage Micrometers	0 to 10	0.50		



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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
Thread measuring cylinders	BS 3777:1964, BS 5590:1978, BS ISO 16239:2013 and specials 0.1 to 5	0.50		Manchester
Plain plug gauges (parallel) cylindrical setting standards and rollers	Diameter: 1 to 50 50 to 100 100 to 150 150 to 200 200 to 300	0.80 1.0 1.5 2.0 3.0		
Plain plug gauges (taper)				
Parallel to 1 in 8 on diameter	3 to 50 50 to 100	3.0 4.0		
1 in 8 to 1 in 3 on diameter	3 to 50 50 to 100	5.0 6.0		
Plain ring gauges (parallel) and setting standards	Diameter: 1.5 to 10 10 to 25 25 to 50 50 to 100 100 to 150 150 to 400	1.0 0.80 1.0 1.5 2.0 3.0	on diameter	
Plain ring gauges (taper)	Diameter:			
Parallel to 1 in 8 on diameter	3 to 50 50 to 100 100 to 200	4.0 5.0 6.0		
1 in 8 to 1 in 3 on diameter	3 to 50 50 to 100 100 to 200	6.0 7.0 8.0		
Length Gauges, flat and spherical ended	0 to 1200 1200 to 2000	$1.0 + (5.0 \times L \text{ in m})$ $1.0 + (8.0 \times L \text{ in m})$		
Plain Gap Gauges (parallel)	2 to 50 50 to 100 100 to 200 200 to 300 300 to 600	3.0 5.0 8.0 12 15		



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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
Screw plug gauges (parallel) including check and setting plugs	Diameter: 1 to 100 100 to 150 150 to 300	CMC on pitch diameter 3.0 4.0 6.0		Manchester
Screw plug gauges (taper) including check plugs	5 to 100 100 to 150	5.0 8.0		
Screw ring gauges (parallel)	1 to 6 6 to 100 100 to 150 150 to 300 300 to 600	See note 4 5.0 6.0 8.0 12		
Screw ring gauges (taper)	6 to 150	7.0		
Screw pitch	0.2 to 8	1.5		
Screw flank angle	0° to 52°	5.0 minutes of arc		
Screw thread adjustable Calliper gauges (parallel)	3 to 50 diameter	See note 5		
Parallels	As BS 906:Parts 1&2:1972 5 to 50 x 100 x 400	1.5 to 5.0		
Vee blocks	BS 3731:1987 20 to 200	2.5 to 5.0		
Receiver, position and profile gauges, jigs, fixtures.	Maximum dimensions Up to 750 x 750 x 750	Dependant on size and 3.0 + (10 x L in m)		
Steel rules	BS 4372:1968 0 to 1000 DIN 866:1983 0 to 5000	5 + (10 x L in m) 5 + (10 x L in m)		
Tapes, measuring (pocket, precision and pi)	0 m to 5 m 5 m to 50 m	20 + (3.0 x L in m) 300 + (10 x L in m)		



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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
ANGLE				Manchester
Angle gauges - NPL type	0° to 90°	4.0 seconds of arc		
Squares Blade type	BS 939:2007 0 to 300 300 to 600 600 to 1000	CMC on Squareness 3.0 5.0 8.0		
Cylindrical	BS 939:2007 0 to 600 600 to 1000	2.0 8.0		
Block	BS 939:2007 0 to 300 300 to 600 600 to 1000	3.0 5.0 8.0		
Right angle and box angle plates	BS 5535:1978 50 to 600	Squareness: 3.0 + (1.0 per 100 mm) Parallelism: 1.0 + (1.0 per 100 mm) See Note 2		
Sine bars and tables	BS 3064:1978 0 to 500 length	Linear dimensions: 1.0 + (10 x L in m) Overall performance: 5.0 seconds of arc		
Sine centres	0 to 500 length or between centres	Linear dimensions: 1.0 + (10 x L in m)		
Compound sine tables	With tables of equivalent up to 500 length	Overall performance 5.0 seconds of arc		
Spirit levels	BS 958:1968 5 seconds of arc to 60 minutes of arc nominal sensitivity	Mean sensitivity: 10% of nominal Minimum 0.50 seconds of arc		
Electronic indicating levels	0 to 20 minutes of arc	1.0 % of range (min 0.30 seconds of arc)		
Clinometers	0° to 360°	10 seconds of arc or greater dependent on sensitivity Optical Instruments 2.0 seconds of arc		



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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
FORM				Manchester
<u>Optical flats</u>	10 to 75 diameter	Flatness – 0.13		
<u>Optical parallels</u>	10 to 30 diameter 10 to 100 length	Flatness – 0.13 Parallelism – 0.20 Length – 0.60		
Toolmakers Flats See Note1	BS 869:1978	0.50		
Surface plates				
Granite and cast iron	BS 817:2008 160 x 100 to 9 000 x 9 000	1.5 + (0.80 x L in m)		
Roundness External Internal	BS 3730 Part2 :1982 0 to 350 diameter 3 to 350 diameter	0.050 on radius 0.050 on radius		
Surface texture	BS 1134	7.0 % of measured value	In support of other measurements	
Straightedges				
Cast Iron, Steel and Granite	BS 5204:Part 1:1975 and BS 5204:Part 2:1977 0 to 6000	1.0 + (2.0 x L in m)		
Steel Balls	1 to 25 diameter 25 to 50 diameter	0.50 on diameter 0.80 on diameter		
MEASURING INSTRUMENTS AND MACHINES				
Micrometers				
External	BS 870:2008 0 to 600	Heads: 2.0		
Internal	BS 959:2008 0 to 900	Setting and extension rods		
Depth	BS 6468:2008 0 to 300	1.0 + (8.0 x L in m)		
Micrometer heads	BS 1734:1951 0 to 50	1.0		
Bench micrometer	0 to 100	Overall performance 2.0		



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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				Manchester
MEASURING INSTRUMENTS AND MACHINES (continued)				
Height setting micrometers	0 to 300	Heads: 1.5 between any two points stepped column 2.5 Overall performance: 3.0		
Riser blocks for above	150 300	2.5 5.0		
3 point Bore micrometers and bore gauges	0 to 300	5.0		
Height gauges - (Simple) including vernier, dial and digital types (See note 6 and note 7)	As BS EN ISO 13225:2012 (0 to 1000)	Length measurement error (E): 10 + (30 x L in m)		
Vernier gauges Calliper Height Depth	BS 887:2008 0 to 1000 BS 1643:2008 0 to 1000 BS 6365:2008 0 to 600	Overall performance: 10 + (30 x L in m)		
Bevel protractors	BS 1685:2008 0° to 360°	6.0 minutes of arc		
Combination Sets	0 to 600	1.0 vernier division		
Dial gauges and dial test indicators	BS 907:2008 and BS 2795:1981 0 to 50	2.0		
Comparators (external)	BS1054:1975 250 to 10 000 magnifications	1.0% of range Minimum 2.0		
Horizontal Comparator				
Horizontal Measuring	0 to 100 length of scale	Minimum 0.30		
NPL type level comparator	MOY/SCMI/42 0 to 1000	0.050 + (0.50 x L in m)		
Optical Dividing Heads				
Rotary tables	0 to 1000 Capacity	Linear dimensions 1.0 + (10 x L in m)		
Inclinable tables	0 to 1000 Capacity	Overall angular performance		
Inclinable rotary tables	0 to 1000 Capacity	3.0 seconds of arc		



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MEASURING INSTRUMENTS AND MACHINES (continued)				
Performance verification of co-ordinate measuring machines	As BS EN ISO 10360-2:2009 0 mm to 1500 mm (longest diagonal using end standards)	0.70 + (0.70 x L in m) µm		
	As BS EN ISO 10360-5:2010 10 mm to 50 mm (single stylus probing test only)	0.90 µm		
Bench Centres	0 to 1000 between centres	Linear dimensions 1.0 + (10 x L in m)		
Thread diameter measuring	NPL schedules MOY/SCMI/9 and MOY/SCMI/12 0 to 300	1.5 overall performance		
Measuring machines plain	MOY/SMCI 16,19 and 78	Magnification 125		
Taper diameter	0 to 100 0 to 100 magnifications	Linear 5.0 Angular 3.0 mins of arc		
Microscopes toolmakers	MOY/SCMI/02 0 to (150 x 150)	2.0 + 2.5/m with eye piece		
Linear scales associated with height and length measuring instruments using a laser interferometer	0 to 3000	0.15 + (1.5 x L in m)		
Feeler gauges and shims	BS 957:2008 0.025 to 1	1.5		
Electronic Height Gauges With microprocessor control	0 to 1000	1.0 + (5.0 x L in m)		
Profile projectors	10 to 100 magnification Linearity Angle	130 at the screen 4.0 2.0 minutes of arc		
Cube moulds for concrete	BS EN 12390-1 2012 100 x 100 x 100 BS EN 196-1 2005 160 x 40 x 40	15		



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FORCE			Intermediate values can be calibrated with an uncertainty interpolated from the next higher and lower values in the table above.	Manchester
Push pull force measuring devices in tension and compression	0.1 N to 2500 N	0.10 %		
Gram Gauges	10 grams force to 5000 grams force	1.0 %		
Load cells (excluding proving devices)	0.2 kN to 100 kN	0.40 %		
TORQUE				
Hand torque tools	As BS EN ISO 6789:2003			
	0.1 N.m to 2500 N.m	1.6 %		
Torque measuring devices	As BS EN 7882:2008			
	0.05 N.m to 2.5 N.m	0.060 %		
	0.5 N.m to 1500 N.m	0.051 %		
MASS				
	(g)	(mg)		
Nominal values	25 000	250		
	20 000	20		
	10 000	10		
	5 000	5.0		
	2 000	1.0		
	1 000	0.50		
	500	0.25		
	200	0.10		
	100	0.053		
	50	0.033		
	20	0.027		
	10	0.020		
	5	0.017		
	2	0.013		
	1	0.010		
	0.5	0.0083		
	0.2	0.0067		
	0.1	0.0053		
	0.05	0.0040		
	0.02	0.0033		
	0.01	0.0027		
	0.005	0.0020		
	0.002	0.0020		
	0.001	0.0020		



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ACCELEROMETRY				Manchester
ACCELERATION TRANSDUCERS				
Working or non-precision grades Piezoelectric type	High frequency test 20 Hz to 5 kHz		Calibration of charge sensitivity by comparison with a reference (precision grade) transducer.	
Nominal peak acceleration 1 g to 5 g _n (10 m/s ² to 50 m/s ²)	System sensitivity > 2 mV/m/s ² (tx) > 20 mV/C/g _n (tx)	2.0 %	System calibration comprising transducer (tx), signal conditioner and power can be undertaken within the quoted uncertainties	
Nominal peak acceleration 0.3 g _n to 2 g _n	Low frequency test 2 Hz to 20 Hz			
	System sensitivity > 3.0 mV/m/s ² (tx) > 30 mV/C/g _n (tx)	2.7 %		
Integral Electronics type				
Nominal peak acceleration 1g _n to 5 g _n (10 to 50 m/s ²)	High frequency test 20 Hz to 5 kHz System sensitivity > 0.1 mV/m/s ² > 10 mV/C/g _n	2.0 %		
Nominal peak acceleration 0.3 g _n to 2 g _n	Low frequency test 2 Hz to 20 Hz System sensitivity > 3.0 mV/m/s ² > 30 mV/C/g _n	2.7 %	Transducer any Temperature from -50 °C to +190 °C	
Nominal peak acceleration 0.3 g _n to 2 g _n	20 Hz to 630 Hz	3.0 %		
CHARGE AMPLIFIERS				
Calibration of voltage output per picocoulomb or millivolt input. Minimum input 1 pC or 10 mV.	1 Hz to 10 Hz 10 Hz to 30 kHz 30 kHz to 100 kHz 100 kHz to 500 kHz	0.80 % 0.29 % 0.32 % 1.5 %		



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ACOUSTICS				Manchester
PISTONPHONES AND SOUND CALIBRATORS			By a comparison method:	
Sound pressure level	84 dB to 125 dB (ref : 20 μ Pa)		For pistonphones using laboratory standard microphones (B&K type 4160 or type 4180), or working standard microphones (B&K type 4144, type 4134 or type 4136) as appropriate.	
	250 Hz 1000 Hz	0.10 dB 0.10 dB		
Frequency	250 Hz 1000 Hz	0.20 Hz 0.20 Hz	For sound calibrators using laboratory standard microphones (B&K type 4160 or type 4180), or working standard microphones (B&K type 4144 or type 4134) as appropriate.	
SOUND LEVEL METERS				
Verification to BS 7580:Part 1:1997	BS7580: Part 1:1997	See Remarks	Verification of Type 1 and Type 2 sound level meters originally manufactured according to BS EN 60651:1994 or BS EN 60804:1994 where the required corrections factors are known	
DC Resistance				
Measurement	0 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 k Ω 2 k Ω to 20 k Ω 20 k Ω to 200 k Ω 200 k Ω to 2 M Ω 2 M Ω to 20 M Ω 20 M Ω to 100 M Ω	32 ppm + 0.030 m Ω 21 ppm + 0.070 m Ω 16 ppm + 0.70 m Ω 16 ppm + 7.0 m Ω 17 ppm + 70 m Ω 27 ppm + 2.0 Ω 51 ppm + 93 m Ω 370 ppm + 11 k Ω		
DC HIGH VOLTAGE				
Measurement and Generation	1 kV to 25 kV 25 kV to 60 kV 60 kV to 100 kV 100 kV to 150 kV	40 ppm 50 ppm 150 ppm 180 ppm		



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AC HIGH VOLTAGE	1 kV to 50 kV 50 Hz	580 ppm		Manchester
AC CURRENT				
Generation	10 A to 1000 A 50 Hz	0.13 %		
Measurement	1 mA to 100 A 50 Hz to 1 kHz	0.11 %		
INDUCTANCE	At 1 kHz 1 μ H to 3 μ H 3 μ H to 5 μ H 5 μ H to 10 μ H 10 μ H to 100 μ H 100 μ H to 1 mH 1 mH to 10 mH 10 mH to 100 mH 100 mH to 1 H 1 H to 10 H	7.0 % 2.2 % 1.2 % 0.15 % + 50 nH 0.040 % + 60 nH 0.030 % + 1.0 μ H 0.030 % + 10 μ H 0.030 % + 100 μ H 0.030 % + 1.0 mH		
CAPACITANCE	At 1 kHz 0.1 pF, 1 pF, 10 pF, 25 pF, 100 pF and 1 nF 10 nF and 100 nF 1 μ F 10 μ F, 100 μ F and 1 mF	0.020 % + 0.010 pF 40 ppm 60 ppm 0.020 %		
	At 1 kHz 1 pF to 10 pF 10 pF to 100 pF	0.35 % to 0.080 % 0.12 %		
	100 Hz to 5 kHz 100 pF to 100 nF 100 nF to 10 μ F	0.060 % 0.030 %		
FREQUENCY				
Measurement	1 μ Hz to 100 Hz 100 Hz to 1.3 GHz	1.0 μ Hz 1.0 in 10^{-10}		
Generation	1 mHz to 100 MHz	1.0 in 10^{-10}		
Rise Time	Voltage range 500 μ V to 20 V	4.4 ns		
Elapsed time	10 ms to 8 hrs	15 in 10^{10} + 500 ns		



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DC CURRENT				Manchester
Generation	1 pA to 10 pA 10 pA to 100 pA 100 pA to 10 nA 10 nA to 100 nA 100 nA to 10 μ A 10 μ A to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 50 A 50 A to 100 A 100 A to 200 A	0.080 pA 4.0 % 0.80 % 0.40 % 0.040 % 40 ppm 40 ppm 80 ppm 80 ppm 80 ppm 120 ppm		
Measurement	0.1 pA to 2 pA 2 pA to 20 pA 20 pA to 200 pA 200 pA to 2 nA 2 nA to 20 nA 20 nA to 100 nA 100 nA to 10 μ A 10 μ A to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 50 A 50 A to 100 A 100 A to 200 A	0.080 pA 4.0 % 4.0 % 0.80 % 0.80 % 0.60 % 0.040 % 40 ppm 40 ppm 80 ppm 80 ppm 80 ppm 120 ppm		



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PRESSURE Gas Pressure (Gauge) Calibration of pressure indicating instruments and gauges. "Pressure equivalent" calibration of Dead Weight Testers (pressure balance supplied with an associated mass set). Gas Pressure (Absolute) Calibration of pressure indicating instruments and gauges Hydraulic Pressure (Gauge) Calibration of pressure indicating instruments and gauges. "Pressure equivalent" calibration of Dead Weight Testers (pressure balance supplied with an associated mass set). Hydraulic Pressure (Absolute) Calibration of pressure indicating instruments and gauges.	-100 kPa to -5 kPa -5 kPa to -3.5 kPa -3.5 kPa to -1.5 kPa -1.5 kPa to +1.5 kPa 1.5 kPa to 3.5 kPa 3.5 kPa to 5 kPa 5 kPa to 700 kPa 700 kPa to 7 MPa 1.0 kPa to 80 kPa 80 kPa to 115 kPa 115 kPa to 800 kPa 800 kPa to 7.1 MPa 600 kPa to 6 MPa 6 MPa to 120 MPa 700 kPa to 6.1 MPa 6.1 MPa to 120.1 MPa	0.0090 % 0.011 % 0.020 % 4.7 Pa 0.020 % 0.010 % 0.0070 % 0.0080 % 0.010 % + 11 Pa 0.0050 % + 10 Pa 0.0070 % + 11 Pa 0.0080 % + 11 Pa 0.010 % 0.012 % 0.010 % + 11 Pa 0.012 % + 11 Pa	Calibrations of devices with an electrical output may be undertaken	Manchester



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (<i>k</i> = 2)	Remarks	Location Code
TEMPERATURE				Yateley
Temperature in air	-40 °C to +90 °C	0.20 °C		
Liquid-in-glass thermometers	-80 °C to -40 °C	0.10 °C		
	-40 °C to 0 °C	0.050 °C		
	0 °C	0.010 °C		
	0 °C to 100 °C	0.050 °C		
	100 °C to 260 °C	0.10 °C		
	260 °C to 450 °C	0.20 °C		
Platinum thermocouples	0 °C to 260 °C	1.2 °C		
	260 °C to 1100 °C	1.0 °C		
	1100 °C to 1500 °C	3.0 °C		
Other thermocouples	-80 °C to +260 °C	0.25 °C		
	260 °C to 500 °C	1.0 °C		
	500 °C to 1500 °C	3.0 °C		
Resistance thermometers	-80 °C to -40 °C	0.030 °C		
	-40 °C to 260 °C	0.010 °C		
	260 °C to 450 °C	0.040 °C		
	450 °C to 600 °C	0.10 °C		
Calibration at Fixed Points				
TP Mercury	-38.8344 °C	5.2 mK		
TP Water	0.01 °C	2.0 mK		
Melting point of Galium	29.7646 °C	2.0 mK		
FP Indium	156.5985 °C	4.6 mK		
FP Tin	231.928 °C	5.0 mK		
FP Zinc	419.527 °C	3.4 mK		
FP Aluminium	660.323 °C	7.6 mK		
Electronic thermometers with sensors Analogue Digital	Range as for sensor	As for sensor - plus: Resolution of instrument One least significant digit		
Block calibrators	-40 °C to +260 °C 260 °C to 600 °C	0.10 °C 0.20 °C	Calibrated with Platinum Resistance Thermometer only.	
	260 °C to 1100 °C 1100 °C to 1300 °C	1.0 °C 3.0 °C	Calibrated with suitable Thermocouple	
Radiation thermometers (pyrometers)	-15 °C to 1 °C 1 °C to 120 °C 120 °C to 500 °C	1.4 °C 1.0 °C 2.0 °C	Only thermometers operating at the wavelength of 8 to 14µm and an emissivity setting of 0.95 can be calibrated	



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HUMIDITY				Yateley
DEW-POINT	-15 °C to +60 °C 60 °C to 70 °C	0.12 °C 0.13 °C		
Relative humidity	7 %rh to 83 %rh	1.3 %rh		
Temperature range	83 %rh to 95 %rh 15 °C to 20 °C	1.5 %rh 0.20 °C		
	7 %rh to 83 %rh 83 %rh to 95 %rh 20 °C to 70 °C	1.3 %rh 1.5 %rh 0.20 °C		
	7 %rh to 88.8 %rh 70 °C to 85 °C	1.3 %rh 0.20 °C		
SALT CAPSULES				
Nominal Values	7 %rh to 80 %rh	1.5 %rh 0.20 °C		
Within the temperature range of 15 °C to 40 °C	80 %rh to 83 %rh	1.6 %rh 0.20 °C		
FLOW				
Flow-rate – gas, and Quantity passed – gas	1 l/min to 700 l/min	0.67 %	Dry air normally used. Any non- corrosive gas may be used.	
PRESSURE				
Gas Pressure (absolute)				
Calibration of pressure indicating instruments and gauges	3.5 kPa to 175 kPa 175 kPa to 7 MPa	0.0075 % + 1.9 Pa 0.0075 % + 1.9 Pa	Calibration of instruments with an electrical output may be undertaken	
Gas Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-95 kPa to -15 kPa -15 kPa to -4.9 kPa -4.9 kPa to -2.5 kPa -2.5 kPa to -490 Pa -490 Pa to +490 Pa 490 Pa to 2.5 kPa 2.5 kPa to 3.5 kPa 3.5 kPa to 175 kPa 175 kPa to 7 MPa	0.0075 % + 27 Pa 4.8 Pa 0.77 Pa 0.41 Pa 0.40 Pa 0.41 Pa 0.77 Pa 0.0075 % 0.0075 %		
Hydraulic Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	0 Pa to 20 MPa 20 MPa to 70 MPa	2.6 kPa 9.6 kPa		



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PHOTOMETRIC				Yateley
Illuminance	0.5 lux to 20000 lux	1.5 %	All measurements carried out at approximately 2856 K	
Luminous Intensity	4.0 cd to 7200 cd	1.3 %		
Correlated Colour Temperature	2856 kelvin	25 K		
Luminance	0.2 cdm ⁻² to 6000 cdm ⁻²	2.0 %		
Luminance factor	50 % to 100 %	1.5 %		
Chromaticity x y	0 to 1 0 to 1	0.0020 0.0010	White light sources only	
ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT				
Surge discharge characteristics			For the calibration of surge generators as specified in BS EN 61000-4-5:2006 and 2014	
Open circuit voltage	10 V to 20 kV	1.1 %		
Voltage Waveform Undershoot	0 to 60%	1.48%		
Voltage front / Rise time	0.1 µs to 3 µs 3µs to 20µs	13.3ns 59.4ns		
Pulse duration	2 µs to 20µs 20µs to 200µs 200µs to 1ms	68.7ns 0.68µs 3.45µs		
Short circuit current pulse	1 A to 5 kA	2.28%		
Current Waveform Undershoot	0 to 60%	2.49%		
Current front / Rise time	0.1µs to 3µs 3µs to 20µs	23.4ns 62.5ns		
Current duration	2µs to 50µs 50µs to 500µs	0.17µs 1.7µs		
Phase angle (Surge on AC line)	0° to 360°	0.7°		
Output impedance	0.1 Ω to 500 Ω	2.5%		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
Electrical fast transient characteristics			For the calibration of EFT/burst generators as specified in BS EN 61000-4-4	Yateley
Peak voltage into 50 Ω	1 V to 8 kV	1.1 %		
Peak voltage into 1 k Ω	1 V to 8 kV	3.2 %		
Rise time	2 ns to 10 ns	0.125 ns		
Pulse width	10 ns to 75 ns	0.33 ns		
	75 ns to 200 ns	0.71 ns		
Burst duration	200 ns to 1 ms	0.12 μ s		
	1 ms to 20 ms	2.8 μ s		
Burst period	50 ms to 500 ms	2 ppm		
Repetition rate	1 kHz to 1.5 MHz	2 ppm		
Impulse Magnetic Field Immunity			For the calibration of impulse Magnetic Field Immunity Generators and Loops as specified in BS EN 61000-4-9	
Peak Short Circuit Current	1 A to 5 kA	2.28 %		
Current Front./ Rise time	3 μ s to 20 μ s	62.5 ns		
Current Duration	2 μ s to 50 μ s	0.17 μ s		
Ring Wave Characteristics			For the calibration of Ring Wave Generators as specified in BS EN 61000-4-12	
Peak voltage	10 V to 7 kV	1.35 %		
Voltage rise time	0.1 μ s to 2 μ s	15.4 ns		
Decaying voltage	Pk 2 0 to 2x Pk V Pk 3 0 to 2 x Pk V Pk 4 0 to 2 x Pk V	1.39 % 1.45 % 1.66 %		
Oscillation frequency	10 kHz to 20 0kHz	23 ppm		
Peak current	1 A to 600 A	2.4 %		
Current rise time	100 ns to 3 μ s	27.9 ns		
Phase angle	0 to 360 degrees	0.7 °		
Output impedance	1 Ω to 100 Ω	2.8 %		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
Voltage dips and interrupts characteristics			For the calibration of voltage dips and interrupts simulators as specified in 61000-4-11	
AC Voltage dip	0 V to 500 V 50 Hz to 400 Hz	0.51 %		
Overshoot / undershoot	0 to 20 %	0.87 %		
Rise/Fall time	0.1 μ s to 1.5 μ s	45 ns		
Dip timing	10 μ s to 5s	11.7 ppm		
Load regulation Phase accuracy	0 V to 500 V 0 ° to 360 °	0.56 % 0.7 °		
Inrush current	To 1000 A Peak	4.1 %		Yateley
Slow Damped Oscillatory Wave Characteristics			For the calibration of Slow Damped Oscillatory Wave Generators as specified in 61000- 4-18	
Peak Voltage	10 V to 7 kV	1.36 %		
Voltage Rise Time	20 ns to 200 ns	5.2 ns		
Decaying Voltage Peak 5 Peak 10	0 to 2 * Pk V 0 to 2 * Pk V	1.41 % 1.41 %		
Oscillation Frequency	10 kHz to 2 MHz	0.1 %		
Peak Current	500 mA to 50 A	2.41 %		
Burst Duration	Up to 3 s	0.01 s		
Repetition Rate	30 / s to 60 / s 300 / s to 600 / s	0.5 % 0.05 %		
Output Impedance	50 Ω to 500 Ω	2.77 %		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
ElectroStatic Discharge				
ESD Generators			For the calibration of ESD Generators to IEC61000-4-2:2009 and ISO 10605:2008.	
DC Voltage	0.1kV to 40kV	$\pm 0.39 \%$,		
Peak Current	0.35A to 150A	$\pm 2.3 \%$,		
Rise Time (ps)	300 400 500 600 700 800 900 1000 1100	± 53.8 ps or 17.9 % ± 48.7 ps or 12.2 % ± 46.3 ps or 9.3 % ± 45.2 ps or 7.5 % ± 44.8 ps or 6.4 % ± 44.9 ps or 5.6 % ± 45.4 ps or 5.0 % ± 46.1 ps or 4.6 % ± 47.1 ps or 4.3 %	Uncertainty calculations in Accordance with Examples in standard.	
Decay points Depending on coupling networks				
150pF/330 Ohms, 330pF/330 Ohms	30 ns and 60 ns 65 ns and 130 ns	2.7 % 2.7 %		
150pF/2000 Ohms 330pF/2000 Ohms	180 ns 400 ns	4.2 % 4.2 %		
150pF/2000 Ohms 330pF/2000 Ohms	360 ns 800 ns	10.5 % 10.5 %		
LF and RF Impedance	Magnitude 1 Ω to 100 Ω		For the measurement of Line Impedance Stabilisation Networks (LISNs)	
	10 Hz to 1 MHz 1 MHz to 108 MHz 108 MHz to 200 MHz 200 MHz to 300 MHz 300 MHz to 500 MHz	0.20 Ω 1.0 Ω 2.0 Ω 4.0 Ω 5.0 Ω		
	Phase 0° to 180° 9 kHz to 108 MHz	1.0°	LISNs, CDNs and ISNs	
	Magnitude 80 Ω to 250 Ω 150 kHz to 30 MHz 30 MHz to 230 MHz	1.0 % 2.0 %	For the measurement of Coupling/Decoupling Networks (CDNs & ISNs)	



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
Longitudinal Conversion Loss (LCL)	30 dB to 81 dB		For the Calibration of ISNs	
	Cat 3	0.19 dB		
	Cat 5	0.32 dB		
	Cat 6	0.57 dB		
	82 to 90 dB	0.61 dB to 1.36 dB		
DISCONTINUOUS INTERFERENCE ANALYSERS			Tests in accordance with BS55016-1-2007	
Pulse Amplitude	-2.5 dBm to +25 dBm	0.20 dB		
Pulse Duration	0.11 ms to 1.33 ms	10 ppm		
Pulse Separation	0.1 ms to 200 ms Initial 13 s of F.1-11/12 All other pulses/tests	0.1% 10 ppm		
RECEIVERS AND ANALYSERS TO CP1106				
Amplitude Accuracy	-40 dBm to +10 dBm		N Type connectors	
	10 Hz to 4 GHz	0.080 dB		
	4 GHz to 12 GHz	0.14 dB		
	12 GHz to 18 GHz	0.19 dB		
	-40 dBm to +10 dBm		K Type connectors	
	10 Hz to 4 GHz	0.080 dB		
	4 GHz to 13 GHz	0.13 dB		
	13 GHz to 19 GHz	0.18 dB		
	19 GHz to 26 GHz	0.20 dB		
	26 GHz to 30 GHz	0.31 dB		
	30 GHz to 39 GHz	0.33 dB		
	39 GHz to 40 GHz	0.36 dB		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
RECEIVERS AND ANALYSERS TO CP1106 (continued)				
Calibration Signal	-40 dBm to 0 dBm 10 MHz to 500 MHz	0.070 dB		Yateley
Frequency Accuracy	10 MHz to 500 MHz	5.8×10^{-10}		
IF Bandwidth Nominal 0 dBm	10 MHz to 500 MHz Gaussian 3/6 dB Gaussian 60 dB	0.11 % of Bandwidth 1.0 % of Bandwidth		
	Non-Gaussian 3/6 dB Non-Gaussian 60 dB	0.20 % of Bandwidth 1.0 % of Bandwidth		
Bandwidth level switching Nominal 0 dBm	10 MHz to 500 MHz	0.070 dB		
Voltage Reflection Coefficient	100 kHz to 3 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.015 0.031 0.065	N Type connectors	
	3 GHz to 18 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.028 0.042 0.078		
	10 MHz to 26 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.036 0.037 0.041	K Type connectors	
	26 GHz to 40 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.053 0.055 0.063		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				Yateley
RECEIVERS AND ANALYSERS TO CP1106 (continued)				
Amplitude Linearity Reference to a nominal 0 dBm	10 MHz to 500 MHz 0 dB to -40 dB 0 dB to -80 dB 0 dB to -90 dB 0 dB to -95 dB	0.070 dB 0.080 dB 0.12 dB 0.17 dB		
Reference Level Switching	10 MHz to 500 MHz Nominal amplitude 0 dBm	0.030 dB		
Attenuator	10.1 MHz and 50.1 MHz 0 dB to 70 dB	0.060 dB		
Tracking Generator Amplitude Accuracy	-30 dBm to +10 dBm 100 kHz to 4 GHz 4 GHz to 12 GHz 12 GHz to 18 GHz	0.11 dB 0.12 dB 0.13 dB		
Tracking Generator Attenuator Accuracy	10 MHz to 500 MHz 0 dB to 60 dB 0 dB to 90 dB 0 dB to 100 dB	0.11 dB 0.21 dB 0.32 dB		



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ELECTRICAL CALIBRATIONS IN SUPPORT OF EMC TESTING EQUIPMENT (continued)				
Pulse Accuracy and Detector Response				Yateley
Sine wave accuracy	60 dBμV 10 Hz to 1 GHz	0.14 dB		
Pulse level accuracy	20 dBμV to 70 dBμV emf	0.84 dB		
Pulse repetition Frequency	0 Hz to 1 kHz 1 kHz to 5 kHz	50 mHz 1.2 Hz		
HARMONIC CONTENT	Carrier Frequency 1 MHz to 1.2 GHz Harmonic Frequency 2 MHz to 2.4 GHz	1.5 dB	Maximum CW amplitude +15 dBm; minimum harmonic level -80 dBc	
SPURIOUS RESPONSES	CW/spurious Response Frequency 1 MHz to 2.4 GHz	1.5 dB	Maximum CW amplitude +30 dBm; minimum spurious response level -90 dBc	
CALIBRATION OF ABSORBING CLAMPS				
Clamp Factor Nominal: 14 dB to 30 dB	30 MHz to 40 MHz 40 MHz to 200 MHz 200 MHz to 700 MHz 700 MHz to 1 GHz	1.5 dB 0.90 dB 0.70 dB 0.60 dB	The uncertainties are for a procedure according to BS EN 55016-1-3:2006. The customer's output attenuator and cable are required, if not supplied uncertainties may increase	
Decoupling Factor DF Nominal: 20 dB to 60 dB	30 MHz to 100 MHz 100 MHz to 400 MHz 400 MHz to 1 GHz	0.70 dB 1.5 dB 2.0 dB		
Decoupling Factor DR Nominal: 20 dB to 60 dB	30 MHz to 200 MHz 200 MHz to 500 MHz 500 MHz to 1 GHz	0.6 dB 1.0 dB 2.0 dB		



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DC AND LF ELECTRICAL STANDARDS					
DC RESISTANCE					
Specific Values	100 $\mu\Omega$	4.0 ppm	The stated uncertainties refer to negligible power dissipation; resistors having significant power dissipation can be measured at voltages (up to 1 kV) and currents (up to 1000 A) with uncertainties in the range 10 ppm to 500 ppm	Yateley	
	1 m Ω	3.0 ppm			
	10 m Ω	0.60 ppm			
	100 m Ω	0.12 ppm			
	1 Ω	0.090 ppm			
	10 Ω	0.090 ppm			
	100 Ω	0.070 ppm			
	1 k Ω	0.090 ppm			
	10 k Ω	0.070 ppm			
	100 k Ω	0.30 ppm			
Other Values	1 M Ω	0.50 ppm	Resistors of modest dimensions suitable for oil immersion can be measured at temperatures in the range 15 °C to 25 °C. Resistors which are not oil immersible can be measured over the temperature range 20 °C to 30 °C		
	10 M Ω	0.80 ppm			
	100 M Ω	1.5 ppm			
	<i>Applied voltage 10 V</i>				
	0 Ω to 1 m Ω	6.0 n Ω			Uncertainties at high values also depend on applied voltage
	1 m Ω to 10 m Ω	6.0 ppm			
	10 m Ω to 100 m Ω	0.40 ppm			
	100 m Ω to 1 Ω	0.20 ppm			The applied voltages are 100 V for values from 100 M Ω to 100 G Ω and 500 V for higher values.
	1 Ω to 10 Ω	0.20 ppm			
	10 Ω to 100 Ω	0.20 ppm			
100 Ω to 1 k Ω	0.20 ppm				
1 k Ω to 10 k Ω	0.20 ppm				
10 k Ω to 100 k Ω	0.30 ppm				
High Resistance system	100 k Ω to 1 M Ω	0.50 ppm			
	1 M Ω to 10 M Ω	0.80 ppm			
	10 M Ω to 100 M Ω	1.50 ppm			
	100 M Ω to 1 G Ω	30 ppm			
	1 G Ω to 10 G Ω	45 ppm			
	10 G Ω to 100 G Ω	55 ppm			
	100 G Ω to 1 T Ω	100 ppm			
	1 T Ω to 10 T Ω	250 ppm			
	10 T Ω to 100 T Ω	250 ppm			



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AC RESISTANCE				Yateley
Specific Values				
Generation	1 Ω 70 Hz 1 kHz 1592 Hz 2 kHz 5 kHz	4.0 ppm 4.0 ppm 4.0 ppm 4.0 ppm 15 ppm		
	10 Ω , 25 Ω , 100 Ω , 1 k Ω and 10 k Ω 70 Hz 1 kHz 1592 Hz 2 kHz 5 kHz 10 kHz 20 kHz	4.0 ppm 4.0 ppm 4.0 ppm 4.0 ppm 10 ppm 15 ppm 30 ppm		
	100 m Ω to 10 k Ω 10 Hz	0.20 %		
Measurement	100 m Ω , 1 Ω , 10 Ω , 100 Ω , 1 k Ω and 10 k Ω 10 Hz	0.15 %		
	1 Ω , 10 Ω , 25 Ω , 100 Ω and 1 k Ω 75 Hz	5.0 ppm		
	1 Ω 1 kHz and 1.592 kHz 2 kHz and 5 kHz	25 ppm 45 ppm		
	10 Ω 1 kHz and 1.592 kHz 2 kHz, 5 kHz, 10 kHz and 20 kHz	25 ppm 30 ppm		
	25 Ω , 100 Ω and 1 k Ω 1 kHz and 1.592 kHz 2 kHz, 5 kHz, 10 kHz and 20 kHz	15 ppm 30 ppm		



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DC VOLTAGE				Yateley
Standard cell value	1.018 V nominal	0.15 ppm	The stated uncertainties can be realised with cells only if they are suitable for oil-immersion at 20 °C or have their own temperature-controlled enclosure of appropriate thermal stability. Standard cells and DC voltage standards of a moderate size can be measured over a temperature range of 15°C to 25°C and on a fully automated system	
Zener References	1.0V 10 V	0.15 ppm 0.12 ppm		
Other values	0 V to 1 mV 1.0 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 1000 V	120 nV 120 nV 130 nV 0.50 ppm 0.25 ppm 0.60 ppm		
	1 kV to 2 kV 2 kV to 10 kV	0.15 % + 100 mV 0.15 % + 600 mV	Measurement only	
DC CURRENT	0 A to 2 pA 2 pA to 20 pA 20 pA to 200 pA 200 pA to 2 nA	0.50 % + 10 fA 0.40 % + 10 fA 0.30 % + 30 fA 0.090 % + 100 fA		
	2 nA to 20 nA 20 nA to 200 nA 200 nA to 1 µA	0.080 % + 1.0 pA 0.080 % + 10 pA 8.0 ppm		
	1 µA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 100 A 100 A to 600 A	4.0 ppm 8.0 ppm 20 ppm 30 ppm 100 ppm		
DC POWER	1 W to 20 kW	The arithmetic sum of the individual uncertainties of the corresponding voltages and current measurements		



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Measured Quantity Instrument or Gauge		Range					Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)			Remarks				Location Code	
AC/DC TRANSFER VOLTAGE (Specific Values)															Yateley
AC/DC transfer difference in ppm at Specific Values, expressed as an expanded uncertainty ($k = 2$).															
Voltage	Frequency (Hz)														
	10	20	40	60	1 k	10 k	20 k	50 k	100 k	300 k	500 k	700 k	1M		
1 mV	250	230	230	230	230	230	240	230	240	280	360	530	870		
2 mV	210	180	210	150	150	160	160	140	150	190	260	390	560		
10 mV	70	68	66	67	72	69	72	69	88	140	210	310	440		
20 mV	99	47	48	45	44	48	48	54	60	120	200	300	440		
100 mV	21	26	20	22	20	20	22	26	28	46	67	91	130		
200 mV	20	22	20	19	20	21	20	22	27	46	67	92	130		
300 mV	20	21	19	19	20	19	20	21	26	37	55	72	99		
500 mV	21	19	19	21	19	20	19	19	23	32	45	58	79		
1 V	19	20	18	19	21	18	19	21	23	27	33	43	56		
2 V	21	19	19	19	19	19	19	18	22	24	28	34	43		
3 V	23	20	19	20	19	20	20	20	22	24	29	38	45		
5 V	19	20	19	19	19	19	19	19	22	24	25	30	38		
10 V	19	22	19	19	19	20	19	19	22	23	26	36	55		
20 V	20	20	19	19	19	19	18	19	23	24	27	33	46		
30 V	23	20	20	20	19	20	19	20	23						
50 V	20	21	19	19	20	20	19	19	25						
100 V	21	19	19	19	19	19	19	19	24						
200 V	21	20	20	20	19	19	20	22	34						
300 V	21	20	21	21	20	20	20	23	33						
500 V	22	22	21	22	20	21	24	34	55						
1 kV	24	21	20	20	20	21	29	38	67						



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Measured Quantity Instrument or Gauge		Range					Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)			Remarks				Location Code	
AC/DC TRANSFER VOLTAGE (Other values)															Yateley
For intermediate values the uncertainty will be the greater of the adjacent points															
AC/DC transfer difference in ppm for other values expressed as an expanded uncertainty ($k = 2$)															
Voltage	Frequency (Hz)														
	10	20	40	60	1 k	10 k	20 k	50 k	100 k	300 k	500 k	700 k	1 M		
1 mV	250	230	240	240	230	230	240	230	240	280	360	530	880		
2 mV	210	180	210	150	150	160	160	150	160	200	270	390	560		
10 mV	76	74	72	73	78	75	77	75	92	140	210	310	440		
20 mV	100	55	56	54	53	56	56	62	66	120	200	300	440		
100 mV	36	39	35	37	35	35	36	39	39	53	72	95	130		
200 mV	35	36	35	35	35	36	35	36	38	53	72	96	140		
300 mV	35	36	35	35	35	35	36	36	37	46	61	77	100		
500 mV	36	35	35	36	35	35	35	35	35	42	52	64	83		
1 V	35	35	34	34	36	34	35	36	35	38	43	51	62		
2 V	36	35	35	35	35	35	35	34	35	36	38	43	51		
3 V	37	35	35	35	35	35	35	35	35	36	39	47	52		
5 V	35	35	35	35	35	34	35	35	35	36	36	40	46		
10 V	35	36	35	35	34	35	35	35	34	35	37	44	61		
20 V	35	35	35	35	34	35	34	35	35	36	38	42	53		
30 V	37	36	35	35	35	35	35	35	35						
50 V	35	36	35	35	35	35	35	35	37						
100 V	36	35	35	35	35	35	35	35	36						
200 V	36	35	35	35	35	35	35	37	43						
300 V	36	36	36	36	35	35	35	37	43						
500 V	36	37	36	36	35	36	38	45	61						
1 kV	38	36	35	35	35	36	41	48	72						



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Measured Quantity Instrument or Gauge		Range					Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)			Remarks				Location Code
AC VOLTAGE (Specific Values)														Yateley
AC Voltage CMCs in ppm at Specific Values, expressed as an expanded uncertainty ($k = 2$)														
Voltage	Frequency (Hz)													
	10	20	40	60	1 k	10 k	20 k	50 k	100 k	300 k	500 k	700 k	1 M	
1 mV	630	620	630	630	620	620	630	630	630	650	680	790	1000	
2 mV	360	340	360	330	330	330	330	330	330	350	390	490	630	
10 mV	93	91	90	91	94	92	94	92	110	150	220	320	440	
20 mV	100	57	57	55	55	58	57	63	68	130	200	310	440	
100 mV	23	27	22	24	22	22	23	27	29	47	68	92	130	
200 mV	21	23	20	20	21	21	21	22	27	47	67	92	130	
300 mV	22	22	20	21	21	20	22	23	27	38	55	73	99	
500 mV	22	20	20	22	20	20	20	20	24	33	45	59	79	
1 V	20	21	19	19	21	19	19	22	23	28	34	44	57	
2 V	21	20	19	19	19	20	19	19	22	24	28	34	44	
3 V	23	20	20	20	19	21	20	20	23	25	29	38	45	
5 V	19	20	19	19	19	19	19	19	22	24	25	30	38	
10 V	19	22	19	19	19	20	19	19	22	23	26	36	55	
20 V	20	20	19	19	19	19	19	19	23	24	27	33	46	
30 V	23	22	21	21	20	21	20	21	24					
50 V	21	22	20	20	21	21	20	20	26					
100 V	22	19	19	19	20	19	19	19	25					
200 V	21	21	20	20	20	20	21	23	34					
300 V	22	21	22	22	20	20	21	24	34					
500 V	22	23	21	23	21	21	25	34	56					
1 kV	24	21	21	21	20	21	29	38	68					



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Measured Quantity Instrument or Gauge	Range						Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)			Remarks				Location Code
AC VOLTAGE (Other Values)														
For intermediate values the uncertainty will be the greater of the adjacent points														
AC Voltage CMCs in ppm at Specific Values, expressed as an expanded uncertainty ($k = 2$)														
Voltage	Frequency (Hz)													
	10	20	40	60	1 k	10 k	20 k	50 k	100 k	300 k	500 k	700 k	1 M	
1 mV	630	620	630	630	630	630	630	630	630	650	680	790	1100	
2 mV	360	340	360	330	330	340	330	330	330	350	390	490	630	
10 mV	97	96	94	95	99	96	98	96	110	150	220	320	440	
20 mV	110	64	64	62	62	65	64	69	73	130	200	310	440	
100 mV	37	40	36	38	36	36	37	40	40	54	73	96	140	
200 mV	36	37	36	35	36	36	36	37	38	54	72	96	140	
300 mV	36	37	35	36	36	35	36	37	38	46	61	77	100	
500 mV	36	35	35	36	35	35	35	35	36	42	52	64	83	
1 V	35	36	35	35	36	35	35	36	35	38	43	51	63	
2 V	36	35	35	35	35	35	35	35	35	36	38	43	51	
3 V	37	35	35	35	35	36	35	35	35	36	39	47	52	
5 V	35	35	35	35	35	35	35	35	35	36	36	40	47	
10 V	35	37	35	35	35	35	35	35	34	35	37	44	61	
20 V	35	35	35	35	35	35	34	35	35	36	38	42	53	
30 V	37	36	36	36	35	36	35	36	36					
50 V	36	36	35	35	36	36	35	35	37					
100 V	36	35	35	35	35	35	35	35	36					
200 V	36	36	35	35	35	35	36	37	43					
300 V	36	36	36	36	35	35	36	38	43					
500 V	37	37	36	37	36	36	38	45	62					
1 kV	38	36	36	36	35	36	41	48	73					



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Measured Quantity Instrument or Gauge	Range			Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks		Location Code	
AC VOLTAGE RATIO	0.000 000 01 to unity 400 Hz to 1 kHz			0.13 ppm of input				Yateley	
Synchro Resolver Standards	0° to 360°			2.0 second of arc					
Synchro Resolver Bridges	0° to 360°			2.0 second of arc					
Synchro Resolver simulators	0° to 360°			2.0 second of arc					
Synchro Resolver indicators	0° to 360°			2.0 second of arc					
AC/DC TRANSFER CURRENT (Specific Values)									
AC/DC transfer difference in ppm at Specific Values, expressed as an expanded uncertainty ($k = 2$).									
Current	Frequency								
	40 Hz	60 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz		
1 mA	40	38	37	39	41	61	65		
10 mA	26	27	28	26	29	54	56		
20 mA	23	23	22	23	25	52	54		
30 mA	44	45	44	45	46	65	68		
50 mA	32	31	32	32	34	57	61		
100 mA	25	26	24	26	28	54	66		
200 mA	26	26	25	28	29	57	100		
300 mA	46	46	47	46	54	76	120		
500 mA	34	35	36	35	44	69	130		
1 A	32	29	30	29	52	82	160		
2 A	32	29	29	28	66	95	170		
3 A	51	49	49	49	92	140	290		
5 A	40	38	38	37	86	130	310		
10 A	37	36	33	41	98	160	400		
15 A	38	35	36	38	110	170	380		
20 A	38	35	34	35	110	170			



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Measured Quantity Instrument or Gauge	Range			Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks		Location Code
AC/DC TRANSFER CURRENT (Other values)								
For intermediate values the uncertainty will be the greater of the adjacent points								
AC/DC transfer difference in ppm for other values expressed as an expanded uncertainty ($k = 2$)								
Current	Frequency							
	40 Hz	60 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz	
1 mA	53	51	51	52	71	131	240	
10 mA	43	44	45	43	65	130	240	
20 mA	42	42	41	42	63	130	240	
30 mA	56	57	56	57	74	130	240	
50 mA	47	47	47	47	67	130	240	
100 mA	43	43	42	44	64	130	240	
200 mA	43	43	43	44	65	130	250	
300 mA	57	58	58	58	79	140	260	
500 mA	48	49	50	49	72	140	260	
1 A	47	45	46	45	78	140	280	
2 A	47	45	45	45	88	150	290	
3 A	62	60	60	60	110	180	370	
5 A	53	51	52	51	100	180	380	
10 A	68	68	67	71	150	280	530	
15 A	69	68	68	69	160	290	520	
20 A	69	68	67	67	160	290		
AC CURRENT (Specific Values)								
AC Current CMCs in ppm at Specific Values, expressed as an expanded uncertainty ($k = 2$)								
Current	Frequency							
	40 Hz	60 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz	
1 mA	40	38	37	39	41	61	65	
10 mA	26	27	28	26	30	54	56	
20 mA	23	23	22	23	25	52	54	
30 mA	45	45	44	45	46	65	68	
50 mA	32	31	32	32	35	57	61	
100 mA	25	26	24	27	28	54	66	
200 mA	26	26	26	28	29	57	100	
300 mA	46	46	47	46	54	76	120	
500 mA	34	35	36	35	44	69	130	
1 A	32	29	31	29	52	82	160	
2 A	33	30	31	30	67	96	170	
3 A	52	49	50	50	93	140	290	
5 A	41	39	39	38	87	132	310	
10 A	38	37	35	42	99	157	400	
15 A	40	36	37	39	110	170	380	
20 A	43	41	40	41	110	170		

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Measured Quantity Instrument or Gauge	Range			Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (<i>k</i> = 2)		Remarks		Location Code
AC CURRENT (Other Values)								
For intermediate values the uncertainty will be the greater of the adjacent points								
AC Current CMCs in ppm at Specific Values, expressed as an expanded uncertainty (<i>k</i> = 2)								
Current	Frequency							
	40 Hz	60 Hz	1 kHz	10 kHz	20 kHz	50 kHz	100 kHz	Yateley
1 mA	53	51	51	52	71	131	240	
10 mA	43	44	45	43	65	130	240	
20 mA	42	42	41	42	63	130	240	
30 mA	56	57	56	57	74	130	240	
50 mA	47	47	47	47	67	130	240	
100 mA	43	43	42	44	64	130	240	
200 mA	43	43	43	44	65	130	250	
300 mA	57	58	58	58	79	140	260	
500 mA	48	49	50	49	73	140	260	
1 A	47	45	46	45	78	140	280	
2 A	48	46	46	46	88	150	290	
3 A	62	60	61	61	110	180	370	
5 A	53	52	52	52	100	180	380	
10 A	69	68	67	71	150	280	530	
15 A	70	68	68	70	160	290	520	
20 A	72	71	70	71	160	290		
AC CURRENT								
Other values		10 µA to 1 mA 40 Hz to 10 kHz.			70 ppm to 45 ppm			
		1 mA to 10 mA 40 Hz to 2 kHz.			70 ppm to 45 ppm			
		20 A to 100 A 40 Hz to 400 Hz			0.060 %			
		100 A to 500 A 40 Hz to 400 Hz			0.080 %			



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Measured Quantity Instrument or Gauge	Range			Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks	Location Code
AC POWER						Sinusoidal waveforms	Yateley
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 1.0 to 0.75 Frequency 16 Hz to 69 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	350	330	280	280	280	330	
2.1 to 5	350	330	280	280	280	330	
5.1 to 10	380	330	300	300	300	350	
10 to 21	400	380	330	330	330	380	
20.1 to 80	480	480	430	430	430	480	
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.75 to 0.5 Frequency 16 Hz to 69 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	380	350	300	300	300	350	
2.1 to 5	350	330	280	280	280	350	
5.1 to 10	400	380	330	330	330	380	
10 to 21	430	400	350	350	350	400	
20.1 to 80	500	500	450	450	450	500	
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.5 to 0.25 Frequency 16 Hz to 69 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	430	400	380	380	380	430	
2.1 to 5	430	400	380	380	380	400	
5.1 to 10	500	480	450	450	450	480	
10 to 21	500	500	450	480	480	500	
20.1 to 80	580	580	550	550	550	580	



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Measured Quantity Instrument or Gauge	Range		Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks		Location Code
AC POWER (continued)					Sinusoidal waveforms		Yateley
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 1.0 to 0.75 Frequency 69 Hz to 180 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	375	350	300	300	300	350	
2.1 to 5	350	330	280	280	280	330	
5.1 to 10	400	380	330	330	330	380	
10 to 21	425	400	350	350	350	400	
20.1 to 80	500	500	450	450	450	500	
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.75 to 0.5 Frequency 69 Hz to 180 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	400	400	350	350	350	380	
2.1 to 5	400	380	330	330	330	380	
5.1 to 10	450	430	400	400	400	430	
10 to 21	480	450	430	430	430	450	
20.1 to 80	580	550	530	530	530	550	
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.5 to 0.25 Frequency 69 Hz to 180 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336	330 to 1008	
0.1 to 2	580	550	550	550	550	580	
2.1 to 5	580	550	530	530	530	580	
5.1 to 10	700	700	630	680	680	700	
10 to 21	730	700	680	680	680	700	
20.1 to 80	830	830	800	800	800	830	



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Measured Quantity Instrument or Gauge	Range			Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code	
AC POWER (continued)					Sinusoidal waveforms	Yateley	
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 1.0 to 0.75 Frequency 180 Hz to 450 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336		330 to 1008
0.1 to 2	450	430	400	400	400		430
2.1 to 5	450	430	400	400	400		430
5.1 to 10	530	500	480	480	480		500
10 to 21	550	530	500	500	500		530
20.1 to 80	680	650	630	630	630		650
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.75 to 0.5 Frequency 180 Hz to 450 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336		330 to 1008
0.1 to 2	650	650	630	630	630		650
2.1 to 5	650	650	630	630	630		650
5.1 to 10	830	800	800	800	800		800
10 to 21	830	830	800	800	800		830
20.1 to 80	1000	1000	1000	1000	1000		1000
AC Power CMCs in ppm, expressed as an expanded uncertainty ($k = 2$) Power Factor 0.5 to 0.25 Frequency 180 Hz to 450 Hz							
Current A	Voltage (V)						
	6.4 to 16	13.2 to 33	31 to 78	67 to 168	134 to 336		330 to 1008
0.1 to 2	1300	1300	1300	1300	1300		1300
2.1 to 5	1300	1300	1300	1300	1300		1300
5.1 to 10	1700	1700	1700	1700	1700		1700
10 to 21	1700	1700	1700	1700	1700		1700
20.1 to 80	2100	2100	2100	2100	2100		2100



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DC Voltage and AC Voltage harmonics				Yateley
DC	0.7 mV to 8 V	160 ppm + 7.0 mV		
	8 V to 16.5 V	160 ppm + 13 mV		
	16.5 V to 39 V	160 ppm + 30 mV		
	39 V to 84 V	160 ppm + 60 mV		
	84 V to 168 V	160 ppm + 130 mV		
	168 V to 504 V	230 ppm + 400 mV		
AC	1.5 mV to 4.8 V	160 ppm + 1.5 mV		
	16 Hz to 450 Hz	220 ppm + 1.5 mV		
	451 Hz to 850 Hz	630 ppm + 1.5 mV		
	851 Hz to 6 kHz			
	4.8 V to 9.9 V	160 ppm + 2.5 mV		
	16 Hz to 450 Hz	220 ppm + 2.5 mV		
	451 Hz to 850 Hz	630 ppm + 2.5 mV		
	851 Hz to 6 kHz			
	9.9 V to 23 V	160 ppm + 2.5 mV		
	16 Hz to 450 Hz	220 ppm + 2.5 mV		
	451 Hz to 850 Hz	630 ppm + 2.5 mV		
	851 Hz to 6 kHz			
	23 V to 50 V	160 ppm + 5.5 mV		
	16 Hz to 450 Hz	220 ppm + 5.5 mV		
	451 Hz to 850 Hz	630 ppm + 5.5 mV		
	851 Hz to 6 kHz			
	50 V to 100 V	160 ppm + 15 mV		
	16 Hz to 450 Hz	220 ppm + 15 mV		
	451 Hz to 850 Hz	680 ppm + 15 mV		
	851 Hz to 6 kHz			
	100 V to 302 V	230 ppm + 40 mV		
	16 Hz to 450 Hz	270 ppm + 40 mV		
	451 Hz to 850 Hz	680 ppm + 40 mV		
	851 Hz to 6 kHz			



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United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Trescal Limited
Issue No: 096 Issue date: 2017

Calibration performed by the Organisation at the locations specified

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DC Current and AC Current harmonics				Yateley
DC	0 A to 125 mA	180 ppm + 90 μ A		
	125 mA to 250 mA	180 ppm + 180 μ A		
	250 mA to 500 mA	180 ppm + 350 μ A		
	500 mA to 1.0 A	180 ppm + 700 μ A		
	1 A to 2.5 A	180 ppm + 1.8 mA		
	2.5 A to 5.0 A	250 ppm + 3.5 mA		
	5 A to 10 A	280 ppm + 7.0 mA		
AC	8 μ A to 75 mA			
	16 Hz to 450 Hz	180 ppm + 8.0 μ A		
	451 Hz to 850 Hz	240 ppm + 8.0 μ A		
	851 Hz to 6 kHz	630 ppm + 8.0 μ A		
	75 mA to 150 mA			
	16 Hz to 450 Hz	180 ppm + 15 μ A		
	451 Hz to 850 Hz	240 ppm + 15 μ A		
	851 Hz to 6 kHz	630 ppm + 15 μ A		
	150 mA to 300 mA			
	16 Hz to 450 Hz	180 ppm + 30 μ A		
	451 Hz to 850 Hz	240 ppm + 30 μ A		
	851 Hz to 6 kHz	630 ppm + 30 μ A		
	300 mA to 600 mA			
	16 Hz to 450 Hz	180 ppm + 60 μ A		
	451 Hz to 850 Hz	240 ppm + 60 μ A		
	851 Hz to 6 kHz	630 ppm + 60 μ A		
	600 mA to 1.5 A			
	16 Hz to 450 Hz	180 ppm + 150 μ A		
	451 Hz to 850 Hz	240 ppm + 150 μ A		
	851 Hz to 6 kHz	625 ppm + 150 μ A		
	1.5 A to 3.0 A			
	16 Hz to 450 Hz	240 ppm + 300 μ A		
	451 Hz to 850 Hz	330 ppm + 300 μ A		
	851 Hz to 6 kHz	650 ppm + 300 μ A		
	3 A to 6 A			
	16 Hz to 450 Hz	280 ppm + 900 μ A		
	451 Hz to 850 Hz	350 ppm + 900 μ A		
	851 Hz to 6 kHz	800 ppm + 900 μ A		
	6 A to 24 A			
	16 Hz to 450 Hz	350 ppm + 3.5 mA		
	451 Hz to 850 Hz	400 ppm + 3.5 mA		
	851 Hz to 6 kHz	850 ppm + 3.5 mA		



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Harmonic values for non-sinusoidal waveforms				Yateley
50 Hz fundamental; current harmonics up to 3 kHz	RMS Values 1 A to 10 A	850 ppm		
Flicker (Pst)	Modulated 230 V 50 Hz sine wave	0.42 %		
AC Power at unity power factor	37.5 W to 6 kW 50 Hz to 60 Hz	0.050 %	Maximum voltage 300 V Maximum current 20 A	
	75 mW to 50 kW 50 Hz to 400 Hz	0.10 %	Maximum voltage 1 k V Maximum current 50 A	
Voltage:Current Phase			The results and uncertainties may be reported in terms of power factor.	
	0° to 360°		250 mA to 5 A 16 V to 1008 V	
	16 Hz to 69 Hz	0.0040°		
	70 Hz to 180 Hz	0.0070°		
	181 Hz to 450 Hz	0.020°		
	451 Hz to 850 Hz	0.040°		
	851 Hz to 3 kHz	0.20°		
	3 kHz to 6 kHz	0.35°		
	0° to 360°		5 A to 21 A 16 V to 1008 V	
	16 Hz to 69 Hz	0.0050°		
	70 Hz to 180 Hz	0.0090°		
	181 Hz to 450 Hz	0.025°		
	451 Hz to 850 Hz	0.050°		
	851 Hz to 3 kHz	0.25°		
	3 kHz to 6 kHz	0.50°		
INDUCTANCE				
Specific Values	At 1 kHz			
	1 µH	5.0 nH		
	10 µH	5.0 nH		
	100 µH	120 ppm		
	500 µH	120 ppm		
	1 mH	120 ppm		
	5 mH	120 ppm		
	10 mH	120 ppm		
	50 mH	120 ppm		
	100 mH	120 ppm		
	500 mH	120 ppm		
	1 H	120 ppm		
	5 H	120 ppm		
	10 H	120 ppm		



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INDUCTANCE (continued)				Yateley
Specific Values (continued)	<i>At nominal 50 Hz</i> 1 H 5 H 10 H <i>At 200 Hz</i> 10 H <i>At 400 Hz</i> 1 H 10 H <i>At 10 kHz</i> 1 mH 10 mH 100 mH 1 H	200 ppm 200 ppm 200 ppm 200 ppm 200 ppm 200 ppm 200 ppm 250 ppm 250 ppm 500 ppm		
Other Values	<i>At 1 kHz</i> 5 nH to 100 μH 100 μH to 100 mH 100 mH to 1 H 1.0 H to 10 H	0.030 % + 10 nH 200 ppm 200 ppm 200 ppm		
CAPACITANCE				
This facility is mainly for the measurement of 2-Terminal, 3-Terminal or 4-Terminal capacitance standards. 2-terminal capacitance standards usually incur larger uncertainties than 3-terminal or 4-terminal capacitors. A number of known reference capacitors are also available, mainly decade values from 0.001 pF to 1 μF, for calibration of bridges and capacitance meters				
Specific Values	<i>At 1 kHz:</i> 0.001 pF 0.01 pF 0.1 pF 1 pF 10 pF 100 pF 1000 pF 10 nF 100 nF 1 μF	0. 005 fF 0. 005 fF 0. 005 fF 0.005 pF 5.0 ppm 1.5 ppm 1.5 ppm 5.0 ppm 30 ppm 40 ppm		
Other Values	<i>At 1 kHz:</i> 0.01 fF to 0.01 pF 0.01 pF to 0.1 pF 0.1 pF to 1 pF	0. 010 fF 0. 010 fF 0. 010 fF		



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CAPACITANCE (continued)	<p><i>At 1 kHz:</i> 1 pF to 10 pF 10 pF to 100 pF 100 pF to 1000 pF 1 nF to 10 nF 10 nF to 100 nF 100 nF to 1000 nF 1 μF to 10 μF</p> <p><i>From 10 Hz to 10 kHz:</i> 1 pF to 1 nF 1 nF to 1 μF</p> <p><i>At 100 Hz:</i> 1 nF to 1 μF 1 μF to 100 μF 100 μF to 10 mF</p> <p>1 nF 100 kHz 200 kHz to 1 MHz</p>	<p>10 ppm 10 ppm 10 ppm 50 ppm 50 ppm 100 ppm 0.060 %</p> <p>22 ppm 100 ppm</p> <p>0.020 % 0.35 % 0.40 %</p> <p>300 ppm 700 ppm</p>		Yateley
CAPACITANCE LOSS (Dissipation factor, $\tan \delta$)	<p>10^{-4} to 1 50 Hz to 10 kHz</p>	<p>0.50×10^{-4}</p>	Uncertainty range stated is for capacitance values ≤ 100 nF at 1 kHz	
PHASE ANGLE				
Generation	<p>0° to 360° 10 Hz to 1 kHz 1 kHz to 6.25 kHz 6.26 kHz to 50 kHz 50 kHz to 100 kHz</p>	<p>($0.010 + 0.000050R$)° ($0.010 + 0.00010R$)° ($0.025 + 0.00025 R$)° ($0.050 + 0.00050 R$)°</p>	R is the ratio between the output voltages and may have any value between 1 and 100	
Measurement	<p>0° to 360° 10 Hz to 30 Hz 30 Hz to 6 kHz 6 kHz to 30 kHz 30 kHz to 50 kHz 50 kHz to 100 kHz</p>	<p>0.050° 0.025° 0.040° 0.050° 0.15°</p>		
AC VOLTAGE Other values	<p>40 Hz to 200 Hz 1 kV to 1.9 kV 1.9 kV to 7 kV</p>	<p>1.8 % + 500 mV 1.8 % + 5.0 V</p>	Measurement only	



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AC VOLTAGE (Wideband to 30 MHz) Generation	10 μ V to 1.1 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 1.1 mV to 3 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz Generation 3 mV to 11 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 11 mV to 33 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 33 mV to 110 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 110 mV to 330 mV 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz 330 mV to 1.1 V 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz	0.85 % + 1.6 μ V 0.70 % + 1.6 μ V 0.80 % + 4.0 μ V 0.95 % + 4.0 μ V 1.1 % + 4.0 μ V 1.8 % + 14 μ V 0.80 % + 2.5 μ V 0.65 % + 2.4 μ V 0.65 % + 5.2 μ V 0.80 % + 5.0 μ V 0.95 % + 5.0 μ V 1.7 % + 5.0 μ V 0.80 % + 6.5 μ V 0.65 % + 6.5 μ V 0.65 % + 8.5 μ V 0.80 % + 8.5 μ V 0.95 % + 8.5 μ V 1.7 % + 8.5 μ V 0.7 % + 13 μ V 0.55 % + 13 μ V 0.55 % + 15 μ V 0.65 % + 15 μ V 0.80 % + 15 μ V 1.3 % + 15 μ V 0.70 % + 31 μ V 0.55 % + 31 μ V 0.55 % + 35 μ V 0.65 % + 35 μ V 0.80 % + 35 μ V 1.3 % + 35 μ V 0.62 % + 80 μ V 0.50 % + 80 μ V 0.50 % + 80 μ V 0.55 % + 80 μ V 0.70 % + 80 μ V 1.2 % + 80 μ V 0.65 % + 310 μ V 0.50 % + 310 μ V 0.50 % + 310 μ V 0.55 % + 310 μ V 0.70 % + 310 μ V 1.2 % + 310 μ V		Yateley



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AC VOLTAGE (Wideband to 30 MHz) Generation (continued)	1.1 V to 3.5 V 10 Hz to 30 Hz 30 Hz to 120 Hz 120 Hz to 2 MHz 2 MHz to 10 MHz 10 MHz to 20 MHz 20 MHz to 30 MHz	0.55 % + 400 μ V 0.40 % + 400 μ V 0.40 % + 400 μ V 0.50 % + 400 μ V 0.65 % + 400 μ V 1.1 % + 400 μ V		Yateley	
RF AND MICROWAVE ELECTRICAL MEASUREMENTS					
FREQUENCY Specific Values	100 kHz, 1 MHz, 5 MHz and 10 MHz	1.0 in 10^{12}	1000 s minimum measuring period	Yateley	
Other Values	5 Hz to 50 Hz 50 Hz to 500 Hz 500 Hz to 5 kHz 5 kHz to 50 kHz 50 kHz to 500 kHz 500 kHz to 99 GHz 99 GHz to 110 GHz 500 MHz to 1.5 GHz 1.5 GHz to 50 GHz 1 GHz to 18 GHz	2.0 in 10^8 2.0 in 10^9 2.1 in 10^{10} 1.9 in 10^{11} 1.0 in 10^{11} 4.0 in 10^{12} 4.0 in 10^{11} 1.5 in 10^{11} to 8.3 in 10^{12} 1.1 in 10^{10} 1 in 10^{12}	For the calibration of signal sources and frequency meters/ counters Measurement only above 50 GHz For frequency generation		
RF AND MICROWAVE MEASUREMENTS: Standards					
VSWR	1.0 to 1.05 250 MHz to 8.25 GHz in 250 MHz steps 1.0 to 1.5 500 MHz to 8.25 GHz 1.5 to 10 500 MHz to 8.25 GHz 1.0 to 1.5 1.8 GHz to 18 GHz 1.5 to 10 1.8 GHz to 18 GHz 1.0 to 1.2 2 GHz to 18 GHz 2 GHz to 18 GHz 2 GHz to 26.5 GHz	0.0030 to 0.0050 0.0090 to 0.019 0.012 to 0.21 0.017 to 0.020 0.018 to 0.20 (0.0080 + 0.00080 f_{GHz}) (0.0080 + 0.0010 f_{GHz}) (0.016 + 0.0015 f_{GHz})	14 mm GPC. Other connectors invoke slightly larger uncertainties 14mm GPC. Other connectors invoke slightly larger uncertainties 14mm GPC. Other connectors invoke slightly larger uncertainties APC-7 connector APC-7 connectors APC 7 connectors Precision Type N APC 3.5 (uncertainty may increase for other 3.5 mm versions)		



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DIRECTIVITY (of VSWR bridges)	20 dB to 56 dB <i>2 GHz to 18 GHz</i>	$(0.0040 + 0.00040 f_{GHz})$	APC 7 connectors	Yateley
	<i>2 GHz to 18 GHz</i>	$(0.0040 + 0.0035 f_{GHz})$	Precision Type N	
	<i>2 GHz to 26.5 GHz</i>	$(0.0080 + 0.00080 f_{GHz})$	APC 3.5 (uncertainty may increase for other 3.5 mm versions)	
VSWR (waveguide)	1.0 to 1.05 <i>2.6 GHz, 2.8 GHz, 3.0 GHz, 3.2 GHz, 3.4 GHz, 3.6 GHz, 3.8 GHz and 3.95 GHz</i>	0.0030 to 0.0040	Waveguide No 10 (WR 284, RG 48/U)	
	1.0 to 1.5 <i>2.6 GHz to 3.95 GHz</i>	0.0080 to 0.020		
	1.5 to 10 <i>2.6 GHz to 3.95 GHz</i>	0.020 to 0.20		
	1.0 to 1.05 <i>3.95 GHz, 4.0 GHz, 4.5 GHz, 5.0 GHz, 5.5 GHz and 5.9 GHz</i>	0.0030 to 0.0040	Waveguide No 12 (WR 187, RG 49/U) fitted with circular clamped flanges	
	1.05 to 1.5 <i>3.9 GHz to 5.9 GHz</i>	0.0080 to 0.20		
	1.5 to 10 <i>3.95 GHz to 5.85 GHz</i>	0.011 to 0.20		
	1.0 to 1.05 <i>6.2 GHz, 6.8 GHz, 7.5 GHz and 8.0 GHz</i>	0.0030	Waveguide No 14 (WR 137, RG 50/U)	
	1.0 to 1.5 <i>5.85 GHz to 8.2 GHz</i>	0.0080 to 0.020		
	1.5 to 10 <i>5.85 GHz to 8.2 GHz</i>	0.011 to 0.20		
	1.0 to 1.05 <i>7.5 GHz, 8.5 GHz and 9.5 GHz</i>	0.004 to 0.006	Waveguide No 15 (WR 112, RG 51/U, R 84)	
	1.05 to 1.5 <i>7 GHz to 10 GHz</i>	0.012 to 0.020		
	<i>1.5 to 10 7 GHz to 10 GHz</i>	0.014 to 0.20		



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VSWR (waveguide) (continued)	1.0 to 1.05 8.25 GHz, 8.50 GHz, 9.30 GHz, 10.0 GHz, 10.5 GHz, 11.0 GHz, 11.5 GHz, 12.0 GHz and 12.4 GHz	0.0040 to 0.0060	Waveguide No 16 (WR 90, RG 52/U) fitted with square bolted flanges or circular clamped flanges.	Yateley
	1.0 to 1.5 8.2 GHz to 12.5 GHz	0.016 to 0.020	Waveguide No 16 (WR 90, RG 52/U)	
	1.5 to 10 8.2 GHz to 12.5 GHz	0.017 to 0.020		
	1.0 to 1.05 12.5 GHz, 14.5 GHz, 15.5 GHz, 16.5 GHz and 17.5 GHz	0.0040		
	1.0 to 1.5 11.9 GHz to 18 GHz	0.016 to 0.020	Waveguide No 18 (WR 62, RG 91/U)	
	1.5 to 10 11.9 GHz to 18 GHz	0.017 to 0.020		



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VSWR (of precision airlines)	1.0 to 1.05 2 GHz to 18 GHz*	$(0.0060 + 0.00030 f_{\text{GHz}})$	APC 7 connectors	Yateley
	2 GHz to 18 GHz*	$(0.0060 + 0.00030 f_{\text{GHz}})$	Precision Type N	
	2 GHz to 26 GHz*	$(0.0080 + 0.00080 f_{\text{GHz}})$	APC 3.5 (Uncertainty may increase for other 3.5 mm versions).	
	*in steps of 1 GHz			
VOLTAGE REFLECTION COEFFICIENT				
Modulus	0.82 to 0.997 500 MHz to 8.25 GHz	0.0060	14 mm 50 Ω GPC	
	0.82 to 0.99 1.8 GHz to 18 GHz	0.023	7 mm coaxial line	
	0.82 to 0.997 2.6 GHz to 3.95 GHz	0.0025	Waveguide No 10 (WR 284, RG 48/U)	
	0.82 to 0.998 3.95 GHz to 5.85 GHz	0.0015	Waveguide No 12 (WR 187, RG 49/U)	
	0.82 to 0.998 5.38 GHz to 8.2 GHz	0.0015	Waveguide No 14 (WR 137, RG 50/U)	
	0.82 to 0.995 8.2 GHz to 12.4 GHz	0.0050	Waveguide No 16 (WR 90, RG 52/U)	
	0.82 to 0.998 12.4 GHz to 18 GHz	0.0015 to 0.0060	Waveguide No 18 (WR 62, RG 91/U)	
	0.82 to 0.998 26.5 GHz to 40 GHz	0.0050	Waveguide No 22 (WR 28, RG 96/U)	
Magnitude	0 to 1.0 50 GHz to 75 GHz 75 GHz to 110 GHz	0.018 0.024	Waveguide No 25 Waveguide No 27	
Phase	-180° to +180° 50 GHz to 75 GHz	$180 \left(\frac{\text{Unc } \Gamma }{\pi \Gamma } \right)^\circ$	Waveguide No 25	
	75 GHz to 110 GHz	$180 \left(\frac{\text{Unc } \Gamma }{\pi \Gamma } \right)^\circ$	Waveguide No 27	



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RF ATTENUATION	<p>100 kHz to 3 GHz 0 dB to 20 dB 20 dB to 50 dB 50 dB to 90 dB 90 dB to 100 dB 100 dB to 110 dB 110 dB to 120 dB</p> <p>3 GHz to 18 GHz 0 dB to 20 dB 20 dB to 50 dB 50 dB to 90 dB 90 dB to 100 dB 100 dB to 110 dB</p> <p>18 GHz to 26.5 GHz 0 dB to 50 dB 20 dB to 50 dB 50 dB to 90 dB 90 dB to 100 dB</p> <p>26.5 GHz to 40 GHz (waveguide) 0 dB to 50 dB 20 dB to 50 dB 50 dB to 90 dB 90 dB to 100 dB</p>	<p>0.002 dB to 0.005 dB 0.005 dB to 0.015 dB 0.010 dB to 0.015 dB 0.014 dB to 0.020 dB 0.015 dB to 0.020 dB 0.020 dB to 0.040 dB</p> <p>0.002 dB to 0.006 dB 0.005 dB to 0.016 dB 0.010 dB to 0.016 dB 0.014 dB to 0.023 dB 0.015 dB to 0.058 dB</p> <p>0.012 dB to 0.025 dB 0.013 dB to 0.025 dB 0.020 dB to 0.028 dB 0.025 dB to 0.033 dB</p> <p>0.011 dB to 0.036 dB 0.012 dB to 0.036 dB 0.019 dB to 0.054 dB 0.033 dB to 0.109 dB</p>	The uncertainties are for incremental attenuation using VM7 system	Yateley
RF VOLTAGE	<p>100 kHz to 1 MHz: 50 μV to 200 mV 200 mV to 3 V</p> <p>1 MHz to 10 MHz: 50 μV to 200 mV 200 mV to 3 V</p> <p>10 MHz to 50 MHz: 50 μV to 200 mV 200 mV to 3 V</p> <p>50 MHz to 100 MHz: 50 μV to 200 mV 200 mV to 3 V</p> <p>100 MHz to 200 MHz: 50 μV to 200 mV 200 mV to 3 V</p> <p>200 MHz to 1000 MHz: 50 μV to 200 mV 200 mV to 3 V</p>	<p>0.60 % 0.060 %</p> <p>0.60 % 0.070 %</p> <p>0.62 % 0.15 %</p> <p>0.62 % 0.15 %</p> <p>0.62 % 0.24 %</p> <p>0.63 % 0.25 %</p>	Supplies above 3 V are not necessarily available over the full frequency range	



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Calibration of thermal voltage converters (TVCs)												Yateley
Frequency MHz	CMCs stated as % of input for the following TVC nominal ratings <i>TVCs are normally calibrated at 90 % to 95 % of their nominal voltage rating, to a maximum of 50 V</i>											
	0.5 V	1 V	2 V	3 V	5 V	10 V	20 V	30 V	50 V	60 V	100 V	
0.1 to 1	0.057	0.057	0.057	0.057	0.061	0.064	0.064	0.067	0.067	0.070	0.070	
	0.064	0.064	0.064	0.064	0.076	0.079	0.079	0.082	0.082	0.085	0.085	
1 to 10	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16	
10 to 50	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17	0.17	0.17	
50 to 100	0.16	0.16	0.16	0.16	0.26	0.28	0.28	0.29	0.29	0.31	0.31	
100 to 200	0.21	0.21	0.21	0.21	0.43	0.45	0.45	0.48	0.48	0.50	0.50	
RFCalibration Factor (coaxial line)		10 μW to 100 μW 100 kHz to 5 GHz 5 GHz to 8 GHz					0.60% to 1.0 % 1.0 % to 1.3 %		For the calibration of 50 Ω coaxial power sensors			
		100 μW to 10 mW 100 kHz to 500 MHz 500 MHz to 2 GHz 2 GHz to 5 GHz 5 GHz to 7 GHz 7 GHz to 8 GHz					0.42 % 0.52 % to 0.63 % 0.63 % to 0.73 % 0.75 % 0.78 %					
		1 mW to 10 mW 8.2 GHz to 12.4 GHz 12.4 GHz to 18 GHz 18.0 GHz to 26.5 GHz 26.5 GHz to 40 GHz					0.98 % 0.98 % 1.5 % 2.4 %					
(Waveguide)		1 mW to 10 mW 2.6 GHz to 3.95 GHz					1.1 %		Waveguide No 10 (WR 284, RG 48/U, R32)			
		3.95 GHz to 5.85 GHz					1.1 %		Waveguide No 12 (WR 187, RG 49/U, R48)			
		5.85 GHz to 8.2 GHz					1.1 %		Waveguide No 14 (WR 137, RG 50/U, R70)			
		8.2 GHz to 12.4 GHz					0.88 %		Waveguide No 16 (WR 90, RG 52/U, R100)			
		12.4 GHz to 18.0 GHz					0.88 %		Waveguide No 18 (WR 62, RG 91/U, R140)			
		10 mW to 10 W 2.6 GHz to 18 GHz					1.1 % to 1.5 %		Waveguide sizes 10 to 18.			



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RF POWER (continued) (Waveguide)	1 mW to 1 W 18.0 GHz to 26.5 GHz 26.5 GHz to 40.0 GHz	1.3 % 1.5 %	Waveguide No 20 (WR 42, RG 53/U, R220) Waveguide No 22 (WR 28, RG 96/U, R320)	Yateley
	10 µW 3.95 GHz to 5.85 GHz 5.85 GHz to 8.2 GHz 8.2 GHz to 12.4 GHz 12.4 GHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz	1.3 % 1.3 % 1.3 % 1.4 % 2.0 % 2.5 %	Waveguide No 12 Waveguide No 14 Waveguide No 16 Waveguide No 18 Waveguide No 20 Waveguide No 22	
Calibration Factor 75 Ω sensors	100 kHz to 200 kHz 200 kHz to 1 MHz 1 MHz to 50 MHz 50 MHz to 100 MHz 100 MHz to 500 MHz 500 MHz to 1 GHz 1 GHz to 2 GHz 2 GHz to 3 GHz	1.3 % 0.81 % 0.81 % 0.81 % 0.93 % 0.92 % 1.4 % 1.6 %	Nominal level 0 dBm to 10 dBm	
RF POWER (millimetric system)				
Effective Efficiency and Calibration Factor	1 mW to 10 mW 60 GHz, 62 GHz and 64 GHz 75 GHz, 77 GHz, 80 GHz, 83 GHz, 85 GHz, 87 GHz, 90 GHz, 92 GHz, 94 GHz, 97 GHz, 100 GHz, 103 GHz, 108 GHz and 110 GHz	2.1 % (effective efficiency) 2.2 % (calibration factor) 3.7 % (effective efficiency) 3.8 % (calibration factor)		
DC POWER	1 mW to 10 W	0.050 %	In support of RF power measurements	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks	Location Code
NOISE TEMPERATURE Excess Noise Ratio (ENR) of a noise source over that of a source at 290 K	13 dB to 17 dB 10 MHz 30 MHz 50 MHz 100 MHz 300 MHz 500 MHz 1.0 GHz 1.5 GHz 2.0 GHz 3.0 GHz 4.0 GHz 5.0 GHz 6.0 GHz 7.0 GHz 8.0 GHz 9.0 GHz 10.0 GHz 11.0 GHz 12.0 GHz 13.0 GHz 14.0 GHz 15.0 GHz 16.0 GHz 17.0 GHz 18.0 GHz 19.0 GHz 20.0 GHz 21.0 GHz 22.0 GHz 23.0 GHz 24.0 GHz 25.0 GHz 26.0 GHz 26.5 GHz			APC7, Type N and APC3.5 connectors. Other connectors (including those to waveguide systems) can be accommodated but with increased uncertainty. ENR values larger or smaller can be accommodated but with increased uncertainty The uncertainty applies to the measurement of a noise source with a source VRC not greater than 0.02, the uncertainty may increase for noise sources of higher VRC.	Yateley
		APC7 and Type N	APC3.5		
		0.090 dB	0.090 dB		
		0.13 dB	0.13 dB		
		0.090 dB	0.090 dB		
		0.090 dB	0.090 dB		
		0.080 dB	0.080 dB		
		0.080 dB	0.080 dB		
		0.080 dB	0.080 dB		
		0.080 dB	0.080 dB		
		0.090 dB	0.080 dB		
		0.090 dB	0.090 dB		
		0.080 dB	0.080 dB		
		0.11 dB	0.11 dB		
		0.090 dB	0.090 dB		
		0.090 dB	0.090 dB		
		0.090 dB	0.090 dB		
		0.080 dB	0.080 dB		
		0.10 dB	0.10 dB		
		0.080 dB	0.080 dB		
		0.12 dB	0.12 dB		
		0.10 dB	0.10 dB		
		0.13 dB	0.12 dB		
		0.10 dB	0.10 dB		
		0.11 dB	0.11 dB		
		0.10 dB	0.10 dB		
		0.14 dB	0.10 dB		
			0.12 dB		
			0.12 dB		
			0.12 dB		
			0.12 dB		
			0.12 dB		
			0.12 dB		
			0.12 dB		
			0.14 dB		



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RF Communications area				
WATTMETER CALIBRATION SYSTEM	3 MHz to 25 MHz <i>1 W to 1000 W</i>	3.5 %		Yateley
	50 MHz to 60 MHz <i>0.1 W to 100 W</i>	3.5 %		
	70 MHz to 1000 MHz <i>0.1 W to 100 W</i>	3.0 %		
FREQUENCY MODULATION	FM deviation 50 Hz to 1 MHz	0.50 %	For carrier frequencies between 50 kHz and 1 GHz and modulation frequencies between 50 Hz and 200 kHz.	
	FM deviation 50 Hz to 1 MHz	1.0 %	For carrier frequencies between 1 GHz and 18 GHz and modulation frequencies between 50 Hz and 200 kHz.	
AMPLITUDE MODULATION	Modulation index 0.01 to 0.15 0.15 to 0.50 0.50 to 0.995	3.0 % 1.0 % 0.5 %	For carrier frequencies between 10 kHz and 1250 MHz and modulation frequencies between 50 Hz and 1 MHz.	
CALIBRATION OF SIGNAL SOURCES			System input VSWR < 1.09:1 up to 1.5 GHz and < 1.2:1 from 1.5 GHz to 18 GHz.	
RF POWER	3.16 μ W to 100 mW <i>100 kHz to 300 kHz</i> <i>300 kHz to 1 MHz</i> <i>1 MHz to 2 GHz</i> <i>2 GHz to 18 GHz</i>	0.27 dB 0.17 dB 0.13 dB 0.27 dB	For 50 Ω Type N connectors. If other types are used the uncertainty may be increased.	
FREQUENCY	0.01 Hz to 10 Hz 10 Hz to 10 MHz 10 MHz to 100 MHz 100 MHz to 1 GHz 1 GHz to 26.5 GHz	1.0 in $10^8 + 10 \mu$ Hz 1.0 Hz 1.0 in $10^9 + 15 \mu$ Hz 10 mHz 100 mHz	Frequency measurement and generation capability.	
	100 kHz to 1 MHz 1 MHz to 10 MHz At 10 MHz	5.0 in 10^9 5.0 in 10^{10} 5.0 in 10^{11}	Frequency measurement capability only.	



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RF ATTENUATION	2.5 MHz to 1.3 GHz: 6 dBm to ≥ -34 dBm 6 dBm to (< -34 dBm, ≥ -54 dBm) 6 dBm to (< -54 dBm, ≥ -104 dBm) 6 dBm to (< -104 dBm, ≥ -120 dBm)	0.060 dB 0.080 dB 0.12 dB 0.15 dB		Yateley
AMPLITUDE MODULATION				
Modulation index	0.001 to 0.95	5.0 %	For carrier frequencies between 1 MHz and 1 GHz and modulation frequencies between 50 Hz and 20 kHz	
FREQUENCY MODULATION				
Frequency deviation	50 Hz to 400 kHz	2.0 %	For carrier frequencies between 1 MHz and 1 GHz and modulation frequencies between 50 Hz and 20 kHz	
AC VOLTAGE	0.1 V to 30 V 50 Hz to 20 kHz	0.20 %		
SINAD (Signal to Noise And Distortion)	Fundamentals in the range of 100 Hz to 100 kHz up to 7 V RMS	2.2 % or 0.19 dB		



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AUTOMATIC NETWORK ANALYSER SYSTEMS							
VOLTAGE TRANSMISSION COEFFICIENT MAGNITUDE							
The uncertainties are for 50Ω Systems fitted with GR900, Type N, TNC, 7 mm, 3.5 mm, SMA, 2.92 mm, Type K or 2.4 mm connectors over their appropriate frequency range. The uncertainties apply to devices with input and output VRC not exceeding 0.01, the uncertainty quoted on certificates may be increased for devices with larger input or output matches. The CMCs below for the 8753 and 8510 ANAs represent the minimum and maximum values obtained from two separate systems in each case.							
8751 ANA	0dB to 25dB	25dB to 45dB	45dB to 65dB	65dB to 85dB	85dB to 100dB		
0.1 to 0.3 MHz	0.024 to 0.041	0.041 to 0.064	0.064 to 0.11	0.11 to 0.69	0.57 to 3.38		
0.3 to 50 MHz	0.024 to 0.041	0.041 to 0.064	0.064 to 0.11	0.11 to 0.79	0.57 to 3.36		
50 to 500 MHz	0.024 to 0.041	0.041 to 0.064	0.064 to 0.11	0.11 to 0.79	0.57 to 3.36		
8753 ANA	0dB to 25dB	25dB to 45dB	45dB to 65dB	65dB to 85dB	85dB to 100dB		
0.3 to 1 GHz	0.024 to 0.025	0.025 to 0.028	0.027 to 0.110	0.064 to 0.60	0.56 to 2.96		
1 to 2 GHz	0.024 to 0.027	0.025 to 0.030	0.027 to 0.122	0.065 to 0.63	0.57 to 2.99		
2 to 3 GHz	0.024 to 0.029	0.026 to 0.031	0.029 to 0.201	0.068 to 0.66	0.57 to 3.27		
8510 ANA	0dB to 25dB	25dB to 45dB	45dB to 65dB	65dB to 85dB	85dB to 90dB		
0.05 to 2 GHz	0.024 to 0.028	0.027 to 0.035	0.035 to 0.075	0.057 to 0.59	0.37 to 1.06		
2 to 10 GHz	0.024 to 0.028	0.028 to 0.037	0.035 to 0.110	0.070 to 0.98	0.50 to 1.68		
10 to 18 GHz	0.036 to 0.040	0.038 to 0.046	0.045 to 0.122	0.120 to 1.07	0.87 to 1.84		
18 to 20 GHz	0.037 to 0.040	0.039 to 0.049	0.046 to 0.201	0.130 to 1.50	1.09 to 2.75		
20 to 26.5 GHz	0.038 to 0.041	0.040 to 0.059	0.055 to 0.360	0.330 to 3.00	2.84 to 5.01		
26.5 to 40 GHz	0.049 to 0.057	0.051 to 0.085	0.068 to 0.490	0.410 to 4.34	3.43 to 7.32		
Transmission Phase (-180° to +180°)	0.1 MHz to 8 GHz 0 dB to 50 dB		0.50°	For coaxial 50Ω systems fitted with: GR900 connectors			
	0.1 MHz to 18 GHz 0 dB to 50 dB		0.50°	7 mm connectors			
	0.1 MHz to 18 GHz 20 dB to 20 dB 20 dB to 50 dB		0.50° 1.0°	Type N connectors			
	8 GHz to 18 GHz 20 dB to 50 dB		2.0°				
	0.1 MHz to 26.5 GHz 0 dB to 20 dB		0.50°	3.5 mm connectors			
	0.1 MHz to 8 GHz 20 dB to 40 dB 40 dB to 50 dB		0.50° 1.0°				
	8 GHz to 26.5 GHz 40 dB to 50 dB		2.0°				



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AUTOMATIC NETWORK ANALYSER SYSTEMS (continued)						
Transmission Phase (-180° to +180°) (continued)	0.1 MHz to 40 GHz <i>0 dB to 20 dB</i> <i>20 dB to 40 dB</i> <i>40 dB to 50 dB</i>	1.0° 2.0° 10°	For coaxial 50Ω systems fitted with: 2.92 mm, Type K and 2.4 mm connectors	Yateley		
VOLTAGE REFLECTION COEFFICIENT (Real, imaginary and magnitude) The uncertainties are for one port devices and may be higher for multi-port devices. 50Ω connectors other than those specified below can be measured but the uncertainties may be increased. The CMCs below represent the maximum and minimum values obtained from both S_{12} and S_{21} measurements and in the case of the 8753 and 8510 ANAs from two separate systems in each case. The ranges and CMCs are shown in VRC terms.						
8751 ANA	For 50 Ω coaxial systems fitted with GR900 (14 mm) or 7 mm connectors.					
0.1 to 500 MHz	0 to 0.2	0.2 to 0.4	0.4 to 0.6		0.6 to 0.8	0.8 to 1.0
	0.005	0.006	0.006 to 0.008		0.008 to 0.012	0.012 to 0.016
8751 ANA	For 50 Ω coaxial systems fitted with Type N, 3.5 mm, 2.92 mm or 2.4 mm connectors					
0.1 to 500 MHz	0 to 0.2	0.2 to 0.4	0.4 to 0.6		0.6 to 0.8	0.8 to 1.0
	0.007	0.007 to 0.009	0.009 to 0.012		0.012 to 0.019	0.019 to 0.027
8753 ANA	For 50 Ω coaxial systems fitted with GR900 (14 mm) connectors					
0.3 to 500 MHz 0.5 to 1.5 GHz 1.5 to 2.0 GHz 2.0 to 3.0 GHz	0 to 0.2	0.2 to 0.4	0.4 to 0.6		0.6 to 0.8	0.8 to 1.0
	0.005 to 0.006	0.006	0.006 to 0.007		0.006 to 0.008	0.006 to 0.010
	0.004 to 0.010	0.005 to 0.010	0.006 to 0.010		0.006 to 0.015	0.006 to 0.022
	0.006 to 0.010	0.006 to 0.010	0.007 to 0.013		0.008 to 0.019	0.011 to 0.029
	0.006 to 0.011	0.006 to 0.011	0.007 to 0.015		0.008 to 0.024	0.011 to 0.036
8753 ANA	For 50Ω coaxial systems fitted with 7 mm and Type N connectors					
0.3 to 3.0 GHz	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0	
	0.005 to 0.007	0.006 to 0.008	0.006 to 0.009	0.006 to 0.010	0.008 to 0.012	



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AUTOMATIC NETWORK ANALYSER SYSTEMS (continued)							
VOLTAGE REFLECTION COEFFICIENT (continued) (Real, imaginary and magnitude)							
8753 ANA	For 50 Ω coaxial systems fitted with 3.5 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0	Yateley	
0.3 to 400 MHz	0.007	0.007 to 0.008	0.008 to 0.009	0.009 to 0.011	0.011 to 0.013		
0.4 to 2.6 GHz	0.007 to 0.008	0.007 to 0.008	0.008 to 0.009	0.008 to 0.011	0.010 to 0.013		
2.6 to 3.0 GHz	0.008	0.008	0.008 to 0.009	0.008 to 0.010	0.010 to 0.013		
8753 ANA	For 50 Ω coaxial systems fitted with 2.92 mm and 2.4 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.3 to 3000 MHz	0.014 to 0.015	0.015	0.015 to 0.018	0.017 to 0.021	0.021 to 0.027		
8510 ANA	For 50 Ω coaxial systems fitted with GR900 (14 mm) connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 0.5 GHz	0.007	0.007	0.007	0.007 to 0.008	0.008 to 0.009		
0.5 to 2 GHz	0.007 to 0.013	0.007 to 0.011	0.007 to 0.017	0.007 to 0.028	0.008 to 0.043		
2 to 5.5 GHz	0.009 to 0.024	0.009 to 0.021	0.008 to 0.037	0.008 to 0.064	0.008 to 0.100		
5.5 to 8 GHz	0.015 to 0.024	0.015 to 0.024	0.016 to 0.039	0.016 to 0.064	0.020 to 0.100		
8510 ANA	For 50 Ω coaxial systems fitted with 7 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 0.5 GHz	0.007	0.007	0.007	0.007 to 0.008	0.008 to 0.010		
0.5 to 2.5 GHz	0.005 to 0.008	0.005 to 0.007	0.005 to 0.007	0.005 to 0.010	0.006 to 0.015		
2.5 to 4 GHz	0.006 to 0.007	0.005 to 0.006	0.005 to 0.006	0.005 to 0.010	0.006 to 0.015		
4 to 8 GHz	0.005 to 0.009	0.005 to 0.006	0.005 to 0.006	0.005 to 0.014	0.007 to 0.022		
8 to 10.5 GHz	0.006 to 0.010	0.006 to 0.007	0.006 to 0.008	0.007 to 0.024	0.007 to 0.037		
10.5 to 14.5 GHz	0.008 to 0.013	0.007 to 0.008	0.008	0.010 to 0.028	0.014 to 0.043		
14.5 to 18 GHz	0.008 to 0.013	0.008	0.008	0.010 to 0.037	0.014 to 0.057		



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AUTOMATIC NETWORK ANALYSER SYSTEMS (continued)							
VOLTAGE REFLECTION COEFFICIENT (continued) (Real, imaginary and magnitude)							
8510 ANA	For 50 Ω coaxial systems fitted with Type N connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 0.1 GHz	0.007	0.007	0.007	0.006 to 0.009	0.007 to 0.011		
0.1 to 3.0 GHz	0.005 to 0.007	0.005 to 0.007	0.005 to 0.008	0.005 to 0.009	0.006 to 0.011		
3.0 to 8.5 GHz	0.006 to 0.010	0.005 to 0.010	0.005 to 0.009	0.005 to 0.011	0.006 to 0.015		
8.5 to 11.5 GHz	0.007 to 0.010	0.007 to 0.010	0.007 to 0.010	0.007 to 0.015	0.007 to 0.022		
11.5 to 15.5 GHz	0.009 to 0.014	0.008 to 0.014	0.008 to 0.016	0.008 to 0.024	0.010 to 0.036		
15.5 to 18.0 GHz	0.009 to 0.014	0.009 to 0.014	0.009 to 0.016	0.010 to 0.024	0.014 to 0.036		
8510 ANA	For 50 Ω coaxial systems fitted with 3.5 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 0.5 GHz	0.007	0.007	0.007	0.007 to 0.008	0.008 to 0.009		
0.5 to 2.5 GHz	0.007 to 0.009	0.007 to 0.009	0.007 to 0.008	0.007 to 0.008	0.007 to 0.009		
2.5 to 4.5 GHz	0.009 to 0.010	0.008 to 0.010	0.007 to 0.009	0.007 to 0.008	0.007 to 0.010		
4.5 to 7.0 GHz	0.008 to 0.010	0.008 to 0.009	0.007 to 0.009	0.006 to 0.008	0.007 to 0.010		
7.0 to 8.0 GHz	0.009 to 0.011	0.008 to 0.011	0.007 to 0.010	0.007 to 0.008	0.007 to 0.011		
8.0 to 11.0 GHz	0.010 to 0.018	0.009 to 0.018	0.008 to 0.016	0.007 to 0.014	0.007 to 0.018		
11 to 17.0 GHz	0.011 to 0.019	0.010 to 0.018	0.009 to 0.016	0.008 to 0.014	0.008 to 0.019		
17 to 21.0 GHz	0.012 to 0.032	0.011 to 0.031	0.010 to 0.028	0.009 to 0.024	0.009 to 0.032		
21 to 26.5 GHz	0.021 to 0.041	0.019 to 0.039	0.016 to 0.035	0.016 to 0.030	0.016 to 0.041		
8510 ANA	For 50 Ω coaxial systems fitted with 2.92 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 1.5 GHz	0.015	0.015 to 0.019	0.016 to 0.030	0.018 to 0.048	0.024 to 0.073		
1.5 to 12 GHz	0.015 to 0.030	0.015 to 0.029	0.016 to 0.033	0.016 to 0.048	0.020 to 0.073		
12 to 20 GHz	0.019 to 0.031	0.018 to 0.030	0.017 to 0.033	0.017 to 0.048	0.021 to 0.072		
20 to 32 GHz	0.020 to 0.035	0.018 to 0.034	0.017 to 0.035	0.017 to 0.048	0.021 to 0.072		
32 to 37 GHz	0.026 to 0.036	0.023 to 0.035	0.021 to 0.035	0.021 to 0.048	0.022 to 0.072		
37 to 40 GHz	0.026 to 0.036	0.023 to 0.035	0.021 to 0.035	0.021 to 0.048	0.023 to 0.072		



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AUTOMATIC NETWORK ANALYSER SYSTEMS (continued)							
VOLTAGE REFLECTION COEFFICIENT (continued) (Real, imaginary and magnitude)							
8510 ANA	For 50 Ω coaxial systems fitted with 2.4 mm connectors						
	0 to 0.2	0.2 to 0.4	0.4 to 0.6	0.6 to 0.8	0.8 to 1.0		
0.05 to 1.5 GHz	0.008	0.008 to 0.009	0.009 to 0.010	0.010 to 0.012	0.012 to 0.017		
1.5 to 5 GHz	0.008 to 0.013	0.008 to 0.013	0.009 to 0.012	0.010 to 0.013	0.012 to 0.018		
5.0 to 10 GHz	0.013 to 0.015	0.012 to 0.015	0.011 to 0.013	0.011 to 0.014	0.013 to 0.019		
10 to 16 GHz	0.013 to 0.016	0.012 to 0.016	0.011 to 0.015	0.011 to 0.021	0.013 to 0.031		
16 to 29 GHz	0.016 to 0.033	0.015 to 0.032	0.015 to 0.029	0.015 to 0.025	0.021 to 0.033		
29 to 40 GHz	0.019 to 0.041	0.018 to 0.039	0.017 to 0.035	0.018 to 0.029	0.023 to 0.035		
Voltage Reflection Coefficient (Phase)	-180° to +180° 0.1 MHz to 40 GHz		$(0.5^2 + (0.05 \times f_{\text{GHz}})^2 + (3 \times U(\text{rp}))^{2 \times 0.5})^{0.5}$ $(0.5^2 + (0.05 \times f_{\text{GHz}})^2 + (U(\text{rp}))^{2 \times 0.5})^{0.5}$ where: $U(\text{rp}) = \frac{\sin^{-1}(U(\text{vrc}))}{\text{VRC}(\text{Mag})}$ If VRC(real) or VRC(imag) < U(vrc), then U(reflection phase) = ± 180°		For coaxial 50Ω systems fitted with type N connectors. For coaxial 50Ω systems fitted with 7mm, 3.5mm, 2.92, Type K and 2.4mm connectors. U(vrc) is the CMC for the corresponding values of reflection coefficient magnitude presented in the previous tables.		
RF POWER (Generation)	-50 dBm to -20 dBm 10 MHz to 50 MHz 50 MHz to 1 GHz 1 GHz to 5 GHz 5 GHz to 10 GHz 10 GHz to 15 GHz 15 GHz to 18 GHz -20 dBm to +16 dBm 10 MHz to 50 MHz 50 MHz to 1 GHz 1 GHz to 5 GHz 5 GHz to 10 GHz 10 GHz to 15 GHz 15 GHz to 18 GHz		1.1 % 1.0 % 1.5 % 1.8 % 2.1 % 2.2 % 1.1 % 1.0 % 1.4 % 1.6 % 1.7 % 1.8 %		These uncertainties are for devices fitted with Type N connectors with a VSWR not exceeding 1.02. The uncertainty will be increased if the device under test has a higher VSWR or is fitted with a different connector type.		



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CALIBRATION FACTOR				Yateley
Nominal power level 0 dBm	10 MHz to 50 MHz 50 MHz to 1 GHz 1 GHz to 5 GHz 5 GHz to 10 GHz 10 GHz to 15 GHz 15 GHz to 18 GHz	0.70 % 0.60 % 1.2 % 1.4 % 1.5 % 1.6 %	These CMCs are for power sensors fitted with Type N connectors in good condition and with a VSWR not exceeding 1.02. The uncertainty will be increased for sensors with a higher VSWR or which is fitted with a different connector type.	
Nominal power level -30 dBm	10 MHz to 50 MHz 50 MHz to 1 GHz 1 GHz to 5 GHz 5 GHz to 10 GHz 10 GHz to 15 GHz 15 GHz to 18 GHz	0.80 % 0.60 % 1.3 % 1.6 % 2.0 % 2.2 %		
AMPLITUDE MODULATION			The uncertainties apply to modulating sinewaves with less than 2% distortion. The uncertainty will be increased for greater levels of distortion.	
(Modulation Factor)	0.05 to 0.50 Carrier 10.7 MHz Modulation 1 kHz	0.0070		
	0.50 to 0.95 Carrier 10.7 MHz Modulation 1 kHz 5 kHz to 40 kHz Carrier 10.7 MHz, 21.4 MHz and 42.8 MHz Modulation 1 kHz	0.013		
		0.70		
FREQUENCY MODULATION				
(Carrier Deviation)	40 kHz to 500 kHz Carrier 10.7 MHz, 21.4 MHz and 42.8 MHz Modulation 1 kHz	2.5 %		
SPECTRUM ANALYSER CALIBRATION				
Frequency response	500 Hz to 3 GHz 3 GHz to 6 GHz 6 GHz to 11 GHz 11 GHz to 26.5 GHz 26.5 GHz to 40 GHz	0.14 dB 0.31 dB 0.40 dB 0.50 dB 0.86 dB		
Scale linearity	500 Hz to 40 GHz	0.15 dB		



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SPECTRUM ANALYSER CALIBRATION (continued)				Yateley
Input level				
IF Gain and				
Attenuator accuracy	500 Hz to 40 GHz Fundamental			
	0 dBm to -30 dBm	0.060 dB		
	-30 dBm to -80 dBm	0.10 dB		
	-80 dBm to -100 dBm	0.15 dB		
	-00 dBm to -110 dBm	0.25 dB		
	-110 dBm to -120 dBm	0.60 dB		
Resolution Bandwidth	50 MHz to 300 MHz	0.59 %		
Reference output	50 MHz to 300 MHz			
	-20 dBm	0.050 dB		
OSCILLOSCOPE CALIBRATION SYSTEM				
Vertical Deflection				
Accuracy	6 mV to 60 mV	1.0 %	Calibration of vertical deflection coefficients using 1 kHz chopped DC	
	60 mV to 200 V	0.50 %		
DC Levels	60 mV to 30 mV	1.0 %	Calibration of vertical deflection coefficients using DC levels.	
	30 mV to 200 V	0.50 %		
Cursor Accuracies	6 mV to 60 mV	1.0 %	Calibration of vertical deflection coefficients using 1kHz chopped DC based on a 12 bit resolution.	
	60 mV to 600 mV	0.5 %		
	600 mV to 12 V	0.15 %		
	12 V to 200 V	0.10 %		
DC Levels	6 mV to 12 mV	1.0 %	Calibration of vertical deflection coefficients using DC levels based on a 12 bit resolution.	
	12 mV to 30 mV	0.50 %		
	30 mV to 60 mV	0.20 %		
	60 mV to 120 mV	0.15 %		
	120 mV to 200 V	0.10 %		
DC Resistance Measurement	10 Ω to 100 Ω	0.050 %	Input resistance measurement	
	100 Ω to 150 Ω	0.60 %		
	50 kΩ to 800 kΩ	0.60 %		
	800 kΩ to 1.2 MΩ	0.20 %		
	1.2 MΩ to 12 MΩ	0.60 %		



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OSCILLOSCOPE CALIBRATION SYSTEM (continued)				
RF Voltage	0.3 V to 3 V peak to peak 100 MHz to 100 MHz 100 MHz to 550 MHz 500 MHz to 1.1 GHz	3.5 % 4.5 % 5.5 %	Uncertainties are for RF voltage developed across a perfectly matched 50 Ω coaxial line system relative to a reference voltage level at 50 kHz in the same system. Uncertainties include those associated with the visual display of voltage levels	Yateley
Bandwidth	100 MHz to 100 MHz 100 MHz to 550 MHz 500 MHz to 1.1 GHz	level: 3.5 % level: 4.5 % level: 5.5 %	The uncertainty quoted on a calibration certificate will be in terms of frequency, based on the relationship between level and frequency at the -3 dB point for the system under calibration	
Risetime Measurement	150 ps to 300 ps 300 ps to 600 ps >600 ps	+15 ps, -12 ps 7.5 % 2.0 %	Measurement of fast risetime square waves	
Risetime Generation	21 ps to 35 ps 35 ps to 150 ps 150 ps to 300 ps 300 ps to 600 ps >600 ps	+7 ps, -11 ps +7 ps, - 7 ps +14 ps, -14 pss 7.5 % 2.0 %	Generation of fast risetime square waves for calibration of amplifiers or mainframes	
Timebase Sweep Rate	0.4 ns to 1 ns 1 ns to 50 s	0.50 % 0.25 %	Calibration of timebase sweep rates	
DC Voltage Measurement	1 mV 2 mV 5 mV 10 mV 20 mV 50 mV 100 mV to 200 V	2.5 % 1.5 % 0.50 % 0.30 % 0.15 % 0.070 % 0.050 %	Calibration of DC voltage reference Includes uncertainty of measurement for stability and reset ability checks	
Period Measurement	1 ns to 50 ms 0.1 s to 5 s	0.10 ppm + 0.10 ps 0.010 %	Calibration of time mark generators The following additional characteristics can be measured: Delay between channels (s) Comparator voltage (V) Horizontal amplifier sensitivity (V/Div) Delay time multiplier (Ratio : 1) Trigger sensitivity Internal (Div) External (V) Common mode rejection (Ratio :1)	



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ELECTRICAL				Manchester, Yateley
Temperature indicators and simulators: Calibration by electrical simulation			Including cold junction compensation	
Type K	-200 °C to -100 °C -100 °C to -25 °C -25 °C to +120 °C 120 °C to 1000 °C 1000 °C to 1372 °C	0.41 °C 0.25 °C 0.21 °C 0.32 °C 0.50 °C		
Type J	-210 °C to -100 °C -100 °C to -30 °C -30 °C to +150 °C 150 °C to 760 °C 760 °C to 1200 °C	0.33 °C 0.21 °C 0.19 °C 0.22 °C 0.28 °C		
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 120 °C 120 °C to 400 °C	0.73 °C 0.30 °C 0.21 °C 0.19 °C		
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1000 °C 1000 °C to 1767 °C	0.70 °C 0.42 °C 0.40 °C 0.54 °C		
Type N	-200 °C to -100 °C -100 °C to -25 °C -25 °C to +120 °C 120 °C to 410 °C 1000 °C to 1300 °C	0.47 °C 0.27 °C 0.24 °C 0.23 °C 0.33 °C		
Type E	-250 °C to -100 °C -100 °C to -25 °C -25 °C to +350 °C 350 °C to 650 °C 659 °C to 1000 °C	0.59 °C 0.21 °C 0.19 °C 0.21 °C 0.26 °C		
Type B	600 °C to 800 °C 800 °C to 1000 °C 1000 °C to 1550 °C 1550 °C to 1820 °C	0.52 °C 0.41 °C 0.36 °C 0.40 °C		
Type C	0 °C to 150 °C 150 °C to 650 °C 650 °C to 1000 °C 1000 °C to 1800 °C 1800 °C to 2316 °C	0.36 °C 0.32 °C 0.59 °C 0.59 °C 1.0 °C		



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ELECTRICAL (continued)					
Temperature indicators and simulators: Calibration by electrical simulation (continued)					
PRT	-200 °C to -80 °C -80 °C to 0 °C 0 °C to 100 °C 100 °C to 300 °C 300 °C to 400 °C 400 °C to 630 °C 630 °C to 800°C	0.060 °C 0.060 °C 0.11 °C 0.11 °C 0.12 °C 0.14 °C 0.27 °C		Manchester, Yateley	
Calibration of 17th Edition Test Equipment					
Continuity	0 Ω to 20 mΩ 20 mΩ to 200 mΩ 200 mΩ to 300 mΩ 300 mΩ to 500 mΩ 500 mΩ to 900 mΩ 900 mΩ to 1 Ω 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ	1.4 % + 13 mΩ 0.45 % + 26 mΩ 0.45 % + 27 mΩ 0.45 % + 26 mΩ 0.44 % + 26 mΩ 0.44 % + 27 mΩ 0.44 % + 26 mΩ 0.44 % + 27 mΩ 0.44 % + 27 mΩ			
Insulation	0 Ω to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	0.70 % + 500 Ω 1.7 % + 35 kΩ 1.7 % + 260 kΩ 2.0 % + 290 kΩ			
Loop Impedance	50 Hz 50 mΩ 100 mΩ 220 mΩ 340 mΩ 500 mΩ 1.0 Ω 5.0 Ω 10 Ω 100 Ω 1 kΩ	0.66 % + 4.7 mΩ 0.64 % + 4.7 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 5.2 mΩ 0.64 % + 93 mΩ 0.64 % + 120 mΩ			
RCD testers					
Timing	20 ms to 5 s	1.5 ms			



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Calibration of 17 th Edition Test Equipment (continued)				
Current	50 Hz 10 mA at 200 ms 30 mA at 200 ms 100 mA at 200 ms 300 mA at 200 ms 1 A at 200 ms	1.8 % + 70 μ A 1.8 % + 110 μ A 1.8 % + 170 μ A 1.8 % + 850 μ A 1.8 % + 700 μ A		Manchester, Yateley
PAT TESTERS				
Earth Bond Resistance	40 m Ω 100 Ω 290 m Ω 390 m Ω 1 Ω 5 Ω 10 Ω 100 Ω 1 k Ω	5.2 m Ω 4.8 m Ω 05.5 m Ω 5.7 m Ω 7.9 m Ω 29 m Ω 60 m Ω 580 m Ω 5.2 Ω		
Earth Bond Current	50 Hz 100 mA 8 A 10 A 20 A	1.5 % + 1.0 mA 1.5 % + 10 mA 1.5 % + 11 mA 1.5 % + 15 mA		
Load Test	0.13 kVA (nominal 440 Ω)	5.8 % +3.1 Ω		
Leakage Current	2 mA to 8 mA	1.7 % + 36 μ A		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DC/LF AUTOMATED AND MANUAL SYSTEMS FOR GENERATION				
DC RESISTANCE				Manchester, Yateley, Donibristle, Stevenage
Generation	1 Ω	86 ppm		
	1.9 Ω	86 ppm		
	10 Ω	26 ppm		
	19 Ω	24 ppm		
	100 Ω	16 ppm		
	190 Ω	16 ppm		
	1 k Ω	12 ppm		
	1.9 k Ω	12 ppm		
	10 k Ω	11 ppm		
	19 k Ω	11 ppm		
	100 k Ω	13 ppm		
	190 k Ω	13 ppm		
	1 M Ω	18 ppm		
	1.9 M Ω	20 ppm		
	10 M Ω	37 ppm		
	19 M Ω	45 ppm		
	100 M Ω	110 ppm		
DC VOLTAGE				
Generation	0 V to 220 mV	7.5 ppm + 0.65 μ V		
	220 mV to 2.2 V	6.5 ppm + 1.0 μ V		
	2.2 V to 11 V	6.5 ppm + 3.5 μ V		
	11 V to 22 V	6.5 ppm + 6.5 μ V		
	22 V to 220 V	7.0 ppm + 80 μ V		
	220 V to 1100 V	8.5 ppm + 470 μ V		
DC CURRENT				
Generation	0 A to 220 μ A	47 ppm + 8.0 nA		
	220 μ A to 2.2 mA	47 ppm + 8.0 nA		
	2.2 mA to 22 mA	47 ppm + 80 nA		
	22 mA to 220 mA	55 ppm + 800 nA		
	220 mA to 2.2 A	75 ppm + 24 μ A		
	2.2 A to 11 A	280 ppm + 380 μ A		
Simulation	11 A to 550 A	0.30 % + 600 mA	Using a 50 turn coil	



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AC VOLTAGE Generation	0.1 mV to 2.2 mV 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz 2.2 mV to 22 mV 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz 22 mV to 220 mV 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz 220 mV to 2.2 V 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	850 ppm + 4.0 μ V 750 ppm + 4.0 μ V 720 ppm + 4.0 μ V 800 ppm + 4.0 μ V 0.10 % + 6.5 μ V 0.13 % + 12 μ V 0.17 % + 25 μ V 0.33 % + 25 μ V 480 ppm + 5.0 μ V 220 ppm + 5.0 μ V 140 ppm + 5.0 μ V 340 ppm + 5.0 μ V 750 ppm + 6.5 μ V 0.11 % + 12 μ V 0.15 % + 25 μ V 0.30 % + 25 μ V 470 ppm + 13 μ V 190 ppm + 8.0 μ V 110 ppm + 8.0 μ V 290 ppm + 8.0 μ V 700 ppm + 25 μ V 860 ppm + 25 μ V 0.14 % + 32 μ V 0.28 % + 80 μ V 470 ppm + 80 μ V 150 ppm + 25 μ V 75 ppm + 6.0 μ V 120 ppm + 16 μ V 220 ppm + 65 μ V 380 ppm + 120 μ V 950 ppm + 320 μ V 0.19 % + 800 μ V		Manchester, Yateley, Donibristle, Stevenage



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
AC VOLTAGE (continued) Generation (continued)	2.2 V to 22 V 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz 22 V to 220 V 10 Hz to 20 Hz 20 Hz to 40 Hz 40 Hz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 220 V to 1100 V 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 30 kHz 220 V to 750 V 30 kHz to 50 kHz 50 kHz to 100 kHz	470 ppm + 800 μ V 150 ppm 240 μ V 75 ppm + 55 μ V 120 ppm + 160 μ V 220 ppm + 320 μ V 470 ppm + 1.3 mV 0.11 % + 4.0 mV 0.24 % + 7.0mV 470 ppm + 8.0 mV 150 ppm + 2.5 mV 80 ppm + 800 μ V 200 ppm + 3.1 mV 470 ppm + 8.0 mV 81 ppm + 3.5 mV 140 ppm + 5.0 mV 470 ppm + 8.5 mV 470 ppm + 8.5 mV 0.18 % + 35 mV		Manchester, Yateley, Donibristle, Stevenage



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AC CURRENT				Manchester, Yateley, Donibristle
Generation	100 nA to 220 μ A 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	140 ppm + 16 nA 550 ppm + 40 nA 0.14 % + 80 nA		
	220 μ A to 2.2 mA 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	140 ppm + 31 nA 550 ppm + 400 nA 0.14 % + 800 nA		
	2.2 mA to 22 mA 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	140 ppm + 410 nA 550 ppm + 4.0 μ A 0.14 % + 8.0 μ A		
Generation	22 mA to 220 mA 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	150 ppm + 3.1 μ A 550 ppm + 40 μ A 0.14 % + 80 μ A		
	220 mA to 2.2 A 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	590 ppm + 31 μ A 670 ppm + 80 μ A 0.80 % + 160 μ A		
	2.2 A to 11 A 40 Hz to 1 kHz 1 kHz to 5 kHz 5 kHz to 10 kHz	370 ppm + 140 μ A 750 ppm + 300 μ A 0.28 % + 600 μ A		
Simulation	11 A to 550 A 45 Hz to 65 Hz	0.30 % + 600 mA	Using a 50 turn coil	
DC/LF AUTOMATED AND MANUAL SYSTEMS FOR MEASUREMENT				
ZERO CHECKS	The uncertainty will be determined by the resolution and stability of the unit under test when applying external shorts and open circuits			Manchester, Yateley, Donibristle
DC RESISTANCE				
Measurement	0 Ω to 12 Ω 12 Ω to 120 Ω 120 Ω to 1.2 k Ω 1.2 k Ω to 12 k Ω 12 k Ω to 120 k Ω 120 k Ω to 1.2 M Ω 1.2 M Ω to 12 M Ω 12 M Ω to 120 M Ω 120 M Ω to 1.2 G Ω	45 ppm + 0.10 m Ω 30 ppm + 1.0 m Ω 22 ppm + 1.0 m Ω 21 ppm + 10 m Ω 23 ppm + 100 m Ω 35 ppm + 3.0 Ω 80 ppm + 140 Ω 600 ppm + 2.1 k Ω 0.65 % + 160 k Ω		



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DC VOLTAGE				Manchester, Yateley, Donibristle
Measurement	0 V to 120 mV 120 mV to 1.2 V 1.2 V to 12 V 12 V to 120 V 120 V to 1050 V	13 ppm + 1.8 μ V 12 ppm + 2.0 μ V 12 ppm + 6.5 μ V 13 ppm + 130 μ V 19 ppm + 750 μ V		
DC CURRENT				
Measurement	0 A to 1.2 μ A 1.2 μ A to 12 μ A 12 μ A to 120 μ A 120 μ A to 1.2 mA 1.2 mA to 12 mA 12 mA to 120 mA 120 mA to 1.05 A	210 ppm + 85 pA 110 ppm + 210 pA 75 ppm + 1.7 nA 75 ppm + 11 nA 75 ppm + 75 nA 95 ppm + 1.1 μ A 170 ppm + 18 μ A		
AC VOLTAGE				
Measurement	10 μ V to 12 mV 10 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz	800 ppm + 9.0 μ V 300 ppm + 8.0 μ V 400 ppm + 8.0 μ V 0.13 % + 8.0 μ V 0.60 % + 11 μ V 4.7 % + 21 μ V		
	12 mV to 120 mV 10 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	800 ppm + 21 μ V 180 ppm + 13 μ V 230 ppm + 13 μ V 400 ppm + 13 μ V 0.15 % + 40 μ V 0.40 % + 40 μ V 1.3 % + 40 μ V 1.8 % + 40 μ V		
	120 mV to 1.2 V 10 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	800 ppm + 140 μ V 140 ppm + 30 μ V 200 ppm + 30 μ V 400 ppm + 40 μ V 0.10 % + 110 μ V 0.36 % + 230 μ V 1.2 % + 1.1 mV 1.8 % + 1.2 mV		



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AC VOLTAGE (continued)				Manchester, Yateley, Donibristle
Measurement	1.2 V to 12 V 10 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 300 kHz 300 kHz to 1 MHz 1 MHz to 2 MHz	750 ppm + 1.3 mV 140 ppm + 300 μ V 200 ppm + 300 μ V 400 ppm + 400 μ V 0.10 % + 600 μ V 0.36 % + 2.5 mV 1.3 % + 12 mV 1.8 % + 12 mV		
	12 V to 120 V 10 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz	750 ppm + 14 mV 280 ppm + 3.5 mV 280 ppm + 3.5 mV 510 ppm + 6.0 mV 0.16 % + 13 mV		
	120 V to 700 V 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 30 kHz	500 ppm + 20 mV 750 ppm + 20 mV 0.16 % + 25 mV		
	At 700 V 30 kHz to 50 kHz 50 kHz to 100 kHz	0.20 % + 25 mV 0.45 % + 25 mV		
	220 V to 1.1 kV 40 Hz to 10 kHz 10 kHz to 30 kHz 30 kHz to 100 kHz	210 ppm + 25 mV 760 ppm + 60 mV 0.65 % + 250 mV		
AC CURRENT				
Measurement	100 nA to 120 μ A 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 1 kHz	0.18 % + 40 nA 0.080 % + 40 nA 0.11 % + 70 nA		
	120 μ A to 1.2 mA 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 10 kHz	0.18 % + 300 nA 0.080 % + 300 nA 0.090 % + 700 nA 0.25 % + 1.3 μ A		



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AC CURRENT (continued)				Manchester, Yateley, Donibristle
Measurement (continued)	1.2 mA to 12 mA 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 10 kHz	0.18 % + 3.0 μ A 0.080 % + 3.0 μ A 0.090 % + 7.0 μ A 0.25 % + 13 μ A		
	12 mA to 120 mA 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 10 kHz	0.18 % + 30 μ A 0.080 % + 30 μ A 0.090 % + 70 μ A 0.25 % + 130 μ A		
	120 mA to 1.05 A 20 Hz to 45 Hz 45 Hz to 100 Hz 100 Hz to 5 kHz 5 kHz to 10 kHz	0.21 % + 250 μ A 0.13 % + 250 μ A 0.16 % + 550 μ A 1.3 % + 1.0 mA		
DISTORTION				Manchester, Yateley
Distortion Factor	20 Hz to 100 kHz			
	0.1 % to 0.25 % 0.2 V to 0.5 V 0.5 V to 2 V 2 V to 300 V	0.083 % absolute 0.043 % absolute 0.023 % absolute		
	0.25 % to 0.4 % 0.2 V to 0.5 V 0.5 V to 2 V 2 V to 300 V	0.068 % absolute 0.068 % absolute 0.032 % absolute		
	0.2 V to 0.5 V 0.5 V to 2 V 2 V to 300 V	0.17 % absolute 0.090 % absolute 0.080 % absolute		
	1.0 % to 100 % 0.2 V to 0.5 V 0.5 V to 2 V 2 V to 300 V	0.90 % absolute 0.80 % absolute 0.80 % absolute		



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DC HIGH VOLTAGE	1.1 kV to 70 kV	0.20 %	Sourcing capability limited to 50 kV	Donibristle
DC CURRENT				
Generation	2.2 A to 10 A 10 A to 100 A	40 ppm + 0.10 μ A 0.025 %	Current up to 2000 A can be simulated at increased uncertainties, using a multi turn coil, for clamp meter calibration	
AC CURRENT	2.2 A to 10 A 50 Hz 10 A to 100 A	0.05 % 0.15 %	Current up to 2000 A can be simulated at increased uncertainties, using a multi turn coil, for clamp meter calibration	
AC RESISTANCE	50 Hz to 1 kHz 1 Ω , 10 Ω , 100 Ω , 1 k Ω and 10 k Ω	10 ppm		
LF CAPACITANCE	1 kHz 100 pF 1 pF to 11.1 μ F 11.1 μ F to 100 μ F	20 ppm 90 ppm 250 ppm	The uncertainty quoted is for measurement of 3-terminal capacitance. 2-terminal capacitance measurements can also be undertaken but there will be an additional uncertainty of 0.5 pF	
INDUCTANCE Generation only	1 kHz 1 mH 10 mH 100 mH 1 H	0.030 % 0.020 % 0.020 % 0.020 %		
FREQUENCY	1 mHz to 1.3 GHz	3.0 in 10^{10}		
Optical Tachometers	60 rpm to 18 000 rpm	0.013 %		
Mechanical Tachometers	300 RPM to 1500 RPM 600 RPM to 3000 RPM 1200 RPM to 6000 RPM	1.5 RPM 2.5 RPM 6.5 RPM		
AC POWER	1 W to 10 kW 30 Hz to 1 kHz	0.40 %	Based on AC voltage and AC current measurements at unity power factor	
RCD Testers (current)	10 mA to 1 A 50 Hz	1.6 %		
RCD Testers (trip time)	10 ms, 35 ms, 100 ms, 300 ms 500 ms, 750 ms and 1 s	1.2 %		



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Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Trescal Limited
Issue No: 096 Issue date: 2017

Calibration performed by the Organisation at the locations specified

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
CAPACITANCE				Donbristle
Measurement	0.1 μ F to 10 μ F at 1 kHz 10 pF to 1 μ F at 10 kHz	0.060 % + 0.020 pF 0.25% + 1.0 fF	Using a Wayne Kerr B905A Bridge	
PORTABLE APPLIANCE TESTER CALIBRATION				
AC Resistance at 50 Hz	0.1 Ω to 2 Ω 0.1 Ω to 1 Ω 2 Ω	0.020 Ω 0.020 Ω 0.030 Ω	Test current 8 amperes Test current 25 amperes Test current 25 amperes	
AC Current at 50 Hz	8 A to 30 A	2.0 A		
FREQUENCY				
Generation	1 MHz, 5 MHz and 10 MHz	8.0 in 10^{11}		
Measurement	1 MHz, 5 MHz and 10 MHz 10 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 100 MHz 100 MHz to 26.5 GHz	1.0 in 10^{10} 1.2 in 10^6 to 6.0 in 10^8 6.0 in 10^8 to 3.7 in 10^9 3.7 in 10^9 to 1.2 in 10^9 1.0 in 10^9		
VOLTAGE REFLECTION COEFFICIENT	0.3 MHz to 8 GHz 0 to 0.2 0.2 to 0.6 0.6 to 0.8	0.010 0.015 0.020	7 mm 50 Ω coaxial line fitted with GPC 7 or Type N connectors. The measurement uncertainty may increase if the device requires the use of a test port cable.	
	8 GHz to 18 GHz 0 to 0.2 0.2 to 0.6 0.6 to 0.8	0.020 0.020 0.025		
	0.5 GHz to 8 GHz 0 to 0.2 0.2 to 0.6 0.6 to 0.8	0.030 0.035 0.040	3.5 mm 50 Ω coaxial line fitted with GPC 3.5 connectors. The measurement uncertainty may increase if the device requires the use of a test port cable.	
	8 GHz to 18 GHz 0 to 0.2 0.2 to 0.6 0.6 to 0.8	0.060 0.060 0.065		



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RF ATTENUATION	<i>0.3 MHz to 3 GHz</i> 0 dB to 40 dB 40 dB to 62 dB 62 dB to 80 dB <i>0.5 GHz to 8 GHz</i> 0 dB to 50 dB 50 dB to 62 dB <i>8 GHz to 18 GHz</i> 0 dB to 40 dB 40 dB to 50 dB 50 dB to 62 dB <i>0.5 GHz to 8 GHz</i> 0 dB to 62 dB <i>8 GHz to 18 GHz</i> 0 dB to 62 dB	0.050 dB 0.090 dB 0.90 dB 0.050 dB 0.070 dB 0.060 dB 0.070 dB 0.090 dB 0.14 dB 0.23 dB	7 mm 50 Ω coaxial line fitted with GPC 7 or Type N connectors. The uncertainty is for devices with input and output VRC not exceeding 0.2. 3.5 mm 50 Ω coaxial line fitted with GPC 3.5 connectors. The uncertainty is for devices with input and output VRC not exceeding 0.2.	Donibristle
RF POWER	0.8 mW to 1.2 mW 50 MHz	0.50 %	For the calibration of 50 Ω power meter reference sources with output VSWR not exceeding 1.05:1	
Calibration Factor			The uncertainties shown for calibration factor are based on a device with a VSWR of 1.03:1 or less. If the measured reflection coefficient is significantly greater than this, the calibration factor uncertainties will be increased accordingly.	
50 Ω coaxial power sensors	Nominal level 1 mW <i>0.1 MHz to 0.3 MHz</i> <i>0.3 MHz to 0.1 GHz</i> <i>0.1 GHz to 2.0 GHz</i> <i>2.0 GHz to 8.0 GHz</i> <i>8.0 GHz to 18.0 GHz</i>	1.3% 1.1% 1.0% 1.3% 1.7%	Connector type: 7 mm Type N	
50 Ω coaxial power sensors	Nominal level 1 μ W <i>0.1 GHz to 2.0 GHz</i> <i>2.0 GHz to 8.0 GHz</i> <i>8.0 GHz to 18.0 GHz</i>	1.9% 2.1% 2.4%	Connector type: 7 mm Type N	



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50 Ω coaxial thermistor mounts	Nominal level 1 mW <i>0.05 GHz to 2.0 GHz</i> <i>2.0 GHz to 8.0 GHz</i> <i>8.0 GHz to 18.0 GHz</i>	1.7% 1.9% 2.1%	Connector type: 7 mm Type N	Donibristle
RF Power Measurement	+20 dBm to -25 dBm <i>100 kHz to 300 kHz</i> <i>300 kHz to 1 MHz</i> <i>1 MHz to 50 MHz</i> <i>50 MHz to 2 GHz</i> <i>2 GHz to 12 GHz</i> <i>12 GHz to 18 GHz</i> <i>18 GHz to 26.5 GHz</i> -25 dBm to -50 dBm <i>50 MHz to 2 GHz</i> <i>2 GHz to 12 GHz</i> <i>12 GHz to 18 GHz</i> -50 dBm to -60 dBm <i>50 MHz to 2 GHz</i> <i>2 GHz to 12 GHz</i> <i>12 GHz to 18 GHz</i> -60 dBm to -65 dBm <i>50 MHz to 2 GHz</i> <i>2 GHz to 12 GHz</i> <i>12 GHz to 18 GHz</i>	0.55 dB 0.26 dB 0.18 dB 0.18 dB 0.25 dB 0.34 dB 0.31 dB 0.22 dB 0.37 dB 0.40 dB 0.24 dB 0.38 dB 0.41 dB 0.38 dB 0.48 dB 0.50 dB	50 Ω coaxial line systems fitted with Type N connectors. The uncertainty is for devices with output VRC not exceeding 0.2.	
RF Power Generation	0 dBm to -67 dBm <i>100 kHz to 4.2 GHz</i> <i>4.2 GHz to 18 GHz</i> -67 dBm to -127 dBm <i>100 kHz to 4.2 GHz</i> <i>4.2 GHz to 18 GHz</i>	0.15 dB 0.22 dB 0.24 dB 0.37 dB	50 Ω coaxial line systems fitted with precision Type N connectors. Devices fitted with non-precision Type N connectors can be calibrated but with increased uncertainties. The CMCs stated are for a load VRC <0.05. The stated uncertainty may be increased if the VRC exceeds this value	
TRANSFER IMPEDANCE (RF current probe calibration)	<i>20 Hz to 9 kHz</i> <i>10 kHz to 500 MHz</i> <i>500 MHz to 1 GHz</i>	0.65 dB 0.37 dB 0.74 dB		



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SPECTRAL INTENSITY	0.1 MHz to 1 GHz 80 dB μ V/MHz to 100 dB μ V/MHz	0.90 dB	The uncertainties for amplitude modulation are presented in terms of modulation depth.	Donibristle
AMPLITUDE MODULATION	Carrier 100 kHz to 10 MHz Modulation 20 Hz to 50 Hz 5% to 50% 50% to 95%	3.0% 3.1%		
	Carrier 150 kHz to 10 MHz Modulation 50 Hz to 10 kHz 5% to 50% 50% to 95%	2.0% 2.1%		
	Carrier 10 MHz to 1.3 GHz Modulation 50 Hz to 90 Hz 5% to 50% 50% to 95%	1.1% 1.3%		
	Carrier 10 MHz to 1.3 GHz Modulation 90 Hz to 10 kHz 5% to 20% 20% to 50% 50% to 80%	1.1% 0.53% 0.85%		
	Carrier 10 MHz to 1.3 GHz Modulation 10 kHz to 50 kHz 5% to 50% 50% to 95%	1.1% 1.3%		
	Carrier 10 MHz to 1.3 GHz Modulation 50 kHz to 100 kHz 5% to 50% 50% to 95%	3.0% 3.1%		
	Carrier 10 MHz to 1.3 GHz Modulation 90 Hz to 10 kHz 80% to 95%	1.3%		
	Carrier 10 MHz to 1.3 GHz Modulation 20 Hz to 50 Hz 5% to 20%	3.0%		



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Temperature indicators, calibration by electrical simulation				Donibristle
Base metal thermocouples	-200 °C to +1600 °C	0.40 °C	including cold junction compensation	
Noble metal thermocouples	-200 °C to +1760 °C	0.40 °C	including cold junction compensation	
Resistance thermometer (Pt 100)	-200 °C to +800 °C	0.030 °C		
TORQUE				
Torque measuring devices	As BS EN 7882:2008 0.05 Nm to 1000 Nm	0.10 %		
Hand torque tools	As BS EN ISO 6789 :2003 0.2 Nm to 1500 Nm	0.84 %		
PRESSURE				
Gas Pressure (Gauge)				
Calibration of pressure indicating instruments and gauges.	-95 kPa to 0 Pa 0 Pa to 3.5 kPa 3.5 kPa to 10 MPa	29 Pa 7.02 Pa 0.0075 %	Calibration of devices with an electrical output may be undertaken	
"Pressure equivalent" calibration of dead-weight testers	3.5 kPa to 10 MPa	0.0075 %		
Gas Pressure (Absolute)				
Calibration of pressure indicating instruments and gauges	10 Pa to 2 kPa 2 kPa to 75 kPa 75 kPa to 115 kPa 115 kPa to 10 MPa	31% 33 Pa 16 Pa 0.0075 % + 16 Pa		
Hydraulic Pressure (Gauge)				
Calibration of pressure indicating instruments and gauges. "Pressure equivalent" calibration of dead-weight testers	550 kPa to 140 MPa 140 MPa to 400 MPa	0.0075 % 0.050 %		



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TEMPERATURE				Donibristle
4-wire platinum resistance thermometers	0.01 °C (Triple point of water) -80 °C to +10 °C 10 °C to 260 °C 260 °C to 650 °C	0.0035 °C 0.020 °C 0.010 °C 0.45 °C		
Base metal thermocouples	-80 °C to 260 °C 260 °C to 650 °C	0.40 °C 1.0 °C		
Dial type and electronic thermometers with sensors:				
Resistance sensors	-80 °C to +260 °C 260 °C to 650 °C	0.040 °C 0.45 °C		
Thermocouple sensors	-80 °C to +260 °C 260 °C to 650 °C	0.40 °C 1.0 °C		
Thermistors	-80 °C to +260 °C 260 °C to 650 °C	0.050 °C 0.45 °C		
Metal block calibrators	-30 °C to +260 °C 260 °C to 650 °C	0.15 °C 0.25 °C		
Liquid in glass thermometers	-80 °C to 250 °C	0.025 °C + ¼ of a scale division		
Air temperature: data loggers.	-50 °C to 50 °C	0.35 °C	Within a temperature controlled chamber	



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VOLUME OF LIQUIDS (SEE NOTE 1)				
Single channel instruments	2 µl to 10 µl 10 µl to 20 µl 20 µl to 100 µl 100 µl to 200 µl 200 µl to 500 µl 0.5 ml to 1 ml 1 ml to 2 ml 2 ml to 5 ml 5 ml to 10 ml 10 ml to 20 ml	0.090 µl 0.090 µl 0.26 µl 0.36 µl 0.90 µl 0.002 ml 0.005 ml 0.011 ml 0.015 ml 0.030 ml	Note 1. For water delivered from piston and/or plunger operated volumetric apparatus (POVA) using in-house gravimetric procedures 1 volume (fixed volume pipettes) 4 volumes (variable volume pipettes) 10 readings (as specified in ISO 8655)	
Multi channel instruments up to 12 channels Simultaneously calibrated	1.0 µl to 20 µl 20 µl to 50 µl 50 µl to 100 µl 100 µl to 200 µl 200 µl to 300 µl 300 µl to 600 µl 600 µl to 1200 µl	0.10 µl 0.20 µl 0.30 µl 0.40 µl 0.40 µl 0.90 µl 2.00 µl	From minimum of 1 volume and minimum of 5 readings up to 4 volumes and up to 10 readings (by agreement with the customer)	
DIMENSIONAL				Donbristle
DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				
MEASURING INSTRUMENTS AND MACHINES				
Micrometers External (including digital and electronic) - Excluding thread micrometers	As BS 870:2008 0 to 1000	Heads: 2.0 between any two points. Setting and extension rods: 1.0 + (8.0 x L in m)		
Vernier gauges Caliper	As BS 887:2008 0 to 1000	Overall performance 10 + (30 x L in m)	The uncertainty quoted is for the departure from flatness, straightness, parallelism or squareness, i.e. the distance separating the two parallel planes which just enclose the surface under consideration. All linear calibrations may be given in Inch units.	



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ELECTRICAL				Stevenage
ZERO CHECKS	The uncertainty will be determined by the resolution and stability of the unit under test when applying external shorts and open circuits			
DC RESISTANCE				
Measurement and Generation				
Specific Values	0.0001 Ω	3.5 ppm	Standard resistors available for calibration of resistance measuring instruments.	
	0.001 Ω	0.80 ppm		
	0.01 Ω	0.70 ppm		
	0.1 Ω	0.70 ppm		
	1 Ω	0.060 ppm		
	10 Ω	0.050 ppm		
	100 Ω	0.050 ppm		
	1 k Ω	0.050 ppm		
	10 k Ω	2.0 ppm		
	100 k Ω	6.0 ppm		
	1 M Ω	6.0 ppm		
	10 M Ω	25 ppm		
Other Values	0.0001 Ω to 0.0003 Ω	500 ppm		
	0.0003 Ω to 0.001 Ω	200 ppm		
	0.001 Ω to 0.003 Ω	200 ppm		
	0.003 Ω to 0.01 Ω	55 ppm		
	0.01 Ω to 0.03 Ω	60 ppm		
	0.03 Ω to 0.3 Ω	40 ppm		
	0.3 Ω to 3 Ω	8.0 ppm		
	3 Ω to 1 k Ω	7.0 ppm		
	1 k Ω to 30 k Ω	2.0 ppm		
	30 k Ω to 3 M Ω	6.0 ppm		
	3 M Ω to 10 M Ω	25 ppm		
Measurement	10 M Ω to 10 G Ω	80 ppm		
	10 G Ω to 100 G Ω	300 ppm		
	100 G Ω to 1 T Ω	0.20 %		
Generation	1 Ω	1.0 ppm		
	10 Ω	1.0 ppm		
	100 Ω	0.50 ppm		
	1 k Ω	0.50 ppm		
	10 k Ω	1.0 ppm		
	100 k Ω	4.0 ppm		
	1 M Ω	3.0 ppm		
	10 M Ω	12 ppm		
	100 M Ω	250 ppm		
	1 G Ω	0.35 %		
	10 G Ω	0.35 %		
	100 G Ω	0.50 %		
	1 T Ω	1.0 %		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
DC VOLTAGE				Stevenage
Standard Cell Values	1.018 V nominal	0.88 μ V		
Specific Values	100 mV 1 V 1.018 V 10 V	5.3 ppm 1.2 ppm 0.89 ppm 1.0 ppm		
Generation	10 V 100 V 1 kV	0.48 ppm 1.2 ppm 1.2 ppm		
	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20V to 200V 200 V to 1100 V	5.8 ppm + 340 nV 2.0 ppm + 660 nV 0.91 ppm + 2.4 μ V 2.0 ppm + 50 μ V2.7 ppm + 390 μ V		
Other values	0 V to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 11 V 11 V to 100 V 100 V to 1 kV 1 kV to 1.1 kV 1.1 kV to 10 kV 10 kV to 30 kV	1.0 μ V 70 ppm 10 ppm 2.4 ppm 2.4 ppm 2.4 ppm 20 ppm 100 ppm 0.55 %		
DC VOLTAGE RATIO	Unity to 10^{-2} 10^{-2} to 10^{-4} 10^{-4} to 10^{-7}	0.20 ppm of input 0.10 ppm of input 0.020 ppm of input	Applied voltages of 100 V may be necessary for to achieve the stated CMCs.	
DC CURRENT				
Specific Values	100 μ A 1 mA 10 mA 100 mA 1 A 10 A	21 ppm 10 ppm 7.2 ppm 8.2 ppm 13 ppm 100 ppm		
Other Values	1 μ A to 100 μ A 100 μ A to 10 mA 10 mA to 100 mA 100 mA to 10 A 10 A to 50 A	13 ppm + 0.10 nA 13 ppm + 0.10 nA 20 ppm 75 ppm 100 ppm		



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DC POWER	1 μ W to 25 kW	The RSS summation of the relevant voltage and current uncertainties	Upper limits of voltage and current are 1 kV and 25 A respectively. Laboratory supplies and loads are not normally available over the full range.	Stevenage
AC VOLTAGE				
Datron 4920 System				
Specific Values	1 V 40 Hz 1 kHz 30 kHz 50 kHz 100 kHz 200 kHz 500 kHz 1 MHz 10 V 40 Hz 1 kHz 30 kHz 50 kHz 100 kHz 200 kHz 500 kHz 1 MHz 100 V 40 Hz 1 kHz 30 kHz 50 kHz 100 kHz 700 V 50 kHz 100 kHz 1000 V 45 Hz 100 Hz 1 kHz 10 kHz 20 kHz 30 kHz	27 ppm 27 ppm 28 ppm 31 ppm 34 ppm 67 ppm 240 ppm 520 ppm 26 ppm 26 ppm 27 ppm 29 ppm 29 ppm 65 ppm 240 ppm 430 ppm 43 ppm 35 ppm 35 ppm 39 ppm 40 ppm 170 ppm 230 ppm 87 ppm 87 ppm 86 ppm 88 ppm 88 ppm 97 ppm		



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AC VOLTAGE (continued)				Stevenage
Datron 4920 System (continued)				
Other values	0.9 mV to 2.7 mV 10 Hz to 100 Hz 100 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	0.033% + 0.30μV 0.020% + 0.30μV 0.047% + 0.30μV 0.13% + 0.30μV 0.32% + 0.30μV		
	2.7 mV to 9 mV 10 Hz to 100 Hz 100 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	0.026% + 0.30μV 0.016% + 0.20μV 0.033% + 0.20μV 0.10% + 0.20μV 0.24% + 0.40μV		
	9 mV to 27 mV 10 Hz to 100 Hz 100 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	0.019% + 0.30μV 0.0093% + 0.20μV 0.018% + 0.20μV 0.054% + 0.30μV 0.14% + 0.40μV		
	27 mV to 90 mV 10 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	42 ppm + 0.50μV 96 ppm + 0.60μV 280 ppm + 0.40μV 720 ppm + 0.50μV		
	90 mV to 1.1 V 10 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	36 ppm + 1.7 μV 67 ppm + 2.0 μV 260 ppm + 1.4 μV 720 ppm + 1.5 μV		
	1.1 V to 3.4 V 10 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	36 ppm + 5.7 μV 66 ppm + 6.7 μV 260 ppm + 5.3 μV 710 ppm + 6.7 μV		
	3.4 V to 11 V 10 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz	36 ppm + 19 μV 65 ppm + 22 μV 260 ppm + 17 μV 720 ppm + 22 μV		



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AC VOLTAGE (continued)				Stevenage
Datron 4920 System (continued)				
Other values (continued)	11 V to 34 V 10 Hz to 30 kHz 30 kHz to 200 kHz 200 kHz to 500 kHz 500 kHz to 1 MHz 34 V to 110 V 10 Hz to 30 kHz 30 kHz to 200 kHz 110 V to 340 V 40 Hz to 20 kHz 20 kHz to 100 kHz 340 V to 1199.5 V 40 Hz to 20 kHz 20 kHz to 100 kHz	36 ppm + 57 μV 65 ppm + 67 μV 260 ppm + 53 μV 710 ppm + 67 μV 37 ppm + 130 μV 80 ppm + 120 μV 44 ppm + 1.4 mV 160 ppm + 4.5 mV 49 ppm + 4.4 mV 160 ppm + 15 mV	The maximum Volt-Hertz product is 7.5 x 10 ⁷ .	
Fluke 5790 System				
	1 mV to 2.2 mV 20 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 300 kHz 300 kHz to 1 MHz 2.2 mV to 7 mV 20 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	650 ppm + 1.3 μV 650 ppm + 2.0 μV 650 ppm + 2.5 μV 800 ppm + 4.0 μV 800 ppm + 4.0 μV 0.16 % + 8.0 μV 0.55 % + 8.0 μV 220 ppm + 1.3 μV 220 ppm + 2.0 μV 220 ppm + 2.5 μV 320 ppm + 4.0 μV 350 ppm + 4.0 μV 900 ppm + 4.0 μV 0.40 % + 8.0 μV 0.40 % + 8.0 μV		



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AC VOLTAGE (continued)				Stevenage
Fluke 5790 System (continued)				
	7 mV to 22 mV 20 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 100 kHz 100 kHz to 200 kHz 200 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	100 ppm + 1.3 μV 100 ppm + 2.0 μV 120 ppm + 2.5 μV 210 ppm + 4.0 μV 210 ppm + 4.0 μV 750 ppm + 4.0 μV 0.30 % + 8.0 μV 0.30 % + 8.0 μV		
	22 mV to 70 mV 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 200 kHz 200 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	60 ppm + 1.5 μV 60 ppm + 1.5 μV 60 ppm + 2.0 μV 80 ppm + 2.5 μV 210 ppm + 4.0 μV 380 ppm + 8.0 μV 0.14 % + 8.0 μV 0.14 % + 8.0 μV		
	70 mV to 700 mV 20 Hz to 40 Hz 40 Hz to 1 kHz 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 200 kHz 200 kHz to 300 kHz 300 kHz to 500 kHz 500 kHz to 1 MHz	45 ppm + 1.5 μV 40 ppm + 1.5 μV 40 ppm + 2.0 μV 70 ppm + 2.5 μV 200 ppm + 4.0 μV 360 ppm + 8.0 μV 0.14 % + 8.0 μV 0.14 % + 8.0 μV		
	700 mV to 22 V 200 kHz to 300 kHz 300 kHz to 1 MHz	520 ppm 0.18 %		
	700 mV to 70 V 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 200 kHz	50 ppm 100 ppm 210 ppm		
	700 mV to 1000 V 20 Hz to 40 Hz 40 Hz to 1 kHz	50 ppm 45 ppm		



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AC VOLTAGE (continued)				Stevenage
Fluke 5790 System (continued)				
	70 V to 220 V 1 kHz to 20 kHz 20 kHz to 70 kHz 70 kHz to 100 kHz	50 ppm 100 ppm 260 ppm		
	220 V to 1000 V 1 kHz to 20 kHz 20 kHz to 100 kHz	170 ppm 990 ppm		
	1.1 kV to 19 kV 50 Hz to 100 Hz	0.40 %	Measurement only	
AC Voltage Waveform Analysis	3 μV to 300 V 20 Hz to 76 kHz	5.0 % of FSD	15 ranges of 30 μV to 300 V FSD in 3-10-30 sequence	
AC VOLTAGE RATIO	10 ⁻⁷ to unity 50 Hz to 1.6 kHz 10 kHz	1.0 x 10 ⁻⁷ of input 5.0 x 10 ⁻⁷ of input	Input voltage in the range 0.5 V to (0.2 f_{Hz})V or 200 V, whichever is the smaller	



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AC CURRENT Measurement	20 Hz to 5 kHz 100 μ A 1 mA 10 mA 100 mA 1 A 10 A	0.026 % 0.015% 0.0090 % 0.0090 % 0.010 % 0.017 %		Stevenage
Measurement and Generation	30 Hz to 20 kHz 200 mA to 25 A	0.070 %		
	30 Hz to 1 kHz 0.1 mA to 2 mA	150 ppm		
	20 Hz to 10 kHz 2 mA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 20 A	80 ppm 100 ppm 120 ppm 200 ppm		
Generation	5 nA to 100 μ A 20 Hz to 1 kHz 1kHz to 5 kHz	0.028 % + 5.0 nA 0.032 % + 6.0 nA		
	100 μ A to 1 mA 20 Hz to 1 kHz 1kHz to 5 kHz	0.016 % + 47 nA 0.018 % + 47 nA		
	1 mA to 10 mA 20 Hz to 1 kHz 1kHz to 5 kHz	0.010 % + 470 nA 0.013 % + 470 nA		
	10 mA to 100 mA 20 Hz to 1 kHz 1kHz to 5 kHz	0.010 % + 470 nA 0.013 % + 470 nA		
	100 mA to 1 A 20 Hz to 1 kHz 1 kHz to 5 kHz	0.022 % + 47 μ A 0.033 % + 62 μ A		
	1 A to 10 A 20 Hz to 1 kHz 1 kHz to 5 kHz	0.029 % + 0.93 mA 0.061 % + 1.2 mA		



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Measured Quantity Instrument or Gauge	Range		Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks		Location Code
AC POWER							Stevenage
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 16 Hz to 69 Hz and for power factors between 1 and 0.75						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	330	290	260	260	260	300	
	340	300	270	270	270	310	
	350	320	290	290	290	330	
380	350	320	330	330	360		
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 16 Hz to 69 Hz and for power factors between 0.75 and 0.5						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	340	300	270	270	270	310	
	350	320	290	290	290	330	
	370	340	300	310	310	340	
400	370	340	340	340	380		
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 16 Hz to 69 Hz and for power factors between 0.5 and 0.25						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	380	350	320	330	330	360	
	430	400	290	380	380	410	
	440	410	380	390	390	420	
470	440	420	420	420	450		
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 69 Hz to 180 Hz and for power factors between 1 and 0.75						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	330	300	260	260	260	310	
	350	320	280	280	280	330	
	360	330	300	300	300	340	
390	370	340	340	340	370		



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AC POWER (continued)							Stevenage
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 69 Hz to 180 Hz and for power factors between 0.75 and 0.5						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	360	330	290	300	300	330	
	390	370	340	340	340	370	
	410	380	350	350	350	390	
	430	410	380	380	380	410	
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 69 Hz to 180 Hz and for power factors between 0.5 and 0.25						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	470	450	420	420	420	450	
	580	560	540	540	540	570	
	590	570	550	550	550	570	
	610	590	570	570	570	590	
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 180 Hz to 450 Hz and for power factors between 1 and 0.75						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	400	370	340	340	340	380	
	450	430	410	410	410	440	
	460	440	420	420	420	450	
	490	470	440	440	440	470	
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 180 Hz to 450 Hz and for power factors between 1 and 0.75						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	400	370	340	340	340	380	
	450	430	410	410	410	440	
	460	440	420	420	420	450	
	490	470	440	440	440	470	
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 180 Hz to 450 Hz and for power factors between 0.75 and 0.5						
Current range A 0.1 to 2 2 to 5 5 to 10 10 to 21	Voltage range (V)						
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008	
	560	540	520	520	520	540	
	690	680	660	660	660	680	
	700	680	670	670	670	690	
	720	700	690	690	690	700	



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Measured Quantity Instrument or Gauge	Range		Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)		Remarks		Location Code	
AC POWER (continued)								Stevenage
	Calibration and Measurement Capability for AC Power in ppm of reading over the frequency range 180 Hz to 450 Hz and for power factors between 0.5 and 0.25							
Current range A	Voltage range (V)							
	6.4 to 13.2	13.2 to 31	31 to 78	78 to 168	168 to 330	330 to 1008		
	0.1 to 2	1100	1100	1100	1100	1100		
	2 to 5	1400	1400	1400	1400	1400		
	5 to 10	1400	1400	1400	1400	1400		
10 to 21	1400	1400	1400	1400	1400			
AC POWER FACTOR	2.1 W to 25 kW 45 Hz to 1 kHz		0.060 %		Maximum voltage 1000 V Current range 21 A to 25 A Measurement at other power factors can be undertaken, either leading or lagging, down to 0.1 power factor, but with increased uncertainties based on an uncertainty of phase angle of $\pm (0.40 + 0.05 f)$ degrees, where f is the test frequency in kHz.			
	0 to unity 16 Hz to 69 Hz		0.00005		For applied voltages between 16 V and 1008 V and for applied currents between 0.25 A and 5 A			
	69 Hz to 180 Hz		0.00009					
	180 Hz to 450 Hz		0.00026					
	450 Hz to 850 Hz		0.00053					
	850 Hz to 3 kHz		0.0026					
	3 kHz to 6 kHz		0.0052					
	0 to unity 16 Hz to 69 Hz		0.00007		For applied voltages between 16 V and 1008 V and for applied currents between 5 A and 21 A			
	69 Hz to 180 Hz		0.00012					
	180 Hz to 450 Hz		0.00035					
	450 Hz to 850 Hz		0.00070					
	850 Hz to 3 kHz		0.0035					
	3 kHz to 6 kHz		0.0070					



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
PHASE ANGLE				Stevenage
Generation	0° to 360° 20 Hz to 10 kHz 10 kHz to 20 kHz 20 kHz to 50 kHz 50 kHz to 100 kHz 100 kHz to 220 kHz	0.010° 0.020° 0.050° 0.090° 0.20°	The uncertainties relate to the calibration of a phase meter of suitable resolution and stability, with equal input levels to each channel. Calibration of variable-phase generators can also be undertaken, with increased uncertainties. The uncertainties for variable-phase generators will be particularly dependent on the purity of the waveform from the generator. Phase calibration can also be undertaken for unequal levels, with increased uncertainties.	
Measurement	0° to 360° 20 Hz to 50 kHz 50 kHz to 100 kHz	0.0050° 0.15°		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
INDUCTANCE				Stevenage
Specific Values	<i>100 Hz:</i> 1 H 10 H <i>1 kHz and 10 kHz:</i> 1 μ H 10 μ H 100 μ H, 1 mH and 10 mH <i>1 kHz:</i> 100 mH and 1 H 10 H <i>10 kHz</i> 100 mH 1 H	0.015 % 0.010 % 0.35 % 0.15 % 0.015 % 0.015 % 0.025 % 0.025 % 0.60 %	The ability to realise the stated uncertainties for inductance is particularly dependent on the electrical and physical characteristics of the inductor being calibrated	
Other Values	<i>100 Hz, 1 kHz and 10 kHz:</i> 1 μ H to 10 μ H 10 μ H to 100 μ H 100 μ H to 100 mH <i>100 Hz and 1 kHz:</i> 100 mH to 10 H	0.40 % 0.20 % 0.10 % 0.10 %		
CAPACITANCE				
Specific Values	1 nF 1 kHz	7.5 ppm		
Other Values	10 pF to 100 pF 100 Hz to 10 kHz 100 pF to 0.1 μ F 50 Hz to 10 kHz 0.1 μ F to 1 μ F 50 Hz to 1 kHz 1 kHz to 10 kHz	0.010 % 0.010 % 0.010 % 0.030 %	Capacitance can be measured below 10 pF and from 1 μ F to 11 μ F, and also up to 100 kHz, with an increased uncertainty which varies in a complex manner with frequency and capacitance. Fixed capacitors within this range are available for the calibration of bridges, capacitance meters and similar instruments.	
CAPACITANCE LOSS				
Dissipation factor ($\tan \delta$)	10^{-4} to unity 1 kHz	0.10 % + 2.0×10^{-5}	For capacitance values ≤ 50 nF. Measurements may be made for greater capacitance values and other frequencies within the range 50 Hz to 10 kHz but the uncertainties may be increased.	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
Electrical Simulation of Temperature indicating devices, including cold junction compensation				Stevenage
Thermocouple Type:				
K	-200 °C to -100 °C	0.28 °C		
	-100 °C to -25 °C	0.17 °C		
	-25 °C to 120 °C	0.15 °C		
	120 °C to 1000 °C	0.22 °C		
	1000 °C to 1372 °C	0.33 °C		
J	-210 °C to -100 °C	0.24 °C		
	-100 °C to -30 °C	0.15 °C		
	-30 °C to 150 °C	0.14 °C		
	150 °C to 760 °C	0.16 °C		
	760 °C to 1200 °C	0.20 °C		
T	-250 °C to -150 °C	0.51 °C		
	-150 °C to 0 °C	0.21 °C		
	0 °C to 120 °C	0.15 °C		
	120 °C to 400 °C	0.14 °C		
R	0 °C to 250 °C	0.47 °C		
	250 °C to 400 °C	0.30 °C		
	400 °C to 1000 °C	0.28 °C		
	1000 °C to 1767 °C	0.33 °C		
S	0 °C to 250 °C	0.39 °C		
	250 °C to 1000 °C	0.31 °C		
	1000 °C to 1400 °C	0.31 °C		
	1400 °C to 1767 °C	0.37 °C		
N	-200 °C to -100 °C	0.33 °C		
	-100 °C to -25 °C	0.19 °C		
	-25 °C to 120 °C	0.17 °C		
	120 °C to 410 °C	0.17 °C		
	410 °C to 1300 °C	0.23 °C		
E	-250 °C to -100 °C	0.40 °C		
	-100 °C to -25 °C	0.15 °C		
	-25 °C to 350 °C	0.14 °C		
	350 °C to 650 °C	0.15 °C		
	650 °C to 1000 °C	0.19 °C		
B	600 °C to 800 °C	0.37 °C		
	800 °C to 1000 °C	0.29 °C		
	1000 °C to 1550 °C	0.26 °C		
	1550 °C to 1820 °C	0.28 °C		
C	0 °C to 150 °C	0.25 °C		
	150 °C to 650 °C	0.22 °C		
	650 °C to 1000 °C	0.26 °C		
	1000 °C to 1800 °C	0.40 °C		



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Electrical Simulation of Temperature indicating devices, including cold junction compensation (continued)				
PRT Indicators	-200 °C to +100 °C 100 °C to 250 °C 250 °C to 350 °C 350 °C to 500 °C 500 °C to 650 °C 650 °C to 700 °C 700 °C to 850 °C	0.058 °C 0.059 °C 0.060 °C 0.061 °C 0.062 °C 0.063 °C 0.064 °C		
Ambient and zero temperature	15 °C to 25 °C -1 °C to +1 °C	0.050 °C 0.050 °C	In support of temperature simulation measurements.	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
FREQUENCY				Stevenage
Specific Values	1 MHz to 10 MHz in 1 MHz intervals	4.5 in 10^{12}	For a comparison procedure over a 7 day period	
Other Values	10 Hz to 120 MHz	1.2 in 10^6 to 1.7 in 10^9	For the calibration of signal sources and frequency meters	
	100 MHz to 20 GHz	1.0 in 10^6 to 1.8 in 10^{11}		
	20 GHz to 26.5 GHz	2.0 in 10^9	For frequency comparison using a synthesiser	
	1 mHz to 18 GHz	4.0 in 10^{11}		
TIME INTERVAL	18 GHz to 40 GHz	1.0 in 10^5	For the calibration of resonant cavity wavemeters.	
	50 ns to 1 s	5 ns		
	1 s to 100 s	1.2 in 10^6 to 3.7 in 10^9		
	100 s to 1000 s	3.7 in 10^9 to 1.2 in 10^9		
	1000 s to 10^4 s	1.2 in 10^9 to 5.8 in 10^8		
10^4 s to 10^5 s	5.8 in 10^8 to 1.6 in 10^9			
RISE TIME	1 s to 1 ns	0.10 % + 20 ps		
	1000 ps to 100 ps	15 ps		
	100 ps to 10 ps	10 ps		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (<i>k</i> = 2)	Remarks	Location Code
ELECTRICAL MEASUREMENTS - RF AND MICROWAVE				Stevenage
NOTE: Where critical, the pin and receptacle depth of precision coaxial connectors used on RF and microwave equipment can be measured and reported on calibration certificates. The quoted uncertainty will not be less than 0.001".				
VOLTAGE REFLECTION COEFFICIENT				
For calibrations using autotesters and bridges in 50 Ω coaxial line	100 Hz to 1 GHz 0.0 to 0.1 0.1 to 0.6 0.6 to 0.9	0.010 to 0.020 0.020 to 0.040 0.040 to 0.070	14 mm 50 Ω coaxial system	
	10 MHz to 18 GHz 0.0 to 0.6 0.6 to 0.9	0.011 to 0.054 0.054 to 0.10	7 mm Type N and PC-7 connectors	
	0.0 to 0.6 10 MHz to 18 GHz 18 GHz to 26.5 GHz	0.015 to 0.043 0.017 to 0.060	3.5 mm WSMA and SMA connectors	
	0.6 to 0.9 10 MHz to 18 GHz 18 GHz to 26.5 GHz	0.043 to 0.078 0.060 to 0.11	3.5 mm WSMA and SMA connectors	
For calibrations using a six-port reflection analyser	0.0 to 0.6 10 MHz to 18 GHz 18 GHz to 26.5 GHz	0.018 to 0.047 0.025 to 0.060	3.5 mm PC-3.5 connectors	
	0.6 to 0.9 10 MHz to 18 GHz 18 GHz to 26.5 GHz	0.047 to 0.081 0.060 to 0.11	3.5 mm PC-3.5 connectors	
	0.0 to 0.6 10 MHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz	0.018 to 0.073 0.025 to 0.080 0.032 to 0.098	2.92 mm Type K connectors	
	0.6 to 0.9 10 MHz to 18 GHz 18 GHz to 26.5 GHz 26.5 GHz to 40 GHz	0.073 to 0.14 0.080 to 0.14 0.098 to 0.18	2.92 mm Type K connectors	
For calibrations using an autotester in 75 Ω coaxial line	0.25 GHz to 18 GHz 0.0 to 0.2 0.2 to 1.0	0.0050 to 0.010 0.010 to 0.023	7 mm Type N and PC-7 connectors	
	0.25 GHz to 26.5 GHz 0.0 to 0.2 0.2 to 1.0	0.013 0.013 to 0.080	3.5 mm PC-3.5 connectors	
For calibrations using an autotester in 75 Ω coaxial line	10 MHz to 300 MHz 0.0 to 0.6 0.6 to 0.9	0.011 to 0.047 0.047 to 0.090	7 mm Type N connectors	



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
RF VOLTAGE				Stevenage
Specific Values	0.5 V, 1 V, 3 V, 5 V, 10 V, 20 V 1 MHz, 10 MHz and 20 MHz 30 MHz 40 MHz 50 MHz	0.090 % 0.070 % 0.070 % 0.15 %	Sources of RF voltage may not be available for all combinations of voltage and frequency	
Other values	20 mV to 100 mV 10 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 100 MHz 100 MHz to 1 GHz 100 MHz to 1.5 GHz	0.32 % 0.34 % 0.55 % 0.81 % 0.88 %	The measurements are of RF voltage developed across a perfectly matched 50 Ω coaxial line system. The uncertainties are for the measurement of the output of a signal generator or the calibration of an instrument for the measurement of RF voltage in such a coaxial line system. If the measurement of RF voltage is required at a specified plane in the coaxial line system, the uncertainties will be increased. The frequency response of the device can be given relative to any frequency between 10 kHz and 1 MHz. Sources of RF voltage may not be available for all combinations of voltage and frequency	
	100 mV to 1 V 10 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 100 MHz 100 MHz to 1.5 GHz	0.40 % 0.43 % 0.61 % 1.0 %		
	1 V to 10 V 10 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 100 MHz 100 MHz to 1.5 GHz	0.46 % 0.50 % 0.65 % 1.0 %		
RF POWER	1 μW to 3 mW 0.3 GHz to 12.4 GHz	6.0 %	Mismatch uncertainty less than 1.5%.	
	10 μW to 3 mW 50 MHz to 200 MHz	(0.90 % to 0.70 %) + 0.10 μW	50 Ω Type N or GPC-7 coaxial system	
	200 MHz to 1 GHz 1 GHz to 4 GHz	(1.1 % to 0.90 %) + 0.10 μW (1.4 % to 1.2 %) + 0.10 μW		
	10 mW to 300 mW 1 kHz to 50 MHz 50 MHz to 100 MHz 100 MHz to 2 GHz 2 GHz to 6 GHz	0.65 % 0.65 % 0.68 % 0.94 %	50 Ω 14 mm coaxial system	



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RF POWER (continued)	300 mW to 15 W 1 kHz to 50 MHz 50 MHz to 1 GHz	0.59 % 0.74 %	50 Ω Type N coaxial system	Stevenage
	15 W to 100 W 50 MHz to 1 GHz	0.79 %		
	0.1 mW to 10 mW 8.2 GHz to 12.4 GHz 12.4 GHz to 17.0 GHz 18 GHz	3.0 % 3.0 % 4.0 %	Waveguide No 16 (WR90, RG52/U)	
	9 kHz to 5 GHz +20 dBm to -50 dBm -50 dBm to -80 dBm -80 dBm to -127dBm	0.15 dB 0.20 dB 0.35 dB	For the calibration of Signal Sources, Spectrum Analysers, Receivers and other similar devices.	
	2 GHz to 18 GHz +10 dBm to -50 dBm -50 dBm to -80 dBm -80 dBm to -100 dBm	0.15 dB 0.20 dB 0.30 dB	The uncertainties are for the measurements in 7 mm coaxial lines fitted with Type N connectors. If adaptors for other types of connector are used then these uncertainties will be increased.	
			If the device being measured presents an imperfect match in 50 Ω coaxial line systems the uncertainties will be increased.	
			For EMC receivers the results may also be given in terms of dB μ W or dB μ V/MHz in a 50 Ω system.	



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CALIBRATION FACTOR (Power sensor calibration)	Calibration and Measurement Capability (CMC) in % calibration factor for the sensor types shown. The CMCs are for 50 Ω sensors with input voltage reflection coefficients not exceeding 0.02. Uncertainties will be increased for higher values of VRC. The reference calibration factor is obtained at 50 MHz.				Stevenage
Nominal level 1 mW <i>Other levels can be used but the uncertainties may be increased.</i>	30 kHz to 4.2 GHz system	10 MHz to 18 GHz system	10 MHz to 26.5 GHz system	10 MHz to 40 GHz system	
Frequency	Type N sensors	Type N and 7 mm sensors	3.5 mm sensors	2.92 mm sensors	
30 kHz	2.8				
50 kHz	1.9				
100 kHz	0.9				
300 kHz	0.59				
500 kHz	0.56				
1 MHz	0.55				
3 MHz	0.58				
5 MHz	0.62				
10 MHz	0.67	1.3	3.7	1.1	
30 MHz	0.67	0.69	1.6	0.87	
100 MHz	0.70	0.59	1.0	0.85	
300 MHz	0.78	0.67	1.0	0.93	
500 MHz	0.78	0.67	1.0	0.93	
1 GHz	0.81	0.69	1.0	0.94	
2 GHz	0.78	0.72	1.1	1.0	
3 GHz	0.93	0.91	1.2	1.0	
4 GHz	1.0	1.0	1.2	1.0	
4.2 GHz	1.1				
5 GHz		1.1	1.3	1.1	
6 GHz		1.4	1.5	1.2	
7 GHz		1.5	1.6	1.3	
8 GHz		1.5	1.6	1.3	
9 GHz		1.7	1.7	1.3	
10 GHz		1.7	1.7	1.3	
11 GHz		1.6	1.7	1.3	
12 GHz		1.5	1.8	1.3	
12.4 GHz		1.6			
13 GHz		1.6	1.8	1.5	
14 GHz		1.9	1.8	1.5	
15 GHz		2.0	1.8	1.5	
16 GHz		2.0	2.0	1.5	
17 GHz		1.8	2.1	1.5	
18 GHz		1.9	2.3	1.5	



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issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Trescal Limited

Issue No: 096 Issue date: 2017

Calibration performed by the Organisation at the locations specified

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
CALIBRATION FACTOR (Power sensor calibration) (continued)	Calibration and Measurement Capability (CMC) in % calibration factor for the sensor types shown. The CMCs are for 50 Ω sensors with input voltage reflection coefficients not exceeding 0.02. Uncertainties will be increased for higher values of VRC. The reference calibration factor is obtained at 50 MHz.			
Nominal level 1 mW <i>Other levels can be used but the uncertainties may be increased.</i>	30 kHz to 4.2 GHz system	10 MHz to 18 GHz system	10 MHz to 26.5 GHz system	10 MHz to 40 GHz system
Frequency	Type N sensors	Type N and 7 mm sensors	3.5 mm sensors	2.92 mm sensors
19 GHz			2.7	2.0
20 GHz			2.9	2.0
20.5 GHz			2.7	
21 GHz			2.6	2.0
21.5 GHz			2.5	
22 GHz			2.4	2.0
22.5 GHz			2.5	
23 GHz			2.6	2.0
23.5 GHz			2.5	
24 GHz			2.4	2.0
24.5 GHz			2.4	
25 GHz			2.4	2.0
25.5 GHz			2.4	
26 GHz			2.4	2.1
26.5 GHz			2.4	
27 GHz				2.3
28 GHz				2.6
29 GHz				2.6
30 GHz				2.6
31 GHz				2.6
32 GHz				2.6
33 GHz				2.7
34 GHz				2.7
35 GHz				2.6
36 GHz				2.6
37 GHz				2.7
38 GHz				2.7
39 GHz				2.6
40 GHz				2.6
Nominal level 1 μ W <i>Other levels can be used but the uncertainties may be increased.</i>	10 MHz to 18 GHz system	10 MHz to 26.5 GHz system	10 MHz to 40 GHz system	
Frequency	Type N sensors	3.5 mm sensors	2.92 mm sensors	
10 MHz	1.6	2.1	1.4	
30 MHz	1.0	1.1	1.1	
100 MHz	0.87	1.0	1.2	
300 MHz	0.87	0.94	1.2	
500 MHz	0.87	0.94	1.2	
1 GHz	1.0	0.94	1.2	

Stevenage



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Nominal level 1 μ W <i>Other levels can be used but the uncertainties may be increased.</i>	10 MHz to 18 GHz system	10 MHz to 26.5 GHz system	10 MHz to 40 GHz system	Stevenage
Frequency	Type N sensors	3.5 mm sensors	2.92 mm sensors	
2 GHz	1.1	1.0	1.2	
3 GHz	1.1	1.1	1.2	
4 GHz	1.1	1.2	1.2	
5 GHz	1.2	1.3	1.4	
6 GHz	1.6	1.5	1.5	
7 GHz	1.8	1.5	1.5	
8 GHz	2.0	1.7	2.4	
9 GHz	2.2	1.9	2.4	
10 GHz	2.2	2.0	2.3	
11 GHz	2.2	2.2	2.5	
12 GHz	2.8	2.0	2.3	
12.4 GHz	2.8			
13 GHz	3.4	2.1	2.5	
14 GHz	3.7	2.3	2.6	
15 GHz	3.1	2.1	2.4	
16 GHz	3.3	2.3	2.5	
17 GHz	3.5	2.3	2.5	
18 GHz	3.1	2.3	2.7	
19 GHz		3.1	3.1	
20 GHz		3.6	3.0	
20.5 GHz		3.8		
21 GHz		3.7	3.1	
21.5 GHz		4.3		
22 GHz		4.5	3.2	
22.5 GHz		4.0		
23 GHz		4.0	3.1	
23.5 GHz		3.8		
24 GHz		3.6	3.0	
24.5 GHz		3.9		
25 GHz		3.8	3.1	
25.5 GHz		3.6		
26 GHz		3.4	3.4	
26.5 GHz		3.4		
27 GHz			4.4	
28 GHz			4.3	
29 GHz			4.2	
30 GHz			4.4	
31 GHz			4.3	
32 GHz			4.4	
33 GHz			4.6	
34 GHz			4.4	
35 GHz			4.4	
36 GHz			4.7	
37 GHz			4.7	
38 GHz			4.4	
39 GHz			4.2	
40 GHz			4.7	



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AMPLITUDE MODULATION				
Modulation Factor	0.05 to 0.50	0.10 %	Modulation generation in discrete steps with 10.7 MHz carrier frequency and 1.045 kHz modulation frequency	Stevenage
	0.50 to 0.70	0.20 %		
	0.70 to 0.95	0.30 %		
	0.05 to 0.50	0.10 %	Modulation generation with 10 MHz to 13 MHz carrier frequency range and 20 Hz to 100 kHz modulation frequency range	
	0.50 to 0.70	0.20 %		
	0.70 to 0.95	0.30 %		
	0.20 to 0.80	0.40 %	Calibration of sources with 10 kHz to 1 GHz carrier frequency range and 30 Hz to 50 kHz modulation frequency range	
Modulation Factor	0 to 0.50	0.50 %	Calibration of sources with 50 kHz to 2.32 GHz carrier frequency range and 1 kHz modulation frequency.	
	0.50 to 0.70	0.50 %		
	0.70 to 0.95	0.60 %		
	0 to 0.95	2.5 %	Calibration of sources with 50 kHz to 5 MHz carrier frequency range and 30 Hz to 15 kHz modulation frequency range.	
	0 to 0.95	2.5 %		
FREQUENCY MODULATION				
Frequency Deviation	249.8 Hz to 1024 kHz	0.30 %	Modulation generation in discrete steps with carrier frequencies from 10.7 MHz to 85.6 MHz and modulation frequency of 1.007 kHz. The uncertainty will depend on the carrier frequency.	



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FREQUENCY MODULATION (continued)				Stevenage
Frequency Deviation (continued)	0 to 500 kHz	0.15 %	Modulation generation with 80 kHz to 1050 MHz carrier frequency range and 20 Hz to 100 kHz modulation frequency range. The uncertainty will depend on the carrier frequency.	
	0 to 5 kHz 5 kHz to 50 kHz	0.50 % 0.40 %	Calibration of sources with 50 kHz to 5.5 MHz carrier frequency range and at 1 kHz modulation frequency. Measurements can be made at other modulation frequencies with increased uncertainties.	
SPECTRAL INTENSITY	9 kHz to 1 GHz	0.79 dB		
ATTENUATION				
Various different systems are available for attenuation measurements, each with different frequency ranges, attenuation ranges, impedance, connector types and uncertainties. For clarity, each system is described separately in this Schedule; these capabilities are listed on the following five pages.				
DC/LF Attenuation	DC and 50 Hz to 10 kHz 0 dB to 20 dB 20 dB to 40 dB 40 dB to 60 dB 60 dB to 80 dB 80 dB to 90 dB 90 dB to 100 dB	0.00030 dB 0.00040 dB 0.0015 dB 0.010 dB 0.060 dB 0.10 dB	DC and LF attenuation measurements using voltage ratio techniques.	
RF Attenuation	10 kHz to 32 MHz 0 dB to 10 dB 10 dB to 20 dB 20 dB to 30 dB 30 dB to 40 dB 40 dB to 50 dB 50 dB to 60 dB 60 dB to 70 dB 70 dB to 80 dB 80 dB to 90 dB 90 dB to 100 dB	0.020 dB 0.020 dB 0.030 dB 0.030 dB 0.030 dB 0.030 dB 0.050 dB 0.050 dB 0.10 dB 0.15 dB	Measurement of attenuation in 50 Ω or 75 Ω coaxial systems.	



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ATTENUATION (continued)				
RF Attenuation (continued)	30 MHz		<u>VM7 System</u> The uncertainties are for the measurement of increments of a variable attenuator, including those within RF signal generators. The measurement of fixed attenuators involves considerations of connector repeatability and mismatch errors and these uncertainties may be increased for the measurement of such devices. <u>Ratiometer System</u> 14 mm coaxial line. <u>Ratiometer System</u> 7 mm coaxial line. <u>Ratiometer System</u> Waveguide Nos 10, 12, 14, 15, 16 and 18. <u>Ratiometer System</u> Waveguide No 22.	Stevenage
	0 dB to 10 dB	0.0040 dB		
	10 dB to 20 dB	0.0040 dB		
	20 dB to 30 dB	0.0070 dB		
	30 dB to 40 dB	0.0070 dB		
	40 dB to 50 dB	0.0070 dB		
	50 dB to 60 dB	0.010 dB		
	60 dB to 70 dB	0.010 dB		
	70 dB to 80 dB	0.015 dB		
	80 dB to 90 dB	0.016 dB		
	90 dB to 100 dB	0.030 dB		
	50 MHz to 5.4 GHz			
	0 dB to 20 dB	0.0070 dB		
	20 dB to 40 dB	0.0090 dB		
	40 dB to 60 dB	0.010 dB		
	60 dB to 70 dB	0.012 dB		
	70 dB to 80 dB	0.016 dB		
	80 dB to 90 dB	0.017 dB		
	90 dB to 100 dB	0.030 dB		
	50 MHz to 8.5 GHz			
	0 dB to 20 dB	0.020 dB		
	20 dB to 30 dB	0.040 dB		
	30 dB to 40 dB	0.050 dB		
	40 dB to 50 dB	0.060 dB		
	50 MHz to 18 GHz			
	0 dB to 20 dB	0.020 dB		
	20 dB to 30 dB	0.040 dB		
	30 dB to 40 dB	0.050 dB		
	40 dB to 50 dB	0.060 dB		
	2.6 GHz to 18 GHz			
	0 dB to 20 dB	0.020 dB		
	20 dB to 30 dB	0.040 dB		
	30 dB to 40 dB	0.050 dB		
	40 dB to 50 dB	0.060 dB		
	26.5 GHz to 40 GHz			
	0 dB to 20 dB	0.040 dB		
20 dB to 30 dB	0.050 dB			
30 dB to 40 dB	0.060 dB			
TORQUE				
Hand torque tools	BS EN ISO 6789:2003 0.5 N·m to 1500 N·m	1.0 % of full scale reading	Calibrations may also be given in lbf.in and lbf.ft.	



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RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETRES, UNLESS OTHERWISE STATED				Stevenage
LENGTH				
Plain plug gauges (parallel) cylindrical setting standards and rollers	0 to 100 diameter	0.80 on diameter		
Plain ring gauges (parallel) and setting standards	2 to 50 diameter 50 to 100 diameter	1.1 on diameter 1.7 on diameter		
Parallels	As BS 906:Parts 1 & 2:1972 5 to 50 x 100 x 450	Dependant on size and grade 1.5 to 5.0		
ANGLE				
Angle plates and box angle plates	As BS 5535:1978 50 to 600	<i>Squareness:</i> 3.0 + (1.0 per 100 mm) <i>Parallelism:</i> 1.0 + (1.0 per 100 mm)	The uncertainty quoted is for the departure from squareness, the distance separating the two parallel planes that just enclose the surface under consideration.	
MEASURING INSTRUMENTS				
Micrometers				
External Internal Depth	As BS 870:2008 0 to 600 As BS 959:2008 0 to 900 As BS 6468:2008 0 to 300	<i>Heads:</i> 2.0 between any two points. <i>Setting and Extension rods up to 300:</i> 1.0 + (5.0 x length in m)		
Micrometer Heads	As BS 1734:1951 0 to 100	1.0		
Vernier caliper, height and depth gauges	As BS 887:2008 0 to 1000 BS 1643:2008 0 to 1000 and BS 6365:2008 0 to 600	Overall performance: 10 + (30 x length in m)		
Dial test indicators	As BS 907:1965 and BS 2795:1981 0 to 50	1.2		
Bore micrometers (three point)	0 to 150 diameter	5.0		



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ELECTRICAL CALIBRATION				
DC RESISTANCE				
Measurement	0 Ω to 300 Ω 300 Ω to 3 k Ω 3 k Ω to 30 k Ω 30 k Ω to 300 k Ω 300 k Ω to 3 M Ω 3 M Ω to 30 M Ω	39 ppm + 1.8 m Ω 37 ppm + 14 m Ω 37 ppm + 140 m Ω 38 ppm + 1.4 Ω 85 ppm + 14 Ω 70 ppm + 350 Ω		Site Calibration
DC CURRENT	0 A to 200 μ A 200 μ A 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 1 A 1 A to 2 A	350 ppm + 10 nA 350 ppm + 50 nA 350 ppm + 480 nA 360 ppm + 10 μ A 0.11 % + 280 μ A		
DC VOLTAGE				
Measurement	0 V to 300 mV 300 mV to 3 V 3 V to 30 V 30 V to 300 V 300 V to 1000 V	40 ppm + 1.3 μ V 25 ppm + 8.0 μ V 25 ppm + 110 μ V 40 ppm + 1.5 mV 50 ppm + 13 mV		
AC VOLTAGE	10 mV to 200 mV 40 Hz to 10 kHz 10 kHz to 50 kHz 50 kHz to 100 kHz 200 mV to 2 V 40 Hz to 10 kHz 10 kHz to 50 kHz 50 kHz to 100 kHz 2 V to 20 V 40 Hz to 10 kHz 10 kHz to 50 kHz 50 kHz to 100 kHz 20 V to 200 V 40 Hz to 10 kHz 10 kHz to 50 kHz 50 kHz to 100 kHz	0.060 % + 120 μ V 1.2 % + 120 μ V 5.8 % + 500 μ V 0.060 % + 240 μ V 0.12 % + 470 μ V 058 % + 2.4 mV 0.060 % + 2.4 mV 0.12 % + 4.7 mV 058 % + 24 mV 0.060 % + 24 mV 0.12 % + 47 mV 058 % + 240 mV		



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AC VOLTAGE (continued)	200 V to 700 V 40 Hz to 10 kHz 10 kHz to 30 kHz	0.060 % + 85 mV 0.12 % + 170 mV		Site Calibration
AC CURRENT	40 Hz to 1 kHz 10 μ A to 200 μ A 200 μ A to 2 mA 2 mA to 20 mA 20 mA to 200 mA 200 mA to 1A 1 A to 2 A	950 ppm + 120 nA 950 ppm + 1.2 μ A 950 ppm + 12 μ A 950 ppm + 120 μ A 0.11 % + 280 μ A 0.29 % + 3.5 mA		
TIME INTERVAL	0 s to 8 hrs	2.0 ms		
TEMPERATURE SIMULATION				
Temperature simulators, Calibration by electrical simulation				
Base metal	-200 °C to +1370 °C	0.47 °C	Including cold junction compensation	
Noble metal	0 °C to +1760 °C	0.47 °C	including cold junction compensation	
Resistance thermometer (Pt 100)	-200 °C to +800 °C	0.15 °C		
Temperature indicators, calibration by electrical simulation				
Base metal	-200 °C to +1370 °C	0.47 °C	Including cold junction compensation	
Noble metal	0 °C to 1760 °C	0.47 °C	including cold junction compensation	
Resistance thermometer (Pt 100)	-200 °C to +800 °C	0.10 °C		



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PRESSURE				Site Calibration
Gas Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-100 kPa to 0 Pa 0 Pa to 40 kPa 40 kPa to 350 kPa 350 kPa to 400 kPa 400 kPa to 2 MPa 2 MPa to 2.8 MPa	230 Pa 100 Pa 180 Pa 400 Pa 1.0 kPa 1.3 kPa	Calibrations of devices with an electrical output may be undertaken	
Gas Pressure (absolute)				
Calibration of pressure indicating instruments and gauges	1.5 kPa to 100 kPa 100 kPa to 140 kPa 140 kPa to 450 kPa 450 kPa to 500 kPa 500 kPa to 2.1 MPa 2.1 MPa to 2.9 MPa	250 Pa 0.14 kPa 0.21 kPa 0.41 kPa 1.0 kPa 1.3 kPa		
Hydraulic Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	0 Pa to 41.4 MPa	31 kPa		
Hydraulic Pressure (absolute)				
Calibration of pressure indicating instruments and gauges	100 kPa to 41.5 MPa	31 kPa		



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TEMPERATURE AND HUMIDITY				Site Calibration
Temperature controlled chambers, autoclaves, media preparators and ovens, with associated indicators and recorders	-20 °C to +250 °C 250 °C to 1000 °C	0.34 °C 6.7 °C		
Humidity controlled chambers (inclusive of associated indicators, controllers and recorders, all with sensors within the specified parameters and ranges)	35 %rh to 95 %rh 20 °C to 70 °C	5.7 %rh		
Block Calibrators	-20 °C to +250 °C 250 °C to 1000 °C	0.91 °C 6.7 °C		
Temperature indicators and recorders with temperature sensors	-20 °C to +200 °C	0.43 °C		
Radiation thermometers (pyrometers)	20 °C to 150 °C 150 °C to 200 °C 200 °C to 250 °C 250 °C to 300 °C 300 °C to 350 °C 350 °C to 400 °C 400 °C to 450 °C 450 °C to 500 °C 500 °C to 550 °C	1.4 °C 1.5 °C 1.9 °C 2.1 °C 2.4 °C 3.0 °C 3.7 °C 4.4 °C 5.1 °C	+ 0.30 % of reading	



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ELECTRICAL CALIBRATION				Mobile
DC RESISTANCE	1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1 k Ω to 10 k Ω 10 k Ω to 100 k Ω 100 k Ω to 1 M Ω 1 M Ω to 100 M Ω	5.0 m Ω 120 ppm + 5.0 m Ω 120 ppm + 13 m Ω 120 ppm + 160 m Ω 120 ppm + 1.6 Ω 470 ppm + 120 Ω 1.0 % + 12 k Ω		
Generation				
Specific values	30 M Ω 100 M Ω 190 M Ω 300 M Ω	0.10 % 0.62 % 0.61 % 0.61 %		
Other values	100 M Ω to 400 M Ω	0.60 % + 40 k Ω		
DC VOLTAGE	0 V to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV 1 kV to 20 kV	69 ppm + 4.2 μ V 52 ppm + 8.2 μ V 47 ppm + 58 μ V 59 ppm + 700 μ V 59 ppm + 12 mV 2.5 %		
AC VOLTAGE	10 mV to 100 mV 45 Hz to 100 Hz	730 ppm + 46 μ V		
	100 mV to 1 V 45 Hz to 20 kHz 20 kHz to 50 kHz	0.14 % + 59 μ V 0.69 % + 99 μ V		
	1 V to 10 V 45 Hz to 20 kHz 20 kHz to 50 kHz	0.46 % + 680 μ V 730 ppm + 490 μ V		
	10 V to 100 V 45 Hz to 20 kHz 20 kHz to 50 kHz	0.14 % + 3.5 mV 0.14 % + 3.6 mV		
	100 V to 750 V 45 Hz to 1 kHz	0.46 % + 5.8 mV		
	750 V to 1 kV 40 Hz to 10 kHz	0.12 % + 50 mV	Generation only	
	1 kV to 20 kV 50 Hz	2.3%		



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DC CURRENT	0 A to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 3 A 3 A to 20 A 20 A to 100 A 100 A to 500 A	600 ppm + 2.6 μ A 600 ppm + 26 μ A 600 ppm + 260 μ A 600 ppm + 1.2 mA 0.12 % + 12 mA 0.20 % + 10 mA 0.30 % + 700 mA		Mobile
AC CURRENT	1 mA to 30 mA 45 Hz to 1 kHz	0.74 % + 130 μ A		
	30 mA to 100 mA 4 Hz to 1 kHz	0.74 % + 130 μ A		
	100 mA to 10 A 45 Hz to 1 kHz	1.5 % + 130 mA		
	320 mA to 3.2 A 45 Hz to 1 kHz	0.20 % + 120 μ A	Generation only	
	3.2 A to 20 A 45 Hz to 1 kHz	0.20 % + 1.2 mA		
FREQUENCY	10 Hz to 100 MHz	1.0 in 10^5 + 1.0 Hz	Measurement only	
TIME INTERVAL	0 s to 1 hour 1 hour to 1 Day	100 ms 100 ms + 1.0 ppm	Mechanically triggered devices, e.g. stopwatches 20 °C \pm 3 °C	
	0 s to 1 hour 1 hour to 1 Day	210 ms 210 ms + 20 ms/hr	Mechanically triggered devices e.g. stopwatches 0 °C to 40 °C	
BANDWIDTH	1 MHz to 250 MHz 30 mV pp to 0.707 V pp	1.4 %	Bandwidth uncertainty will be expressed in terms of frequency relative to the -3 dB point.	
	250 MHz to 1 GHz 30 mV pp to 2 V pp	5.4 %		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
RECEIVERS AND ANALYSERS TO CP1106				Mobile
Amplitude Accuracy				
	-40 dBm to +10 dBm 10 Hz to 4 GHz 4 GHz to 12 GHz 12 GHz to 18 GHz	0.080 dB 0.14 dB 0.19 dB	N Type connectors	
	-40 dBm to +10 dBm 10 Hz to 4 GHz 4 GHz to 13 GHz 13 GHz to 19 GHz 19 GHz to 26 GHz 26 GHz to 30 GHz 30 GHz to 39 GHz 39 GHz to 40 GHz	0.080 dB 0.13 dB 0.18 dB 0.20 dB 0.31 dB 0.33 dB 0.36 dB	K Type connectors	
Calibration Signal	-40 dBm to 0 dBm 10 MHz to 500 MHz	0.070 dB		
Frequency Accuracy	10 MHz to 500 MHz	5.8×10^{-10}		
IF Bandwidth Nominal 0 dBm	10 MHz to 500 MHz Gaussian 3/6 dB Gaussian 60 dB	0.11 % of Bandwidth 1.0 % of Bandwidth		
	Non-Gaussian 3/6 dB Non-Gaussian 60 dB	0.20 % of Bandwidth 1.0 % of Bandwidth		
Bandwidth level switching Nominal 0 dBm	10 MHz to 500 MHz	0.070 dB		
Voltage Reflection Coefficient				
	100 kHz to 3 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.015 0.031 0.065	N Type connectors	
	3 GHz to 18 GHz 0 to 0.2 0.2 to 0.4 0.4 to 0.6	0.028 0.042 0.078		



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RECEIVERS AND ANALYSERS TO CP1106 (continued)				Mobile
	10 MHz to 26 GHz		K Type connectors	
	0 to 0.2	0.036		
	0.2 to 0.4	0.037		
	0.4 to 0.6	0.041		
	26 GHz to 40 GHz			
	0 to 0.2	0.053		
	0.2 to 0.4	0.055		
	0.4 to 0.6	0.063		
Amplitude Linearity Referenced to a nominal level of 0 dBm	10 MHz to 500 MHz			
	0 dB to -40 dB	0.070 dB		
	0 dB to -80 dB	0.080 dB		
	0 dB to -90 dB	0.12 dB		
	0 dB to -95 dB	0.17 dB		
Reference Level Switching	10 MHz to 500 MHz Nominal amplitude 0 dBm	0.030 dB		
Attenuator	10.1 MHz and 50.1 MHz 0 dB to 70 dB	0.060 dB		
Tracking Generator Amplitude Accuracy	-30 dBm to +10 dBm 100 kHz to 4 GHz 4 GHz to 12 GHz 12 GHz to 18 GHz	0.11 dB 0.12 dB 0.13 dB		
Tracking Generator Attenuator Accuracy	10 MHz to 500 MHz 0 dB to 60 dB 0 dB to 90 dB 0 dB to 100 dB	0.11 dB 0.21 dB 0.32 dB		



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Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
RECEIVERS AND ANALYSERS TO CP1106 (continued)				
Pulse Accuracy and Detector Response				
Sine wave accuracy	10 Hz to 1 GHz at 60 dB μ V	0.14 dB		
Pulse level accuracy	20 dB μ V to 70 dB μ V emf	0.84 dB		
Pulse repetition frequency	0 Hz to 1 kHz 1 kHz to 5 kHz	50 mHz 1.2 Hz		
Surge discharge characteristics			For the calibration of surge generators as specified in BS EN 61000-4-5:2006 and 2014	
Open circuit voltage	10 V to 20 kV	3.2 %		
Voltage waveform undershoot	0 to 60 %	1.48 %		
Voltage front / Rise time	0.1 μ s to 3 μ s 3 μ s to 20 μ s	13.3 ns 59.4 ns		
Pulse duration	2 μ s to 20 μ s 20 μ s to 200 μ s 200 μ s to 1 ms	68.7 ns 0.68 μ s 3.45 μ s		
Short circuit current pulse	1 A to 5 kA	2.28 %		
Current waveform undershoot	0 to 60 %	2.49 %		
Current front / rise time	0.1 μ s to 3 μ s 3 μ s to 20 μ s	23.4 ns 62.5 ns		
Current duration	2 μ s to 50 μ s 50 μ s to 500 μ s	0.17 μ s 1.7 μ s		
Phase angle (surge on AC line)	0 ° to 360 °	0.7 °		
Output impedance	0.1 Ω to 500 Ω	2.5 %		



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Electrical fast transient characteristics			For the calibration of EFT/Burst generators as specified in BS EN 61000-4-4	Mobile
Peak voltage into 50 Ω	1 V to 8 kV	1.1 %		
Peak voltage into 1 k Ω	1 V to 8 kV	3.2 %		
Rise time	2 ns to 10 ns	0.125 ns		
Pulse width	10 ns to 75 ns 75 ns to 200 ns	0.33 ns 0.71 ns		
Burst duration	200 ns to 1 ms 1 ms to 20 ms	0.12 μ s 2.8 μ s		
Burst period	50 ms to 500 ms	2 ppm		
Repetition rate	1 kHz to 1.5 MHz	2 ppm		
Ring wave characteristics			For the calibration of Ring Wave Generators as specified in BS EN 61000-4-12	
Peak voltage	10 V to 7 kV	1.35 %		
Voltage rise time	0.1 μ s to 2 μ s	15.4 ns		
Decaying voltage	Pk 2 0 to 2x PkV Pk 3 0 to 2x PkV Pk 4 0 to 2x PkV	1.39 % 1.45 % 1.66 %		
Oscillation frequency	10 kHz to 200 kHz	23 ppm		
Peak current	1 A to 600 A	2.4 %		
Current rise time	100 ns to 3 μ s	27.9 ns		
Phase angle	0 to 360 degrees	0.7 °		
Output impedance	1 Ω to 100 Ω	2.8 %		
Voltage dips and interrupts characteristics			For the calibration of voltage dips and interrupts simulators as specified in BS EN 61000-4-11	
AC Voltage dip	0 V to 500 V 50 Hz to 400 Hz	0.51 %		
Overshoot / undershoot	0 to 20 %	0.87 %		
Rise/Fall time	0.1 s to 15 μ s	45 ns		



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Dip timing	10 μs to 5 s	11.7 ppm	For the calibration of Slow Damped Oscillatory Wave Generators as specified in IEC 61000-4-18	Mobile
Load regulation	0 V to 500 V	0.56 %		
Phase accuracy	0 ° to 360 °	0.7 °		
Inrush current	To 1000A peak	4.1 %		
Slow Damped Oscillatory Wave Characteristics				
Peak Voltage	10 V to 7 kV	1.36 %		
Voltage Rise Time	20 ns to 200 ns	5.2 ns		
Decaying Voltage Peak 5 Peak 10	0 to 2 * Pk V 0 to 2 * Pk V	1.41 % 1.41 %		
Oscillation Frequency	10 kHz to 2 MHz	0.1 %		
Peak Current	500 mA to 50 A	2.41 %		
Burst Duration	Up to 3 s	0.01 s		
Repetition Rate	30 / s to 60 / s 300 / s to 600 / s	0.5 % 0.05 %		
Output Impedance	50 Ω to 500 Ω	2.77 %		
Calibration of 17 th Edition Test Equipment				
Continuity	0 Ω to 20 mΩ	1.4 % + 13 mΩ		
	20 mΩ to 200 mΩ	0.45 % + 26 mΩ		
	200 mΩ to 300 mΩ	0.45 % + 27 mΩ		
	300 mΩ to 500 mΩ	0.45 % + 26 mΩ		
	500 mΩ to 900 mΩ	0.44 % + 26 mΩ		
	900 mΩ to 1 Ω	0.44 % + 27 mΩ		
	1 Ω to 10 Ω	0.44 % + 26 mΩ		
	10 Ω to 100 Ω	0.44 % + 27 mΩ		
	100 Ω to 1 kΩ	0.44 % + 27 mΩ		
Insulation	0 Ω to 1 MΩ	0.70 % + 500 Ω		
	1 MΩ to 10 MΩ	1.7 % + 35 kΩ		
	10 MΩ to 100 MΩ	1.7 % + 260 kΩ		
	100 MΩ to 1 GΩ	2.0 % + 290 kΩ		



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Calibration of 17th Edition Test Equipment (continued)				
Loop Impedance	50 Hz			Mobile
	50 mΩ	0.66 % + 4.7 mΩ		
	100 mΩ	0.64 % + 4.7 mΩ		
	220 mΩ	0.64 % + 5.2 mΩ		
	340 mΩ	0.64 % + 5.2 mΩ		
	500 mΩ	0.64 % + 5.2 mΩ		
	1.0 Ω	0.64 % + 5.2 mΩ		
	5.0 Ω	0.64 % + 5.2 mΩ		
	10 Ω	0.64 % + 5.2 mΩ		
	100 Ω	0.64 % + 93 mΩ		
	1 kΩ	0.64 % + 120 mΩ		



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Calibration of 17 th Edition Test Equipment (continued)				
RCD testers				Mobile
Timing	20 ms to 5 s	1.5 ms		
Current	50 Hz			
	10 mA at 200 ms	1.8 % + 70 μ A		
	30 mA at 200 ms	1.8 % + 110 μ A		
	100 mA at 200 ms	1.8 % + 170 μ A		
	300 mA at 200 ms	1.8 % + 850 μ A		
	1 A at 200 ms	1.8 % + 700 μ A		
PAT TESTERS				
Earth Bond Resistance	40 m Ω	5.2 m Ω		
	100 Ω	4.8 m Ω		
	290 m Ω	05.5 m Ω		
	390 m Ω	5.7 m Ω		
	1 Ω	7.9 m Ω		
	5 Ω	29 m Ω		
	10 Ω	60 m Ω		
	100 Ω	580 m Ω		
	1 k Ω	5.2 Ω		
Earth Bond Current	50 Hz			
	100 mA	1.5 % + 1.0 mA		
	8 A	1.5 % + 10 mA		
	10 A	1.5 % + 11 mA		
	20 A	1.5 % + 15 mA		
Load Test	0.13 kVA (nominal 440 Ω)	5.8 % +3.1 Ω		
Leakage Current	2 mA to 8 mA	1.7 % + 36 μ A		



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Temperature simulators, calibration by electrical simulation				Mobile
Resistance thermometers (Pt 100)	-200 °C to +800 °C	0.10 °C		
Base metal thermocouples	-200 °C to -100 °C -100 °C to +1372 °C	1.7 °C 1.2 °C	Including cold junction compensation	
Noble metal thermocouples	0 °C to 100 °C 100 °C to 400 °C 400 °C to 1770 °C	4.0 °C 2.7 °C 2.0 °C	Including cold junction compensation	
Temperature indicators, calibration by electrical simulation				
Resistance thermometers (Pt 100)	-200 °C to +800 °C	0.15 °C		
Base metal thermocouples	-200 °C to -100 °C -100 °C to +1372 °C	1.7 °C 1.2 °C	Including cold junction compensation	
Noble metal thermocouples	0 °C to 100 °C 100 °C to 400 °C 400 °C to 1770 °C	4.0 °C 2.7 °C 2.0 °C	Including cold junction compensation	
HUMIDITY Calibration of rh probes:	15 °C to 20 °C 36 %rh to 90 %rh	1.7 %rh to 3.8 %rh	The accreditation covers other humidity units directly related to dew point, e.g. vapour pressure, ppm volume, g/kg, etc.	
	20 °C to 30 °C 26 %rh to 90 %rh	1.3 %rh to 3.7 %rh		
	30 °C to 50 °C 25 %rh to 75 %rh	1.2 %rh to 2.9 %rh		



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HUMIDITY (continued)				Mobile
Calibration of chambers: Dew-Point	0 °C to 82 °C	0.58 °C		
Relative Humidity	10 °C to 20 °C 50 %rh to 98 %rh	2.4 %rh to 4.2 %rh	Dew Point and Relative Humidity Instruments may be calibrated in accordance with the schedule measured quantities and range	
	20 °C to 40 °C 30 %rh to 98 %rh	1.5 %rh to 3.9 %rh		
	40 °C to 60 °C 10 %rh to 98 %rh	1.5 %rh to 3.4 %rh		
	60 °C to 80 °C 10 %rh to 98 %rh	1.5 %rh to 3.0 %rh		
	85 °C and 85 %rh	3.5 %rh		
TEMPERATURE				
Temperature controlled chambers/ovens	-80 to +100 °C 100 °C to 260 °C	0.20 °C 0.40 °C	Temperature controlled baths calibrated using PRTs.	
Temperature controlled furnaces	0 °C to 1100 °C 1100 °C to 1300 °C	3.0 °C 5.0 °C	Calibrated using type R thermocouples.	
Temperature controlled ovens/chambers	-80 °C to +260 °C 260 °C to 400 °C	1.0 °C 3.0 °C	Calibrated using type T thermocouples.	
Temperature controlled ovens/chambers	400 °C to 700 °C	5.0 °C	Calibrated using type K thermocouples.	
Temperature controlled ovens/chambers	0 °C to 1200 °C	5.0 °C	Calibrated using type N thermocouples	
Temperature Indicators	-80 °C to -25 °C -25 °C to +140 °C 140 °C to 1100 °C 1100 °C to 1300 °C	0.20 °C 0.50 °C 3.0 °C 5.0 °C		



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PRESSURE				Mobile
Gas Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-95 kPa to 0 Pa 0 Pa to 1 MPa 1 MPa to 2 MPa 2 MPa to 10 MPa	720 Pa 720 Pa 1.8 kPa 4.2 kPa	Calibration of pressure devices with an electrical output may be undertaken	
Hydraulic Pressure (gauge)				
Calibration of pressure indicating instruments and gauges	0 Pa to 70 MPa	100 kPa	Calibration of pressure devices with an electrical output may be undertaken	
Gas Pressure (Absolute)				
Calibration of pressure indicating instruments and gauges	5 kPa to 80 kPa 80 kPa to 115 kPa 115 kPa to 200 kPa	700 Pa 52 Pa 700 Pa	Absolute pressure calibrations may be undertaken over the gauge pressure ranges with the addition of the barometric pressure and uncertainty of 52 Pa	
MASS				
Weighing Machines (Non Automatic)	50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 50 kg	0.13 mg 0.21 mg 0.42 mg 1.1 mg 2.1 mg 4.2 mg 10 mg 34 mg 71 mg 230 mg	Weights are available in OIML Class F1 from 1 mg to 10 kg. Maximum grouped load 50 kg. Other loads within the overall listed range may also be used.	



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<p>VOLUME OF LIQUIDS (SEE NOTE 1)</p> <p>Single channel instruments</p> <p>Multi channel instruments up to 12 channels Simultaneously calibrated</p>	<p>2 µl to 10 µl 10 µl to 20 µl 20 µl to 100 µl 100 µl to 200 µl 200 µl to 500 µl 0.5 ml to 1 ml 1 ml to 2 ml 2 ml to 5 ml 5 ml to 10 ml 10 ml to 20 ml</p> <p>1.0 µl to 20 µl 20 µl to 50 µl 50 µl to 100 µl 100 µl to 200 µl 200 µl to 300 µl 300 µl to 600 µl 600 µl to 1200 µl</p>	<p>0.090 µl 0.090 µl 0.26 µl 0.36 µl 0.90 µl 0.002 ml 0.005 ml 0.011 ml 0.015 ml 0.030 ml</p> <p>0.10 µl 0.20 µl 0.30 µl 0.40 µl 0.40 µl 0.90 µl 2.00 µl</p>	<p>Note 1. For water delivered from piston and/or plunger operated volumetric apparatus (POVA) using in-house gravimetric procedures</p> <p>1 volume (fixed volume pipettes) 4 volumes (variable volume pipettes) 10 readings (as specified in ISO 8655)</p> <p>From minimum of 1 volume and minimum of 5 readings up to 4 volumes and up to 10 readings (by agreement with the customer)</p>	
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DIMENSIONAL MEASUREMENTS: RANGE IN MILLIMETRES AND UNCERTAINTY IN MICROMETERS UNLESS OTHERWISE STATED				Manchester (Site calibration)
Electronic Height Gauges with microprocessor control	0 to 1000	$1.0 + (5.0 \times L \text{ in m})$		
Comparators - Horizontal (external)	BS1054:1975 250 to 10 000 magnifications	1.0% of range, minimum 2.0		
Horizontal measuring machines	0 to 1200	$0.30 + (4.0 \times L \text{ in m})$		
NPL type level comparator	MOY/SCMI/42 0 to 1000 mm	$0.050 + (0.50 \times L \text{ in m})$		
Gauge block comparators	0 to 100 mm	$0.050 + (0.5 \times L \text{ in m})$		
Optical dividing heads				
Rotary tables		Linear dimensions		
Inclinable tables	0 to 1000 Capacity	$1 + (10 \times L \text{ in m})$ Overall angular performance 3 seconds of arc		
Inclinable rotary tables				
Profile projectors	10 to 100 magnification Linear Angle	125 at the screen 4.0 2 minutes of arc		
Microscopes toolmakers	MOY/SCMI/02 0 to 150 x 150 mm	$2.0 + 2.5/m$ with eye piece		
Measuring machines plain taper diameter	MOY/SMCI 16,19 and 78 0 to 100 magnifications	1.5 (overall performance)		
Linear scales associated with height and length measuring instruments using a laser interferometer	0 to 3000	$0.15 + (1.5 \times L \text{ in m})$		
Performance verification of co-ordinate measuring machines	As BS EN ISO 10360-2:2009 0 mm to 1500 mm (longest diagonal using end standards) As BS EN ISO 10360-5:2010 10 mm to 50 mm	$0.70 + (0.70 \times L \text{ in m})$ μm $0.90 \mu\text{m}$		



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FORM Surface Plates Granite Cast iron	As BS 817:2008	1.5 + (0.80 x diagonal in m)	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.	Manchester (Site calibration)
END				