Schedule of Accreditation

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0452

Accredited to ISO/IEC 17025:2017

Eurofins E&E ETC Limited

Issue No: 036 **Issue date:** 17 May 2021

Caddsdown Industrial Estate
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Calibration performed by the Organisation at the locations specified

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Caddsdown Industrial Estate Clovelly Road Bideford Devon EX39 3DX	**Local contact** Steve Campion Tel: +44 (0)1237 423388 Fax: +44 (0)1237 423434 E-Mail: enquiryetc@eurofins.com	Electrical dc and lf Electrical rf Antennas	Bideford

Site activities performed away from the locations listed above:

Location details		Activity	Location code
Customers' sites or premises The customers' site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer	**Local contact** Steve Campion Tel: +44 (0)1237 423388 Fax: +44 (0)1237 423434 E-Mail: enquiryetc@eurofins.com	Electrical dc and lf Electrical rf	Site

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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
DC RESISTANCE				Bideford
Measurement	*At 10 A:*			
	100 µΩ to 1 mΩ	130 ppm	Other test currents may be used but with increased uncertainties.	
	1 mΩ to 10 mΩ	42 ppm		
	At 1 A:			
	10 mΩ to 100 mΩ	37 ppm		
	100 mΩ to 1 Ω	33 ppm		
	From 10 V to 1 kV:		Using voltage and current method.	
	200 MΩ to 2 GΩ	0.031 %		
	2 GΩ to 20 GΩ	0.037 %		
	20 GΩ to 200 GΩ	0.042 %		
	200 GΩ to 2 TΩ	0.12 %		
	From 1 kV to 5 kV:		Using voltage and current method.	
	200 MΩ to 2 GΩ	0.15 %		
	2 GΩ to 20 GΩ	0.15 %		
	20 GΩ to 200 GΩ	0.16 %		
	200 GΩ to 2 TΩ	0.19 %		
Measurement and generation	0 Ω to 1 Ω	15 µΩ		
	1 Ω to 20 Ω	15 ppm		
	20 Ω to 200 Ω	10 ppm		
	200 Ω to 2 kΩ	10 ppm		
	2 kΩ to 20 kΩ	10 ppm		
	20 kΩ to 200 kΩ	15 ppm		
	200 kΩ to 2 MΩ	19 ppm		
	2 MΩ to 20 MΩ	21 ppm		
	20 MΩ to 200 MΩ	190 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
DC RESISTANCE (continued)				Bideford
Generation	100 μΩ to 2 mΩ 2 mΩ to 20 mΩ 20 mΩ to 200 mΩ 200 mΩ to 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ	160 ppm 45 ppm 42 ppm 37 ppm 6.7 ppm 6.4 ppm 6.4 ppm 6.5 ppm 6.7 ppm 14 ppm 15 ppm 150 ppm	Application of known resistance values for the calibration of resistance measuring instruments.	
	From 10 V to 1 kV: 200 MΩ to 2 GΩ 2 GΩ to 20 GΩ 20 GΩ to 200 GΩ 200 GΩ to 2 TΩ	 0.031 % 0.037 % 0.042 % 0.12 %		
	From 1 kV to 5 kV: 200 MΩ to 2 GΩ 2 GΩ to 20 GΩ 20 GΩ to 200 GΩ 200 GΩ to 2 TΩ	 0.15 % 0.15 % 0.16 % 0.19 %		
DC VOLTAGE				
Generation	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V 1 kV to 30 kV	14 ppm + 0.12 μV 6.6 ppm 6.3 ppm 6.7 ppm 7.2 ppm 0.14 %	Application of known DC voltages for the calibration of voltage measuring instruments.	
Measurement	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V 1 kV to 40 kV	18 ppm + 0.16 μV 8.6 ppm 8.4 ppm 9.0 ppm 9.7 ppm 0.14 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
DC CURRENT				
Generation	10 pA to 200 pA	0.056 %	Application of known DC currents for the calibration of current measuring instruments.	
	200 pA to 2 nA	0.034 %		
	2 nA to 20 nA	0.029 %		
	20 nA to 200 nA	0.023 %		
	200 nA to 2 µA	0.019 %		
	2 µA to 20 µA	0.014 %		
	20 µA to 200 µA	11 ppm		
	200 µA to 2 mA	11 ppm		
	2 mA to 20 mA	12 ppm		
	20 mA to 200 mA	14 ppm		
	200 mA to 1 A	22 ppm		
	1 A to 20 A	46 ppm		
	20 A to 100 A	0.15 %		
			Using multi-turn coils:	
Current clamp calibration	0 A to 20 A	0.25 %	Single turn	
	0 A to 1000 A	0.34 %	10 or 50 turns	
	1000 A to 5000 A	0.36 %	10 or 50 turns	
Measurement	10 pA to 200 pA	0.056 %		Bideford
	200 pA to 2 nA	0.038 %		
	2 nA to 20 nA	0.034 %		
	20 nA to 200 nA	0.027 %		
	200 nA to 2 µA	0.023 %		
	2 µA to 20 µA	0.019 %		
	20 µA to 200 µA	14 ppm		
	200 µA to 2 mA	14 ppm		
	2 mA to 20 mA	16 ppm		
	20 mA to 200 mA	27 ppm		
	200 mA to 1 A	39 ppm		
	1 A to 20 A	46 ppm		
	20 A to 100 A	0.15 %		
	100 A to 250 A	0.17 %		
	250 A to 1000 A	0.31 %		
AC VOLTAGE	*100 mHz to 10 Hz*			
	V_{rms} 2.5 mV to 707 V			
	V_{pk} 1000 V maximum	0.15 % + 5.0 µV		
Generation	*10 Hz to 30 Hz*		Application of known AC voltages for the calibration of voltage measuring instruments.	
Specific Values	1 V	75 ppm		
	10 V	75 ppm		
	100 V	78 ppm		
	30 Hz to 300 Hz			
	10 mV	300 ppm		
	100 mV	140 ppm		
	1 V	73 ppm		
	10 V	73 ppm		
	100 V	78 ppm		
	1000 V	84 ppm	40 Hz minimum	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC VOLTAGE (continued)				Bideford
Generation (continued)	*300 Hz to 1 kHz*			
Specific Values	10 mV	300 ppm		
	100 mV	120 ppm		
	1 V	70 ppm		
	10 V	70 ppm		
	100 V	75 ppm		
	1000 V	84 ppm		
	1 kHz to 10 kHz			
	10 mV	310 ppm		
	100 mV	130 ppm		
	1 V	76 ppm		
	10 V	76 ppm		
	100 V	81ppm		
	1000 V	95 ppm		
	10 kHz to 30 kHz			
	10 mV	370 ppm		
	100 mV	220 ppm		
	1 V	130 ppm		
	10 V	130 ppm		
	100 V	130 ppm		
	1000 V	170 ppm		
	30 kHz to 100 kHz			
	10 mV	460 ppm		
	100 mV	360 ppm		
	1 V	140 ppm		
	10 V	150 ppm		
	100 V	170 ppm		
	700 V	470 ppm		
	100 kHz to 300 kHz			
	1 V	710 ppm		
	10 V	710 ppm		
	300 kHz to 1 MHz			
	1 V	0.12 %		
	10 V	0.13 %		
Other Values	*10 Hz to 30 Hz*			
	200 mV to 2 V	190 ppm to 83 ppm		
	2 V to 20 V	190 ppm to 83 ppm		
	20 V to 200 V	190 ppm to 85 ppm		

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) Other Values	*30 Hz to 300 Hz* 2 mV to 5 mV 5 mV to 10 mV 10 mV to 50 mV 50 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V	 2900 ppm to 1200 ppm 1200 ppm to 650 ppm 650 ppm to 200 ppm 200 ppm to 160 ppm 140 ppm to 77 ppm 140 ppm to 77 ppm 140 ppm to 81 ppm 100 ppm to 87 ppm		Bideford
	300 Hz to 1 kHz 2 mV to 5 mV 5 mV to 10 mV 10 mV to 50 mV 50 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V	 2900 ppm to 1200 ppm 1200 ppm to 650 ppm 650 ppm to 190 ppm 190 ppm to 140 ppm 91 ppm to 71 ppm 91 ppm to 71 ppm 94 ppm to 76 ppm 100 ppm to 87 ppm	40 Hz minimum	
	1 kHz to 10 kHz 2 mV to 5 mV 5 mV to 10 mV 10 mV to 50 mV 50 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V	 2900 ppm to 1200 ppm 1200 ppm to 660 ppm 660 ppm to 200 ppm 200 ppm to 150 ppm 96 ppm to 77 ppm 96 ppm to 77 ppm 99 ppm to 82 ppm 110 ppm to 98 ppm		
	10 kHz to 30 kHz 2 mV to 5 mV 5 mV to 10 mV 10 mV to 50 mV 50 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1000 V	 2900 ppm to 1200 ppm 1200 ppm to 690 ppm 690 ppm to 270 ppm 270 ppm to 230 ppm 140 ppm to 130 ppm 140 ppm to 130 ppm 180 ppm to 140 ppm 180 ppm to 170 ppm		
	30 kHz to 100 kHz 2 mV to 5 mV 5 mV to 10 mV 10 mV to 50 mV 50 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 700 V	 2900 ppm to 1200 ppm 1200 ppm to 740 ppm 740 ppm to 390 ppm 390 ppm to 370 ppm 180 ppm to 140 ppm 190 ppm to 160 ppm 240 ppm to 170 ppm 480 ppm to 470 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC VOLTAGE (continued)	*100 kHz to 300 kHz*			Bideford
Generation (continued)	200 mV to 2 V	840 ppm to 730 ppm		
Other Values	2 V to 20 V	840 ppm to 730 ppm		
	300 kHz to 1 MHz			
	200 mV to 2 V	0.26 % to 0.13 %		
	2 V to 20 V	0.27 % to 0.14 %		
	At 50 Hz			
	1 kV to 7 kV	0.30 %		
Measurement	*10 Hz to 30 Hz*			
Specific Values	1 V	99 ppm		
	10 V	99 ppm		
	100 V	100 ppm		
	30 Hz to 300 Hz			
	10 mV	320 ppm		
	100 mV	150 ppm		
	1 V	98 ppm		
	10 V	98 ppm		
	100 V	100 ppm		
	1000 V	110 ppm	40 Hz minimum	
	300 Hz to 1 kHz			
	10 mV	310 ppm		
	100 mV	140 ppm		
	1 V	95 ppm		
	10 V	95 ppm		
	100 V	99 ppm		
	1000 V	110 ppm		
	1 kHz to 10 kHz			
	10 mV	320 ppm		
	100 mV	150 ppm		
	1 V	110 ppm		
	10 V	110 ppm		
	100 V	110 ppm		
	1000 V	120 ppm		
	10 kHz to 30 kHz			
	10 mV	400 ppm		
	100 mV	260 ppm		
	1 V	190 ppm		
	10 V	190 ppm		
	100 V	190 ppm		
	1000 V	220 ppm		
	30 kHz to 100 kHz			
	10 mV	500 ppm		
	100 mV	410 ppm		
	1 V	230 ppm		
	10 V	240 ppm		
	100 V	50 ppm		
	700 V	500 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC VOLTAGE (continued)	*30 kHz to 100 kHz*			Bideford
Measurement (continued)	10 mV	500 ppm		
Specific Values	100 mV	410 ppm		
	1 V	230 ppm		
	10 V	240 ppm		
	100 V	50 ppm		
	700 V	500 ppm		
	100 kHz to 300 kHz			
	1 V	930 ppm		
	10 V	930 ppm		
	300 kHz to 1 MHz			
	1 V	0.14 %		
	10 V	0.15 %		
Measurement; other values	*10 Hz to 30 Hz*			
	200 mV to 2 V	150 ppm to 100 ppm		
	2 V to 20 V	150 ppm to 100 ppm		
	20 V to 200 V	150 ppm to 100 ppm		
	30 Hz to 300 Hz			
	2 mV to 5 mV	2300 ppm to 980 ppm		
	5 mV to 10 mV	980 ppm to 560 ppm		
	10 mV to 50 mV	560 ppm to 180 ppm		
	50 mV to 200 mV	180 ppm to 160 ppm		
	200 mV to 2 V	150 ppm to 100 ppm		
	2 V to 20 V	150 ppm to 100 ppm		
	20 V to 200 V	150 ppm to 100 ppm		
	200 V to 1000 V	120 ppm to 110 ppm		
	300 Hz to 1 kHz			
	2 mV to 5 mV	1200 ppm to 560 ppm		
	5 mV to 10 mV	560 ppm to 380 ppm		
	10 mV to 50 mV	380 ppm to 140 ppm		
	50 mV to 200 mV	140 ppm to 140 ppm		
	200 mV to 2 V	150 ppm to 98 ppm		
	2 V to 20 V	150 ppm to 98 ppm		
	20 V to 200 V	150 ppm to 100 ppm		
	200 V to 1000 V	120 ppm to 110 ppm		
	1 kHz to 10 kHz			
	2 mV to 5 mV	2300 ppm to 980 ppm		
	5 mV to 10 mV	980 ppm to 560 ppm		
	10 mV to 50 mV	560 ppm to 180 ppm		
	50 mV to 200 mV	180 ppm to 160 ppm		
	200 mV to 2 V	160 ppm to 110 ppm		
	2 V to 20 V	160 ppm to 110 ppm		
	20 V to 200 V	160 ppm to 110 ppm		
	200 V to 1000 V	140 ppm to 130 ppm	40 Hz minimum	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC VOLTAGE (continued)				Bideford
Measurement (continued)	*10 kHz to 30 kHz*			
Other Values	2 mV to 5 mV	4600 ppm to 1900 ppm		
	5 mV to 10 mV	1900 ppm to 1000 ppm		
	10 mV to 50 mV	1000 ppm to 320 ppm		
	50 mV to 200 mV	320 ppm to 280 ppm		
	200 mV to 2 V	300 ppm to 190 ppm		
	2 V to 20 V	300 ppm to 190 ppm		
	20 V to 200 V	300 ppm to 190 ppm		
	200 V to 1000 V	250 ppm to 220 ppm		
	30 kHz to 100 kHz			
	2 mV to 5 mV	1.2 % to 0.46 %		
	5 mV to 10 mV	0.46 % to 2400 ppm		
	10 mV to 50 mV	2400 ppm to 620 ppm		
	50 mV to 200 mV	620 ppm to 470 ppm		
	200 mV to 2 V	1200 ppm to 330 ppm		
	2 V to 20 V	1200 ppm to 340 ppm		
	20 V to 200 V	1200 ppm to 340 ppm		
	200 V to 700 V	770 ppm to 560 ppm		
	100 kHz to 300 kHz			
	200 mV to 2 V	1.2 % to 0.25 %		
	2 V to 20 V	1.2 % to 0.25 %		
	300 kHz to 1 MHz			
	200 mV to 2 V	12 % to 2.3 %		
	2 V to 20 V	12 % to 2.3 %		
	1 kV to 28 kV, *40 Hz to 60 Hz*	0.30 %		
	1 kV to 4 kV, *60 Hz to 1 kHz*	1.0 %		
AC CURRENT				
Generation (specific values)	100 µA		Application of known AC currents for the calibration of current measuring instruments.	
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	170 ppm		
	1 kHz to 5 kHz	240 ppm		
	5 kHz to 10 kHz	610 ppm		
	1 mA			
	10 Hz to 55 Hz	150 ppm		
	55 Hz to 1 kHz	130 ppm		
	1 kHz to 5 kHz	180 ppm		
	5 kHz to 10 kHz	530 ppm		
	10 mA			
	10 Hz to 55 Hz	150 ppm		
	55 Hz to 1 kHz	75 ppm		
	1 kHz to 5 kHz	75 ppm		
	5 kHz to 10 kHz	92 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC CURRENT (continued)				Bideford
Generation (specific values) (continued)	100 mA			
	10 Hz to 55 Hz	150 ppm		
	55 Hz to 1 kHz	75 ppm		
	1 kHz to 5 kHz	75 ppm		
	5 kHz to 10 kHz	92 ppm		
	1 A			
	10 Hz to 55 Hz	180 ppm		
	55 Hz to 1 kHz	96 ppm		
	1 kHz to 5 kHz	110 ppm		
	5 kHz to 10 kHz	120 ppm		
Generation (other values)	10 µA to 20 µA		Application of known AC currents for the calibration of current measuring instruments.	
	10 Hz to 55 Hz	290 ppm		
	55 Hz to 1 kHz	290 ppm		
	1 kHz to 5 kHz	340 ppm		
	5 kHz to 10 kHz	650 ppm		
	20 µA to 200 µA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	170 ppm		
	1 kHz to 5 kHz	270 ppm		
	5 kHz to 10 kHz	630 ppm		
	200 µA to 2 mA			
	10 Hz to 55 Hz	160 ppm		
	55 Hz to 1 kHz	140 ppm		
	1 kHz to 5 kHz	210 ppm		
	5 kHz to 10 kHz	560 ppm		
	2 mA to 20 mA			
	10 Hz to 55 Hz	160 ppm		
	55 Hz to 1 kHz	88 ppm		
	1 kHz to 5 kHz	140 ppm		
	5 kHz to 10 kHz	200 ppm		
	20 mA to 200 mA			
	10 Hz to 55 Hz	160 ppm		
	55 Hz to 1 kHz	88 ppm		
	1 kHz to 5 kHz	140 ppm		
	5 kHz to 10 kHz	200 ppm		
	200 mA to 1 A			
	10 Hz to 55 Hz	190 ppm		
	55 Hz to 1 kHz	120 ppm		
	1 kHz to 5 kHz	360 ppm		
	5 kHz to 10 kHz	480 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC CURRENT (continued)				Bideford
Generation (other values, continued)	1 A to 20 A			
	30 Hz to 55 Hz	190 ppm		
	55 Hz to 1 kHz	120 ppm		
	1 kHz to 5 kHz	170 ppm		
Current clamp calibration	*10 Hz to 5 kHz*		Using multi-turn coils:	
	100 µA to 1 A	0.28 %	Single turn	
	30 Hz to 5 kHz			
	1 A to 10 A	0.31 %	Single turn	
	30 Hz to 100 Hz			
	3.2 A to 500 A	0.66 %	10 or 50 turns	
	100 Hz to 440 Hz			
	3.2 A to 500 A	1.8 %	10 or 50 turns	
Measurement (specific values)	100 µA			
	10 Hz to 55 Hz	180 ppm	Measurement of AC current using digital multimeter and current shunt.	
	55 Hz to 1 kHz	180 ppm		
	1 kHz to 5 kHz	250 ppm		
	5 kHz to 10 kHz	620 ppm		
	1 mA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	150 ppm		
	1 kHz to 5 kHz	190 ppm		
	5 kHz to 10 kHz	540 ppm		
	10 mA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	100 ppm		
	1 kHz to 5 kHz	100 ppm		
	5 kHz to 10 kHz	130 ppm		
	100 mA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	110 ppm		
	1 kHz to 5 kHz	110 ppm		
	5 kHz to 10 kHz	130 ppm		
	1 A			
	10 Hz to 55 Hz	200 ppm		
	55 Hz to 1 kHz	120 ppm		
	1 kHz to 5 kHz	140 ppm		
	5 kHz to 10 kHz	160 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC CURRENT (continued)				Bideford
Measurement (other values)	10 µA to 20 µA			
	10 Hz to 55 Hz	300 ppm		
	55 Hz to 1 kHz	300 ppm		
	1 kHz to 5 kHz	350 ppm		
	5 kHz to 10 kHz	660 ppm		
	20 µA to 200 µA			
	10 Hz to 55 Hz	190 ppm		
	55 Hz to 1 kHz	190 ppm		
	1 kHz to 5 kHz	280 ppm		
	5 kHz to 10 kHz	640 ppm		
	200 µA to 2 mA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	160 ppm		
	1 kHz to 5 kHz	220 ppm		
	5 kHz to 10 kHz	560 ppm		
	2 mA to 20 mA			
	10 Hz to 55 Hz	170 ppm		
	55 Hz to 1 kHz	110 ppm		
	1 kHz to 5 kHz	160 ppm		
	5 kHz to 10 kHz	220 ppm		
	20 mA to 200 mA			
	10 Hz to 55 Hz	180 ppm		
	55 Hz to 1 kHz	120 ppm		
	1 kHz to 5 kHz	160 ppm		
	5 kHz to 10 kHz	220 ppm		
	200 mA to 1 A			
	10 Hz to 55 Hz	220 ppm		
	55 Hz to 1 kHz	150 ppm		
	1 kHz to 5 kHz	510 ppm		
	5 kHz to 10 kHz	670 ppm		
	1 A to 20 A			
	30 Hz to 55 Hz	190 ppm		
	55 Hz to 1 kHz	120 ppm		
	1 kHz to 5 kHz	170 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC PHASE ANGLE			Using FFT Analyser	Bideford
Voltage : Voltage, square wave	0° to 360° *0.1 Hz to 10 kHz* *10 kHz to 30 kHz* *30 kHz to 100 kHz*	 0.0049° 0.0077° 0.022°		
Voltage : Voltage, sine wave	0° to 360° *10 mV to 30 V, 10 Hz to 1 kHz* *10 mV to 30 V, 1 kHz to 5 kHz* *30 V to 300 V, 10 Hz to 1 kHz* *30 V to 300 V, 1 kHz to 5 kHz*	 0.0059° 0.0082° 0.0084° 0.011°		
Voltage : Current, sine wave	0° to 360° *10 mV to 300 V* *10 mA to 1.5 A* *10 Hz to 1 kHz*	 0.0085°		
	0° to 360° *10 mV to 300 V* *10 mA to 1.5 A* *1 kHz to 5 kHz*	 0.013°		
	0° to 360° *10 mV to 300 V* *1.5 A to 6 A* *10 Hz to 1 kHz*	 0.0087°		
	0° to 360° *10 mV to 300 V* *1.5 A to 6 A* *1 kHz to 5 kHz*	 0.016°		
	0° to 360° *10 mV to 300 V* *6 A to 20 A* *10 Hz to 1 kHz*	 0.014°		
	0° to 360° *10 mV to 300 V* *6 A to 20 A* *1 kHz to 5 kHz*	 0.059°		
Current : Current, sine wave	0° to 360° *10 mA to 1.5 A* *10 Hz to 1 kHz*	 0.0062°		
	0° to 360° *10 mA to 1.5 A* *1 kHz to 5 kHz*	 0.011°		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC PHASE ANGLE (continued)			Using FFT Analyser	
Current : Current, sine wave (continued)	0° to 360° *1.5 A to 6 A* *10 Hz to 1 kHz*	0.0068°		
	0° to 360° *1.5 A to 6 A* *1 kHz to 5 kHz*	0.018°		
	0° to 360° *6 A to 20 A* *10 Hz to 1 kHz*	0.017°		
	0° to 360° *6 A to 20 A* *1 kHz to 5 kHz*	0.082°		
DC and AC POWER			Measurement and generation, using phantom load techniques	Bideford
	DC 0.1 nW to 100 kW (voltage 10 mV to 1 kV; current 10 pA to 100 A).	The RSS summation of the CMCs for voltage and current. See examples below for further details.		
	10 Hz to 5 kHz 0 W to 6 kW (voltage 10 mV to 300 V; current 10 mA to 20 A).	The RSS summation of the CMCs for voltage, current and power factor (cos(Φ)). See examples overleaf for further details.		
Example DC power CMCs from 10 mV to 1 kV:	10 pA to 200 pA 200 pA to 2 nA 2 nA to 20 nA 20 nA to 200 nA 200 nA to 2 µA 2 µA to 20 µA 20 µA to 20 A 20 A to 100 A	560 ppm 380 ppm 340 ppm 270 ppm 230 ppm 190 ppm 47 ppm 0.15 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
DC and AC POWER (continued) Example AC Power CMCs	Voltage 200 mV to 200 V Current 10 mA to 1 A Frequency 10 Hz to 30 Hz	Phase / ppm / µW/VA: 0° 220 220 45° 260 190 70° 460 160 90° 150		Bideford

Voltage Range	Phase	30 Hz to 55 Hz					
		10 mA to 1.6 A		1.6 A to 6 A		6 A to 20 A	
		ppm	µW/VA	ppm	µW/VA	ppm	µW/VA
10 mV to 50 mV	0°	260	260	260	260	260	260
	45°	300	210	300	210	360	250
	70°	480	170	490	170	720	250
	90°		150		150		240
50 mV to 200 mV	0°	250	250	250	250	250	250
	45°	290	210	290	210	350	250
	70°	480	160	490	170	720	250
	90°		150		150		240
200 mV to 300 V	0°	220	220	220	220	220	220
	45°	270	190	270	190	330	230
	70°	460	160	470	160	710	240
	90°		150		150		240
		55 Hz to 1 kHz					
		10 mA to 1.6 A		1.6 A to 6 A		6 A to 20 A	
		ppm	µW/VA	ppm	µW/VA	ppm	µW/VA
10 mV to 50 mV	0°	220	220	220	220	220	220
	45°	260	190	260	190	330	230
	70°	460	160	470	160	710	240
	90°		150		150		240
50 mV to 200 mV	0°	200	200	200	200	200	200
	45°	250	180	250	180	320	220
	70°	450	160	460	160	700	240
	90°		150		150		240
200 mV to 300 V	0°	160	160	160	160	160	160
	45°	220	160	220	160	290	210
	70°	440	150	450	150	690	240
	90°		150		150		240

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
DC and AC POWER (continued) Example AC Power CMCs (continued)				Bideford

Voltage Range	Phase	1 kHz to 5 kHz					
		10 mA to 1.6 A		1.6 A to 6 A		6 A to 20 A	
		ppm	µW/VA	ppm	µW/VA	ppm	µW/VA
10 mV to 50 mV	0°	400	400	250	250	250	250
	45°	460	330	370	260	1100	750
	70°	740	250	810	280	2800	970
	90°		230		280		1000
50 mV to 200 mV	0°	390	390	230	230	230	230
	45°	460	320	360	260	1100	750
	70°	740	250	800	270	2800	970
	90°		230		280		1000
200 mV to 300 V	0°	380	380	210	210	210	210
	45°	450	320	350	250	1100	740
	70°	730	250	800	270	2800	970
	90°		230		280		1000

NOTE

The example CMCs for AC Power are shown both in terms of ppm and µW/VA and may be expressed using either term for most of the phase (power factor) range. However, at low values of power factor, the uncertainties in ppm terms approach infinity, so the µW/VA terminology will normally be used in these circumstances.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
AC HARMONICS AND DISTORTION				Bideford
NOTE The total harmonic distortion of a repetitive waveform (THD) is often defined as the ratio of the RMS values of the harmonics with reference to that of the fundamental. This is referred to herein as THD_F. Certain types of distortion analyser use a broad band voltmeter in conjunction with a notch filter. The total signal (including harmonics) is used as a "100 % reference"; the notch filter is then used to remove the fundamental and the residue is displayed as the "THD". This is referred to herein as THD_R, the subscript R referring to the RMS value of the reference voltage. It should be noted that THD_R cannot exceed 100 % as the total signal is used as the reference, whereas THD_F can have any value. At relatively low values, the two converge, e.g. if THD_F = 10 % then THD_R = 9.5 %. At higher values of THD the differences between the two can be very significant indeed. For this reason, the capabilities described below distinguish clearly between the two definitions.				
Generation of Harmonic Distortion, THD_R and THD_F	THD_R 0.006 % to 100 % THD_F 0.006 % to 1000 % *30 Hz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz*	 0.62 % to 5.7 % 0.85 % to 5.8 % 1.7 % to 6.4 %	Fundamental: 3 mV to 300 V, 30 Hz to 20 kHz. Harmonic(s): 3 µV to 300 V. Not all combinations of voltage and frequency may be available.	
Measurement of Harmonic Distortion, THD_R and THD_F	THD_R 0.00032 % to 100 % THD_F 0.00032 % to 1000 % *30 Hz to 100 kHz*	 0.73 % to 1.8 %	Fundamental: 3 mV to 300 V, 30 Hz to 20 kHz. Harmonic(s): 3 µV to 300 V	
Harmonic Amplitude Measurement and Generation	3 µV to 300 V *30 Hz to 100 kHz*	 0.90 % to 1.7 %		
Flicker Measurement and Generation	In accordance with EN61000-4-15	0.37 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
CAPACITANCE				Bideford
Measurement and generation	*At 100 Hz:*			
	100 pF to 190 pF	0.60 %	Using standard capacitors and LCR meter.	
	190 pF to 350 pF	0.26 %		
	350 pF to 1 nF	0.17 %		
	1 nF to 1 µF	0.080 %		
	1 µF to 100 µF	0.10 %		
	At 1 kHz:			
	10 pF to 15 pF	0.62 %		
	15 pF to 25 pF	0.32 %		
	25 pF to 100 pF	0.24 %		
	100 pF to 1 µF	0.080 %		
	1 µF to 100 µF	0.10 %		
	At 10 kHz:			
	10 pF to 25 pF	0.32 %		
	25 pF to 70 pF	0.24 %		
	70 pF to 100 nF	0.080 %		
	100 nF to 1 µF	0.085 %		
INDUCTANCE				
Measurement and Generation	*At 100 Hz:*			
	100 µH to 250 µH	0.59 %	Using standard inductors and LCR meter.	
	250 µH to 600 µH	0.25 %		
	600 µH to 1 mH	0.15 %		
	1 mH to 100 mH	0.11 %		
	100 mH to 1 H	0.27 %		
	At 1 kHz:			
	10 µH to 25 µH	0.59 %		
	25 µH to 60 µH	0.25 %		
	60 µH to 100 µH	0.14 %		
	100 µH to 150 µH	0.14 %		
	150 µH to 1 H	0.092 %		
	At 10 kHz:			
	10 µH to 20 µH	0.14 %		
	20 µH to 1 mH	0.099 %		
	1 mH to 10 mH	0.092 %		
	10 mH to 100 mH	0.13 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
FREQUENCY MEASUREMENT				Bideford
Specific Value	10 MHz	1 in 10^{10}	Can be expressed as average periodic time (1/f) for repetitive waveforms.	
Other Values	1 Hz to 1 GHz 1 GHz to 40 GHz	14 in 10^9 1.5 in 10^9		
TIME INTERVAL	100 ps to 1 ns 1 ns to 10 ns 10 ns to 100 ns 100 ns to 1 µs 1 µs to 100 µs 100 µs to 10^5 s	2.2 % 220 ppm 22 ppm 14 ppm 14 ppm 15 in 10^9 + 400 ps	Repetitive and Single Event	
PULSE TRANSITION TIME				
Measurement	150 ps to 500 ps 500 ps to 10 s	1.3 % 0.91 %	Using fast rise oscilloscope; for the calibration of Waveform Generators	
Generation	500 ps to 10 s	1.6 %	Using fast rise pulse generator; for the calibration of oscilloscopes and other measurement devices	
ELECTRICAL SIMULATION OF TEMPERATURE				
Measurement and Generation				
Thermocouple Simulation				
Type K	-270 °C to +1372 °C	0.12 °C to 0.30 °C	By millivolt injection; excluding cold junction compensation	
Type J	-210 °C to +1200 °C	0.12 °C to 0.23 °C		
Type E	-270 °C to +1000 °C	0.12 °C to 0.22 °C		
Type N	-270 °C to +1300 °C	0.12 °C to 0.27 °C		
Type T	-270 °C to +400 °C	0.12 °C to 0.22 °C		
Type S	0 °C to 1768 °C	0.18 °C to 0.29 °C		
Type R	0 °C to 1768 °C	0.17 °C to 0.28 °C		
Type B	0 °C to 1820 °C	0.19 °C to 0.34 °C		
Thermocouple CJC	Ambient (23 °C)	0.13 °C		
PRT Simulation	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 850 °C	0.027 °C to 0.049 °C 0.049 °C to 0.12 °C 0.12 °C to 0.21 °C	By application of equivalent DC resistance values.	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF POWER				Bideford

The CMCs below are for the measurement of RF Power in 50 Ω coaxial systems expressed in terms of % of the linearly expressed value for the stated frequency and power ranges. The capabilities are for the measurement of sources, such as signal generators and synthesisers.

Type N coaxial systems

Frequency range	-60 dBm to -50 dBm	-50 dBm to -40 dBm	-40 dBm to -20 dBm
9 kHz to 10 MHz	1.6 %	1.5 %	1.2 %

Frequency range	-62 dBm to -55 dBm	-55 dBm to -20 dBm	-20 dBm to +20 dBm	+20 dBm to +44 dBm	+44 dBm to +55 dBm
9 kHz to 10 MHz			1.3 %	2.2 %	2.7 %
10 MHz to 50 MHz	1.4 %	1.3 %	1.3 %	2.2 %	2.7 %
50 MHz to 1 GHz	1.5 %	1.4 %	1.3 %	2.0 %	2.3 %
1 GHz to 5 GHz	1.6 %	1.5 %	1.3 %	2.0 %	3.3 %
5 GHz to 10 GHz	2.0 %	1.9 %	1.4 %	2.1 %	3.8 %
10 GHz to 12.5 GHz	2.1 %	2.0 %	1.5 %	2.6 %	5.6 %
12.5 GHz to 15 GHz	2.1 %	2.0 %	1.5 %	2.7 %	
15 GHz to 18 GHz	2.3 %	2.3 %	1.6 %	2.7 %	

3.5 mm coaxial systems

Frequency range	-62 dBm to -55 dBm	-55 dBm to -20 dBm	-20 dBm to +20 dBm
50 MHz to 1 GHz	1.6 %	1.5 %	1.4 %
1 GHz to 5 GHz	1.6 %	1.5 %	1.4 %
5 GHz to 10 GHz	1.7 %	1.6 %	1.5 %
10 GHz to 15 GHz	2.0 %	1.9 %	1.6 %
15 GHz to 20 GHz	2.6 %	2.5 %	2.0 %
20 GHz to 26.5 GHz	3.4 %	3.3 %	2.3 %

2.92 mm coaxial systems

Frequency range	-62 dBm to -55 dBm	-55 dBm to -20 dBm	-20 dBm to +20 dBm
50 MHz to 1 GHz	1.7 %	1.7 %	1.4 %
1 GHz to 5 GHz	1.8 %	1.7 %	1.5 %
5 GHz to 10 GHz	1.9 %	1.9 %	1.7 %
10 GHz to 15 GHz	2.1 %	2.0 %	1.7 %
15 GHz to 20 GHz	2.4 %	2.4 %	2.0 %
20 GHz to 25 GHz	2.5 %	2.5 %	2.0 %
25 GHz to 30 GHz	3.1 %	3.1 %	2.3 %
30 GHz to 35 GHz	3.7 %	3.7 %	2.3 %
35 GHz to 40 GHz	4.8 %	4.8 %	2.3 %

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF POWER (continued)				Bideford
The CMCs below are for the measurement of RF Power in 50 Ω coaxial systems expressed in terms of % of the linearly expressed value for the stated frequency and power ranges. The capabilities are for the measurement of sources, such as signal generators and synthesisers.				
2.4 mm coaxial systems				
Frequency range	-62 dBm to -55 dBm	-55 dBm to -20 dBm	-20 dBm to +20 dBm	
50 MHz to 1 GHz	1.7 %	1.6 %	1.4 %	
1 GHz to 5 GHz	1.8 %	1.7 %	1.4 %	
5 GHz to 10 GHz	1.9 %	1.8 %	1.6 %	
10 GHz to 15 GHz	2.0 %	2.0 %	1.7 %	
15 GHz to 20 GHz	2.4 %	2.3 %	2.0 %	
20 GHz to 25 GHz	2.6 %	2.6 %	2.0 %	
25 GHz to 30 GHz	2.9 %	2.9 %	2.1 %	
30 GHz to 35 GHz	3.2 %	3.1 %	2.3 %	
35 GHz to 40 GHz	3.8 %	3.7 %	2.7 %	
Specific value	*1 mW, 50 MHz* Type N coaxial systems 3.5 mm coaxial systems 2.92 mm coaxial systems 2.4 mm coaxial systems	 0.65 % 0.69 % 0.80 % 0.69 %	For the measurement of sources, including the calibrator output of RF power meters.	
The CMCs below are for the generation of RF Power in 50 Ω coaxial systems expressed in terms of % of the linearly expressed value for the stated frequency and power ranges. The capabilities are for the calibration of receivers, spectrum analysers and similar items.				
Type N coaxial systems				
Frequency range	-70 dBm to -50 dBm	-50 dBm to -20 dBm	-20 dBm to +20 dBm	
9 kHz to 10 MHz	1.5 %	1.3 %	1.3 %	
10 MHz to 50 MHz	1.5 %	1.3 %	1.3 %	
50 MHz to 1 GHz	1.5 %	1.3 %	1.3 %	
1 GHz to 5 GHz	1.5 %	1.4 %	1.3 %	
5 GHz to 10 GHz	1.7 %	1.5 %	1.4 %	
10 GHz to 15 GHz	1.7 %	1.5 %	1.4 %	
15 GHz to 18 GHz	2.2 %	1.7 %	1.6 %	
Frequency range	+20 dBm to +34 dBm	+20 dBm to +47 dBm	+47 dBm to +55 dBm	
9 kHz to 10 MHz		2.1 %	4.7 %	
10 MHz to 50 MHz		2.1 %	4.7 %	
50 MHz to 1 GHz		2.1 %	4.7 %	
1 GHz to 3 GHz	2.4 %			

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF POWER (continued)				Bideford
The CMCs below are for the generation of RF Power in 50 Ω coaxial systems expressed in terms of % of the linearly expressed value for the stated frequency and power ranges. The capabilities are for the calibration of receivers, spectrum analysers and similar items.				
3.5 mm coaxial systems				
Frequency range	-70 dBm to -50 dBm	-50 dBm to -20 dBm	-20 dBm to +14 dBm	
50 MHz to 1 GHz	1.7 %	1.4 %	1.4 %	
1 GHz to 5 GHz	1.6 %	1.5 %	1.4 %	
5 GHz to 10 GHz	1.7 %	1.6 %	1.5 %	
10 GHz to 15 GHz	2.0 %	1.9 %	1.9 %	
15 GHz to 20 GHz	2.5 %	2.4 %	2.2 %	
20 GHz to 26.5 GHz	2.9 %	2.9 %	2.4 %	
2.92 mm coaxial systems				
Frequency range	-70 dBm to -50 dBm	-50 dBm to -20 dBm	-20 dBm to +14 dBm	
50 MHz to 1 GHz	1.7 %	1.5 %	1.4 %	
1 GHz to 5 GHz	1.7 %	1.6 %	1.5 %	
5 GHz to 10 GHz	1.9 %	1.8 %	1.7 %	
10 GHz to 15 GHz	2.0 %	1.9 %	1.8 %	
15 GHz to 20 GHz	2.4 %	2.3 %	2.4 %	
20 GHz to 25 GHz	2.5 %	2.3 %	2.5 %	
25 GHz to 30 GHz	2.9 %	2.8 %	3.0 %	
30 GHz to 35 GHz	3.3 %	3.3 %	3.1 %	
35 GHz to 40 GHz	3.6 %	3.5 %	3.4 %	
2.4 mm coaxial systems				
Frequency range	-70 dBm to -50 dBm	-50 dBm to -20 dBm	-20 dBm to +14 dBm	
50 MHz to 1 GHz	1.6 %	1.4 %	1.4 %	
1 GHz to 5 GHz	1.7 %	1.5 %	1.6 %	
5 GHz to 10 GHz	1.8 %	1.6 %	1.7 %	
10 GHz to 15 GHz	1.9 %	1.8 %	1.8 %	
15 GHz to 20 GHz	2.3 %	2.2 %	2.2 %	
20 GHz to 25 GHz	2.6 %	2.4 %	2.7 %	
25 GHz to 30 GHz	2.9 %	2.8 %	2.9 %	
30 GHz to 35 GHz	3.1 %	3.0 %	3.0 %	
35 GHz to 40 GHz	4.0 %	3.9 %	4.1 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)		Remarks	Location code
RF CALIBRATION FACTOR	Type N 50 Ω coaxial systems	Nominal level 0 dBm	Nominal level -30 dBm	For calibration of RF power sensors by comparison with standard sensors.	Bideford
	9 kHz to 10 MHz	0.59 %	0.63 %		
	10 MHz to 50 MHz	0.59 %	0.62 %		
	50 MHz to 1 GHz	0.70 %	0.73 %		
	1 GHz to 5 GHz	0.73 %	0.82 %		
	5 GHz to 10 GHz	0.81 %	1.3 %		
	10 GHz to 15 GHz	0.96 %	1.3 %		
	15 GHz to 18 GHz	1.1 %	1.5 %		
	3.5 mm 50 Ω coaxial systems	Nominal level 0 dBm	Nominal level -30 dBm		
	50 MHz to 1 GHz	0.74 %	0.84 %		
	1 GHz to 5 GHz	0.82 %	0.92 %		
	5 GHz to 10 GHz	0.99 %	1.1 %		
	10 GHz to 15 GHz	1.4 %	1.5 %		
	15 GHz to 20 GHz	1.9 %	2.2 %		
	20 GHz to 26.5 GHz	2.5 %	3.1 %		
	2.92 mm 50 Ω coaxial systems	Nominal level 0 dBm	Nominal level -30 dBm		
	50 MHz to 1 GHz	0.78 %	1.1 %		
	1 GHz to 5 GHz	0.94 %	1.2 %		
	5 GHz to 10 GHz	1.3 %	1.4 %		
	10 GHz to 15 GHz	1.5 %	1.6 %		
	15 GHz to 20 GHz	2.1 %	2.0 %		
	20 GHz to 25 GHz	2.3 %	2.1 %		
	25 GHz to 30 GHz	2.7 %	2.7 %		
	30 GHz to 35 GHz	3.2 %	3.4 %		
	35 GHz to 40 GHz	3.2 %	4.6 %		
	2.4 mm 50 Ω coaxial systems	Nominal level 0 dBm	Nominal level -30 dBm		
	50 MHz to 1 GHz	0.72 %	0.88 %		
	1 GHz to 5 GHz	0.89 %	0.98 %		
	5 GHz to 10 GHz	1.1 %	1.2 %		
	10 GHz to 15 GHz	1.3 %	1.4 %		
	15 GHz to 20 GHz	1.8 %	1.8 %		
	20 GHz to 25 GHz	2.1 %	2.1 %		
	25 GHz to 30 GHz	2.6 %	2.5 %		
	30 GHz to 35 GHz	2.8 %	2.8 %		
	35 GHz to 40 GHz	3.2 %	3.4 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF VOLTAGE	200 µV to 1 mV		50 Ω systems only	Bideford
	9 kHz to 100 kHz	1.1 %		
	100 kHz to 1 MHz	1.1 %	Derived from RF Power measurements.	
	1 MHz to 100 MHz	1.1 %		
	100 MHz to 1 GHz	1.4 %		
	1 GHz to 1.5 GHz	2.1 %		
	1 mV to 10 mV			
	9 kHz to 100 kHz	0.96 %		
	100 kHz to 1 MHz	0.96 %		
	1 MHz to 100 MHz	0.96 %		
	100 MHz to 1 GHz	1.3 %		
	1 GHz to 1.5 GHz	2.1 %		
	10 mV to 1 V			
	9 kHz to 20 kHz	0.80 %		
	20 kHz to 1 MHz	0.80 %		
	1 MHz to 100 MHz	0.80 %		
	100 MHz to 1 GHz	1.2 %		
	1 GHz to 1.5 GHz	2.1 %		
	1 V to 10 V			
	9 kHz to 20 kHz	0.74 %		
	20 kHz to 1 MHz	0.99 %		
	1 MHz to 100 MHz	0.99 %		
	100 MHz to 1 GHz	1.7 %		
	1 GHz to 1.5 GHz	2.8 %		
VOLTAGE REFLECTION COEFFICIENT	*5 MHz to 1 GHz*		50 Ω systems only. Reflection bridge method.	
	0.00 to 0.05	0.016		
	0.05 to 0.1	0.019		
	0.1 to 0.2	0.030		
	0.2 to 0.7	0.090		
	0.7 to 1.0	0.16		
	1 GHz to 2 GHz			
	0.00 to 0.05	0.022		
	0.05 to 0.1	0.023		
	0.1 to 0.2	0.029		
	0.2 to 0.7	0.077		
	0.7 to 1.0	0.11		
	2 GHz to 5 GHz			
	0.00 to 0.05	0.021		
	0.05 to 0.1	0.034		
	0.1 to 0.2	0.065		
	0.2 to 0.7	0.22		
	0.7 to 1.0	0.32		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
VOLTAGE REFLECTION COEFFICIENT (continued)				Bideford
	5 GHz to 10 GHz			
	0.00 to 0.05	0.026		
	0.05 to 0.1	0.028		
	0.1 to 0.2	0.038		
	0.2 to 0.7	0.11		
	0.7 to 1.0	0.14		
	10 GHz to 15 GHz			
	0.00 to 0.05	0.033		
	0.05 to 0.1	0.035		
	0.1 to 0.2	0.042		
	0.2 to 0.7	0.093		
	0.7 to 1.0	0.13		
	15 GHz to 18 GHz			
	0.00 to 0.05	0.035		
	0.05 to 0.1	0.038		
	0.1 to 0.2	0.050		
	0.2 to 0.7	0.13		
	0.7 to 1.0	0.18		
LF VECTOR NETWORK ANALYSIS				
This section of the Schedule presents the CMCs for a vector network analysis system. Measurements are made as complex quantities. Transmission magnitude capabilities are expressed in dB terms and reflection magnitude is expressed in terms of voltage reflection coefficient (VRC). These may also be reported in terms of voltage standing wave ratio (VSWR), return loss (dB) or Impedance magnitude and phase. Measurements are made in a 50 Ω coaxial system using an Agilent E5061B network analyser with appropriate test port leads in a 10 Hz bandwidth.				
N Type 50 Ω system				
Reflection magnitude	VRC 0 to 0.1			
	1 kHz to 50 kHz	0.0020 to 0.0022		
	50 kHz to 100 kHz	0.0021 to 0.0037		
	100 kHz to 200 kHz	0.0036 to 0.0054		
	200 kHz to 500 kHz	0.0054 to 0.0061		
	500 kHz to 1 MHz	0.0022 to 0.0061		
	1 MHz to 100 MHz	0.0020 to 0.0022		
	100 MHz to 500 MHz	0.0020 to 0.0031		
	500 MHz to 2 GHz	0.0025 to 0.0043		
	2 GHz to 3 GHz	0.0022 to 0.0057		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
Reflection magnitude (continued)	VRC 0.1 to 0.5			Bideford
	1 kHz to 50 kHz	0.0020 to 0.0031		
	50 kHz to 100 kHz	0.0021 to 0.0038		
	100 kHz to 200 kHz	0.0036 to 0.0053		
	200 kHz to 500 kHz	0.0053 to 0.0060		
	500 kHz to 1 MHz	0.0022 to 0.0060		
	1 MHz to 100 MHz	0.0019 to 0.0060		
	100 MHz to 500 MHz	0.0020 to 0.0044		
	500 MHz to 2 GHz	0.0022 to 0.017		
	2 GHz to 3 GHz	0.0040 to 0.017		
	VRC 0.5 to 1.0			
	1 kHz to 50 kHz	0.0024 to 0.0049		
	50 kHz to 100 kHz	0.0024 to 0.0050		
	100 kHz to 200 kHz	0.0024 to 0.0048		
	200 kHz to 500 kHz	0.0024 to 0.0053		
	500 kHz to 1 MHz	0.0024 to 0.0054		
	1 MHz to 100 MHz	0.0024 to 0.0051		
	100 MHz to 500 MHz	0.0025 to 0.0056		
	500 MHz to 2 GHz	0.0038 to 0.041		
	2 GHz to 3 GHz	0.012 to 0.041		
Reflection phase	VRC 0.004 to 0			
	1 kHz to 3 GHz	180°		
	VRC 0.001 to 0.004			
	1 kHz to 3 GHz	106° to 180°		
	VRC 0.01 to 0.001			
	1 kHz to 3 GHz	10.7° to 32.1°		
	VRC 1 to 0.01			
	1 kHz to 3 GHz	0.14° to 3.8°		
Transmission magnitude	Attenuation 0 dB to 20 dB			
	1 kHz to 2 GHz	0.0020 to 0.051		
	2 GHz to 3 GHz	0.028 to 0.090		
	20 dB to 70 dB			
	1 kHz to 3 GHz	0.047 to 0.13		
Transmission phase	0° to ± 180°			
	Attenuation 0 dB to 70 dB			
	1 kHz to 3 GHz	0.003° to 0.89°		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AUTOMATIC NETWORK ANALYSER SYSTEM; VOLTAGE TRANSMISSION COEFFICIENT MAGNITUDE AND PHASE: The CMCs are for 50Ω coaxial systems fitted with Type N, 3.5 mm, 2.92 mm or 2.4 mm connectors over the frequency ranges as specified below. The CMCs are presented in dB terms for magnitude and in degrees for phase.			

Type N systems	0 dB	to	40 dB	40 dB	to	50 dB	50 dB	to	60 dB	60 dB	to	70 dB
10 MHz to 100 MHz												
Magnitude	0.085	to	0.11	0.090	to	0.22	0.092	to	0.64	0.11	to	2.0
Phase	0.36	to	0.48	0.41	to	1.4	0.43	to	4.2	0.57	to	13
100 MHz to 1 GHz												
Magnitude	0.085	to	0.11	0.090	to	0.22	0.090	to	0.11	0.090	to	0.21
Phase	0.36	to	0.48	0.41	to	0.48	0.42	to	0.57	0.45	to	1.3
1 GHz to 12 GHz												
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.090	0.090	to	0.091
Phase	0.45	to	1.5	0.48	to	1.5	0.48	to	1.5	0.48	to	1.5
12 GHz to 18 GHz												
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.090	0.090	to	0.090
Phase	1.5	to	2.0	1.5	to	2.0	1.5	to	2.0	1.5	to	2.0
3.5 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB			
50 MHz to 1 GHz												
Magnitude	0.085	to	0.091	0.090	to	0.20	0.090	to	0.56			
Phase	0.36	to	0.55	0.42	to	1.2	0.45	to	3.7			
1 GHz to 12 GHz												
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.091			
Phase	0.45	to	1.5	0.48	to	1.5	0.49	to	1.5			
12 GHz to 26.5 GHz												
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.090			
Phase	1.5	to	2.8	1.5	to	2.8	1.5	to	2.8			
2.92 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB			
50 MHz to 100 MHz												
Magnitude	0.057	to	0.066	0.063	to	0.19	0.064	to	0.56			
Phase	0.36	to	0.42	0.41	to	1.2	0.57	to	3.7			
100 MHz to 26.5 GHz												
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.066			
Phase	0.36	to	1.9	0.41	to	1.9	0.44	to	1.9			
26.5 GHz to 40 GHz												
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.071			
Phase	1.9	to	2.6	1.9	to	2.6	1.9	to	2.6			
2.4 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB			
50 MHz to 1 GHz												
Magnitude	0.057	to	0.066	0.063	to	0.19	0.064	to	0.56			
Phase	0.36	to	0.55	0.42	to	1.2	0.44	to	3.7			
1 GHz to 5 GHz												
Magnitude	0.057	to	0.063	0.063	to	0.064	0.064	to	0.066			
Phase	0.41	to	0.66	0.45	to	0.67	0.45	to	0.67			
5 GHz to 26.5 GHz												
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.070			
Phase	0.64	to	1.9	0.66	to	1.9	0.67	to	1.9			
26.5 GHz to 40 GHz												
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.071			
Phase	1.9	to	2.6	1.9	to	2.6	1.9	to	2.6			

Location Code: Bideford

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AUTOMATIC NETWORK ANALYSER SYSTEM		Location Code: Bideford	
VOLTAGE REFLECTION COEFFICIENT MAGNITUDE: The CMCs are for 50Ω coaxial systems fitted with Type N, 3.5 mm, 2.92 mm or 2.4 mm connectors over the frequency ranges as specified below. The CMCs are presented in VRC terms.			

Connector type	Frequency	VRC range 0.0 to 0.2			VRC range 0.2 to 1.0		
Type N	10 MHz to 1 GHz	0.0061	to	0.0062	0.0062	to	0.012
	1 GHz to 12 GHz	0.0061	to	0.0078	0.0062	to	0.017
	12 GHz to 18 GHz	0.0077	to	0.0078	0.0077	to	0.018
3.5 mm	50 MHz to 1 GHz	0.00050	to	0.0010	0.00080	to	0.0015
	1 GHz to 12 GHz	0.00080	to	0.0020	0.0010	to	0.0028
	12 GHz to 26.5 GHz	0.0019	to	0.0024	0.0019	to	0.0037
2.92 mm	50 MHz to 1 GHz	0.0072	to	0.0073	0.0075	to	0.019
	1 GHz to 26.5 GHz	0.0072	to	0.018	0.0075	to	0.029
	26.5 GHz to 40 GHz	0.012	to	0.015	0.011	to	0.029
2.4 mm	50 MHz to 1 GHz	0.0019	to	0.0023	0.0020	to	0.0045
	1 GHz to 26.5 GHz	0.0023	to	0.0031	0.0023	to	0.0069
	26.5 GHz to 40 GHz	0.0031	to	0.0037	0.0031	to	0.0084

VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180°				
Type N systems				
VRC 0.0000 to 0.0003	*10 MHz to 1 GHz*	175° to 180°		Location Code: Bideford
	1 GHz to 12 GHz	175° to 180°		
	12 GHz to 18 GHz	180°		
VRC 0.0003 to 0.0005	*10 MHz to 1 GHz*	87° to 175°		
	1 GHz to 12 GHz	87° to 180°		
	12 GHz to 18 GHz	109° to 180°		
VRC 0.0005 to 0.001	*10 MHz to 1 GHz*	70° to 87°		
	1 GHz to 12 GHz	70° to 110°		
	12 GHz to 18 GHz	87° to 110°		
VRC 0.001 to 0.01	*10 MHz to 1 GHz*	35° to 70°		
	1 GHz to 12 GHz	35° to 88°		
	12 GHz to 18 GHz	44° to 88°		
VRC 0.01 to 0.1	*10 MHz to 1 GHz*	3.5° to 35°		
	1 GHz to 12 GHz	3.4° to 44°		
	12 GHz to 18 GHz	4.4° to 44°		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180° (continued)				
Type N systems (continued)				
VRC 0.1 to 1	*10 MHz to 1 GHz*	0.69° to 3.5°		
	1 GHz to 12 GHz	0.69° to 4.4°		
	12 GHz to 18 GHz	1.0° to 4.4°		
3.5 mm systems				
VRC 0.0000 to 0.0001	*50 MHz to 1 GHz*	103° to 180°		
	1 GHz to 12 GHz	138° to 180°		
	12 GHz to 26.5 GHz	180°		
VRC 0.0001 to 0.0005	*50 MHz to 1 GHz*	32° to 139°		
	1 GHz to 12 GHz	49° to 180°		
	12 GHz to 26.5 GHz	105° to 180°		
VRC 0.0005 to 0.001	*50 MHz to 1 GHz*	32° to 49°		
	1 GHz to 12 GHz	49° to 105°		
	12 GHz to 26.5 GHz	105° to 106°		
VRC 0.001 to 0.01	*50 MHz to 1 GHz*	2.7° to 49°		
	1 GHz to 12 GHz	4.6° to 105°		
	12 GHz to 26.5 GHz	10° to 131°		
VRC 0.01 to 0.1	*50 MHz to 1 GHz*	0.30° to 4.6°		Bideford
	1 GHz to 12 GHz	0.48° to 10°		
	12 GHz to 26.5 GHz	1.0° to 10°		
VRC 0.1 to 1	*50 MHz to 1 GHz*	0.083° to 0.28°		
	1 GHz to 12 GHz	0.083° to 0.53°		
	12 GHz to 26.5 GHz	0.16° to 0.66°		
2.92 mm systems				
VRC 0.000 to 0.003	*50 MHz to 1 GHz*	137° to 180°		
	1 GHz to 5 GHz	136° to 180°		
	5 GHz to 26.5 GHz	180°		
	26.5 GHz to 40 GHz	180°		
VRC 0.003 to 0.004	*50 MHz to 1 GHz*	103° to 137°		
	1 GHz to 5 GHz	103° to 180°		
	5 GHz to 26.5 GHz	145° to 180°		
	26.5 GHz to 40 GHz	175° to 180°		
VRC 0.004 to 0.005	*50 MHz to 1 GHz*	82° to 103°		
	1 GHz to 5 GHz	82° to 145°		
	5 GHz to 26.5 GHz	116° to 177°		
	26.5 GHz to 40 GHz	140° to 177°		
VRC 0.005 to 0.01	*50 MHz to 1 GHz*	41° to 82°		
	1 GHz to 5 GHz	41° to 116°		
	5 GHz to 26.5 GHz	58° to 142°		
	26.5 GHz to 40 GHz	70° to 142°		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180° (continued)				
2.92 mm systems (continued)				
VRC 0.01 to 0.1	*50 MHz to 1 GHz*	4.1° to 41°		
	1 GHz to 5 GHz	4.1° to 58°		
	5 GHz to 26.5 GHz	5.8° to 71°		
	26.5 GHz to 40 GHz	7.0° to 71°		
VRC 0.1 to 1	*50 MHz to 1 GHz*	1.1° to 4.1°		
	1 GHz to 5 GHz	1.1° to 5.8°		
	5 GHz to 26.5 GHz	1.2° to 7.0°		
	26.5 GHz to 40 GHz	1.6° to 7.0°		
2.4 mm systems				
VRC 0.000 to 0.001	*50 MHz to 1 GHz*	107° to 180°		
	1 GHz to 5 GHz	130° to 180°		
	5 GHz to 26.5 GHz	170° to 180°		
	26.5 GHz to 40 GHz	176° to 180°		
VRC 0.001 to 0.002	*50 MHz to 1 GHz*	53° to 130°		
	1 GHz to 5 GHz	64° to 177°		
	5 GHz to 26.5 GHz	84° to 176°		
	26.5 GHz to 40 GHz	87° to 180°		
VRC 0.002 to 0.003	*50 MHz to 1 GHz*	35° to 64°		
	1 GHz to 5 GHz	43° to 88°		
	5 GHz to 26.5 GHz	56° to 86°		
	26.5 GHz to 40 GHz	58° to 107°		
VRC 0.003 to 0.004	*50 MHz to 1 GHz*	27° to 43°		
	1 GHz to 5 GHz	32° to 58°		
	5 GHz to 26.5 GHz	42° to 58°		
	26.5 GHz to 40 GHz	44° to 71°		
VRC 0.004 to 0.005	*50 MHz to 1 GHz*	21° to 32°		
	1 GHz to 5 GHz	25° to 44°		
	5 GHz to 26.5 GHz	33° to 44°		
	26.5 GHz to 40 GHz	35° to 53°		
VRC 0.005 to 0.01	*50 MHz to 1 GHz*	10° to 25°		
	1 GHz to 5 GHz	13° to 35°		
	5 GHz to 26.5 GHz	17° to 35°		
	26.5 GHz to 40 GHz	17° to 43°		
VRC 0.01 to 0.1	*50 MHz to 1 GHz*	1.0° to 13°		
	1 GHz to 5 GHz	1.3° to 17°		
	5 GHz to 26.5 GHz	1.7° to 17°		
	26.5 GHz to 40 GHz	2.1° to 21°		
VRC 0.1 to 1	*50 MHz to 1 GHz*	0.25° to 1.3°		
	1 GHz to 5 GHz	0.25° to 1.8°		
	5 GHz to 26.5 GHz	0.36° to 1.7°		
	26.5 GHz to 40 GHz	0.38° to 2.1°		

Bideford

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF ATTENUATION			50 Ω systems only	Bideford
Tuned receiver method	0 dB to 30 dB			
	9 kHz to 100 kHz	0.032 dB		
	100 kHz to 10 MHz	0.032 dB		
	10 MHz to 50 MHz	0.032 dB		
	50 MHz to 1 GHz	0.051 dB		
	1 GHz to 5 GHz	0.055 dB		
	5 GHz to 10 GHz	0.087 dB		
	10 GHz to 15 GHz	0.12 dB		
	15 GHz to 18 GHz	0.13 dB		
	30 dB to 60 dB			
	9 kHz to 100 kHz	0.045 dB		
	100 kHz to 10 MHz	0.045 dB		
	10 MHz to 50 MHz	0.045 dB		
	50 MHz to 1 GHz	0.072 dB		
	1 GHz to 5 GHz	0.079 dB		
	5 GHz to 10 GHz	0.12 dB		
	10 GHz to 15 GHz	0.16 dB		
	15 GHz to 18 GHz	0.18 dB		
	60 dB to 70 dB			
	9 kHz to 100 kHz	0.055 dB		
	100 kHz to 10 MHz	0.055 dB		
	10 MHz to 50 MHz	0.055 dB		
	50 MHz to 1 GHz	0.088 dB		
	1 GHz to 5 GHz	0.097 dB		
	5 GHz to 10 GHz	0.14 dB		
	10 GHz to 15 GHz	0.20 dB		
	15 GHz to 18 GHz	0.22 dB		
	70 dB to 80 dB			
	9 kHz to 100 kHz	0.080 dB		
	100 kHz to 10 MHz	0.056 dB		
	10 MHz to 50 MHz	0.056 dB		
	50 MHz to 1 GHz	0.088 dB		
	1 GHz to 5 GHz	0.097 dB		
	5 GHz to 10 GHz	0.15 dB		
	10 GHz to 15 GHz	0.20 dB		
	15 GHz to 18 GHz	0.22 dB		
	80 dB to 90 dB			
	9 kHz to 100 kHz	0.13 dB		
	100 kHz to 10 MHz	0.067 dB		
	10 MHz to 50 MHz	0.063 dB		
	50 MHz to 1 GHz	0.093 dB		
	1 GHz to 5 GHz	0.10 dB		
	5 GHz to 10 GHz	0.15 dB		
	10 GHz to 15 GHz	0.23 dB		
	15 GHz to 18 GHz	0.24 dB		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF ATTENUATION (continued)			50 Ω systems only	Bideford
Tuned receiver method (continued)	90 dB to 100 dB			
	9 kHz to 100 kHz	0.29 dB		
	100 kHz to 10 MHz	0.14 dB		
	10 MHz to 50 MHz	0.12 dB		
	50 MHz to 1 GHz	0.15 dB		
	1 GHz to 5 GHz	0.16 dB		
	5 GHz to 10 GHz	0.22 dB		
	10 GHz to 15 GHz	0.35 dB		
	15 GHz to 18 GHz	0.37 dB		
	100 dB to 110 dB			
	9 kHz to 100 kHz	0.67 dB		
	100 kHz to 10 MHz	0.48 dB		
	10 MHz to 50 MHz	0.33 dB		
	50 MHz to 1 GHz	0.34 dB		
	1 GHz to 5 GHz	0.36 dB		
	5 GHz to 10 GHz	0.39 dB		
	10 GHz to 15 GHz	0.76 dB		
	15 GHz to 18 GHz	1.3 dB		
Power meter method	0 dB to 25 dB			
	9 kHz to 20 kHz	0.050 dB		
	20 kHz to 1 MHz	0.029 dB		
	1 MHz to 10 MHz	0.025 dB		
	10 MHz to 50 MHz	0.032 dB		
	50 MHz to 1 GHz	0.030 dB		
	1 GHz to 5 GHz	0.033 dB		
	5 GHz to 10 GHz	0.046 dB		
	10 GHz to 15 GHz	0.060 dB		
	15 GHz to 18 GHz	0.061 dB		
	25 dB to 60 dB			
	9 kHz to 20 kHz	0.053 dB		
	20 kHz to 1 MHz	0.035 dB		
	1 MHz to 10 MHz	0.032 dB		
	10 MHz to 50 MHz	0.032 dB		
	50 MHz to 1 GHz	0.031 dB		
	1 GHz to 5 GHz	0.035 dB		
	5 GHz to 10 GHz	0.054 dB		
	10 GHz to 15 GHz	0.078 dB		
	15 GHz to 18 GHz	0.078 dB		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
RF ATTENUATION (continued)			50 Ω systems only	Bideford
Power meter method (continued)	60 dB to 70 dB			
	9 kHz to 20 kHz	0.24 dB		
	20 kHz to 1 MHz	0.23 dB		
	1 MHz to 10 MHz	0.23 dB		
	10 MHz to 50 MHz	0.12 dB		
	50 MHz to 1 GHz	0.12 dB		
	1 GHz to 5 GHz	0.12 dB		
	5 GHz to 10 GHz	0.13 dB		
	10 GHz to 15 GHz	0.14 dB		
	15 GHz to 18 GHz	0.14 dB		
FREQUENCY MODULATION				
	0 Hz to 5 kHz	0.10 kHz	Using modulation meter. Carrier frequency range: 50 kHz to 1 GHz Modulation frequency range: 10 Hz to 200 kHz or 1/5 of carrier frequency (Distortion <0.5 %)	
	5 kHz to 20 kHz	0.11 kHz		
	20 kHz to 100 kHz	0.50 kHz		
	100 kHz to 700 kHz	3.4 kHz		
AMPLITUDE MODULATION				
	0 %AM to 20 %AM	0.16 %AM	Using modulation meter. Carrier frequency range: 50 kHz to 1 GHz Modulation frequency range: 30 Hz to 100 kHz or 1/5 of carrier frequency (Distortion <0.5 %)	
	20 %AM to 50 %AM	0.32 %AM		
	50 %AM to 80 %AM	0.53 %AM		
	80 %AM to 95 %AM	1.1 %AM		
RF INTERMODULATION PRODUCTS	0 dB to -80 dB		Spectrum analyser method.	
	10 kHz to 110 MHz	0.94 dB		
	110 MHz to 18 GHz	1.9 dB		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
ELECTROSTATIC VOLTAGE	0.1 kV to 30 kV	0.69 %	Field meters for measuring charged surfaces	Bideford
HIGH IMPEDANCE CONTACT VOLTAGE	0.1 kV to 30 kV	0.61 %	Electrostatic voltmeter and other high resistance voltmeters for measuring charged surfaces	
ELECTROSTATIC DISCHARGE GENERATORS				
Air discharge voltage Pulse transition time Peak current Decay current	0.5 kV to 30 kV 500 ps to 50 ns 0.1 A to 30 A 0.1 A to 30 A	0.73 % 2.2 % 3.7 % 5.0 %	EN61000-4-2:2009 EN61000-4-2:1995 ISO10605:2008 EN61340-3-1:2007 MIL-STD-331C:2005 Corr 1:2009 (Personnel) EIA/JES22-A114-B June 2000 EIA/JES22-A115-A October 1997 The measurement bandwidth is the lowest specified by the associated standard.	
BURST TRANSIENT GENERATOR CHARACTERISTICS				
Peak voltage Rise time Pulse width Repetition Frequency Burst duration Burst period	0.1 kV to 5 kV 3.5 ns to 50 s 10 ns to 100 ns 1 kHz to 1 MHz 100 µs to 100 ms 1 ms to 1 s	2.6 % 0.91 % 0.91 % 0.91 % 0.91 % 0.14 %	For the calibration of Electrical Fast Transient generators and CDNs to 61000-4-4	
SURGE PULSE CHARACTERISTICS				
Voltage Current Impedance Front/Rise Time Pulse Duration Phase	0.25 kV to 6.6 kV 0.2 kA to 3.3 kA 1 Ω to 100 Ω 0.1 µs to 50 µs 1 µs to 1 ms 0° to 360°	2.1 % 2.8 % 4.6 % 0.91 % 0.91 % 0.5° to 3.3°	For the calibration of surge generators to 61000-4-5	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
LISN MEASUREMENT				Bideford
This section of the Schedule presents the CMCs for the measurement of complex impedance of a Line Impedance Stabilisation Network (LISN) using a vector network analysis system. Measurements are made as complex quantities. Reflection magnitude is expressed in terms of Impedance with Magnitude and Phase. Measurements are made in a 50 Ω coaxial system using an Agilent E5061B network analyser with appropriate test port leads in a 10 Hz bandwidth. Actual uncertainties are calculated dynamically during the measurement and may be larger than indicated below.				
N Type 50 Ω system				
Impedance Magnitude	Magnitude 0 Ω to 150 Ω			
	1kHz to 9kHz	0.30 Ω		
	9 kHz to 150 kHz	0.30 Ω		
	150 kHz to 30 MHz	1.0 Ω		
	30 MHz to 300 MHz	3.0 Ω		
	300MHz to 400MHz	5.0 Ω		
Impedance Phase	Phase 0° to 180°			
	9kHz to 108MHz	1.0º		
Voltage Division	*1kHz to 400MHz*	0.25 dB		
Isolation	*9 kHz to 108 MHz*			
	Up to 60 dB	1.0 dB		
	>60 dB	5.0 dB		
CDN MEASUREMENT				
This section of the Schedule presents the CMCs for the measurement of complex impedance of a CDN using a vector network analysis system. Measurements are made as complex quantities. Reflection magnitude is expressed in terms of Impedance with Magnitude and Phase. Measurements are made in a 50 Ω coaxial system using an Agilent E5061B network analyser with appropriate test port leads in a 10 Hz bandwidth. Actual uncertainties are calculated dynamically during the measurement and may be larger than indicated below.				
Impedance Magnitude	Magnitude 50 Ω to 250 Ω			
	150 kHz to 80 MHz	1.0 %		
	80 MHz to 230 MHz	2.0 %		
	230 MHz to 300 MHz	3.0 %		
Impedance Phase	Phase 0° to 180°			
	150 kHz to 300 MHz	5.0º		
Coupling Factor	150 kHz to 300 MHz	0.39 dB		
Isolation	150 kHz to 300 MHz			
	0 dB to 60 dB	1.0 dB		
	>60 dB	5.0 dB		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
Spectral Intensity	50 dBμV/MHz to 150 dBμV/MHz		For the calibration of Impulse Generators	
	9 kHz to 10 MHz	0.44 dB		
	10 MHz to 50 MHz	0.41 dB		
	50 MHz to 1 GHz	0.41 dB		
Impulse Measurement				
Detector Pulse Measurements	*9 kHz to 10 MHz*	0.55 dB	Absolute and relative CISPR detector response to pulses and response to varying repetition rates	
	10 MHz to 50 MHz	0.53 dB		
	50 MHz to 1 GHz	0.55 dB		
Detector response to narrowband interference	Band A to D	0.096 dB	Average and RMS CISPR detector response to any drifting narrow band interference	
VOLTAGE DIPS, SHORT INTERRUPTIONS VOLTAGE VARIATIONS GENERATORS				
Dip RMS Voltage	1 V to 500 V	0.58 % + 50 mV	For the calibration of Voltage Dips and Interrupts generators to EN61000-4-11	Bideford
Voltage Variations	1 V to 500 V	1.5 %		
Transition rise and fall time	0.1 µs to 1 s	0.91 %		
Interruptions Overshoot Voltage	25 % to 100 %	2.8 %		
Phase Angle	0° to 360°	2.9°		
Dip Variations timing	10 µs to 30 s	0.91 %		
Peak Inrush Current	1 A to 1000 A	2.9 %		
DAMPED OSCILLATORY GENERATORS				
Voltage	100 V to 6.6 kV		For the calibration of Damped Oscillatory Wave Generators in accordance with EN 61000-4-10, EN 61000-4-12, EN 61000-4-18, ANSI C37.90.1	
	Frequency ≤1 MHz	2.1 %		
	Frequency 1 MHz to 50 MHz	2.9 %		
Ring Wave Current	1 A to 400 A	2.8 %		
DOW Current	1 A to 150 A	3.6 %		
Impedance	5 Ω to 500 Ω	4.6 %		
Rise time	1 ns to 10 µs	0.91 %		
Frequency	10 kHz to 100 MHz	0.91 %		
Repetition Rate	100 µs to 1 s	0.91 %		
Burst Duration	1 ms to 5 s	0.91 %		
Phase	0° to 360°	3.3°		
Burst Period	1 ms to 1 s	0.14 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
ANTENNA MEASUREMENTS				Bideford
Monopole Antenna Antenna Factor	20 Hz to 30 MHz 30 MHz to 100 MHz	1.4 dB/m 1.6 dB/m	Equivalent capacitance method.	
Antenna Factor and Apparent Gain			Best capability using the three antenna method or by comparison with similar antennas using the standard antenna method.	
Biconical and Broad Band Dipoles	20 MHz to 300 MHz 300 MHz to 1 GHz	1.5 dB (1.8 dB at 1 m) 1.5 dB (1.8 dB at 1 m)	Measurement distance 10 m, 3.0 m and 1.0 m.	
Log Periodic	80 MHz to 18 GHz	1.5 dB (1.6 dB at 1 m)	Measurement distances 3.0 m and 1.0 m; calculated results for 10 m and for Free Space.	
Bilog and hybrid antennas	20 MHz to 18 GHz	1.5 dB (1.8 dB at 1 m)	Measurement distances 3.0 m and 1.0 m; calculated results for 10 m and for Free Space.	
Horn Antennas	200 MHz to 1 GHz 1 GHz to 18 GHz	1.5 dB 1.5 dB	Horn measurement at 3 m and 1.0 m.	
Voltage Reflection Coefficient	18 GHz to 26.5 GHz 30 MHz to 1 GHz 1 GHz to 18 GHz	1.5 dB 0.090 0.13		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
BURST TRANSIENT GENERATOR CHARACTERISTICS				
Peak voltage	0.1 kV to 5 kV	2.6 %	For the calibration of Electrical Fast Transient generators, Coupling Clamps and CDNs to EN 61000-4-4	
Rise time	3.5 ns to 50 s	0.91 %		
Pulse width	10 ns to 100 ns	0.91 %		
Repetition Frequency	1 kHz to 1 MHz	0.91 %		
Burst duration	100 µs to 100 ms	0.91 %		
Burst period	1 ms to 1 s	0.14 %		
SURGE PULSE CHARACTERISTICS				
Voltage	0.25 kV to 6.6 kV	2.1 %	For the calibration of Surge generators and coupling Networks to EN 61000-4-5	
Current	0.2 kA to 3.3 kA	2.8 %		
Impedance	1 Ω to 100 Ω	4.6 %		
Front/Rise Time	0.1 µs to 50 µs	0.91 %		
Pulse Duration	1.0 µs to 1.0 ms	0.91 %		
Phase	0° to 360°	0.5° to 3.3°		
VOLTAGE DIPS, SHORT INTERRUPTIONS, VOLTAGE VARIATIONS GENERATORS				
Dip RMS Voltage	1 V to 500 V	0.58 % + 50 mV	For the calibration of Voltage Dips and Interrupts generators in accordance with EN 61000-4-11	Site
Voltage Variations	1 V to 500 V	1.5 %		
Transition rise and fall time	0.1 µs to 1.0 s	0.91 %		
Interruptions Overshoot Voltage	25 % to 100 %	2.8 %		
Phase Angle	0° to 360°	2.9°		
Dip Variations timing	10 µs to 30.0 s	0.91 %		
Peak Inrush Current	1 A to 1000 A	2.9 %		
DAMPED OSCILLATORY GENERATORS				
Voltage	100 V to 6.6 kV		For the calibration of Damped Oscillatory Wave Generators in accordance with EN 61000-4-10, EN 61000-4-12, EN 61000-4-18, ANSI C37.90.1	
	Frequency ≤1 MHz	2.1 %		
	Frequency 1 MHz to 50 MHz	2.9 %		
Ringwave Current	1 A to 400 A	2.8 %		
DOW Current	1 A to 150 A	3.6 %		
Impedance	5 Ω to 500 Ω	4.6 %		
Rise time	1 ns to 10 µs	0.91 %		
Frequency	10 kHz to 100 MHz	0.91 %		
Repetition Rate	100 µs to 1 s	0.91 %		
Burst Duration	1 ms to 5 s	0.91 %		
Phase	0° to 360°	3.3°		
Burst Period	1 ms to 1 s	0.14 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location code
ELECTROSTATIC DISCHARGE GENERATORS				
Air discharge voltage Pulse transition time Peak current Decay current	0.5 kV to 30 kV 500 ps to 50 ns 0.1 A to 30 A 0.1 A to 30 A	0.73 % 2.2 % 3.7 % 5.0 %	EN61000-4-2:2009 EN61000-4-2:1995 ISO10605:2008 EN61340-3-1:2007 MIL-STD-331C:2005 Corr 1:2009 (Personnel) EIA/JES22-A114-B June 2000 EIA/JES22-A115-A October 1997 The measurement bandwidth is the lowest specified by the associated standard.	Site
END				

Appendix - Calibration and Measurement Capabilities

Introduction

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

Calibration and Measurement Capabilities (CMCs)

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

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e., one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples are shown below. It should be noted that these expressions are not mathematical formulae but are instead written in a commonly used shorthand for expressing uncertainties - therefore, for the purposes of clarity, and indication of how they are to be interpreted is also provided below.

<u>DC voltage, 100 mV to 1 V:</u> 0.0025 % + 5.0 µV:

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

<u>Hydraulic pressure, 0.5 MPa to 140 MPa:</u> 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is 0.0036 %·p + ($0.12 \cdot 10^{-6} \cdot p \cdot 10^{-6}$) + 4.0 Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.