


Schedule to CERTIFICATE OF ACCREDITATION	
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Authorised Representative	Mr Kewal Bagal General Manager Energy & Communications
Client No.	4859
Programme	Metrology & Calibration Laboratory
Accreditation Number	583
Initial Accreditation Date	31 October 1995
Conformance Standard	NZS ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories
Testing Services Summary	3.65 Miscellaneous Electrical Tests 5.82 Resistors, Resistance Boxes and Potential Dividers 5.88 Calibrators for Instrumentation 5.89 Indicating Instruments and Recording Instruments 5.91 Frequency Measurement and Time Measurement
Signatories	Mr Antony Cuthbertson 3.65, 5.82, 5.88, 5.89 {excluding (I)}, 5.91 Mr R L Jones 5.89 [(I) only], Site Certification Cat 1-5 Mr John Malcolm 3.65 Mr Geoff Simpson 5.89 Mr Alan Michael Woods 3.65, 5.82, 5.88, 5.89 {excluding (I)}, 5.91

Authorised: General Manager 	Issue 27	Date: 16/04/15	Page 1 of 10
---	----------	----------------	--------------

Schedule to

CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

Calibration temperature 23 °C ± 2 °C (in laboratory)
 All measurement uncertainties are based on a level of confidence of at least 95 %.
 Calibrations are performed at the premises of the accredited laboratory, apart from metering installation measurements which are carried out on site.

3.65 Miscellaneous Electrical Tests

- (a) In service checks on insulating protective equipment including gloves, sleeves and blankets and other equipment in accordance with specifications such as ASTM D120, F478, F479, F496, D1048, D1049, D1050, D1051, F711, F712 and EEA Dec 2004

5.82 Resistors, Resistance Boxes and Potential Dividers

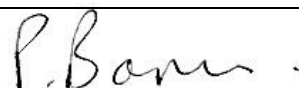
- (a) Precision resistors, resistance boxes and conductance boxes

Refer to 5.89 (i) below

5.88 Calibrators for Instrumentation

		Least uncertainty of measurement (% of measurement + % of range, unless otherwise stated)
(a)	DC voltage	
	100 mV	0.0037 % + 0.0035 %
	1 V	0.0025 % + 0.0007 %
	10 V	0.0024 % + 0.0005 %
	100 V	0.0038 % + 0.0006 %
	1000 V	0.0041 % + 0.001 %
	1000 V to 10 kV	1 % + 1 digit
	10 kV to 100 kV	1 % + 1 digit
(b)	AC voltage	
	100 mV	
	3 Hz to 5 Hz	1.0 % + 0.04 %
	5 Hz to 10 Hz	0.35 % + 0.04 %
	10 Hz to 20 kHz	0.06 % + 0.04 %
	20 kHz to 50 kHz	0.12 % + 0.05 %
	50 kHz to 100 kHz	0.6 % + 0.08 %
	100 kHz to 300 kHz	4.0 % + 0.50 %
	1 V	
	3 Hz to 5 Hz	1.0 % + 0.03 %
	5 Hz to 10 Hz	0.35 % + 0.03 %
	10 Hz to 20 kHz	0.06 % + 0.03 %
	20 kHz to 50 kHz	0.12 % + 0.05 %
	50 kHz to 100 kHz	0.6 % + 0.08 %
	100 kHz to 300 kHz	4.0 % + 0.50 %

Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 2 of 10

Schedule to

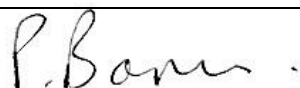
CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

10 V	3 Hz to 5 Hz	1 % + 0.03 %
	5 Hz to 10 Hz	0.35 % + 0.03 %
	10 Hz to 20 kHz	0.06 % + 0.03 %
	20 kHz to 50 kHz	0.12 % + 0.05 %
	50 kHz to 100 kHz	0.6 % + 0.08 %
	100 kHz to 300 kHz	4 % + 0.5 %
100 V	3 Hz to 5 Hz	1 % + 0.03 %
	5 Hz to 10 Hz	0.35 % + 0.03 %
	10 Hz to 20 kHz	0.06 % + 0.03 %
	20 kHz to 50 kHz	0.12 % + 0.05 %
	50 kHz to 100 kHz	0.6 % + 0.08 %
	100 kHz to 300 kHz	4 % + 0.5 %
1000 V	3 Hz to 5 Hz	1 % + 0.0225 %
	5 Hz to 10 Hz	0.35 % + 0.0225 %
	10 Hz to 20 kHz	0.06 % + 0.0225 %
	20 kHz to 50 kHz	0.12 % + 0.0375 %
	50 kHz to 100 kHz	0.6 % + 0.06 %
	100 kHz to 300 kHz	4 % + 0.375 %
1000 V to 10 kV		1 % + 1 digit
10 kV to 100 kV		1 % + 1 digit
(c)	DC current	
	100 µA	0.05 % + 0.025 %
	1 mA	0.05 % + 0.005 %
	10 mA	0.05 % + 0.02 %
	100 mA	0.05 % + 0.005 %
	400 mA	0.05 % + 0.005 %
	1 A	0.05 % + 0.02 %
	3 A	0.1 % + 0.02 %
	10 A	0.15 % + 0.008 %
(d)	AC current	
100 µA	3 Hz to 5 Hz	1.1 % + 0.06 %
	5 Hz to 10 Hz	0.35 % + 0.06 %
	10 Hz to 5 kHz	0.15 % + 0.06 %
	5 kHz to 10 kHz	0.35 % + 0.7 %
1 mA	3 Hz to 5 Hz	1 % + 0.04 %
	5 Hz to 10 Hz	0.3 % + 0.04 %
	10 Hz to 5 kHz	0.1 % + 0.04 %
	5 kHz to 10 kHz	0.2 % + 0.25 %

Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 3 of 10

Schedule to

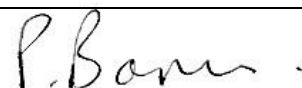
CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

10 mA	3 Hz to 5 Hz	1.1 % + 0.06 %
	5 Hz to 10 Hz	0.35 % + 0.06 %
	10 Hz to 5 kHz	0.15 % + 0.06 %
	5 kHz to 10 kHz	0.35 % + 0.7 %
100 mA	3 Hz to 5 Hz	1 % + 0.04 %
	5 Hz to 10 Hz	0.3 % + 0.04 %
	10 Hz to 5 kHz	0.1 % + 0.04 %
	5 kHz to 10 kHz	0.2 % + 0.25 %
400 mA	3 Hz to 5 Hz	1 % + 0.1 %
	5 Hz to 10 Hz	0.3 % + 0.1 %
	10 Hz to 1 kHz	0.1 % + 0.1 %
	1 kHz to 10 kHz	0.2 % + 0.7 %
1A	3 Hz to 5 Hz	1 % + 0.04 %
	5 Hz to 10 Hz	0.3 % + 0.04 %
	10 Hz to 5 kHz	0.1 % + 0.04 %
	5 kHz to 10 kHz	0.35 % + 0.7 %
3A	3 Hz to 5 Hz	1.1 % + 0.06 %
	5 Hz to 10 Hz	0.35 % + 0.06 %
	10 Hz to 5 kHz	0.15 % + 0.06 %
	5 kHz to 10 kHz	0.35 % + 0.7 %
10A	3 Hz to 5 Hz	1.1 % + 0.06 %
	5 Hz to 10 Hz	0.35 % + 0.06 %
	10 Hz to 5 kHz	0.15 % + 0.06 %
	5 kHz to 10 kHz	0.35 % + 0.7 %
(e)	Resistance	
	10 Ω	0.01 % + 0.03 %
	100 Ω	0.01 % + 0.004 %
	1 kΩ	0.01 % + 0.001 %
	10 kΩ	0.01 % + 0.001 %
	100 kΩ	0.01 % + 0.001 %
	1 MΩ	0.01 % + 0.001 %
	10 MΩ	0.04 % + 0.001 %
	100 MΩ	0.8 % + 0.01 %
	1 GΩ	2.0 % + 0.01 %
	Electrical simulation of temperature signal for calibration of resistance temperature device (RTD) calibrators	
	-200 °C	0.09 °C
	-100 °C	0.08 °C

Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 4 of 10

Schedule to

CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

0 °C	0.06 °C
100 °C	0.08 °C
300 °C	0.12 °C
600 °C	0.22 °C

(f) Other measurement ranges

Frequency (over the range 100 mV to 1000 V)

3 Hz to 5 Hz	0.1 % of reading
5 Hz to 10 Hz	0.05 % of reading
10 Hz to 40 Hz	0.03 % of reading
40 Hz to 300 kHz	0.01 % of reading
300 kHz to 1 MHz	0.01 % of reading

Capacitance

1 nF	2 % + 2.5 %
10 nF	1 % + 0.5 %
100 nF	1 % + 0.5 %
1 µF	1 % + 0.5 %
10 µF	1 % + 0.5 %
100 µF	1 % + 0.5 %
1 mF	1 % + 0.5 %
10 mF	1 % + 0.5 %
100 mF	4 % + 0.2 %

5.89 Indicating Instruments and Recording Instruments

Least uncertainty of measurement

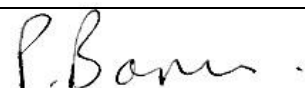
(a) DC voltmeters

0 mV to <330 mV	0.060 % + 3 µV
0 V to <3.3 V	0.050 % + 5 µV
0 V to <33 V	0.050 % + 50 µV
30 V to <330 V	0.055 % + 500 µV
100 V to 1020 V	0.055 % + 1500 µV

(b) AC voltmeters

1.0 mV to <33 mV	10 Hz to 45 Hz	0.87 % + 20 µV
	45 Hz to 10 kHz	0.15 % + 20 µV
	10 kHz to 20 kHz	0.20 % + 20 µV
	20 kHz to 50 kHz	0.25 % + 20 µV
	50 kHz to 100 kHz	0.35 % + 33 µV
33 mV to <330 mV	10 Hz to 45 Hz	0.73 % + 50 µV

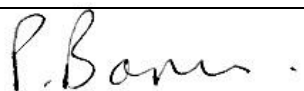
Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 5 of 10

Schedule to				
CERTIFICATE OF ACCREDITATION				
DELTA Utility Services Limited Metrology & Calibration Laboratory SCOPE OF ACCREDITATION		Accreditation No 583		
	45 Hz to 10 kHz	0.05 % + 20 μ V		
	10 kHz to 20 kHz	0.10 % + 20 μ V		
	20 kHz to 50 kHz	0.16 % + 40 μ V		
	50 kHz to 100 kHz	0.24 % + 170 μ V		
0.33 V to <3.3 V	10 Hz to 45 Hz	0.15 % + 250 μ V		
	45 Hz to 10 kHz	0.03 % + 60 μ V		
	10 kHz to 20 kHz	0.08 % + 60 μ V		
	20 kHz to 50 kHz	0.14 % + 300 μ V		
	50 kHz to 100 kHz	0.24 % + 1700 μ V		
3.3 V to <33 V	10 Hz to 45 Hz	0.15 % + 2500 μ V		
	45 Hz to 10 kHz	0.04 % + 600 μ V		
	10 kHz to 20 kHz	0.08 % + 2600 μ V		
	20 kHz to 50 kHz	0.19 % + 5000 μ V		
	50 kHz to 100 kHz	0.24 % + 17000 μ V		
33 V to <330 V	45 Hz to 1 kHz	0.05 % + 6.6 mV		
	1 kHz to 10 kHz	0.08 % + 15 mV		
	10 kHz to 20 kHz	0.09 % + 33 mV		
330 V to 1020 V	45 Hz to 1 kHz	0.05 % + 80 mV		
	1 kHz to 5 kHz	0.20 % + 100 mV		
	5 kHz to 10 kHz	0.20 % + 500 mV		
(c)	DC ammeters			
	0 mA to < 3.3 mA	0.013 % + 0.05 μ A		
	0 mA to < 33 mA	0.014 % + 0.25 μ A		
	0 mA to < 330 mA	0.022 % + 3.3 μ A		
	0 A to < 2.2 A	0.030 % + 44 μ A		
	0 A to < 11 A	0.060 % + 330 μ A		
	11 A to < 16.5 A	0.5 % + 0.02 A		
	16.5 A to < 150 A	0.5 % + 0.14 A		
	150 A to 1025 A	0.5 % + 0.5 A		
(d)	AC ammeters			
0.029 mA to < 0.33 mA	10 Hz to 20 Hz	0.576 % + 0.15 μ A		
	20 Hz to 45 Hz	0.337 % + 0.15 μ A		
	45 Hz to 1 kHz	0.125 % + 0.25 μ A		
	1 kHz to 5 kHz	0.400 % + 0.15 μ A		
	5 kHz to 10 kHz	1.870 % + 0.15 μ A		
0.33 mA to < 3.3 mA	10 Hz to 20 Hz	0.576 % + 0.3 μ A		
	20 Hz to 45 Hz	0.298 % + 0.3 μ A		
	45 Hz to 1 kHz	0.143 % + 0.3 μ A		
	1 kHz to 5 kHz	0.311 % + 0.3 μ A		
Authorised: General Manager		Issue 27	Date: 16/04/15	Page 6 of 10

Schedule to

CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

	5 kHz to 10 kHz	0.600 % + 0.3 μ A
3.3 mA to < 33 mA	10 Hz to 20 Hz	0.579 % + 3 μ A
	20 Hz to 45 Hz	0.301 % + 3 μ A
	45 Hz to 1 kHz	0.170 % + 3 μ A
	1 kHz to 5 kHz	0.311 % + 3 μ A
	5 kHz to 10 kHz	0.600 % + 3 μ A
33 mA to < 330 mA	10 Hz to 20 Hz	0.313 % + 30 μ A
	20 Hz to 45 Hz	0.325 % + 30 μ A
	45 Hz to 1 kHz	0.250 % + 30 μ A
	1 kHz to 5 kHz	0.270 % + 30 μ A
	5 kHz to 10 kHz	1.200 % + 30 μ A
0.33 A to < 2.2 A	10 Hz to 45 Hz	0.20 % + 300 μ A
	45 Hz to 1 kHz	0.22 % + 300 μ A
	1 kHz to 5 kHz	0.75 % + 300 μ A
2.2 A to 11 A	45 Hz to 65 Hz	0.123 % + 2 mA
	65 Hz to 500 Hz	0.129 % + 2 mA
	500 Hz to 1000 Hz	0.330 % + 2 mA
11 A to < 16.5 A	45 Hz to 65 Hz	0.56 % + 0.03 A
16.5 A to < 150 A	45 Hz to 65 Hz	0.56 % + 0.25 A
150 A to < 1025 A	45 Hz to 65 Hz	0.56 % + 0.9 A
11 A to < 16.5 A	65 Hz to 440 Hz	1 % + 0.03 A
16.5 A to < 150 A	65 Hz to 440 Hz	1 % + 0.25 A
150 A to < 1025 A	65 Hz to 440 Hz	1 % + 0.9 A

(e) **Wattmeters**

Least uncertainty for power (W and VA) is calculated as the root sum of squares of the uncertainties for the appropriate voltage and current values (and power factor, if applicable).

Voltage limitations: 33 mVac to 1000 Vac, or 0 V to 1000 Vdc.

Current limitations: 3.3 mAac to 11 Aac, or 0 A to 11 Adc.

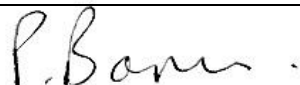
Auxiliary voltage limitations: 10 mVac to 3.3 Vac, or 0 V to 3.3 Vdc.

The range of direct output is from 108.9 μ Wac through to 120 kWac, or 108.9 μ Wdc through to 100 kWdc, and from 108.9 μ VAac through to 120 kVAac, or 108.9 μ VAdc through to 100 kVAdc.

Power can be simulated over greater ranges for equipment incorporating current clamps or current transformers. (Maximum output available for the voltage input is 1000 V, and maximum output available for the "current" input is 11 A or 3.3 V).

(f) **Varmeters**

Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 7 of 10

Schedule to

CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

Least uncertainty for reactive power (VAr) is calculated as the root sum of squares of the uncertainties for the appropriate voltage, current, and power factor values.

Voltage and current limitations apply as for Wattmeters above.

(g) Phase angle indicators

0° to 179.98°	10 Hz to 65 Hz	0.15°
	65 Hz to 500 Hz	0.9°
	500 Hz to 1 kHz	2°
	1 kHz to 5 kHz	6°
	5 kHz to 10 kHz	10°

(i) Ohmmeters and Resistors

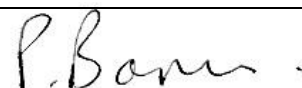
0 Ω to < 11 Ω		0.012 % + 0.006 Ω
11 Ω to < 33 Ω		0.012 % + 0.015 Ω
33 Ω to < 110 Ω		0.009 % + 0.015 Ω
110 Ω to < 330 Ω		0.009 % + 0.015 Ω
330 Ω to < 1.1 kΩ		0.009 % + 0.06 Ω
1.1 kΩ to < 3.3 kΩ		0.009 % + 0.06 Ω
3.3 kΩ to < 11 kΩ		0.009 % + 0.6 Ω
11 kΩ to < 33 kΩ		0.009 % + 0.6 Ω
33 kΩ to < 111 kΩ		0.011 % + 6 Ω
110 kΩ to < 330 kΩ		0.012 % + 6 Ω
330 kΩ to < 1100 kΩ		0.015 % + 55 Ω
1.1 MΩ to < 3.3 MΩ		0.014 % + 55 Ω
3.3 MΩ to < 11 MΩ		0.060 % + 550 Ω
11 MΩ to < 33 MΩ		0.100 % + 550 Ω
33 MΩ to < 110 MΩ		0.500 % + 5.5 kΩ
110 MΩ to 330 MΩ		0.645 % + 16.5 kΩ

(j) LCR meters

Capacitance meters and Capacitors

0.33 nF to < 0.5 nF	50 Hz to 1000 Hz	0.50 % + 0.01 nF
0.5 nF to < 1.1 nF		0.50 % + 0.01 nF
1.1 nF to < 3.3 nF		0.50 % + 0.01 nF
3.3 nF to < 11 nF		0.50 % + 0.01 nF
11 nF to < 33 nF		0.25 % + 0.1 nF
33 nF to < 110 nF		0.25 % + 0.1 nF
110 nF to < 330 nF		0.25 % + 0.3 nF
0.33 μF to < 1.1 μF		0.25 % + 1.0 nF
1.1 μF to < 3.3 μF		0.35 % + 3 nF
3.3 μF to < 11 μF	50 Hz to 400 Hz	0.35 % + 10 nF
11 μF to < 33 μF		0.40 % + 30 nF
33 μF to < 110 μF	50 Hz to 200 Hz	0.50 % + 100 nF

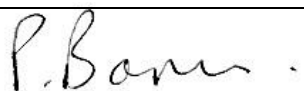
Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 8 of 10

Schedule to		
CERTIFICATE OF ACCREDITATION		
DELTA Utility Services Limited Metrology & Calibration Laboratory SCOPE OF ACCREDITATION		Accreditation No 583
	110 μ F to < 330 μ F 330 μ F to 1100 μ F	50 Hz to 100 Hz 0.70 % + 300 nF 1.00 % + 300 nF
(l)	Energy meters	
	Calibration of single and multiple phase energy meters to the accuracy requirements of classes 0.2, 0.5, 1.0 and 2.0 as defined in IEC 61036, 60687, 60521 (or 62053 - 22, 62053 - 21 and 62053 - 11) in accordance with in-house methods and EIPC 2010 Part 10 Metering	
	Active Meters (units Wh/Vah)	
	Power factor (PF)	
	1.0	0.015 %
	0.5 lag	0.3 %
	0.8 lead	0.187 %
	Reactive Meters (units Varh/Vah)	
	Power Factor (QF)	
	1.0	0.32 %
	0.5 lag	0.64 %
	0.8 lead	0.4 %
	Certification of metering installations in accordance with EIPC 2010 Part 10 Metering Cat 1, 2, 3, 4, and 5	
(q)	Other specified devices	
	Voltage simulation of temperature by simulated thermocouple output and thermocouple measurement.	
	Thermocouple Type	
	B	600 $^{\circ}$ C to < 800 $^{\circ}$ C 0.44 $^{\circ}$ C 800 $^{\circ}$ C to < 1000 $^{\circ}$ C 0.34 $^{\circ}$ C 1000 $^{\circ}$ C to 1550 $^{\circ}$ C 0.30 $^{\circ}$ C > 1550 $^{\circ}$ C to 1820 $^{\circ}$ C 0.33 $^{\circ}$ C
	C	0 $^{\circ}$ C to < 150 $^{\circ}$ C 0.30 $^{\circ}$ C 150 $^{\circ}$ C to 650 $^{\circ}$ C 0.26 $^{\circ}$ C > 650 $^{\circ}$ C to 1000 $^{\circ}$ C 0.31 $^{\circ}$ C > 1000 $^{\circ}$ C to 1800 $^{\circ}$ C 0.50 $^{\circ}$ C > 1800 $^{\circ}$ C to 2316 $^{\circ}$ C 0.84 $^{\circ}$ C
	E	-250 $^{\circ}$ C to < -100 $^{\circ}$ C 0.50 $^{\circ}$ C -100 $^{\circ}$ C to < -25 $^{\circ}$ C 0.16 $^{\circ}$ C -25 $^{\circ}$ C to -350 $^{\circ}$ C 0.14 $^{\circ}$ C > 350 $^{\circ}$ C to 650 $^{\circ}$ C 0.16 $^{\circ}$ C
Authorised: General Manager		Issue 27 Date: 16/04/15
		Page 9 of 10

Schedule to

CERTIFICATE OF ACCREDITATION

DELTA Utility Services Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation No 583

	> 650 °C to 1000 °C	0.21 °C
J	-210 °C to < -100 °C	0.27 °C
	-100 °C to < -30 °C	0.16 °C
	-30 °C to 150 °C	0.14 °C
	> 150 °C to 760 °C	0.17 °C
	> 760 °C to 1200 °C	0.23 °C
K	-200 °C to < -100 °C	0.33 °C
	-100 °C to < -25 °C	0.18 °C
	-25 °C to 120 °C	0.16 °C
	> 120 °C to 1000 °C	0.26 °C
	> 1000 °C to 1372 °C	0.40 °C
N	-200 °C to < -100 °C	0.40 °C
	-100 °C to < -25 °C	0.22 °C
	-25 °C to < 120 °C	0.19 °C
	120 °C to 410 °C	0.18 °C
	> 410 °C to 1300 °C	0.27 °C
R	0 °C to < 250 °C	0.57 °C
	250 °C to < 400 °C	0.35 °C
	400 °C to 1000 °C	0.33 °C
	> 1000 °C to 1767 °C	0.40 °C
S	0 °C to < 250 °C	0.47 °C
	250 °C to 1000 °C	0.36 °C
	> 400 °C to 1400 °C	0.37 °C
	> 1400 °C to < 1767 °C	0.46 °C
T	-250 °C to < -150 °C	0.63 °C
	-150 °C to < 0 °C	0.24 °C
	0 °C to < 120 °C	0.16 °C
	120 °C to 400 °C	0.14 °C

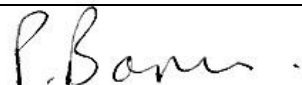
5.91 Frequency Measurement and Time Measurement

(a) Frequency meters

Least uncertainty of measurement

0.01 Hz to < 120 Hz	25 ppm + 2 mHz
120 Hz to < 1200 Hz	25 ppm + 2 mHz
1.2 kHz to < 12 kHz	25 ppm + 2 mHz
12 kHz to < 120 kHz	25 ppm + 2 mHz
120 kHz to < 1200 kHz	25 ppm + 2 mHz
1.2 MHz to 2 MHz	25 ppm + 2 mHz

Authorised:
 General Manager



Issue 27

Date: 16/04/15

Page 10 of 10