Schedule of Accreditation

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Accredited to ISO/IEC 17025:2005

Ministry of Defence

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Calibration Centre **Bolkiah Garrison BB3510** **Negara Brunei Darussalam**	**Contact: Mr Lim Tiong Thai** **Tel: +673-2-386475** **Fax: +673-2-380643** **E-Mail: cal_lab@mindef.gov.bn** Website:

Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address Calibration Centre Bolkiah Garrison BB3510 Negara Brunei Darussalam	**Local contact** Mr Lim Tiong Thai +673-2-386475	Electrical dc& lf and rf Mass Torque Temperature Pressure Humidity Dimensional	Lab

Site activities performed away from the locations listed above:

Location details		Activity	Location code
The customers' site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer.	**Local contact** Mr Lim Tiong Thai +673-2-386475	Mass	Site

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL				Lab
DC VOLTAGE	10 V Reference	0.50 ppm	This uncertainty can be realised with voltage standards within 20 ppm of the nominal voltage and only if they have their own temperature controlled enclosure of appropriate thermal stability	
Decade Values	10 μV, 100 μV and 1 mV 10 mV 100 mV 1 V 10 V 100 V 1 kV	0.50 μV 70 ppm 10 ppm 2.5 ppm 1.5 ppm 3.0 ppm 3.5 ppm	The stated CMCs are for values that lie within ± 0.5 % of those listed.	
Other values	0 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 100 V 100 V to 1 kV	1.0 μV 8.0 ppm 7.0 ppm 11 ppm 18 ppm		
DC RESISTANCE				Lab
Specific values				
Generation	0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1.9 Ω 19 kΩ 19 MΩ	4.0 ppm 4.0 ppm 4.0 ppm 4.0 ppm 4.0 ppm 4.0 ppm 3.5 ppm 4.0 ppm 3.5 ppm 10 ppm 16 ppm 10 ppm 15 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)				Lab
Specific Values (continued)				
Measurement	0.1 Ω 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1.9 Ω 19 kΩ 19 MΩ	7.0 ppm 5.5 ppm 5.5 ppm 5.0 ppm 5.0 ppm 5.0 ppm 5.0 ppm 6.0 ppm 12 ppm 20 ppm 12 ppm 8.0 ppm 30 ppm	The stated CMCs are for values that lie within ± 10 % of those listed.	
Other values	0 mΩ to 1 mΩ 1 mΩ to 10 mΩ 10 mΩ to 100 mΩ 0 Ω to 0.1 Ω 0.1 Ω to 1 Ω 1 Ω to 5 Ω 5 Ω to 12 Ω 12 Ω to 50 Ω 50 Ω to 120 Ω 120 Ω to 120 kΩ 120 kΩ to 500 kΩ 500 kΩ to 1.2 MΩ 1.2 MΩ to 5 MΩ 5 MΩ to 12 MΩ 12 MΩ to 120 MΩ 120 MΩ to 1 GΩ	0.050 % + 0.70 μΩ 0.060 % + 3.0 μΩ 75 ppm + 30 μΩ 60 μΩ 610 ppm 66 ppm 29 ppm 54 ppm 24 ppm 18 ppm 33 ppm 26 ppm 130 ppm 86 ppm 830 ppm 0.90 %	Current carrying resistors	
DC CURRENT	0 μA to 1 μA 1 μA to 100 mA 100 mA to 10 A 10 A to 20 A	70 pA 65 ppm 65 ppm 110 ppm		Lab

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty ($k = 2$)	Remarks	Location Code
AC VOLTAGE				Lab
Specific values Specific frequencies	*40 Hz, 1 kHz, 10 kHz, 20 kHz, 50 kHz* 10 mV 20 mV 100 mV 200 mV 600 mV 1 V 2 V 6 V 10 V 20 V 60 V 100 V 200 V 1 kV	 190 ppm 150 ppm 80 ppm (85 ppm at 50 kHz) 80 ppm 80 ppm 50 ppm 50 ppm 50 ppm 50 ppm 50 ppm 50 ppm 50 ppm 50 ppm (60 ppm at 50 kHz) 60 ppm (65 ppm at 20 kHz and 75 ppm at 50 kHz)		
	40 Hz, 100 Hz, 400 Hz 10 mV 100 mV 1 V, 10 V, 100 V	 190 ppm 80 ppm 50 ppm		
	40 Hz, 400 Hz, 500 Hz 20 mV 200 mV 600 mV 2 V, 6 V, 20 V, 60 V 200 V 1000 V	 150 ppm 80 ppm 80 ppm 50 ppm 50 ppm 60 ppm		
Other Values	5 mV to 12 mV *20 Hz to 40 Hz* *40 Hz to 1 kHz* *1 kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz*	 0.16 % 0.14 % 0.14 % 0.18 % 0.60 %		
	12 mV to 50 mV *20 Hz to 40 Hz* *40 Hz to 1 kHz* *1 kHz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz*	 670 ppm 550 ppm 570 ppm 670 ppm 0.11 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				Lab
Other values (continued)	50 mV to 120 mV			
	20 Hz to 40 Hz	280 ppm		
	40 Hz to 1 kHz	200 ppm		
	1 kHz to 20 kHz	240 ppm		
	20 kHz to 50 kHz	430 ppm		
	50 kHz to 100 kHz	960 ppm		
	120 mV to 500 mV			
	20 Hz to 40 Hz	430 ppm		
	40 Hz to 1 kHz	270 ppm		
	1 kHz to 20 kHz	310 ppm		
	20 kHz to 50 kHz	430 ppm		
	50 kHz to 100 kHz	970 ppm		
	500 mV to 1.2 V			
	20 Hz to 40 Hz	210 ppm		
	40 Hz to 1 kHz	190 ppm		
	1 kHz to 20 kHz	240 ppm		
	20 kHz to 50 kHz	390 ppm		
	50 kHz to 100 kHz	940 ppm		
	1.2 V to 5 V			
	20 Hz to 40 Hz	430 ppm		
	40 Hz to 1 kHz	270 ppm		
	1 kHz to 20 kHz	300 ppm		
	20 kHz to 50 kHz	430 ppm		
	50 kHz to 100 kHz	960 ppm		
	5.0 V to 12 V			
	20 Hz to 40 Hz	210 ppm		
	40 Hz to 1 kHz	190 ppm		
	1 kHz to 20 kHz	240 ppm		
	20 kHz to 50 kHz	390 ppm		
	50 kHz to 100 kHz	950 ppm		
	12 V to 50 V			
	20 Hz to 40 Hz	480 ppm		
	40 Hz to 1 kHz	350 ppm		
	1 kHz to 20 kHz	350 ppm		
	20 kHz to 50 kHz	480 ppm		
	50 kHz to 100 kHz	0.15 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
AC VOLTAGE (continued)				Lab
Other values (continued)	50 V to 120 V			
	20 Hz to 40 Hz	300 ppm		
	40 Hz to 1 kHz	290 ppm		
	1 kHz to 20 kHz	290 ppm		
	20 kHz to 50 kHz	440 ppm		
	50 kHz to 100 kHz	0.14 %		
	120 V to 500 V			
	40 Hz to 1 kHz	930 ppm		
	1 kHz to 20 kHz	0.11 %		
	20 kHz to 50 kHz	0.16 %		
	500 V to 1 kV			
	40 Hz to 1 kHz	910 ppm		
	1 kHz to 20 kHz	0.11 %		
	20 kHz to 50 kHz	0.16 %		
AC CURRENT	10 mA to 12 mA			Lab
	20 Hz to 45 Hz	0.25 %		
	45 Hz to 100 Hz	0.11 %		
	100 Hz to 5 kHz	0.060 %		
	12 mA to 50 mA			
	20 Hz to 45 Hz	0.32 %		
	45 Hz to 100 Hz	0.22 %		
	100 Hz to 5 kHz	0.21 %		
	50 mA to 120 mA			
	20 Hz to 45 Hz	0.26 %		
	45 Hz to 100 Hz	0.11 %		
	100 Hz to 5 kHz	0.070 %		
	120 mA to 500 mA			
	20 Hz to 45 Hz	0.33 %		
	45 Hz to 100 Hz	0.24 %		
	100 Hz to 5 kHz	0.26 %		
	500 mA to 1 A			
	20 Hz to 45 Hz	0.27 %		
	45 Hz to 100 Hz	0.14 %		
	100 Hz to 5 kHz	0.18 %		
	1 A to 10 A			
	40 Hz to 1 kHz	0.070 %		
	10 A to 20 A			
	40 Hz to 400 Hz	0.10 %		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
DISTORTION				Lab
Distortion Factor	0.1 % to 0.25 %			
	0.2 V to 0.5 V	0.083 % distortion factor	The capabilities for distortion factor relate to fundamental components in the frequency range 20 Hz to 100 kHz.	
	0.5 V to 2 V	0.043 % distortion factor		
	2 V to 300 V	0.023 % distortion factor		
	0.25 % to 0.4 %			
	0.2 V to 0.5 V	0.068 % distortion factor		
	0.5 V to 2 V	0.068 % distortion factor		
	2 V to 300 V	0.032 % distortion factor		
	0.4 % to 1.0 %			
	0.2 V to 0.5 V	0.17 % distortion factor		
	0.5 V to 2 V	0.090 % distortion factor		
	2 V to 300 V	0.080 % distortion factor		
	1.0 % to 100 %			
	0.2 V to 0.5 V	0.90 % distortion factor		
	0.5 V to 2 V	0.80 % distortion factor		
	2 V to 300 V	0.80 % distortion factor		
FREQUENCY				Lab
Specific values	100 kHz	2.7 parts in 10^{11}		
	1 MHz	2.7 parts in 10^{11}		
	5 MHz	5.4 parts in 10^{11}		
	10 MHz	3.0 parts in 10^{12}		
Other Values	10 Hz to 100 Hz	3.0 parts in 10^{6}		
	100 Hz 1 kHz	2.0 parts in 10^{6}		
	1 kHz to 10 kHz	2.0 parts in 10^{7}		
	10 kHz to 1 GHz	1.0 parts in 10^{8}		
RF POWER				Lab
Power reference sources	1 mW			
	50 MHz	0.60 %		
	+ 20 dBm to - 20 dBm		The stated CMCs relate to the calibration of stable 50 Ω coaxial sources having an output VSWR of 1.01 or less and fitted with Type N connectors.	
	300 kHz to 4.2 GHz	0.27 dB		
	- 20 dBm to - 40 dBm			
	3 MHz to 1.3 GHz	0.31 dB		
	- 40 dBm to - 80 dBm			
	3 MHz to 1.3 GHz	0.36 dB		
	- 80 dBm to - 120 dBm			
	3 MHz to 1.3 GHz	0.38 dB		
	- 120 dBm to - 127 dBm			
	3 MHz to 1.3 GHz	0.40 dB		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
RF POWER (Cont'd)				
Specific frequencies	*2 MHz, 10 MHz, 15 MHz, 25 MHz, 30 MHz, 43 MHz, 50 MHz, 60 MHz, 88 MHz, 100 MHz, 125 MHz, 180 MHz, 200 MHz, 250 MHz, 350 MHz, 400 MHz and 500 MHz*			
	1 W to 100 W	3.5 %		
RF ATTENUATION	3 dB, 6 dB, 10 dB and 20 dB			Lab
	50 MHz to 6 GHz	0.10 dB		
	30 dB and 40 dB		The uncertainties for RF attenuation and VSWR refer to a 50Ω coaxial system using type N precision connectors	
	50 MHz to 3 GHz	0.15 dB		
	3 GHz to 4 GHz	0.20 dB		
	4 GHz to 6 GHz	0.25 dB		
VSWR				Lab
	1.0 to 1.2			
	50 MHz to 1 GHz	0.050		
	1 GHz to 3 GHz	0.10		
	3 GHz to 6 GHz	0.15		
RF CALIBRATION FACTOR				Lab
Substitution Method	100 kHz	2.2 %	Referenced to 1 mW at 50 MHz	
	300 kHz	1.9 %		
	500 kHz	1.9 %		
	1 MHz	1.9 %		
	3 MHz	1.8 %		
	5 MHz	1.8 %		
	10 MHz	1.8 %		
	30 MHz	1.8 %		
	100 MHz	1.8 %		
	300 MHz	1.8 %		
	500 MHz	1.8 %		
	1 GHz	1.8 %		
	1.5 GHz	1.9 %		
	2 GHz	1.9 %		
	2.6 GHz	2.1 %		
Splitter method	100 kHz to 4.2 GHz	2.3 %	Referenced to 1 mW at 50 MHz	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
CAPACITANCE and DISSIPATION FACTOR				Lab
Specific frequencies		C_p (pF) D (tan δ)		
	1 pF			
	1 kHz	0.0014 0.00065		
	1 MHz	0.0039 0.00030		
	10 pF			
	1 kHz	0.0036 0.00030	For the calibration of standard four terminal pair capacitors. The CMCs quoted for dissipation factor apply to D values between zero and 0.002	
	1 MHz	0.0071 0.0011		
	100 pF			
	1 kHz	0.062 0.00030		
	1 MHz	0.081 0.00030		
	1000 pF			
	1 kHz	0.33 0.00030		
	1 MHz	0.44 0.00030		
OSCILLOSCOPE CALIBRATION				Lab
Time Interval (Horizontal deflection coefficients)				
	1 µs	0.020 µs		
	5 µs	0.10 µs		
	20 µs	0.50 µs		
	500 µs	10 µs		
	1 ms	0.020 ms		
	5 ms	0.10 ms		
	10 ms	0.20 ms		
	50 ms	1.0 ms		
	100 ms	2.1 ms		
DC AMPLITUDE (Vertical deflection coefficients)				
	10 mV	0.20 mV		
	20 mV	0.50 mV		
	50 mV	1.1 mV		
	100 mV	2.1 mV		
	200 mV	5.1 mV		
	500 mV	11 mV		
	1 V	2.1 mV		
	2 V	51 mV		
	5 V	110 mV		
	10 V	210 mV		

DC AMPLITUDE (Vertical deflection coefficients) Cont'd				
Rise Time	1 ns 1 ns 1 ns	210 ps 200 ps 200 ps	Nominal 25 mV Nominal 250 mV Nominal 1 V	
Bandwidth	50 kHz to 300 MHz	3.1 % 5.0 %	Digital Oscilloscopes Analogue Oscilloscopes	
MASS	Nominal value (g)	(mg)		Lab
	20 000 10 000 5 000 2 000 1 000 500 200 100 50 20 10 5 2 1 0.5 0.2 0.1 0.05 0.02 0.01 0.005 0.002 0.001	20 10 5.0 2.0 0.50 0.25 0.10 0.050 0.033 0.025 0.020 0.015 0.012 0.010 0.0080 0.0060 0.0050 0.0040 0.0030 0.0025 0.0020 0.0020 0.0020		
NON-AUTOMATIC WEIGHING MACHINES				Lab and Site
	5g 10g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 50 kg 100 kg 200 kg 250 kg 500 kg	0.023 mg 0.032 mg 0.044 mg 0.073 mg 0.13 mg 0.27 mg 0.69 mg 1.3 mg 3.8 mg 9.6 mg 19 mg 306 mg 770 mg 1.7 g 5.2 g 5.6 g 8.9 g	Weights are available in OIML Class E2 from 1 mg to 20 kg F1 from 1 mg to 20 kg Max grouped load 59 kg M1 From 1 kg to 20 kg Max. grouped load 500 kg Other loads within the overall listed range may also be used	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
TORQUE				Lab
Hand torque tools	To BS EN ISO 6789:2003			
	1356 N·m to 6780 N·m	50 N·m		
	680 N·m to 1356 N·m	18 N·m		
	340 N·m to 680 N·m	5.0 N·m		
	135 N·m to 340 N·m	2.5 N·m		
	56 N·m to 135 N·m	1.0 N·m		
	6 N·m to 56 N·m	0.40 N·m		
	0 N·m to 6 N·m	0.040 N·m		
TEMPERATURE				Lab
Temperature indicators with sensors	- 60 °C to + 90 °C 90 °C to 250 °C	0.14 °C 0.060 °C		
Liquid in glass thermometers	- 60 °C to + 50 °C 50 °C to 90 °C 90 °C to 250 °C	0.16 °C 0.32 °C 0.094 °C		
Calibration of temperature probes in air	0 °C to 70 °C	0.20 °C		
HUMIDITY				Lab
Hygrometers	35 %rh 50 %rh 80 %rh *For the temperature range 20 °C to 25 °C*	0.75 %rh 1.1 %rh 1.4 %rh		
PRESSURE				Lab
<u>Hydraulic Pressure (Gauge)</u>				
"Pressure equivalent" calibration of dead weight testers	600 kPa to 6 MPa 6 MPa to 60 MPa	0.010 % + 20 Pa 0.010 %	1. Pressure equivalent is restricted to Budenberg type devices.	
Calibration of pressure indicating instruments and gauges	500 kPa to 140 MPa	0.0060 % + 30 Pa	2. Calibration of pressure measuring devices with an electrical output may be undertaken.	
<u>Pneumatic Pressure (Gauge)</u>				
Calibration of pressure indicating instruments and gauges	16 kPa to 310 kPa 310 kPa to 3 MPa 3 MPa to 7 MPa	0.0043 % 0.0033 % 0.0039 %	3. Pressure measurements may be expressed in other units of pressure as required	

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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
LENGTH Measuring Instruments and Machines Micrometers External	As BS 870:2008 2 micrometres to 25 mm	2.0 micrometres between any two points		Lab
END				