Schedule of Accreditation

issued by

United Kingdom Accreditation Service

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

UKAS CALIBRATION **0509** **Accredited to ISO/IEC 17025:2017**	**Ministry of Defence** **Issue No:** 050 **Issue date:** 09 May 2024	
	Calibration Centre **Bolkiah Garrison BB3510** **Negara** **Brunei Darussalam**	**Contact: Mr Sofri Rahman** **Tel: +673-2-386475** **Fax: +673-2-380643** **E-Mail: cal_lab@mindef.gov.bn**

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 Sofri Rahman +673-2-386475	Electrical, DC and LF Electrical, RF and microwave Mass Temperature Pressure Humidity Dimensional Torque Force	A

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 Sofri Rahman +673-2-386475	Mass Temperature Rotational speed and elapsed time	B

Calibration and Measurement Capability (CMC)

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
Values and uncertainties listed below are applicable for the calibration of both measurement instruments and for instruments with an output. the method used is by direct comparison unless otherwise stated in the remarks column				
ELECTRICAL				
DC VOLTAGE	10 V Reference	0.50 μV/V	This uncertainty can be realised with voltage standards within 0.002 % of the nominal voltage and only if they have their own temperature controlled enclosure of appropriate thermal stability	A
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 μV/V 10 μV/V 2.5 μV/V 1.5 μV/V 3.0 μV/V 2.5 μV/V	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 μV/V 7.0 μV/V 11 μV/V 18 μV/V		
DC RESISTANCE				A
Specific values				
Generation	0.1 Ω 1 Ω 1.9 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 19 kΩ 100 kΩ 1 MΩ 10 MΩ 19 MΩ 100 MΩ 1 GΩ	4.0 μV/V 4.0 μV/V 16 μV/V 4.0 μV/V 4.0 μV/V 4.0 μV/V 4.0 μV/V 10 μV/V 3.5 μV/V 4.0 μV/V 3.5 μV/V 35 μV/V 9.0 μV/V 170 μV/V		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL (continued)				
DC RESISTANCE (continued)				A
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 1 GΩ	7.0 μΩ/Ω 5.5 μΩ/Ω 5.5 μΩ/Ω 5.0 μΩ/Ω 5.0 μΩ/Ω 5.0 μΩ/Ω 5.0 μΩ/Ω 5.0 μΩ/Ω 12 μΩ/Ω 40 μΩ/Ω 12 μΩ/Ω 8.0 μΩ/Ω 30 μΩ/Ω 165 μΩ/Ω	The stated CMCs are for values that lie within 10 % of those listed.	
Other values Current carrying resistors	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 0.090 % + 3.0 μΩ 0.024 % + 30 μΩ 60 μΩ 610 μΩ/Ω 66 μΩ/Ω 29 μΩ/Ω 54 μΩ/Ω 24 μΩ/Ω 18 μΩ/Ω 33 μΩ/Ω 26 μΩ/Ω 130 μΩ/Ω 86 μΩ/Ω 830 μΩ/Ω 0.90 %	At 5 A DC At 5 A DC At 1 A DC	
DC CURRENT	0 μA to 1 μA 1 μA to 100 mA 100 mA to 10 A 10 A to 20 A	75 pA 65 μA/A 60 μA/A 110 μA/A		A

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL (continued)				
AC VOLTAGE Specific values Set frequencies	*40 Hz, 1 kHz, 10 kHz, 20 kHz and 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	 205 μV/V 170 μV/V 90 μV/V 90 μV/V 90 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 75 μV/V		A
Specific values range frequencies	10 mV *100 Hz and 400 Hz* *20 mV* *500 Hz* *100 mV* *100 Hz and 400 Hz* *200 mV and 600 mV* *500 Hz* 1 V 100 Hz and 400 Hz 2 V and 6 V 500 Hz 10 V 100 Hz and 400 Hz 20 V and 60 V 500 Hz 100 V 100 Hz and 400 Hz 200 V 500 Hz 1000 V 400 Hz and 500 Hz	 205 μV/V 170 μV/V 90 μV/V 90 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 65 μV/V 75 μV/V		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL (continued)				
AC VOLTAGE Specific values (continued) Specific frequencies	2 mV to 10 mV	0.35 %		A
	5 mV to 12 mV			
	20 Hz to 40 Hz	0.15 %		
	40 Hz to 1 kHz	0.13 %		
	1 kHz to 20 kHz	0.14 %		
	20 kHz to 50 kHz	0.18 %		
	50 kHz to 100 kHz	0.60 %		
Other values	12 mV to 50 mV			
	20 Hz to 40 Hz	0.067 %		
	40 Hz to 1 kHz	0.054 %		
	1 kHz to 20 kHz	0.055 %		
	20 kHz to 50 kHz	0.067 %		
	50 kHz to 100 kHz	0.11 %		
	50 mV to 120 mV			
	20 Hz to 40 Hz	295 μV/V		
	40 Hz to 1 kHz	170 μV/V		
	1 kHz to 20 kHz	220 μV/V		
	20 kHz to 50 kHz	440 μV/V		
	50 kHz to 100 kHz	965 μV/V		
	120 mV to 500 mV			
	20 Hz to 40 Hz	130 μV/V		
	40 Hz to 1 kHz	230 μV/V		
	1 kHz to 20 kHz	270 μV/V		
	20 kHz to 50 kHz	410 μV/V		
	50 kHz to 100 kHz	950 μV/V		
	500 mV to 1.2 V			
	20 Hz to 40 Hz	150 μV/V		
	40 Hz to 1 kHz	125 μV/V		
	1 kHz to 20 kHz	185 μV/V		
	20 kHz to 50 kHz	360 μV/V		
	50 kHz to 100 kHz	930 μV/V		
	1.2 V to 5 V			
	20 Hz to 40 Hz	410 μV/V		
	40 Hz to 1 kHz	230 μV/V		
	1 kHz to 20 kHz	270 μV/V		
	20 kHz to 50 kHz	410 μV/V		
	50 kHz to 100 kHz	950 μV/V		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
Other values (continued)	5 V to 12 V			A
	20 Hz to 40 Hz	160 μV/V		
	40 Hz to 1 kHz	130 μV/V		
	1 kHz to 20 kHz	190 μV/V		
	20 kHz to 50 kHz	360 μV/V		
	50 kHz to 100 kHz	930 μV/V		
	12 V to 50 V			
	20 Hz to 40 Hz	460 μV/V		
	40 Hz to 1 kHz	315 μV/V		
	1 kHz to 20 kHz	315 μV/V		
	20 kHz to 50 kHz	460 μV/V		
	50 kHz to 100 kHz	0.15 %		
	50 V to 120 V			
	20 Hz to 40 Hz	270 μV/V		
	40 Hz to 1 kHz	250 μV/V		
	1 kHz to 20 kHz	250 μV/V		
	20 kHz to 50 kHz	420 μV/V		
	50 kHz to 100 kHz	0.14 %		
	120 V to 500 V			
	40 Hz to 1 kHz	0.062 %		
	1 kHz to 20 kHz	0.081 %		
	20 kHz to 50 kHz	0.15 %		
	500 V to 1 kV			
	40 Hz to 1 kHz	0.059 %		
	1 kHz to 20 kHz	0.079 %		
	20 kHz to 50 kHz	0.15 %		
AC CURRENT	10 mA to 12 mA			A
	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 %		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
AC CURRENT continued				A
	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 %		
DISTORTION				A
Distortion Factor	0.1 % to 0.25 %			
	0.2 V to 0.5 V	33 % distortion factor	The capabilities for distortion factor relate to fundamental components in the frequency range 20 Hz to 100 kHz.	
	0.1 % to 0.4 %			
	0.5 V to 2 V	17 % distortion factor		
	0.1 % to 0.25 %			
	2 V to 5 V	9.0 % distortion factor		
	0.25 % to 100 %			
	2 V to 300 V	8.0 % distortion factor		
FREQUENCY				A
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^{12}		
	10 MHz	3.0 parts in 10^{12}		
Other Values	dc to 100 Hz	26 µHz	Can be reported as elapsed time for repetitive events. 1/f	
	100 Hz to 1 kHz	160 µHz		
	1 kHz to 10 kHz	26 µHz		
	10 kHz to 1 MHz	160 µHz		
	1 MHz to 10 MHz	1.6 mHz		
	10 MHz to 100 MHz	16 mHz		
	100 MHz to 1 GHz	160 mHz		
	1 GHz	1.6 Hz		
Rotational speed and elapsed time				A & B
RPM	10 RPM to 12 000 RPM	0.10 RPM	Mechanical Tachometer.	
	10 RPM to 100 0000 RPM	0.60 RPM	Optical Tachometers Centrifuges and Calibrators	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
TIME INTERVAL				A & B
Stopwatch elapsed time	10 s to 1 Hr 1 Hr to 1 day	41 ms 231 ms	Manually Triggered	
RF POWER				A
Signal sources	*300 kHz to 4.2 GHz* + 20 dBm to - 20 dBm	0.24 dB	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.	
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	3.0 %		
	550 MHz 600 MHz 650 MHz, 700 MHz, 750 MHz, 800 MHz, 850 MHz, 900 MHz, 950 MHz 1 GHz 1 W to 100 W	4.0 %		
RF ATTENUATION	0 dB, to 40 dB *50 MHz to 6 GHz*	0.10 dB	The uncertainties for RF attenuation and VRC refer to a 50Ω coaxial system using type N precision connectors	A
VOLTAGE REFLECTION COEFFICIENT SWR	1.0 to 1.20 (0 to 0.1) *50 MHz to 6 GHz*	0.050		A
TUNED RF LEVEL				A
With respect to 1 mW into 50 Ω	*3 MHz to 1.3 GHz* 0 dBm to –40 dBm -40 dBm to -80 dBm -80 dBm to -120 dB	0.27 dB 0.32 dB 0.38 dB		

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
RF CALIBRATION FACTOR				A
Substitution Method	100 kHz 300 kHz 500 kHz 1 MHz 3 MHz 5 MHz 10 MHz 30 MHz 100 MHz 300 MHz 500 MHz 1 GHz 1.5 GHz 2 GHz 2.6 GHz	3.0 % 2.1 % 1.9 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 % 1.7 %	Referenced to 1 mW at 50 MHz	
Splitter method	100 kHz to 4.2 GHz 300 kHz 500 kHz 1 MHz 3 MHz 10 MHz 50 MHz 100 MHz 300 MHz 1 GHz 2 GHz 3 GHz 4.2 GHz	2.7 % 1.4 % 1.2 % 1.0 % 1.1 % 1.1 % 1.1 % 1.0 % 1.0 % 1.0 % 1.0 % 1.2 % 1.6 %	Referenced to 1 mW at 50 MHz	
CAPACITANCE and DISSIPATION FACTOR Specific frequencies		C_p (pF)	D (tan δ)	A
	1 pF *1 kHz to 100 kHz* *1 MHz* 10 pF *1 kHz to 100 kHz* *1 MHz* 100 pF *1 kHz to 100 kHz* *1 MHz* 1000 pF *1 kHz to 100 kHz* *1 MHz*	 0.0037 0.0043 0.0033 0.0028 0.031 0.057 0.62 0.72	 0.0027 0.0029 0.00049 0.0013 0.00034 0.00036 0.00037 0.00036	For the calibration of standard four terminal pair capacitors. The CMCs quoted for dissipation factor apply to D values between zero and 0.002

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
OSCILLOSCOPE CALIBRATION				A
TIME INTERVAL (Horizontal deflection coefficients)	1 µs 5 µs 20 µs 500 µs 1 ms 5 ms 10 ms 50 ms 100 ms	25 ns 139 ns 551 ns 11 µs 23 µs 111 µs 233 µs 1.1 ms 2.3 ms		
DC AMPLITUDE (Vertical deflection coefficients)	10 mV 20 mV 50 mV 100 mV 200 mV 500 mV 1 V 2 V 5 V 10 V	0.14 mV 0.20 mV 0.47 mV 0.91 mV 2.0 mV 6.0 mV 12 mV 30 mV 62 mV 120 mV		
RISETIME	1 ns to 10 ns 1 ns to 10 ns 1 ns to 10 ns	217 ps 214 ps 213 ps	Nominal 25 mV Nominal 250 mV Nominal 1 V	
BANDWIDTH	50 kHz to 300 MHz	1.7 % 4.2 %	Digital Oscilloscopes Analogue Oscilloscopes	

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
MASS	Nominal value (g)	(mg)	Substitution Method E2 from 1 mg to 26 kg	
Artefacts	26 000 25 000 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 20 10 5.4 2.7 1.0 0.53 0.27 0.10 0.053 0.033 0.027 0.020 0.017 0.013 0.010 0.0083 0.0067 0.0053 0.0040 0.0033 0.0027 0.0020 0.0020 0.0020		A
Non-Automatic Weighing Machines	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	Methods consistent with EURAMET CG18 Weights are available in OIML Class E2 from 1 mg to 20 kg F1 from 1 mg to 20 kg Max grouped load 62 kg M1 From 1 kg to 20 kg Max. grouped load 260 kg Other loads within the overall listed range may also be used Max. grouped load 500 kg	A & B

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
TORQUE				
Hand torque tools	1.4 N·m to 1356 N·m	1.6 %	BS EN ISO 6789:2:2017	A
	135 N·m to 340 N·m 56 N·m to 135 N·m 3 N·m to 56 N·m 135 N·m to 340 N·m 56 N·m to 135 N·m 3 N·m to 56 N·m	50 N·m 18 N·m 5.0 N·m 2.5 N·m 1.0 N·m 0.40 N·m	BS EN ISO 6789:2003 (withdrawn) The uncertainty quoted is for both the application of the calibration torque and the characteristics of the device being calibrated. Calibrations may also be given in lbf·in and lbf·ft.	A
FORCE	4.45 kN to 44.48 kN (1000 lbf to 10 000 lbf)	0.20 %	Calibration of force measuring devices e.g. load cells and load measuring rings but excluding proving devices. Compression only.	A
TEMPERATURE			Calibration by comparison with reference instruments	
Temperature indicators with sensors	-60 °C to 100 °C 0 °C 100 °C to 200 °C 200 °C to 300 °C	0.052 °C 0.045 °C 0.056 °C 0.073 °C	In liquid bath	A
Liquid in glass thermometers	-60 °C to -30 °C -30 °C to 0 °C 0 °C 0 °C to 200 °C 200 °C to 240 °C	0.14 °C 0.079 °C 0.068 °C 0.076 °C 0.091 °C		A
Calibration of temperature probes in air	0 °C to 70 °C	1.2 °C		A
Temperature controlled, chambers, environmental cabinets fridges, freezers, ovens and similar apparatus	-60 °C to 25 °C 25 °C to 250 °C	1.6 °C 1.3 °C	multipoint time dependent temperature profiling, also referred to as spatial temperature surveying or mapping	A & B

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
RELATIVE HUMIDITY			Calibration by comparison with reference salt solutions	
Hygrometers	35 %rh 50 %rh 80 %rh 35 %rh to 80 %rh At 15 °C At 20 °C At 25 °C At 30 °C	1.3 %rh 1.3 %rh 1.3 %rh 3.0 %rh to 5.0 %rh 2.7 %rh to 3.7 Rrh 2.7 %rh to 3.3 %rh 2.9 %rh to 3.7 %rh	For the temperature range 15 °C to 30 °C In air Chamber by comparison with referemce hygrometer and Platinium Resistance Thermometers Instrument sensor volume less than 15 mm x 15 mm larger instruments will have a larger uncertainty	A
LENGTH Measuring Instruments and Machines Micrometers External	0 mm to 25 mm	2.0 µm between any two points	BS 870:2008	A
PRESSURE <u>Hydraulic Pressure (Gauge)</u> "Pressure equivalent" calibration of dead weight-testers.	500 kPa to 3.5 MPa 3.5 MPa to 7 MPa 7 MPa to 70 MPa 70 MPa to 140 MPa	0.012 % 0.0067 % + 42 Pa 0.0067 % + 42 Pa 0.0069 % + 42 Pa	Methods consistent with EURAMET CG3 and CG17	A
Calibration of pressure indicating instruments and gauges	500 kPa to 3.5 MPa 3.5 MPa to 7 MPa 7 MPa to 70 MPa 70 MPa to 140 MPa	0.012 % 0.0067 % + 42 Pa 0.0067 % + 42 Pa 0.0069 % + 42 Pa	Calibration of pressure measuring devices with an electrical output may be undertaken.	A

Measured Quantity Instrument or Gauge	Range	Expanded Measurement Uncertainty (k = 2)	Remarks	Location Code
<u>Pneumatic Pressure (Gauge)</u>				
Calibration of pressure indicating instruments and gauges	-95 kPa to -3.5 kPa 3.5 kPa to 172 kPa 50 kPa to 3 MPa 100 kPa ro 7 MPa	0.0091 % + 33 Pa 0.0091 % 0.0073 % 0.0073 %	Pressure measurements may be expressed in other units of pressure as required.	A
<u>Pneumatic Pressure (Absolute)</u>				A
Calibration of pressure indicating instruments and gauges	3.5 kPa to 50 kPa 50 kPa to 3 MPa 100 kPa to 7 MPa	0.0091 % + 2.9 Pa 0.0073 % + 2.9 Pa 0.0073 % + 2.9 Pa		
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 measurement uncertainty 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 CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The measurement uncertainty is calculated according to the procedures given in the GUM and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published measurement uncertainty in certificates issued under its accreditation.

Expression of CMCs - symbols and units

It should be noted that the percentage symbol (%) represents the number 0.01. In cases where the measurement uncertainty is stated as a percentage, this is to be interpreted as meaning percentage of the measurand.
Thus, for example, a measurement uncertainty of 1.5 % means $1.5 \times 0.01 \times q$, where q is the quantity value.

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