



CERTIFICATE OF ACCREDITATION

In terms of section 22(2) (b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

CONCILIUM TECHNOLOGIES (PTY) LTD
Co. Reg. No.: 1999/013330/07
RADIO FREQUENCY CALIBRATION LABORATORY

Accreditation Number: **CAL 108-07-00**

is a South African National Accreditation System accredited Calibration laboratory
provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying scope of accreditation
Annexure "A", bearing the above accreditation number for

RADIO FREQUENCY METROLOGY

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17025:2017

The accreditation demonstrates technical competency for a defined scope and the operation of a
laboratory quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the
relevant SANAS accreditation symbol to issue facility reports and/or certificates

Mr M Phaloane
Acting Chief Executive Officer

Effective Date: 27 February 2024
Certificate Expires: 30 January 2027



ANNEXURE A

SCOPE OF ACCREDITATION

RADIO FREQUENCY METROLOGY

Accreditation Number: CAL 108-07-00

Permanent Address of Laboratory: Concilium Technologies (Pty) Ltd 10 Central Park 13 Esdoring Nook Highveld Technopark Centurion 0157 Postal Address: 10 Central Park 13 Esdoring Nook Highveld Technopark Centurion 0157 Tel: (012) 678-9200 E-mail: Gavin.Schuster@concilium.co.za		Technical Signatory: Mr GD Schuster Nominated Representative: Mr GD Schuster Issue No.: 23 Date of Issue: 24 April 2024 Expiry Date: 30 January 2022		
ITEM	MEASURED QUANTITY OR TYPE OF GAUGE OR INSTRUMENT AND NOMINAL RANGE	NOMINAL FREQUENCY	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY ($\pm$)	METHOD / PROCEDURE
11	RADIO FREQUENCY MEASUREMENTS			
11.1	Radio Frequency Power			
11.1.1	Absolute power in coaxial line: power meter, power source			
i)	0 dBm (1 mW) -60 dBm to -20 dBm (1 nW to 10 μ W) -30 dBm to +20 dBm (1 μ W to 100 mW) -60 dBm to +20 dBm (1 nW to 100 mW) -60 dBm to +20 dBm (1 nW to 100 mW) -110 dBm to -30 dBm (10 fW to 1 μ W) -110 dBm to -60 dBm (10 fW to 1 nW) -110 dBm to -60 dBm (10 fW to 1 nW) N-Type Connector (50 Ω)	50 MHz 10 MHz to 1 GHz 100 kHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz 100 kHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz	0,08 dB 0,2 dB 0,2 dB 0,3 dB 0,4 dB 0,2 dB + 0,005 dB per dBm 0,3 dB + 0,010 dB per dBm 0,4 dB + 0,015 dB per dBm	Direct measurement method using a power source or comparative measurement using a reference standard or indirect method through a directional couple or splitter.

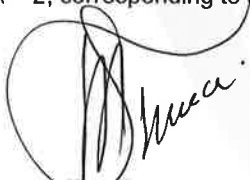
Original Date of Accreditation: 1980

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* Generation Limitation: 100 kHz to 26,5 GHz: + 13 dBm

** Generation Limitation: 26,5 GHz to 50 GHz: +4 dBm

The CMC, expressed as an expanded uncertainty of measurement, is stated as the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, corresponding to a confidence level of approximately 95%


 Accreditation Manager

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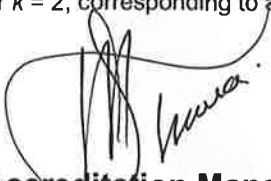
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ii)	-30 dBm to +20 dBm (1 μ W to 100 mW) -30 dBm to +20 dBm (1 μ W to 100 mW) -30 dBm to +20 dBm (1 μ W to 100 mW)	50 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 26,5 GHz	0,2 dB 0,3 dB 0,4 dB	Direct measurement method using a power sensor or comparative measurement using a reference standard or indirect method through a directional couple or splitter	
	-100 dBm to -30 dBm (10 fW to 1 μ W) -100 dBm to -60 dBm (10 fW to 1 nW) -100 dBm to -60 dBm (10 fW to 1 nW) PC – 3.5 Connector (50 Ω)	10 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 26,5 GHz	0,2 dB + 0,005 dB per dBm 0,3 dB + 0,010 dB per dBm 0,4 dB + 0,015 dB per dBm		
iii)	-60 dBm to - 20 dBm (1 nW to 10 μ W) -60 dBm to - 20 dBm (1 nW to 10 μ W) -60 dBm to - 20 dBm (1 nW to 10 μ W) -60 dBm to - 20 dBm (1 nW to 10 μ W)	50 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz 40 GHz to 50 GHz	0,2 dB 0,3 dB 0,4 dB 0,6 dB		
	-30 dBm to + 20 dBm (1 μ W to 100 mW) -30 dBm to + 20 dBm (1 μ W to 100 mW) -30 dBm to + 20 dBm (1 μ W to 100 mW) -30 dBm to + 20 dBm (1 μ W to 100 mW)	50 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz 40 GHz to 50 GHz	0,2 dB 0,3 dB 0,4 dB 0,5 dB		
	-100 dBm to - 30 dBm (10 fW to 1 μ W) -100 dBm to - 30 dBm (10 fW to 1 μ W) -100 dBm to - 30 dBm (10 fW to 1 μ W) -100 dBm to - 30 dBm (10 fW to 1 μ W) PC – 2.4 Connector (50 Ω)	10 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 40 GHz 40 GHz to 50 GHz	0,2 dB + 0,005 dB per dBm 0,3 dB + 0,010 dB per dBm 0,4 dB + 0,015 dB per dBm 0,5 dB + 0,020 dB per dBm		
	iv)	-30 dBm to +20 dBm (1 μ W to 100 mW) (Generation limitation : + 13 dBm)	100 kHz to 2 GHz		0,2 dB
		-110 dBm to -30 dBm (10 fW to 1 μ W) N-Type Connector (75 Ω)	100 kHz to 2 GHz		0,2 dB + 0,005 dB per dBm
	11.2	Scalar RF reflection coefficient and attenuation			
11.2.3	Attenuation in coaxial line: Passive device				
i)	0 dB to 60 dB 60 dB to 80 dB 80 dB to 110 dB DC Attenuation (50 Ω all connector types)	DC DC DC	0,002 dB 0,01 dB 0,15 dB		Voltage ratio method or Substitution method or Direct method

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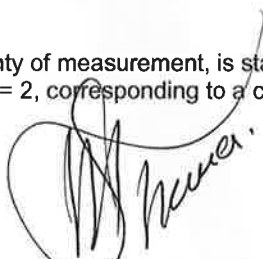
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11.2.3	Attenuation in coaxial line (values in dB): Passive device				
ii)	0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB	100 kHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz	0,04 dB + 0,005 dB per dB 0,1 dB + 0,010 dB per dB 0,15 dB + 0,015 dB per dB	Power ratio method or Substitution method or Direct method using a RF detector	
	100 dB to 120 dB 100 dB to 120 dB 100 dB to 120 dB N-Type Connector (50 Ω)	100 kHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz	1 dB 2 dB 3 dB		
	iii)	0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB PC -3.5 Connector (50 Ω)	10 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz 18 GHz to 26,5 GHz		0,04 dB + 0,005 dB per dB 0,10 dB + 0,010 dB per dB 0,15 dB + 0,015 dB per dB 0,2 dB + 0,015 dB per dB
iv)		0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB 0 dB to 100 dB PC-2.4 Connector (50 Ω)	10 MHz to 1 GHz 1 GHz to 10 GHz 10 GHz to 18 GHz 18 GHz to 26,5 GHz 26,5 GHz to 40 GHz 40 GHz to 50 GHz		0,04 dB + 0,015 dB per dB 0,1 dB + 0,020 dB per dB 0,15 dB + 0,020 dB per dB 0,2 dB + 0,020 dB per dB 0,4 dB + 0,015 dB per dB 0,5 dB + 0,025 dB per dB
		v)	0 dB to 100 dB (75 Ω, N-Type connector)		100 kHz to 2 GHz
	vi)	0 dB to 60 dB 60 dB to 80 dB 80 dB to 110 dB (75 Ω, N-Type connector)	DC DC DC		0,002 dB 0,01 dB 0,15 dB
11.2.1	Reflection coefficient in coaxial line: passive device				
i)	Ratio 0 to 1 Ratio 0 to 1 Ratio 0 to 1 N-Type Connector (50 Ω)	5 Hz to 10 MHz 10 MHz to 15 GHz 15 GHz to 18 GHz	0,010 + 0,056 ρ ² 0,011 + 0,031 ρ ² 0,013 + 0,100 ρ ²		Calibration against a standard by using directional bridge and/or ripple extraction method and/or direct measurement method
ii)	Ratio 0 to 1 Ratio 0 to 1 Ratio 0 to 1 PC -3.5 Connector (50 Ω)	10 MHz to 15 GHz 15 GHz to 18 GHz 18 GHz to 26,5 GHz	0,017 + 0,037 ρ ² 0,013 + 0,100 ρ ² 0,018 + 0,172 ρ ²		

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11.2.1 iii)	Ratio 0 to 1	10 MHz to 15 GHz		0,011 + 0,057 ρ ²	Calibration against a standard by using directional bridge and/or ripple extraction method and/or direct measurement method
	Ratio 0 to 1	15 GHz to 18 GHz		0,013 + 0,100 ρ ²	
iv)	Ratio 0 to 1	18 GHz to 26,5 GHz		0,018 + 0,172 ρ ²	
	Ratio 0 to 1	26,5 GHz to 40 GHz		0,050 + 0,167 ρ ²	
	Ratio 0 to 1	40 GHz to 50 GHz		0,059 + 0,290 ρ ²	
	PC -2.4 Connector (50 Ω)				
	Ratio 0 to 1	5 Hz to 10 MHz		0,010 + 0,056 ρ ²	
	Ratio 0 to 1	10 MHz to 2 GHz		0,014 + 0,081 ρ ²	
11.6	Signal and pulse characteristics				
11.6.3	Modulation, AM and FM: Signal generator, spectrum analyser, modulation meter, jitter meter				
i)	Amplitude Modulation (50 Ω)				
	Modulation Depth	Carrier	Modulation		Calibration using direct measurement method with selective detectors (e.g. spectrum analysers) / Modulation meter or calibration using bessel functions
	0 % to 99 %	100 kHz to 1 MHz	20 Hz to 50 kHz	2 • 10 ⁻² • M + 0,01 %	
	0 % to 99 %	1 MHz to 1,3 GHz	20 Hz to 100 kHz	1 • 10 ⁻² • M + 0,01 %	
	1 % to 95 %	1,3 GHz to 18 GHz	60 Hz to 100 kHz	3 • 10 ⁻² • M	
5 % to 90 %	18 GHz to 50 GHz	60 Hz to 100 kHz	3 • 10 ⁻² • M		
ii)	Frequency Modulation (50 Ω)				
	Peak Deviation	Carrier	Modulation		
	0 Hz to 75 kHz	100 kHz to 1 MHz	20 Hz to 35 kHz	5 • 10 ⁻³ • f + 1 Hz	
	0 Hz to 75 kHz	1 MHz to 1,3 GHz	20 Hz to 416 kHz	5 • 10 ⁻³ • f + 1 Hz	
	480 Hz to 3 MHz	1,3 GHz to 7 GHz	200 Hz to 1,25 MHz	5 • 10 ⁻³ • f + 10 Hz	
	480 Hz to 10 MHz	7 GHz to 18 GHz	200 Hz to 4,16 MHz	5 • 10 ⁻³ • f + 10 Hz	
	480 Hz to 8 MHz	18 GHz to 26,5 GHz	200 Hz to 3,33 MHz	5 • 10 ⁻³ • f + 10 Hz	
	75 kHz to 8 MHz	26,5 GHz to 50 GHz	31,185 kHz to 3,33 MHz	5 • 10 ⁻³ • f	

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