



**RF Test Solutions Limited**

**Client Number 2434**

409 Cuba Street, Alicetown, Lower Hutt, 5010

**Telephone 04 570-2480**

**www.rftest.co.nz**

**Authorised Representative**

Mr Michael Tecofsky  
Laboratory Manager

**Programme**

Metrology & Calibration Laboratory

**Accreditation Number 492**

**Initial Accreditation Date 5 July 1993**

**Conformance Standard**

ISO/IEC 17025:2017

General requirements for the competence of testing and calibration laboratories

**Laboratory Services Summary**

- 5.55 Speed Measuring Devices
- 5.61 Temperature Measuring Equipment
- 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
- 5.92 Waveform Measurement
- 5.93 Signal Sources
- 5.95 Communications Equipment
- 5.97 High Voltage Testing

**Key Technical Personnel**

|                     |  |
|---------------------|--|
| Mr Tristan Gibbs    | 5.55, 5.61, 5.82, 5.88, 5.89, 5.91, 5.92, 5.93, 5.95, 5.97 |
| Mr Bertrand Gloria  | 5.55, 5.61, 5.82, 5.88, 5.89, 5.97                         |
| Mr Michael Taylor   | 5.55, 5.61, 5.82, 5.88, 5.89, 5.91, 5.92, 5.93, 5.95, 5.97 |
| Mr Michael Tecofsky | 5.55, 5.61, 5.82, 5.88, 5.89, 5.91, 5.92, 5.93, 5.95, 5.97 |

|                                      |  |          |               |              |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 1 of 17 |
|--------------------------------------|--|----------|---------------|--------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

Calibration temperature 23 °C ± 5 °C, Relative Humidity 20 % to 80 %.

Calibration and Measurement Capability (CMC) Uncertainties are expressed as an expanded uncertainty with a level of confidence of approximately 95 % (k = 2) <sup>Note1</sup>.

Measurement results are traceable to the International System of Units (SI) via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

Calibrations can be performed at the premises of the accredited laboratory or at the customer's premises using a mobile calibration facility or in the field.

**5.55 Speed Measuring Devices**

(b) Speedometers

Laser and Lidar speed measuring instruments by simulation (frequency) to an in-house method based on manufacturer's recommendations

| Lidar laser measurements | CMC Uncertainty |
|--------------------------|-----------------|
| 5 km/h to 100 km/h       | 0.6 km/h        |
| 150 km/h                 | 0.6 km/h        |
| 200 km/h                 | 0.6 km/h        |
| 250 km/h                 | 0.6 km/h        |
| 300 km/h                 | 0.6 km/h        |

| Radar measurements | CMC Uncertainty |
|--------------------|-----------------|
| 5 km/h             | 0.2 km/h        |
| 50 km/h            | 0.3 km/h        |
| 100 km/h           | 0.5 km/h        |
| 150 km/h           | 0.6 km/h        |
| 200 km/h           | 0.8 km/h        |
| 250 km/h           | 0.9 km/h        |
| 300 km/h           | 1.0 km/hr       |

**5.61 Temperature Measuring Equipment**

(o) Indicators, recorders and controllers

Electrical simulation of thermocouple (types J, K and T) output to an in-house method based on manufacturer's recommendations

| Measurand          | CMC Uncertainty |
|--------------------|-----------------|
| -200 °C to 1200 °C | 0.4 °C          |

|                                      |  |          |               |              |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 2 of 17 |
|--------------------------------------|--|----------|---------------|--------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

**5.82 Resistors, Resistance Boxes and Potential Dividers**

- (a) Precision resistors, resistance boxes and conductance boxes
- (b) Volt ratio boxes and potential dividers
- (c) DC shunts
- (d) AC shunts

In accordance with in-house methods based on manufacturer's recommendations  
 Measurand and CMC Uncertainties as for 5.88(e) to maximum 20 A

**5.88 Calibrators for Instrumentation**

In accordance with in-house methods based on manufacturer's recommendations

|           |                 |
|-----------|-----------------|
| Measurand | CMC Uncertainty |
|-----------|-----------------|

(a) DC voltage

|                   |           |
|-------------------|-----------|
| 0 V               | 340 nV    |
| 0.001 V to 0.01 V | 42 µV/V   |
| 0.01 V to 0.1 V   | 14 µV/V   |
| 0.1 V to 1 V      | 8 µV/V    |
| 1 V to 10 V       | 7 µV/V    |
| 10 V to 100 V     | 11 µV/V   |
| 100 V to 1 kV     | 11 µV/V   |
| 1 kV to 10 kV     | 1900 µV/V |
| 10 kV to 20 kV    | 1600 µV/V |
| 20 kV to 25 kV    | 1500 µV/V |
| 25 kV to 30 kV    | 1500 µV/V |
| 30 kV to 40 kV    | 1400 µV/V |

(b) AC voltage

|                  |                   |        |
|------------------|-------------------|--------|
| 0.01 mV to 10 mV | 1 Hz to 1 kHz     | 0.07 % |
|                  | 1.1 kHz to 20 kHz | 0.14 % |
|                  | 21 kHz to 100 kHz | 0.60 % |
|                  | 101 kHz to 1 MHz  | 1.4 %  |
| 10 mV to 100 mV  | 1 Hz to 1 kHz     | 0.03 % |
|                  | 1.1 kHz to 20 kHz | 0.04 % |
|                  | 21 kHz to 100 kHz | 0.11 % |
|                  | 101 kHz to 1 MHz  | 0.37 % |
| 0.1 V to 1 V     | 1 Hz to 1 kHz     | 0.03 % |
|                  | 1.1 kHz to 20 kHz | 0.04 % |
|                  | 21 kHz to 100 kHz | 0.10 % |
|                  | 101 kHz to 1 MHz  | 0.36 % |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 3 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                |                   |        |
|----------------|-------------------|--------|
| 1 V to 10 V    | 1 Hz to 1 kHz     | 0.03 % |
|                | 1.1 kHz to 20 kHz | 0.04 % |
|                | 21 kHz to 100 kHz | 0.05 % |
|                | 101 kHz to 1 MHz  | 0.36 % |
| 10 V to 100 V  | 1 Hz to 1 kHz     | 0.04 % |
|                | 1.1 kHz to 20 kHz | 0.04 % |
|                | 21 kHz to 100 kHz | 0.05 % |
| 100 V to 1 kV  | 1 Hz to 1 kHz     | 0.08 % |
| 1 kV to 5 kV   | 50 Hz             | 1.2 %  |
| 5 kV to 10 kV  | 50 Hz             | 1.4 %  |
| 10 kV to 15 kV | 50 Hz             | 1.5 %  |

(c) DC current

|                             |                 |
|-----------------------------|-----------------|
| 0 A                         | 2 nA            |
| 0.01 $\mu$ A to 100 $\mu$ A | 38 $\mu$ A/A    |
| 0.1 mA to 1 mA              | 32 $\mu$ A/A    |
| 1 mA to 10 mA               | 32 $\mu$ A/A    |
| 10 mA to 100 mA             | 50 $\mu$ A/A    |
| 0.1 A to 1 A                | 140 $\mu$ A/A   |
| 1 A to 10 A                 | 160 $\mu$ A/A   |
| 10 A to 20 A                | 160 $\mu$ A/A   |
| 20 A to 50 A                | 1100 $\mu$ A/A  |
| 50 A to 100 A               | 1100 $\mu$ A/A  |
| 100 A to 200 A              | 1100 $\mu$ A/A  |
| 200 A to 300 A              | 1100 $\mu$ A/A  |
| 300 A to 500 A              | 11000 $\mu$ A/A |
| 500 A to 750 A              | 11000 $\mu$ A/A |

(d) AC current

|                          |       |        |
|--------------------------|-------|--------|
| 1 $\mu$ A to 100 $\mu$ A | 1 kHz | 0.11 % |
| 0.1 mA to 1 mA           | 1 kHz | 0.06 % |
| 1 mA to 10 mA            | 1 kHz | 0.06 % |
| 10 mA to 100 mA          | 1 kHz | 0.06 % |
| 0.1 A to 1 A             | 1 kHz | 0.14 % |
| 1 A to 10 A              | 50 Hz | 0.09 % |
| 1 A to 10 A              | 1 kHz | 0.10 % |
| 10 A to 20 A             | 50 Hz | 0.09 % |

(e) Resistance

|              |                       |
|--------------|-----------------------|
| 0 $\Omega$   | 250 $\mu\Omega$       |
| 10 $\Omega$  | 34 $\mu\Omega/\Omega$ |
| 100 $\Omega$ | 29 $\mu\Omega/\Omega$ |
| 1 k $\Omega$ | 19 $\mu\Omega/\Omega$ |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 4 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|        |          |
|--------|----------|
| 10 kΩ  | 19 μΩ/Ω  |
| 100 kΩ | 19 μΩ/Ω  |
| 1 MΩ   | 31 μΩ/Ω  |
| 10 MΩ  | 100 μΩ/Ω |
| 100 MΩ | 840 μΩ/Ω |

**5.89 Indicating Instruments and Recording Instruments**

In accordance with in-house methods based on manufacturer's recommendations

Measurand CMC Uncertainty

(a) DC voltmeters

|                 |         |
|-----------------|---------|
| 1 mV to 220 mV  | 11 μV/V |
| 0.22 V to 2.2 V | 6 μV/V  |
| 2.2 V to 11 V   | 7 μV/V  |
| 11 V to 22 V    | 6 μV/V  |
| 22 V to 220 V   | 7 μV/V  |
| 220 V to 1.1 kV | 7 μV/V  |

(b) AC voltmeters

|                    |                    |           |
|--------------------|--------------------|-----------|
| 0.001 mV to 2.2 mV | 10 Hz to 20 Hz     | 2100 μV/V |
|                    | 20 Hz to 40 Hz     | 2000 μV/V |
|                    | 40 Hz to 20 kHz    | 2000 μV/V |
|                    | 20 kHz to 50 kHz   | 2000 μV/V |
|                    | 50 kHz to 100 kHz  | 2200 μV/V |
|                    | 100 kHz to 300 kHz | 3800 μV/V |
|                    | 300 kHz to 500 kHz | 6800 μV/V |
|                    | 500 kHz to 2 MHz   | 7900 μV/V |
|                    | 2 MHz to 5 MHz     | 7900 μV/V |
|                    | 5 MHz to 10 MHz    | 8200 μV/V |
|                    | 10 MHz to 20 MHz   | 8200 μV/V |
| 2.2 mV to 22 mV    | 20 MHz to 30 MHz   | 8700 μV/V |
|                    | 10 Hz to 20 Hz     | 410 μV/V  |
|                    | 20 Hz to 40 Hz     | 320 μV/V  |
|                    | 40 Hz to 20 kHz    | 320 μV/V  |
|                    | 20 kHz to 50 kHz   | 320 μV/V  |
|                    | 50 kHz to 100 kHz  | 550 μV/V  |
|                    | 100 kHz to 300 kHz | 1000 μV/V |
| 300 kHz to 500 kHz | 1500 μV/V          |           |
| 500 kHz to 2 MHz   | 2500 μV/V          |           |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 5 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                 |                    |                |
|-----------------|--------------------|----------------|
|                 | 2 MHz to 5 MHz     | 6200 $\mu$ V/V |
|                 | 5 MHz to 10 MHz    | 6300 $\mu$ V/V |
|                 | 10 MHz to 20 MHz   | 6300 $\mu$ V/V |
|                 | 20 MHz to 30 MHz   | 6500 $\mu$ V/V |
| 22 mV to 220 mV | 10 Hz to 20 Hz     | 220 $\mu$ V/V  |
|                 | 20 Hz to 40 Hz     | 120 $\mu$ V/V  |
|                 | 40 Hz to 20 kHz    | 120 $\mu$ V/V  |
|                 | 20 kHz to 50 kHz   | 120 $\mu$ V/V  |
|                 | 50 kHz to 100 kHz  | 310 $\mu$ V/V  |
|                 | 100 kHz to 300 kHz | 810 $\mu$ V/V  |
|                 | 300 kHz to 500 kHz | 970 $\mu$ V/V  |
|                 | 500 kHz to 2 MHz   | 1500 $\mu$ V/V |
|                 | 2 MHz to 5 MHz     | 6000 $\mu$ V/V |
|                 | 5 MHz to 10 MHz    | 6100 $\mu$ V/V |
|                 | 10 MHz to 20 MHz   | 6100 $\mu$ V/V |
|                 | 20 MHz to 30 MHz   | 6200 $\mu$ V/V |
| 0.22 V to 2.2 V | 10 Hz to 20 Hz     | 150 $\mu$ V/V  |
|                 | 20 Hz to 40 Hz     | 69 $\mu$ V/V   |
|                 | 40 Hz to 20 kHz    | 69 $\mu$ V/V   |
|                 | 20 kHz to 50 kHz   | 69 $\mu$ V/V   |
|                 | 50 kHz to 100 kHz  | 110 $\mu$ V/V  |
|                 | 100 kHz to 300 kHz | 240 $\mu$ V/V  |
|                 | 300 kHz to 500 kHz | 430 $\mu$ V/V  |
|                 | 500 kHz to 2 MHz   | 1000 $\mu$ V/V |
|                 | 2 MHz to 5 MHz     | 4100 $\mu$ V/V |
|                 | 5 MHz to 10 MHz    | 4200 $\mu$ V/V |
|                 | 10 MHz to 20 MHz   | 4200 $\mu$ V/V |
|                 | 20 MHz to 30 MHz   | 4400 $\mu$ V/V |
| 2.2 V to 22 V   | 10 Hz to 20 Hz     | 150 $\mu$ V/V  |
|                 | 20 Hz to 40 Hz     | 69 $\mu$ V/V   |
|                 | 40 Hz to 20 kHz    | 69 $\mu$ V/V   |
|                 | 20 kHz to 50 kHz   | 69 $\mu$ V/V   |
|                 | 50 kHz to 100 kHz  | 110 $\mu$ V/V  |
|                 | 100 kHz to 300 kHz | 230 $\mu$ V/V  |
|                 | 300 kHz to 500 kHz | 530 $\mu$ V/V  |
|                 | 500 kHz to 2 MHz   | 1200 $\mu$ V/V |
|                 | 2 MHz to 5 MHz     | 3200 $\mu$ V/V |
|                 | 5 MHz to 10 MHz    | 3300 $\mu$ V/V |
|                 | 10 MHz to 20 MHz   | 3300 $\mu$ V/V |
|                 | 20 MHz to 30 MHz   | 3500 $\mu$ V/V |
| 22 V to 220 V   | 10 Hz to 20 Hz     | 150 $\mu$ V/V  |
|                 | 20 Hz to 40 Hz     | 74 $\mu$ V/V   |
|                 | 40 Hz to 20 kHz    | 74 $\mu$ V/V   |

|                                      |  |          |               |              |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 6 of 17 |
|--------------------------------------|--|----------|---------------|--------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|  |                    |                      |
|--|--------------------|----------------------|
|  | 20 kHz to 50 kHz   | 74 $\mu\text{V/V}$   |
|  | 50 kHz to 100 kHz  | 210 $\mu\text{V/V}$  |
|  | 100 kHz to 300 kHz | 500 $\mu\text{V/V}$  |
| 220 V to 1100 V                        | 50 Hz to 1 kHz     | 73 $\mu\text{V/V}$   |
| <b>(c) DC ammeters</b>                 |                    |                      |
| 0.1 $\mu\text{A}$ to 220 $\mu\text{A}$ |                    | 89 $\mu\text{A/A}$   |
| 0.22 mA to 2.2 mA                      |                    | 58 $\mu\text{A/A}$   |
| 2.2 mA to 22 mA                        |                    | 60 $\mu\text{A/A}$   |
| 22 mA to 220 mA                        |                    | 88 $\mu\text{A/A}$   |
| 0.22 A to 2.2 A                        |                    | 130 $\mu\text{A/A}$  |
| 2.2 A to 11 A                          |                    | 310 $\mu\text{A/A}$  |
| 11 A to 100 A                          |                    | 3000 $\mu\text{A/A}$ |
| 100 A to 150 A                         |                    | 3100 $\mu\text{A/A}$ |
| 150 A to 250 A                         |                    | 3000 $\mu\text{A/A}$ |
| 250 A to 500 A                         |                    | 2900 $\mu\text{A/A}$ |
| <b>(d) AC ammeters</b>                 |                    |                      |
| 10 $\mu\text{A}$ to 220 $\mu\text{A}$  | 10 Hz to 1 kHz     | 200 $\mu\text{A/A}$  |
| 1 $\mu\text{A}$ to 220 $\mu\text{A}$   | 1 kHz to 5 kHz     | 730 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 1700 $\mu\text{A/A}$ |
| 0.22 mA to 2.2 mA                      | 10 kHz to 1 kHz    | 140 $\mu\text{A/A}$  |
|  | 1 kHz to 5 kHz     | 140 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 730 $\mu\text{A/A}$  |
| 2.2 mA to 22 mA                        | 10 Hz to 1 kHz     | 150 $\mu\text{A/A}$  |
|  | 1 kHz to 5 kHz     | 150 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 740 $\mu\text{A/A}$  |
| 22 mA to 220 mA                        | 10 Hz to 1 kHz     | 160 $\mu\text{A/A}$  |
|  | 1 kHz to 5 kHz     | 160 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 740 $\mu\text{A/A}$  |
| 0.22 A to 2.2 A                        | 40 Hz to 1 kHz     | 600 $\mu\text{A/A}$  |
|  | 1 kHz to 5 kHz     | 600 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 700 $\mu\text{A/A}$  |
| 2.2 A to 11 A                          | 40 Hz to 1 kHz     | 770 $\mu\text{A/A}$  |
|  | 1 kHz to 5 kHz     | 780 $\mu\text{A/A}$  |
|  | 5 kHz to 10 kHz    | 2800 $\mu\text{A/A}$ |
| 11 A to 100 A                          | 45 Hz              | 3000 $\mu\text{A/A}$ |
|  | 440 Hz             | 8100 $\mu\text{A/A}$ |
| 100 A to 500 A                         | 45 Hz              | 6600 $\mu\text{A/A}$ |
|  | 300 Hz             | 9000 $\mu\text{A/A}$ |
| <b>(e) Wattmeters</b>                  |                    |                      |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 7 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

The CMC Uncertainty of measurement for power is calculated as the root sum of squares of the uncertainties for the voltage listed in 5.89, the current listed in 5.88 and 152 parts per million (ppm) for possible load phase error. Testing Performed at Unity Power Factor.

(g) Phase angle indicators

-90°, -180°, 90°, 180° & 0° (at 2.5 V) 1.2°

(i) Ohmmeters

|        |          |
|--------|----------|
| 0 Ω    | 50 μΩ    |
| 1 Ω    | 76 μΩ/Ω  |
| 1.9 Ω  | 74 μΩ/Ω  |
| 10 Ω   | 24 μΩ/Ω  |
| 19 Ω   | 23 μΩ/Ω  |
| 100 Ω  | 15 μΩ/Ω  |
| 190 Ω  | 15 μΩ/Ω  |
| 1 kΩ   | 13 μΩ/Ω  |
| 1.9 kΩ | 13 μΩ/Ω  |
| 10 kΩ  | 14 μΩ/Ω  |
| 19 kΩ  | 14 μΩ/Ω  |
| 100 kΩ | 15 μΩ/Ω  |
| 190 kΩ | 15 μΩ/Ω  |
| 1 MΩ   | 32 μΩ/Ω  |
| 1.9 MΩ | 32 μΩ/Ω  |
| 10 MΩ  | 49 μΩ/Ω  |
| 19 MΩ  | 53 μΩ/Ω  |
| 100 MΩ | 380 μΩ/Ω |

(j) LCR meters

|        |                  |        |
|--------|------------------|--------|
| 1 pF   | 1 kHz            | 12 %   |
| 10 pF  | 300 Hz           | 11 %   |
| 10 pF  | 1 kHz            | 1.2 %  |
| 100 pF | 50 Hz to 100 Hz  | 11 %   |
| 100 pF | 300 Hz           | 1.1 %  |
| 100 pF | 1 kHz            | 0.14 % |
| 1 nF   | 50 Hz to 100 Hz  | 1.1 %  |
| 1 nF   | 300 Hz to 1 kHz  | 0.13 % |
| 10 nF  | 50 Hz to 1 kHz   | 0.13 % |
| 100 nF | 50 Hz to 1 kHz   | 0.13 % |
| 1 μF   | 50 Hz to 1 kHz   | 0.13 % |
| 10 μH  | 1 kHz            | 11 %   |
| 100 μH | 100 Hz to 300 Hz | 11 %   |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 8 of 17





RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                |                  |                |
|----------------|------------------|----------------|
| 100 $\mu$ H    | 1 kHz            | 1.1 %          |
| 1 mH           | 50 Hz            | 11 %           |
| 1 mH           | 100 Hz to 300 Hz | 1.1 %          |
| 1 mH           | 1 kHz            | 0.15 %         |
| 10 mH          | 50 Hz to 100 Hz  | 1.1 %          |
| 10 mH          | 300 Hz to 1 kHz  | 0.15 %         |
| 100 mH         | 50 Hz to 1 kHz   | 0.15 %         |
| 1 H            | 50 Hz to 1 kHz   | 0.15 %         |
| 10 $\Omega$    | 100 Hz           | 30 m $\Omega$  |
| 100 k $\Omega$ | 100 Hz           | 170 $\Omega$   |
| 1 $\Omega$     | 1 kHz            | 6.3 m $\Omega$ |
| 100 $\Omega$   | 1 kHz            | 150 m $\Omega$ |
| 10 k $\Omega$  | 1 kHz            | 15 $\Omega$    |
| 100 k $\Omega$ | 1 kHz            | 170 $\Omega$   |
| 2 M $\Omega$   | 1 kHz            | 17 k $\Omega$  |
| 10 $\Omega$    | 10 kHz           | 30 m $\Omega$  |
| 100 k $\Omega$ | 10 kHz           | 170 $\Omega$   |

(q) Other specified devices

**RCD Testers**

|                 |  |        |
|-----------------|--|--------|
| Timing          |  |        |
| 1 ms to 1000 ms |  | 0.08 % |
| Test current    |  |        |
| 3 mA            |  | 0.19 % |
| 5 mA            |  | 0.11 % |
| 6 mA            |  | 0.09 % |
| 10 mA           |  | 0.08 % |
| 15 mA           |  | 0.05 % |
| 30 mA           |  | 0.19 % |
| 50 mA           |  | 0.11 % |
| 100 mA          |  | 0.08 % |
| 150 mA          |  | 0.05 % |
| 250 mA          |  | 0.22 % |
| 300 mA          |  | 0.19 % |
| 500 mA          |  | 0.11 % |
| 1000 mA         |  | 0.08 % |

**Insulation Testers**

|                         |  |        |
|-------------------------|--|--------|
| Insulation test voltage |  |        |
| 1 kV                    |  | 0.18 % |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 9 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|       |        |
|-------|--------|
| 10 kV | 0.19 % |
| 20 kV | 0.16 % |
| 25 kV | 0.15 % |
| 30 kV | 0.15 % |
| 40 kV | 0.14 % |

Insulation resistance

|        |         |
|--------|---------|
| 1 MΩ   | 33 μΩ/Ω |
| 10 MΩ  | 0.11 %  |
| 100 MΩ | 0.24 %  |

Loop Resistance Testers

|               |          |
|---------------|----------|
| 1 Ω to 10 Ω   | 150 μΩ/Ω |
| 10 Ω to 100 Ω | 150 μΩ/Ω |

AC Source Power

|                |          |
|----------------|----------|
| 20 Hz to 1 kHz | 150 μW/W |
|----------------|----------|

Testing performed at unity power factor up to 4.8 kVA or 4.8 kW

CMC Uncertainty of measurement for power is calculated as the root sum of squares of the uncertainties for the voltage and current listed in 5.88 and 150 ppm for possible load phase error.

Angle Position Indicators

North Atlantic Angle Position Indicators by reference to a North Atlantic Syncro/Resolver in accordance with manufacturer's instructions documented in method GSE 1749.  
 For 26 V & 115 V at 400 Hz

Resolver measurements

|      |                 |
|------|-----------------|
| 0°   | 3 arc seconds   |
| 45°  | 2.9 arc seconds |
| -45° | 2.9 arc seconds |
| 90°  | 3 arc seconds   |
| -90° | 3 arc seconds   |

Syncro measurements

|      |                 |
|------|-----------------|
| 0°   | 3 arc seconds   |
| 45°  | 3.2 arc seconds |
| -45° | 3.2 arc seconds |
| 90°  | 5.1 arc seconds |
| -90° | 5.1 arc seconds |

**5.91 Frequency Measurement and Time Measurement**

|                                      |  |          |               |               |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 10 of 17 |
|--------------------------------------|--|----------|---------------|---------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

In accordance with in-house methods based on manufacturer's recommendations

- (a) Frequency meters
- (c) Counters
- (d) Time interval meters

DC to 46.6 GHz with reference uncertainty of 6.2 parts in  $10^{11}$  at 10 MHz. Typical CMCs for a good frequency meter as below

| Measurand | CMC Uncertainty |
|-----------|-----------------|
| 1 MHz     | 0.0001 Hz       |
| 100 MHz   | 0.0068 Hz       |
| 880 MHz   | 0.050 Hz        |
| 5 GHz     | 0.39 Hz         |
| 12.4 GHz  | 0.97 Hz         |
| 20 GHz    | 6.7 Hz          |
| 30 GHz    | 6.4 Hz          |
| 40 GHz    | 6.7 Hz          |
| 46 GHz    | 7.3 Hz          |

**5.92 Waveform Measurement**

In accordance with in-house methods based on manufacturer's recommendations

| Measurand | CMC Uncertainty |
|-----------|-----------------|
|-----------|-----------------|

- (a) Frequency characteristics

Measurand and CMC Uncertainties as for 5.91(d)

- (b) Input characteristics

| Reflection coefficient<br>Frequency range | VRC range  | CMC Uncertainty |
|---|------------|-----------------|
| 0.1 MHz to 10 MHz                         | 0 to 0.1   | 0.037 VRC       |
| 0.01 GHz to 20 GHz                        | 0 to 0.1   | 0.012 VRC       |
| 20 GHz to 26.5 GHz                        | 0 to 0.1   | 0.019 VRC       |
| 0.1 MHz to 10 MHz                         | 0.1 to 0.5 | 0.12 VRC        |
| 0.01 GHz to 20 GHz                        | 0.1 to 0.5 | 0.067 VRC       |
| 20 GHz to 26.5 GHz                        | 0.1 to 0.5 | 0.086 VRC       |
| VSWR frequency range                      | VSWR range |                 |
| 0.1 MHz to 10 MHz                         | 1 to 1.2   | 0.088 VSWR      |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 11 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                    |          |            |
|--------------------|----------|------------|
| 0.01 GHz to 20 GHz | 1 to 1.2 | 0.029 VSWR |
| 20 GHz to 26.5 GHz | 1 to 1.2 | 0.045 VSWR |
| 0.1 MHz to 10 MHz  | 1.2 to 3 | 0.78 VSWR  |
| 0.01 GHz to 20 GHz | 1.2 to 3 | 0.47 VSWR  |
| 20 GHz to 26.5 GHz | 1.2 to 3 | 0.58 VSWR  |

Note: The reflection coefficient of the device under test will influence the associated uncertainty

(c) Timing characteristics

Measurand and CMC Uncertainties as for 5.91(d)

(d) Distortion

| Distortion range | Frequency range  |         |
|------------------|------------------|---------|
| 0.01 % to 1 %    | 25 Hz to 100 kHz | 0.009 % |
| 1 % to 10 %      | 25 Hz to 100 kHz | 0.30 %  |
| 10 % to 50 %     | 25 Hz to 100 kHz | 1.5 %   |
| 50 % to 100 %    | 25 Hz to 100 kHz | 1.5 %   |

(e) Other characteristics

Power Measurement  
 Measurand and CMC Uncertainties as for 5.95 (h)

Modulation Characteristics  
 Measurand and CMC Uncertainties as for 5.93 (c)

**5.93 Signal Sources**

In accordance with in-house methods based on manufacturer's recommendations

| Measurand | CMC Uncertainty |
|-----------|-----------------|
|-----------|-----------------|

(a) Frequency characteristics

Measurand and CMC Uncertainties as for 5.91(d)

(b) Output characteristics

| Frequency ranges | Amplitude range |          |
|------------------|-----------------|----------|
| 3 Hz to 3 GHz    | -10 dBc         | 0.15 dB  |
|                  | -20 dBc         | 0.15 dB  |
|                  | -30 dBc         | 0.081 dB |

|                                      |  |          |               |               |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 12 of 17 |
|--------------------------------------|--|----------|---------------|---------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                    |          |          |
|--------------------|----------|----------|
|                    | -40 dBc  | 0.081 dB |
|                    | -50 dBc  | 0.081 dB |
|                    | -60 dBc  | 0.081 dB |
|                    | -70 dBc  | 0.081 dB |
|                    | -80 dBc  | 0.081 dB |
|                    | -90 dBc  | 0.081 dB |
|                    | -100 dBc | 0.081 dB |
|                    | -110 dBc | 0.083 dB |
|                    | -120 dBc | 0.10 dB  |
|                    | -130 dBc | 0.21 dB  |
|                    | -140 dBc | 0.62 dB  |
|                    | -150 dBc | 1.9 dB   |
| 3 GHz to 6.6 GHz   | -10 dBc  | 0.15 dB  |
|                    | -20 dBc  | 0.15 dB  |
|                    | -30 dBc  | 0.081 dB |
|                    | -40 dBc  | 0.081 dB |
|                    | -50 dBc  | 0.081 dB |
|                    | -60 dBc  | 0.081 dB |
|                    | -70 dBc  | 0.081 dB |
|                    | -80 dBc  | 0.081 dB |
|                    | -90 dBc  | 0.082 dB |
|                    | -100 dBc | 0.088 dB |
|                    | -110 dBc | 0.13 dB  |
|                    | -120 dBc | 0.35 dB  |
|                    | -130 dBc | 1.1 dB   |
|                    | -140 dBc | 3.4 dB   |
|                    | -150 dBc | 10 dB    |
| 6.6 GHz to 22 GHz  | -10 dBc  | 0.15 dB  |
|                    | -20 dBc  | 0.15 dB  |
|                    | -30 dBc  | 0.081 dB |
|                    | -40 dBc  | 0.081 dB |
|                    | -50 dBc  | 0.081 dB |
|                    | -60 dBc  | 0.081 dB |
|                    | -70 dBc  | 0.081 dB |
|                    | -80 dBc  | 0.081 dB |
|                    | -90 dBc  | 0.083 dB |
|                    | -100 dBc | 0.10 dB  |
|                    | -110 dBc | 0.21 dB  |
|                    | -120 dBc | 0.62 dB  |
|                    | -130 dBc | 1.9 dB   |
|                    | -140 dBc | 6.1 dB   |
| 22 GHz to 26.5 GHz | -10 dBc  | 0.15 dB  |
|                    | -20 dBc  | 0.15 dB  |
|                    | -30 dBc  | 0.081 dB |

|                                      |  |          |               |               |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 13 of 17 |
|--------------------------------------|--|----------|---------------|---------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|          |          |
|----------|----------|
| -40 dBc  | 0.081 dB |
| -50 dBc  | 0.081 dB |
| -60 dBc  | 0.081 dB |
| -70 dBc  | 0.081 dB |
| -80 dBc  | 0.082 dB |
| -90 dBc  | 0.090 dB |
| -100 dBc | 0.14 dB  |
| -110 dBc | 0.39 dB  |
| -120 dBc | 1.2 dB   |
| -130 dBc | 3.8 dB   |
| -140 dBc | 12 dB    |

Spurious Signals within 1 MHz from the fundamental  
 Note: For offsets greater than 1 MHz, an additional uncertainty due to frequency response will be included.

(c) Modulation characteristics

Amplitude Modulation

|                   |        |
|-------------------|--------|
| 0.1 MHz to 10 MHz | 0.87 % |
| 10 MHz to 3 GHz   | 0.58 % |
| 3 GHz to 26.5 GHz | 1.7 %  |

Frequency Modulation  
 0.25 GHz to 26.5 GHz

1.1 %

Phase Modulation  
 100 kHz to 26.5 GHz

1.1 %

(e) Other characteristics

50 MHz, 1 mW Reference Source

|            |        |
|------------|--------|
| Range 1 mW | 3.7 µW |
|------------|--------|

**5.95 Communications Equipment**

In accordance with in-house methods based on manufacturer's recommendations

Measurand CMC Uncertainty

- (b) Radio transmission measuring equipment
- (f) Spectrum analysis measuring equipment

Measurand and CMC Uncertainties as for 5.91(d), 5.95(h) and 5.95(i)

|                                      |  |          |               |               |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 14 of 17 |
|--------------------------------------|--|----------|---------------|---------------|



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

(h) Power measuring equipment

Flatness, +20 dBm to -30 dBm

|                    |       |
|--------------------|-------|
| 0.001 MHz to 1 MHz | 1.1 % |
| 1 MHz to 4.2 GHz   | 3.5 % |
| 4.2 GHz to 18 GHz  | 9.1 % |
| 18 GHz to 26.5 GHz | 11 %  |

Flatness, 3 V<sub>rms</sub>, using a thermal converter

|                  |        |
|------------------|--------|
| 1 kHz to 1 MHz   | 0.84 % |
| 1 MHz to 30 MHz  | 0.86 % |
| 30 MHz to 80 MHz | 1.0 %  |

(i) Attenuators and amplifiers

100 kHz to 3.05 GHz

|        |          |
|--------|----------|
| 10 dB  | 0.023 dB |
| 20 dB  | 0.029 dB |
| 30 dB  | 0.035 dB |
| 40 dB  | 0.040 dB |
| 50 dB  | 0.046 dB |
| 60 dB  | 0.052 dB |
| 70 dB  | 0.068 dB |
| 80 dB  | 0.073 dB |
| 90 dB  | 0.086 dB |
| 100 dB | 0.091 dB |
| 110 dB | 0.096 dB |
| 120 dB | 0.10 dB  |
| 130 dB | 0.11 dB  |
| 140 dB | 0.18 dB  |

3.05 GHz to 6.6 GHz

|        |          |
|--------|----------|
| 10 dB  | 0.023 dB |
| 20 dB  | 0.029 dB |
| 30 dB  | 0.035 dB |
| 40 dB  | 0.040 dB |
| 50 dB  | 0.046 dB |
| 60 dB  | 0.052 dB |
| 70 dB  | 0.068 dB |
| 80 dB  | 0.073 dB |
| 90 dB  | 0.086 dB |
| 100 dB | 0.091 dB |
| 110 dB | 0.097 dB |
| 120 dB | 0.11 dB  |
| 130 dB | 0.18 dB  |

Operations Manager  
 Authorisation:

Issue 39

Date:28/07/21

Page 15 of 17



RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492

|                      |                             |          |
|----------------------|-----------------------------|----------|
|                      | 136 dB                      | 0.18 dB  |
| 6.6 GHz to 13.2 GHz  |                             |          |
|                      | 10 dB                       | 0.023 dB |
|                      | 20 dB                       | 0.029 dB |
|                      | 30 dB                       | 0.035 dB |
|                      | 40 dB                       | 0.040 dB |
|                      | 50 dB                       | 0.046 dB |
|                      | 60 dB                       | 0.052 dB |
|                      | 70 dB                       | 0.068 dB |
|                      | 80 dB                       | 0.073 dB |
|                      | 90 dB                       | 0.086 dB |
|                      | 100 dB                      | 0.092 dB |
|                      | 110 dB                      | 0.10 dB  |
|                      | 120 dB                      | 0.17 dB  |
|                      | 127 dB                      | 0.18 dB  |
| 13.2 GHz to 19.2 GHz |                             |          |
|                      | 10 dB                       | 0.023 dB |
|                      | 20 dB                       | 0.029 dB |
|                      | 30 dB                       | 0.035 dB |
|                      | 40 dB                       | 0.040 dB |
|                      | 50 dB                       | 0.046 dB |
|                      | 60 dB                       | 0.052 dB |
|                      | 70 dB                       | 0.068 dB |
|                      | 80 dB                       | 0.073 dB |
|                      | 90 dB                       | 0.087 dB |
|                      | 100 dB                      | 0.10 dB  |
|                      | 110 dB                      | 0.17 dB  |
|                      | 119 dB                      | 0.17 dB  |
| 19.2 GHz to 26.5 GHz |                             |          |
|                      | 10 dB                       | 0.023 dB |
|                      | 20 dB                       | 0.029 dB |
|                      | 30 dB                       | 0.035 dB |
|                      | 40 dB                       | 0.040 dB |
|                      | 50 dB                       | 0.046 dB |
|                      | 60 dB                       | 0.052 dB |
|                      | 70 dB                       | 0.068 dB |
|                      | 80 dB                       | 0.073 dB |
|                      | 90 dB                       | 0.087 dB |
|                      | 100 dB                      | 0.10 dB  |
|                      | 110 dB                      | 0.17 dB  |
|                      | 112 dB                      | 0.17 dB  |
| <b>5.97</b>          | <b>High Voltage Testing</b> |          |

|                                      |  |          |               |               |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date:28/07/21 | Page 16 of 17 |
|--------------------------------------|--|----------|---------------|---------------|





RF Test Solutions Limited  
 Metrology & Calibration Laboratory  
**SCOPE OF ACCREDITATION**

Accreditation Number 492


In accordance with in-house methods based on manufacturer's recommendations

- (a) Direct voltage
- (b) Alternating voltage

Measurand and CMC Uncertainties as for 5.89(a) and 5.89(b)

**Note 1:**

Unless stated otherwise the CMC is based on the performance of the best available device and measurement uncertainties achieved for specific calibrations may be greater than the CMC Uncertainty. A laboratory may not report measurement uncertainties lower than its CMC. However, if the device under calibration has a greater accuracy than the device used to calculate the CMC the laboratory may be able to use the calibration data to lower its CMC Uncertainty. Please contact the laboratory to discuss your specific requirements.

|                                      |   |          |                |               |
|--------------------------------------|---|----------|----------------|---------------|
| Operations Manager<br>Authorisation: |  | Issue 39 | Date: 28/07/21 | Page 17 of 17 |
|--------------------------------------|---|----------|----------------|---------------|