



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

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CALIBRATION

Valid To: February 28, 2017

Certificate Number: 3399.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,3</sup> (±)	Comments
DC Voltage – Generate	(0 to 220) mV (> 220 mV to 2.2 V) (> 2.2 to 11) V (> 11 to 22) V (> 22 to 220) V (> 220 to 1100) V	3.5 $\mu$ V/V + 3.5 $\mu$ V 6.5 $\mu$ V/V + 3.5 $\mu$ V 7 $\mu$ V/V + 5 $\mu$ V 7.5 $\mu$ V/V + 7.5 $\mu$ V 8.5 $\mu$ V/V + 85 $\mu$ V 9 $\mu$ V/V + 650 $\mu$ V	Fluke 5700A
DC Voltage – Measure	(0 to 120) mV (> 120 mV to 1.2 V) (> 1.2 to 12) V (> 12 to 120) V (> 120 to 1050) V	5 $\mu$ V/V + 3.5 $\mu$ V 11 $\mu$ V/V + 3.5 $\mu$ V 12 $\mu$ V/V + 3.5 $\mu$ V 14 $\mu$ V/V + 55 $\mu$ V 30 $\mu$ V/V + 550 $\mu$ V	Keysight 3458A
Resistance – Measure	(0 to 12) $\Omega$ (>12 to 120) $\Omega$ (>120 to 1200) $\Omega$ (>1.2 to 12) k $\Omega$ (>12 to 120) k $\Omega$ (>120 to 1200) k $\Omega$ (>1.2 to 12) M $\Omega$	13 $\mu\Omega/\Omega$ + 240 $\mu\Omega$ 10 $\mu\Omega/\Omega$ + 2.5 m $\Omega$ 14 $\mu\Omega/\Omega$ + 3.5 m $\Omega$ 14 $\mu\Omega/\Omega$ + 25 m $\Omega$ 16 $\mu\Omega/\Omega$ + 85 m $\Omega$ 20 $\mu\Omega/\Omega$ + 3 $\Omega$ 60 $\mu\Omega/\Omega$ + 150 $\Omega$	Keysight 3458A

II. Electrical – RF/Microwave

Parameter/Range	Range	CMC <sup>2,3</sup> (±)	Comments
RF Power - Measure (Absolute)			
(-40 to 10) dBm	10 MHz to 4 GHz	0.082 dB	R&S NRP-Z21
	(>4 to 12) GHz	0.12 dB	
	(>12 to 16) GHz	0.15 dB	
	(>16 to 18) GHz	0.17 dB	
(-20 to < 0) dBm	9 kHz to 10 MHz	0.060 dB	R&S NRP-Z51
	10 MHz to 6 GHz	0.048 dB	
	(>6 to 12) GHz	0.065 dB	
	(>12 to 16) GHz	0.086 dB	
	(>16 to 18) GHz	0.099 dB	
(-40 to 10) dBm	10 MHz to 10 GHz	0.099 dB	R&S NRP-Z55
	(>10 to 20) GHz	0.12 dB	
	(>20 to 25) GHz	0.14 dB	
	(>25 to 34) GHz	0.24 dB	
	(>34 to 40) GHz	0.27 dB	
(0 to 10) dBm	9 kHz to 10 MHz	0.050 dB	R&S NRP-Z91
	10 MHz to 6 GHz	0.035 dB	
	(>6 to 12) GHz	0.048 dB	
	(>12 to 16) GHz	0.065 dB	
(-20 to 10) dBm	(>16 to 18) GHz	0.082 dB	R&S NRP-Z51
	10 MHz to 10 GHz	0.091 dB	
	(>10 to 20) GHz	0.12 dB	
	(>20 to 25) GHz	0.15 dB	
	(>25 to 34) GHz	0.24 dB	
(-20 to 10) dBm	(>34 to 40) GHz	0.29 dB	R&S NRP-Z55
	10 MHz to 10 GHz	0.11 dB	
	(>10 to 20) GHz	0.13 dB	
	(>20 to 25) GHz	0.15 dB	
(-20 to 10) dBm	(>25 to 33) GHz	0.24 dB	R&S NRP-Z52

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
RF Power – Generate Power Sensors (Absolute)			
(-30 to 13) dBm	9 kHz to 1 MHz (>1 to 70) MHz >70 MHz to 2 GHz (>2 to 8) GHz (>8 to 12.4) GHz (>12.4 to 13) GHz (>13 to 18) GHz	0.020 dB 0.020 dB 0.026 dB 0.030 dB 0.036 dB 0.043 dB 0.047 dB	R&S NRVC
(-30 to <-10) dBm (-10 to <0) dBm (0 to 23) dBm (>23 to 26) dBm (>26 to 34) dBm	Linearity @ 50 MHz	0.024 dB 0.020 dB 0.018 dB 0.022 dB 0.025 dB	R&S NRVC-B2
RF Power - Generate (Absolute)			
(-20 to 10) dBm	9 kHz to 18 GHz	0.077 dB	R&S NRP-Z51
(-40 to 10) dBm	10 MHz to 6 GHz (>6 to 12) GHz (>12 to 18) GHz	0.10 dB 0.12 dB 0.16 dB	R&S NRP-Z21
(-20 to 10) dBm	10 MHz to 10 GHz (>10 to 20) GHz (>20 to 25) GHz (>25 to 27) GHz	0.11 dB 0.13 dB 0.15 dB 0.24 dB	R&S NRP-Z52
	10 MHz to 10 GHz (>10 to 20) GHz (>20 to 24) GHz (>24 to 26) GHz (>26 to 28) GHz (>28 to 37) GHz (>37 to 40) GHz	0.11 dB 0.15 dB 0.18 dB 0.22 dB 0.28 dB 0.32 dB 0.36 dB	R&S NRP-Z55
(-30 to -20) dBm	128 MHz	0.073 dB	R&S NRP-Z91

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
Attenuation – Measure			
(10 to 60) dB (in 10 dB steps)	10 MHz to 1 GHz, 2 GHz, 3GHz (>1 to <3) GHz	0.05 dB 0.12 dB	R&S RSG, R&S FSQ26
(1 to 60) dB	10 MHz, 50 MHz, 100 MHz, 500 MHz, 1 GHz 10 MHz to 1 GHz, 2 GHz, 3 GHz (>1 to <3) GHz	0.08 dB 0.15 dB 0.33 dB	
70 dB	10 MHz, 50 MHz, 100 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz >10 MHz to <3 GHz	0.06 dB 0.15 dB	
80 dB	10 MHz, 50 MHz, 100 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz >10 MHz to <3 GHz	0.06 dB 0.26 dB	
(>60 to <80) dB	10 MHz, 50 MHz, 100 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz >10 MHz to <1 GHz (>1 to <3) GHz	0.14 dB 0.24 dB 0.42 dB	
Internal Step Attenuator <sup>4</sup> –			
(10 to 60) dB (in 10 dB steps)	10 MHz 100 MHz, 1 GHz 2 GHz 3 GHz	0.13 dB 0.11 dB 0.13 dB 0.18 dB	R&S RSG
(5 to 70) dB	128 MHz	0.07 dB	



Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments
Reflection S <sub>11</sub> /S <sub>22</sub> – Measure Type-N (50 Ω) (cont)	(>15 to 18) GHz (0 to 0.1) lin	0.012 lin (180 to 6.9) deg	R&S ZV-Z270 with R&S ZVA40
	(>0.1 to 0.25) lin	0.012 lin (6.9 to 2.8) deg	
	(>0.25 to 0.5) lin	(0.012 to 0.014) lin (2.8 to 1.6) deg	
	(>0.5 to 1) lin	(0.014 to 0.022) lin (1.6 to 1.3) deg	
3.5 mm (50 Ω)	(10 to <50) MHz (0 to 0.1) lin	0.048 lin (180 to 27.8) deg	R&S ZV-Z235 with R&S ZVA40
	(>0.1 to 0.25) lin	(0.048 to 0.052) lin (27.8 to 12.0) deg	
	(>0.25 to 0.5) lin	(0.052 to 0.062) lin (12.0 to 7.2) deg	
	(>0.5 to 1) lin	(0.062 to 0.098) lin (7.2 to 5.7) deg	
	(50 to 700) MHz (0 to 0.1) lin	0.021 lin (180 to 12.1) deg	
	(>0.1 to 0.25) lin	(0.021 to 0.028) lin (12.1 to 6.5) deg	
	(>0.25 to 0.5) lin	(0.028 to 0.043) lin (6.5 to 5.0) deg	
	(>0.5 to 1) lin	(0.043 to 0.085) lin (5.0 to 4.9) deg	

Parameter/Range	Frequency	CMC <sup>2,3</sup> (±)	Comments		
Reflection S <sub>11</sub> /S <sub>22</sub> – Measure 3.5 mm (50 Ω) (cont)	>700 MHz to 24 GHz (0 to 0.1) lin	0.013 lin (180 to 7.5) deg	R&S ZV-Z235 with R&S ZVA40		
	(>0.1 to 0.25) lin	(0.013 to 0.016) lin (7.5 to 3.7) deg			
	(>0.25 to 0.5) lin	(0.016 to 0.024) lin (3.7 to 2.8) deg			
	(>0.5 to 1) lin	(0.024 to 0.045) lin (2.8 to 2.6) deg			
	(>24 to 26.5) GHz (0 to 0.1) lin	0.020 lin (180 to 11.5) deg			
	(>0.1 to 0.25) lin	(0.020 to 0.028) lin (11.5 to 6.5) deg			
	(>0.25 to 0.5) lin	(0.028 to 0.043) lin (6.5 to 5.0) deg			
	(>0.5 to 1) lin	(0.043 to 0.085) lin (5.0 to 4.9) deg			
	2.92 mm (50 Ω)	(10 to <50) MHz (0 to 0.1) lin		0.051 lin (180 to 29.6) deg	R&S ZV-Z229 with R&S ZVA40
		(>0.1 to 0.25) lin		(0.051 to 0.056) lin (29.6 to 12.9) deg	
(>0.25 to 0.5) lin		(0.056 to 0.067) lin (12.9 to 7.7) deg			
(>0.5 to 1) lin		(0.067 to 0.104) lin (7.7 to 6.0) deg			

Parameter/Range	Frequency	CMC <sup>2,3</sup> ( $\pm$ )	Comments
Reflection S <sub>11</sub> /S <sub>22</sub> – Measure 2.92 mm (50 $\Omega$ ) (cont)	(50 to 700) MHz (0 to 0.1) lin	0.028 lin (180 to 16.1) deg	R&S ZV-Z229 with R&S ZVA40
	(>0.1 to 0.25) lin	(0.028 to 0.035) lin (16.1 to 8.1) deg	
	(>0.25 to 0.5) lin	(0.035 to 0.050) lin (8.1 to 5.8) deg	
	(>0.5 to 1) lin	(0.050 to 0.092) lin (5.8 to 5.3) deg	
	>700 MHz to 24 GHz (0 to 0.1) lin	0.016 lin (180 to 9.2) deg	
	(>0.1 to 0.25) lin	(0.016 to 0.019) lin (9.2 to 4.4) deg	
	(>0.25 to 0.5) lin	(0.019 to 0.027) lin (4.4 to 3.1) deg	
	(>0.5 to 1) lin	(0.027 to 0.048) lin (3.1 to 2.8) deg	
	(>24 to 40) GHz (0 to 0.1) lin	0.027 lin (180 to 15.6) deg	
	(>0.1 to 0.25) lin	(0.027 to 0.034) lin (15.6 to 7.8) deg	
	(>0.25 to 0.5) lin	(0.034 to 0.049) lin (7.8 to 5.7) deg	
	(>0.5 to 1) lin	(0.049 to 0.092) lin (5.7 to 5.3) deg	



III. Electrical – RF/Microwave Device Specific Parameters

Parameter/Equipment	Frequency	CMC <sup>2,3</sup> (±)	Comments
CISPR 16-1-1 Pulses – Detector Peak (absolute) Peak (relative) Quasipeak (absolute) Quasipeak (relative) Average (absolute) Average (relative) RMS (absolute) RMS (relative)	Band A – (9 to 150) kHz	0.35 dB 0.15 dB 0.35 dB 0.15 dB 0.30 dB 0.20 dB 0.30 dB 0.15 dB	Schwarzbeck IGUU 2916, IGUU 2918.  Pulse-modulated RF generator.
CISPR 16-1-1 Pulses – Detector Peak (absolute) Peak (relative) Quasipeak (absolute) Quasipeak (relative) Average (absolute) Average (relative) RMS (absolute) RMS (relative)	Band B - 150 kHz to 30 MHz	0.35 dB 0.15 dB 0.35 dB 0.15 dB 0.50 dB 0.15 dB 0.45 dB 0.15 dB	Schwarzbeck IGUU 2916, IGUU 2918.  Pulse-modulated RF generator

Parameter/Equipment	Frequency	CMC <sup>2,3</sup> (±)	Comments
CISPR 16-1-1 Pulses			
Detector	Band C/D – 30 MHz to 1 GHz		Schwarzbeck IGUU 2916, IGUU 2918.
Peak (absolute)		0.35 dB	
Peak (relative)		0.15 dB	
Quasipeak (absolute)		0.35 dB	
Quasipeak (relative)		0.15 dB	
Average (absolute)		0.60 dB	
Average (relative)		0.10 dB	
RMS (absolute)		0.40 dB	
RMS (relative)		0.15 dB	
CISPR 16-1-1 Pulses			
Detector	Band E – 1 GHz to 18 GHz		Schwarzbeck IGUU 2916, IGUU 2918.
Peak (absolute)		0.35 dB	
Average (absolute)		0.40 dB	
Average (relative)		0.10 dB	
RMS (absolute)		0.40 dB	
RMS (relative)		0.20 dB	

Parameter/Equipment	Frequency	CMC <sup>2,3</sup> (±)	Comments
CISPR 16-1-1 – Response to intermittent, Unsteady and Drifting Narrowband Disturbances  Detector:  Average  RMS  Detector :  Average  RMS	Band A/B	0.15 dB	Pulse-modulated RF generator
		0.15 dB	
		0.15 dB	
	Band C/D/E	0.15 dB	
		0.15 dB	
		0.15 dB	
CISPR 16-1-1 Overall Selectivity –  200 Hz IFBW  9 kHz IFBW  120 kHz IFBW  1 MHz IFBW	1.5 dB 6 dB 20 dB	1.4 Hz	GPS - Cosmo research GCET
		0.7 Hz	
		0.4 Hz	
	1.5 dB 6 dB 20 dB	0.06 kHz	
		0.04 kHz	
		0.02 kHz	
	1.5 dB 6 dB 20 dB	0.8 kHz	
		0.38 kHz	
		0.23 kHz	
	3 dB 6 dB 9 dB 20 dB	4 kHz	
		3.7 kHz	
		3.1 kHz	
3.8 kHz			

Parameter/Equipment	Frequency	CMC <sup>2,3</sup> (±)	Comments
SSB Phase Noise – Carrier: 640 MHz <u>Offset</u>			R&S FSU-B5
100 Hz	.. > -115 dBc(1Hz)	2.5 dB	
1 kHz	.. > -135 dBc(1Hz)	1.0 dB	
10 kHz	.. > -135 dBc(1Hz)	0.75 dB	
100 kHz	.. > -135 dBc(1Hz)	0.75 dB	
1 MHz	.. > -150 dBc(1Hz)	0.50 dB	
SHI Second-Order Harmonic Distortion	40 MHz 290 MHz 1790 MHz	1.0 dB 1.0 dB 1.0 dB	RF generator with low-pass filter
TOI Third-Order Harmonic Intercept Point	(0.01 to 3.6) GHz	1.0 dB	2 tone measurement with 2 MW generators
Displayed Average Noise Level (DANL)	(0.01 to 1) kHz (> 0.001 to 40) GHz	1.5 dB 0.5 dB	50 Ω Termination.
IF Bandwidth –			GPS - Cosmo research GCET (Hz/IFBW Hz)%
100 Hz to 10 MHz (Normal filter)	3 dB 60 dB  60 dB/3 dB Shape factor	0.81 % 0.14 %  0.05	
10 Hz to 1 MHz (EMI filter)	6 dB 60 dB  60 dB/6 dB Shape factor	0.85 % 0.13 %  0.03	

#### IV. Time & Frequency

Parameter/Range	Frequency	CMC <sup>2,3</sup> ( $\pm$ )	Comments
Frequency – Measuring Equipment	10 MHz	1.8 pHz/Hz	GPS - Cosmo research GCET
Measure	(10 to <100) Hz 100 Hz to <1 kHz (1 to <10) kHz 10 kHz to 3 GHz (>3 to <20) GHz (20 to 40) GHz	0.2 $\mu$ Hz/Hz 11 nHz/Hz 16 pHz/Hz 8.6 pHz/Hz 400 pHz/Hz 69 pHz/Hz	GPS – Cosmo research GCET and Agilent 53132A, 53152A

<sup>1</sup> This laboratory offers commercial calibration service.

<sup>2</sup> Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

<sup>3</sup> In the statement of CMC, the value is defined as the percentage of range or full scale.

<sup>4</sup> Nominal Attenuation



## *Accredited Laboratory*

A2LA has accredited

**ROHDE & SCHWARZ JAPAN K.K.**

*Saitama-shi, Saitama, JAPAN*

for technical competence in the field of

**Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).



Presented this 19<sup>th</sup> day of August 2015.

A handwritten signature in black ink, reading "Peter Abney".

President & CEO  
For the Accreditation Council  
Certificate Number 3399.01  
Valid to February 28, 2017

*For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.*