



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: November 30, 2013

Certificate Number: 2863.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Electrical – DC/Low Frequency

| Parameter/Equipment | Range | CMC ^{2,4,5} (±) | Comments |
|------------------------------------|--|--|-------------------------------------|
| DC Voltage ³ – Generate | (0 to 0.22) V (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V | 4.0 μV/V + 2.6 μV 7.2 μV/V + 1.7 μV 6.7 μV/V + 4.6 μV 6.0 μV/V + 37 μV 8.5 μV/V + 53 μV 9.4 μV/V + 570 μV | Fluke 5700A/ 5725A |
| DC Voltage ³ – Measure | (0 to 0.1) V (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V | 5.6 μV/V + 1.5 μV 5.2 μV/V + 1.2 μV 4.7 μV/V + 2.5 μV 6.6 μV/V + 45 μV 19 μV/V + 160 μV | Agilent 3458A/100 PLC option 002 |
| DC Current ³ – Generate | (0 to 220) μA 220 μA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA 220 mA to 1 A (1 to 2.2) A (2.2 to 11) A | 46 μA/A + 0.010 μA 50 μA/A + 0.009 μA 51 μA/A + 0.083 μA 59 μA/A + 0.84 μA 74 μA/A - 0.73 μA 80 μA/A + 25 μA 0.015 % - 46 μA 0.030 % + 400 μA | Fluke 5700A |

| Parameter/Equipment | Range | CMC ^{2,4,5} (±) | Comments |
|--|--|--|---------------|
| DC Current ³ – Measure | (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1.1 A | 20 μ A/A + 0 μ A 20 μ A/A + 0.1 μ A 20 μ A/A + 0.06 μ A 35 μ A/A + 0.60 μ A 0.011 % + 11 μ A | Agilent 3458A |
| Resistance ³ – Generate, Fixed Points | 0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 k Ω 1.9 k Ω 10 k Ω 19 k Ω 100 k Ω 190 k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω | 0.25 m Ω 0.27 m Ω 0.31 m Ω 0.37 m Ω 2.6 m Ω 3.0 m Ω 4.1 m Ω 13 m Ω 36 m Ω 130 m Ω 0.25 Ω 1.4 Ω 2.7 Ω 20 Ω 42 Ω 400 Ω 1.5 k Ω 13 k Ω | Fluke 5700A |
| Resistance ³ – Measure | (0 to 10) Ω (10 to 100) Ω 100 to 1 k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω | 18 $\mu\Omega/\Omega$ + 74 $\mu\Omega$ 13 $\mu\Omega/\Omega$ + 740 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 7.6 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 74 $\mu\Omega$ 11 $\mu\Omega/\Omega$ + 740 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 2.4 $\mu\Omega$ 53 $\mu\Omega/\Omega$ + 110 $\mu\Omega$ 0.05 % + 4.3 k Ω 0.5 % + 290 k Ω | Agilent 3458A |
| AC Current ³ – Generate (10 to 220) μ A 220 μ A to 2.2 mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 0.054 % + 0.064 μ A 0.025 % + 0.064 μ A 80 μ A/A + 0.064 μ A 0.059 % + 0.42 μ A 0.14 % + 0.10 μ A 0.068 % + 0.051 μ A 0.037 % + 0.047 μ A 0.017 % + 0.052 μ A 0.06 % + 0.42 μ A 0.15 % + 0.84 μ A | Fluke 5700A |

| Parameter/Range | Frequency | CMC ^{2, 4, 5} (±) | Comments |
|--|---|--|---------------|
| AC Current ³ – Generate (cont) | | | |
| (2.2 to 22) mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 0.068 % + 0.51 μA 0.037 % + 0.47 μA 0.017 % + 0.51 μA 0.06 % + 4.2 μA 0.015 % + 8.5 μA | Fluke 5700A |
| (22 to 220) mA | (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 0.068 % + 4.2 μA 0.037 % + 3.2 μA 0.02 % + 3.0 μA 0.06 % + 42 μA 0.15 % + 0.08 mA | |
| 220 mA to 2.2 A | 20 Hz to 1 kHz 220 mA to 1.0 A >1 A to 2.2 A | 0.064 % + 35 μA 0.067 % + 30 μA | |
| | (1 to 5) kHz 220 mA to 1.0 A >1 A to 2.2 A | 0.072 % + 87 μA 0.08 % + 76 μA | |
| (2.2 to 11) A | (5 to 10) kHz | 0.84 % + 0.076 mA | |
| | 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 0.044 % + 130 μA 0.088 % + 300 μA 0.31 % + 0.63 mA | |
| AC Current ³ – Measure | | | |
| (0 to 100) μA | (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz | 0.4 % + 31 nA 0.15 % + 31 nA 0.06 % + 31 nA | Agilent 3458A |
| (0.1 to 1) mA | (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz | 0.4 % + 310 nA 0.15 % + 210 nA 0.06 % + 210 nA | |
| (1 to 10) mA | (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz | 0.4 % + 3.1 μA 0.15 % + 2.1 μA 0.06 % + 2.1 μA | |
| (10 to 100) mA | (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz | 0.4 % + 31 μA 0.15 % + 21 μA 0.06 % + 21 μA | |

| Parameter/Range | Frequency | CMC ^{2,4} (±) | Comments |
|---|--|--|---------------|
| AC Current ³ – Measure (cont) 100 mA to 1.05 A | (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz | 0.4 % + 220 µA 0.16 % + 220 µA 0.08 % + 220 µA 0.1 % + 220 µA | Agilent 3458A |
| AC Voltage ³ – Generate (0 to 2.2) mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.055 % + 4.5 µV 0.025 % + 4.7 µV 0.017 % + 4.6 µV 0.042 % + 4.7 µV 0.082 % + 6.9 µV 0.11 % + 13 µV 0.18 % + 27 µV 0.41 % + 35 µV | Fluke 5700A |
| (2.2 to 22) mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.055 % + 4.5 µV 0.025 % + 4.7 µV 0.017 % + 4.6 µV 0.042 % + 4.7 µV 0.082 % + 6.9 µV 0.11 % + 13 µV 0.18 % + 27 µV 0.41 % + 35 µV | |
| (22 to 220) mV | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.051 % + 14 µV 0.021 % + 8.5 µV 90 µV/V + 9.3 µV 0.030 % + 10 µV 0.076 % + 26 µV 0.093 % + 26 µV 0.16 % + 39 µV 0.30 % + 88 µV | |
| 220 mV to 2.2 V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.051 % + 83 µV 0.016 % + 24 µV 88 µV/V + 4.4 µV 0.013 % + 14 µV 0.024 % + 66 µV 0.041 % + 130 µV 0.10 % + 350 µV 0.20 % + 850 µV | |

| Parameter/Range | Frequency | CMC ^{2,4,5} (±) | Comments |
|---|--|--|-----------------------|
| AC Voltage ³ – Generate (cont) | | | |
| (2.2 to 22) V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.051 % + 830 μV 0.010 % + 170 μV 87 μV/V + 51 μV 0.013 % + 160 μV 0.024 % + 330 μV 0.050 % + 1500 μV 0.12 % + 4.2 mV 0.25 % + 7.6 mV | Fluke 5700A |
| (22 to 220) V | (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (>22 to 100) V _{rms} (>100 to 220) V _{rms} (50 to 100) kHz (>22 to 100) V _{rms} (>100 to 220) V _{rms} (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz | 0.051 % + 8.4 mV 0.016 % + 2.4 mV 0.009% + 740 μV 0.022 % + 3000 μV 0.025 % + 3500 μV 0.051 % + 8.4 mV 0.052 % + 8.7 mV 0.13 % + 95 mV 0.45 % + 93 mV 0.11 % + 180 mV | |
| (0 to 250) V _{max} Output, 1100 V range | (15 to 50) Hz 50 Hz to 1 kHz 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz | 0.039 % + 17 mV 92 μV/V + 3.0 mV 92 μV/V + 2.9 mV 92 μV/V + 2.9 mV 0.051 % + 8.9 mV | Fluke 5700A/ 5725A |
| (0 to 750) V | (30 to 50) kHz (50 to 100) kHz | 0.053 % + 8.9 mV 0.20 % + 30 mV | |
| AC Voltage ³ – Measure | | | |
| (0 to 10) mV | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz | 0.03 % + 3.1 μV 0.02 % + 1.2 μV 0.03 % + 1.7 μV 0.1 % + 1.6 μV 0.5 % + 1.3 μV 4 % + 2.1 μV 1.2 % + 6.6 μV 7 % + 7.5 μV 20 % + 8.2 μV | Agilent 3458A |

| Parameter/Range | Frequency | CMC ^{2,5} (±) | Comments |
|---|---|--|---------------|
| AC Voltage ³ – Measure (cont) | | | |
| (10 to 100) mV | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz | 70 µV/V + 4.1 µV 70 µV/V + 2.1 µV 0.014 % + 2.3 µV 0.03 % + 2.6 µV 0.08 % + 2.3 µV 0.3 % + 15 µV 1 % + 28 µV 1.5 % + 20 µV 4 % + 74 µV 4 % + 83 µV 15 % + 110 µV | Agilent 3458A |
| 100 mV to 1 V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz | 70 µV/V + 41 µV 70 µV/V + 21 µV 0.014 % + 22 µV 0.03 % + 22 µV 0.08 % + 22 µV 0.3 % + 120 µV 1 % + 300 µV 1.5 % + 210 µV 4 % + 730 µV 4 % + 830 µV 15 % + 1 mV | |
| (1 to 10) V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz | 70 µV/V + 420 µV 70 µV/V + 220 µV 0.014 % + 240 µV 0.03 % + 250 µV 0.08 % + 220 µV 0.3 % + 1.1 mV 1 % + 1.1 mV 1.5 % + 1.1 mV 4 % + 7.1 mV 4 % + 8.1 mV 15 % + 11 mV | |
| (10 to 100) V | (1 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz | 0.02 % + 4.1 mV 0.02 % + 2.6 mV 0.035 % + 2.4 mV 0.12 % + 2.1 mV 0.4 % + 11 mV 1.5 % + 40 mV | |

| Parameter/Range | Frequency | CMC ^{2,4,5} (±) | Comments |
|--|--|--|---|
| AC Voltage ³ – Measure (cont) (100 to 750) V | (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz | 0.04 % + 31 mV 0.04 % + 16 mV 0.06 % + 16 mV 0.12 % + 16 mV 0.3 % + 15 mV | Agilent 3458A |
| AC Voltage Flatness ³ – Generate 0.3 mV to 3.5 V (0.3 to 1.1) mV (0.3 to 3) mV 3 mV to 3.5 V | (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz | 0.27 % 0.14 % 0.46 % 0.62 % 0.80 % 2.4 % 0.22 % 0.37 % 0.55 % 1.4 % 0.12 % 0.21 % 0.38 % 0.86 % | Fluke 5700A or 5700A-03 (referenced to 1 kHz) |
| AC Voltage Flatness ³ – Measure Up to 3 V | 10 Hz 100 Hz (10, 30) kHz 100 kHz 300 kHz 1 MHz 3 MHz 8 MHz 10 MHz 20 MHz 30 MHz 50 MHz 70 MHz 80 MHz 100 MHz | 0.02 % + 6.9 μV/V 80 μV + 5.5 μV/V 80 μV + 3.2 μV/V 0.01 % + 8.0 μV/V 0.01 % + 5.2 μV/V 0.01 % + 6.5 μV/V 0.13 % + 59 μV/V 0.13 % + 110 μV/V 0.13 % + 91 μV/V 0.25 % + 210 μV/V 0.25 % + 240 μV/V 0.61 % + 340 μV/V 0.9 % + 240 μV/V 1.1 % + 790 μV/V 1.3 % + 940 μV/V | By comparison to 1395A's thermal voltage converters |

| Parameter/Range | Frequency | CMC ^{2, 4, 5, 11} (±) | Comments |
|---|--|---|--|
| Resistance ³ – Generate 0.1 Ω (1, 10) Ω 100 Ω (1, 10, 100) kΩ | DC to 1 MHz, direct measurement | 1 % of value 0.1 % of value 0.03 % of value 0.03 % of value | 16074A |
| Capacitance ³ – Generate Direct Measure (1, 10) pF (100, 1000) pF (0.01, 0.1, 1) μF Algorithmic Derivation 1 pF (10, 100) pF 1000 pF | 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz (1, 2) MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz | 0.01 % 0.01 % 0.01 % 0.05 % 0.06 % 0.10 % 0.2 % 0.3 % 1.0 % 1.5 % 0.025 % 0.03 % 0.04 % 0.06 % 0.15 % 0.20 % 0.05 % 0.06 % 0.10 % 0.15 % 0.20 % 0.50 % 0.70 % | 16380A/16380C standard air capacitor set, BNC 4 terminal pair |

II. Electrical – RF/Microwave

| Parameter/Equipment/Range | CMC ^{2, 10} (±) | Comments |
|--|---------------------------------------|---|
| Amplitude Modulation ^{3, 8} – Measure | | Agilent 8902A measuring receiver: |
| (0.15 to 10) MHz (5% to < 10%) AM (10% to 99%) AM | 0.025AM + 0.03 % 0.025AM + 0.14 % | rate: 50 Hz to 10 kHz, depth: 5% to 99% |
| (5% to < 10%) AM (10% to 99%) AM | 0.038AM + 0.03 % 0.038AM + 0.13 % | rate: 20 Hz to 10 kHz, depth: to 99% |
| (10 to 1300) MHz (5% to <10%) AM (10% to 99%) AM | 0.012AM + 0.033 % 0.012AM + 0.17 % | rate: 50 Hz to 10 kHz, depth: 5% to 99% |
| (5% to <10%) AM (10% to 99%) AM | 0.038AM + 0.030 % 0.037AM + 0.16 % | rate: 20 Hz to 10 kHz, depth: to 99% |
| 1300 MHz to 26.5 GHz (5% to <10%) AM (10% to 99%) AM | 0.019AM + 0.029 % 0.019AM + 0.14 % | rate: 50 Hz to 10 kHz, depth: 5% to 99% |
| 10 MHz to 26.5 GHz (5% to <10%) AM (10% to 99%) AM | 0.038AM + 0.030 % 0.038AM + 0.11 % | rate: 20 Hz to 10 kHz, depth: to 99% |

| Parameter/Equipment/Range | CMC ^{2,10} (\pm) | Comments |
|---|--|--|
| Frequency Modulation ^{3,9} – Measure | | Agilent 8902A measuring receiver: 40.0 to 400.0: 1 digit = 100 Hz 4.00 to 39.99: 1 digit = 10 Hz 0 to 3.999: 1 digit = 1 Hz |
| (0.25 to 10) MHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM | 0.024FM + 2.6 Hz Pk 0.024FM + 10 Hz Pk | rate: 20 Hz to 10 kHz, \leq 40 kHz peak |
| (10 to 1300) MHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.012FM + 2.6 Hz Pk 0.012FM + 12 Hz Pk 0.012FM + 110 Hz Pk | rate: 50 Hz to 100 kHz, \leq 400 kHz peak |
| (10 to 1300) MHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.059FM + 2.8 Hz Pk 0.059FM + 13 Hz Pk 0.059FM + 110 Hz Pk | rate: 20 Hz to 200 kHz, \leq 400 kHz peak |
| 10 MHz to 26.5 GHz (10 to 1300) MHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.012FM + 2.4 Hz Pk 0.012FM + 12 Hz Pk 0.012FM + 120 Hz Pk | |
| (>1.3 to 6.2) GHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.0099FM + 10 Hz Pk 0.012FM + 12 Hz Pk 0.012FM + 100 Hz Pk | rate: 50 Hz to 100 kHz, \leq 400 kHz peak |
| (>6.2 to 12.4) GHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.0075FM + 24 Hz Pk 0.012FM + 12 Hz Pk 0.012FM + 85 Hz Pk | |
| (>12.4 to 18.6) GHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.0049FM + 52 Hz Pk 0.011FM + 36 Hz Pk 0.012FM + 110 Hz Pk | |
| (>18.6 to 26.5) GHz (0 to <4) kHz Peak FM (\geq 4 to < 40) kHz Peak FM (\geq 40 to < 400) kHz Peak FM | 0.0035FM + 80 Hz Pk 0.011FM + 46 Hz Pk 0.012FM + 100 Hz Pk | |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|--|--|---|--|
| Tuned, Absolute, RF Power ^{3,7} – Measure (≤ +10 to ≥ -22) dBm (< -22 to ≥ -42) dBm (< -42 to ≥ -50) dBm (< -50 to ≥ -60) dBm (< -60 to ≥ -72) dBm (< -72 to ≥ -80) dBm (< -80 to ≥ -92) dBm (< -92 to ≥ -102) dBm (< -102 to ≥ -110) dBm (< -110 to ≥ -120) dBm (< -120 to ≥ -127) dBm | 2.5 MHz to 26.5 GHz | 0.17 dB 0.18 dB 0.20 dB 0.21 dB 0.22 dB 0.23 dB 0.24 dB 0.27 dB 0.28 dB 0.31 dB 0.34 dB | Agilent 8902A w/ 11722A or 11792A and 11793A |
| Tuned, Relative, RF Power ³ – Measure (≤ +10 to ≥ +2) dBm (< +2 to ≥ -12) dBm (< -12 to ≥ -22) dBm (< -22 to ≥ -31) dBm (< -31 to ≥ -40) dBm (< -40 to ≥ -50) dBm (< -50 to ≥ -61) dBm (< -61 to ≥ -71) dBm (< -71 to ≥ -80) dBm (< -80 to ≥ -90) dBm (< -90 to ≥ -100) dBm (< -100 to ≥ -110) dBm (< -110 to ≥ -120) dBm (< -120 to ≥ -127) dBm | 2.5 MHz to 26.5 GHz | 0.081 dB 0.071 dB 0.081 dB 0.088 dB 0.095 dB 0.12 dB 0.15 dB 0.16 dB 0.17 dB 0.19 dB 0.22 dB 0.23 dB 0.27 dB 0.30 dB | Agilent 8902A w/ 11722A or 11792A and 11793A |
| RF Absolute Power ^{3,6} – Generate Into 50 Ω (10 to 3) V _{p-p} 2.99 V to 1 mV _{p-p} | 0.001 Hz to 100 kHz SWR 1.2:1 0.001 Hz to 100 kHz SWR 1.2:1 | 0.12 dB 0.23 dB | Agilent 3325A/B w/ BNC(f) |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|---|--|-------------------------------|------------------------------|
| RF Absolute Power ^{3, 6} – Generate (cont) | | | |
| Into 50 Ω (10 to 3) V _{p-p} | 100 kHz to 20 MHz SWR ≤ 1.2:1 | 0.47 dB | Agilent 3325A/B w/ BNC(f) |
| 2.999 V to 1 mV _{p-p} | 100 kHz to 10 MHz SWR ≤ 1.2:1 | 0.70 dB | |
| (2.999 to 0.1) V _{p-p} | (10 to 20) MHz SWR ≤ 1.2:1 | 0.70 dB | |
| (99.99 to 1) mV _{p-p} | (10 to 20) MHz SWR ≤ 1.2:1 | 1.0 dB | |
| Full Amplitude, 50Ω 13.01 dBm | 1 kHz to 25 MHz 200 Hz to 80 MHz | 0.14 dB 0.23 dB | |
| Full Amplitude, 75Ω 11.25 dBm | 1 kHz to 25 MHz 200 Hz to 25 MHz | 0.14 dB 0.23 dB | |
| In 2 dB steps, 50 Ω (0 to -18) dBm (-20 to -58) dBm (-60 to -98) dBm | 200 Hz to 80 MHz 200 Hz to 80 MHz 200 Hz to 80 MHz | 0.28 dB 0.34 dB 0.47 dB | |
| In 2 dB steps, 75 Ω (0 to -18) dBm | 200 Hz to 25 MHz (25 to 80) MHz | 0.28 dB 0.41 dB | |
| (-20 to -58) dBm | 200 Hz to 25 MHz (25 to 80) MHz | 0.34 dB 0.52 dB | |
| (-60 to -98) dBm | 200 Hz to 25 MHz (25 to 80) MHz | 0.47 dB 0.81 dB | |
| In 0.01 dB steps (0 to -1.99) dBm | 100 kHz to 2.56 GHz SWR ≤ 1.5:1 | 0.036 dB | |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|---|--|--|------------------------------|
| RF Absolute Power ^{3,6} – Generate (cont) | | | |
| Into 50 Ω (+16 to -119.9) dBm | 100 kHz to 2.56 GHz SWR ≤ 1.5:1 | 1.2 dB | Agilent 8663A, Type-N(f) |
| (-120 to -129.9) dBm | 100 kHz to 2.56 GHz SWR ≤ 1.5:1 | 3.5 dB | Agilent 8663A, Type-N(f) |
| > +10 dBm | 10 MHz to 2 GHz SWR ≤ 1.6:1 (≥ 2 to ≤ 20) GHz SWR ≤ 1.6: | 1.4 dB 1.5 dB | Agilent 83650B, 2.4 mm(m) |
| > -10 dBm | 10 MHz to 2 GHz SWR ≤ 1.6:1 (≥ 2 to ≤ 20) GHz SWR ≤ 1.6:1 (> 20 to ≤ 40) GHz SWR ≤ 1.8:1 (> 40 to ≤ 50) GHz SWR ≤ 2:1 | 0.72 dB 0.84 dB 1.1 dB 2.0 dB | Agilent 83650B, 2.4 mm(m) |
| Into 50 Ω > -60 dBm | 10 MHz to 2 GHz SWR ≤ 1.6:1 (≥ 2 to ≤ 20) GHz SWR ≤ 1.6:1 (> 20 to ≤ 40) GHz SWR ≤ 1.8:1 (> 40 to ≤ 50) GHz SWR ≤ 2:1 | 1.1 dB 1.2 dB 1.4 dB 2.4 dB | Agilent 83650B, 2.4 mm(m) |
| ≤ -60 dBm | 10 MHz to 2 GHz SWR ≤ 1.6:1 (≥ 2 to ≤ 20) GHz SWR ≤ 1.6:1 (> 20 to ≤ 40) GHz SWR ≤ 1.8:1 (> 40 to ≤ 50) GHz SWR ≤ 2:1 | 1.7 dB 1.8 dB 2.0 dB 3.0 dB | Agilent 83650B, 2.4 mm(m) |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|-------------------------------------|---------------------------------|----------------------|-------------------------------|
| Attenuation ³ – Generate | | | |
| Coaxial, 1 dB Step (0 to 11) dB | | | |
| 0 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.027 dB 0.029 dB | Agilent 8494G w/ Type-N(f) |
| 1 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.027 dB 0.029 dB | |
| 2 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.027 dB 0.029 dB | |
| 3 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.028 dB 0.029 dB | |
| 4 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.028 dB 0.030 dB | |
| 5 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.029 dB 0.030 dB | |
| 6 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.030 dB 0.030 dB | |
| 7 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.030 dB 0.030 dB | |
| 8 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.030 dB 0.030 dB | |
| 9 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.031 dB 0.030 dB | |
| 10 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.031 dB 0.030 dB | |
| 11 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.031 dB 0.030 dB | |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|---|---------------------------------|----------------------|-------------------------------|
| Attenuation ³ – Generate (cont) | | | |
| Coaxial, 10 dB Step | | | |
| 0 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.027 dB 0.029 dB | Agilent 8494G w/ Type-N(f) |
| 10 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.031 dB 0.030 dB | |
| 20 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.033 dB 0.032 dB | |
| 30 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.036 dB 0.035 dB | |
| 40 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.054 dB 0.048 dB | |
| 50 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.062 dB 0.057 dB | |
| 60 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.064 dB 0.058 dB | |
| 70 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.070 dB 0.060 dB | |
| 80 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.084 dB 0.068 dB | |
| 90 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.091 dB 0.074 dB | |
| 100 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.093 dB 0.076 dB | |
| 110 dB | 50 MHz to 2 GHz (2 to 4) GHz | 0.11 dB 0.077 dB | |

| Parameter/Range | Frequency | CMC ² (±) | Comments |
|---|-------------------------------|----------------------|---------------------------|
| Attenuation ³ – Generate (cont) | | | |
| Coaxial, Fixed | | | |
| 3 dB | DC to 2 GHz, SWR < 1.25:1 | 0.028 dB | Agilent 8491A/B Type-N |
| | (2 to 4) GHz, SWR < 1.2:1 | 0.029 dB | |
| | (4 to 18) GHz, SWR < 1.2:1 | 0.053 dB | |
| 6 dB | DC to 2 GHz, SWR < 1.25:1 | 0.029 dB | |
| | (2 to 4) GHz, SWR < 1.2:1 | 0.030 dB | |
| | (4 to 18) GHz, SWR < 1.2:1 | 0.053 dB | |
| 10 dB | DC to 2 GHz, SWR < 1.25:1 | 0.031 dB | |
| | (2 to 4) GHz, SWR < 1.2:1 | 0.030 dB | |
| | (4 to 18) GHz, SWR < 1.2:1 | 0.053 dB | |
| Coaxial, Fixed | | | |
| 20 dB | DC to 2 GHz, SWR < 1.5:1 | 0.032 dB | Agilent 8491A/B Type-N |
| | (2 to 4) GHz, SWR < 1.5:1 | 0.032 dB | |
| | (4 to 18) GHz, SWR < 1.5:1 | 0.053 dB | |

| Parameter/Range | CMC ² (±) | Comments |
|---|--|---|
| Reflection ³ S ₁₁ / S ₂₂ – Measure | | |
| 30 kHz to 1.3 GHz (0 to 1.0) lin | (± 0.0044 to ±0.022) lin (± 180 to ± 1.3) deg | Network analyzer Agilent 8753ES Type-N precision cal kit 85032B APC 7mm precision cal kit Agilent 85031B |
| 300 kHz to 1.3 GHz (0 to 1.0) lin | (± 0.0071 to ±0.034) lin (± 180 to ± 2.0) deg | |
| 300 kHz to 1.3 GHz (0 to 1.0) lin | (± 0.0038 to ±0.017) lin (± 180 to ± 0.96) deg | Network analyzer Agilent 8753ES Type N precision cal kit 85032B |
| (1.3 to 3) GHz (0 to 1.0) lin | (± 0.0051 to ±0.026) lin (± 180 to ± 1.5) deg | |
| (3 to 6) GHz (0 to 1.0) lin | (±0.011 to ±0.050) lin (± 180 to ± 2.9) deg | |
| 300 kHz to 1.3 GHz (0 to 1.0) lin | (± 0.0019 to ±0.0072) lin (± 180 to ±0.41) deg | Network analyzer Agilent 8753ES APC 7mm precision cal kit Agilent 85031B |
| (1.3 to 3) GHz (0 to 1.0) lin | (± 0.0036 to ± 0.010) lin (± 180 to ± 0.59) deg | |
| (3 to 6) GHz (0 to 1.0) lin | (± 0.0057 to ± 0.018) lin (± 180 to ± 1.1) deg | |
| Transmission ³ S ₁₂ / S ₂₁ – Measure | | |
| 30 kHz to 1.3 GHz (0 to 20) dB | (± 0.041 to ± 0.063) dB (± 0.42 to ± 0.46) deg | Network analyzer 8753ES Type-N precision cal kit 85032B |
| (20 to 40) dB | (± 0.063 to ± 0.088) dB (± 0.46 to ± 0.62) deg | |
| (40 to 60) dB | (± 0.088 to ± 0.28) dB (± 0.62 to ± 1.9) deg | |
| (1.3 to 3) GHz (0 to 20) dB | (± 0.056 to ± 0.076) dB (± 0.87 to ± 1.3) deg | |
| (20 to 40) dB | (± 0.076 to ± 0.10) dB (± 1.3 to ± 1.4) deg | |
| (40 to 60) dB | (± 0.10 to ± 0.32) dB (± 1.4 to ± 2.2) deg | |

| Parameter/Range | CMC ² (±) | Comments |
|---|--|--|
| Transmission ³ S ₁₂ / S ₂₁ – Measure (3 to 6) GHz (0 to 20) dB (20 to 40) dB (40 to 60) dB | (± 0.094 to ± 0.13) dB (± 1.2 to ± 1.5) deg (± 0.13 to ± 0.16) dB (± 1.5 to ± 1.6) deg (± 0.16 to ± 0.50) dB (± 1.6 to ± 3.5) deg | Network analyzer 8753ES Type-N precision cal kit 85032B |

III. Time and Frequency

| Parameter/Equipment | Range | CMC ² (±) | Comments |
|--|----------------|----------------------|---------------------------------|
| Frequency ³ – Measuring Equipment | 5 MHz, 10 MHz | 11 pHz/Hz | Datum 8040 |
| Frequency ³ – Measure | 1 Hz to 40 GHz | 50 pHz/Hz | Agilent 53132A Agilent 5352B |

¹ This laboratory offers commercial calibration service and field calibration service.

² Calibration and Measurement Capability (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. Calibration and Measurement Capabilities 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.

³ Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being

larger than the CMC.

⁴ Based on using the standard at the temperature the Fluke 5720A/5725A was calibrated ($\text{tcal} \pm 5 \text{ }^\circ\text{C}$) and assuming the instrument is zeroed at least every seven days or when the ambient temperature changes more than $5 \text{ }^\circ\text{C}$. For resistance a zero calibration is performed at least every 12 hours within $\pm 1 \text{ }^\circ\text{C}$ of use. CMC is based upon 1-year specifications and is read as a portion or percent output plus floor specification. The floor specification is expressed as a fixed value or a portion or percent of the range.

⁵ Based on using the Agilent 3458A at the temperature (tcal) it was calibrated $\pm 5 \text{ }^\circ\text{C}$ and an auto-calibration (ACAL) was performed within the previous 24 hours ($\pm 1 \text{ }^\circ\text{C}$ of ambient temperature). CMC is based upon 1-year specifications and is read as a portion or percent output plus floor specification. The floor specification is expressed as a fixed value or a portion or percent of the range.

⁶ The Calibration and Measurement Capability does not include the mismatch.

⁷ Ranges are based upon the system combination used:

| Instrument/System | Ranges |
|---|--|
| Agilent 8902A | 2.5 MHz to 1.3 GHz Range 1 & 2 – SWR 1.18:1 Range 3 – SWR 1.4:1 |
| Agilent 8902A w/ HP 11722A | 2.5 MHz to 1.3 GHz Range 1 & 2 – SWR 1.33:1 Range 3 – SWR 1.5:1 |
| Agilent 8902A w/ Agilent11792A or Agilent 11793A | (50 to 1300) MHz SWR 1.15:1 (1.3 to 18) GHz SWR 1.25:1 (18 to 26.5) GHz SWR 1.4:1 |

⁸ Calibration and Measurement Capabilities are based upon the AM depths. For depths between 0 % and 9.99 %, the digit uncertainty (resolution) is 0.01 %. For depths between 10 % and 99.9 % FS, the digit uncertainty (resolution) is 0.1 %.

⁹ Calibration and Measurement Capabilities are based upon the peak phase deviations. For deviations between 0 and 3.999, the digit uncertainty (resolution) is 1 Hz. For deviations between 0 and 39.99, the digit uncertainty (resolution) is 10 Hz. For deviations between 40 and 400, the digit uncertainty (resolution) is 100 Hz.

¹⁰ In the statement of CMC, *AM* represents the amplitude modulation and *FM* represents the frequency modulation.

¹¹ In the statement of CMC, percentages are to be read as percent of reading, unless otherwise noted.



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

AGILENT TECHNOLOGIES MEXICO, S. DE R.L.

Tlaquepaque, Jalisco, Mexico

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 the requirements of ANSI/NCSL Z540-1-1994 and the requirements of ANSI/NCSL Z540.3-2006 and 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 22nd day of January 2009.

A handwritten signature in black ink, reading "Peter Abney", written over a horizontal line.

President & CEO
For the Accreditation Council
Certificate Number 2863.01
Valid to November 30, 2013

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