



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: May 31, 2025

Certificate Number: 3128.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 10}:

I. Cell Phone Test System

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
W-CDMA TRx/Performance Test System (ME7873F) ³ –			
UL Measurement Accuracy:	Max Output	0.27 dB	Signal analyzer, signal generator, power meter & power sensor, calibration receiver
(0.5 to 2) GHz	TX IM(UL)	0.27 dB	
Modulation	TX IM(IM)	0.28 dB	
	Min Output	0.28 dB	
Relative Level			
Measurement Accuracy:			
(0.5 to 2) GHz	1 dB Step	0.01 dB	
Modulation	2 dB Step	0.01 dB	
	3 dB Step	0.01 dB	
	26 dB Step	0.20 dB	
RACH Measurement Accuracy (Absolute Level Measurement):			
(0.5 to 2) GHz	Pre1f (+5 dBm)	0.29 dB	
Modulation	Pre1f	0.31 dB	
	PreMAX	0.27 dB	
	Off Power	0.34 dB	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
W-CDMA TRx/Performance Test System (ME7873F) ³ – (cont)			
RACH Measurement Accuracy (Relative Level Measurement):			
(0.5 to 2) GHz Modulation	Power Difference	0.01 dB	Signal analyzer, signal generator, power meter & power sensor, calibration receiver
DPCCH Measurement Accuracy:			
(0.5 to 2) GHz Modulation	8.4.4 (UL)	0.30 dB	
	8.7.9 (UL)	0.30 dB	
	8.7.9 (UL)	0.30 dB	
TX Spurious Measurement Accuracy (General) CW:	(0.15 to 10) MHz	0.27 dB	
	(10 to 2200) MHz	0.32 dB	
	(2.2 to 4) GHz	0.61 dB	
	(4 to 12.75) GHz	1.2 dB	
TX Spurious Measurement Accuracy (Additional) CW:			
GSM	(921 to 925) MHz	0.30 dB	
	(925 to 960) MHz	0.31 dB	
	(1805 to 1880) MHz	0.31 dB	
PHS	(1884.5 to 1919.6) MHz	0.30 dB	
DL Band	Band I, II, III, IV, V, VII, VIII, IX, XI; 800 MHz	0.33 dB	
RX Spurious Measurement Accuracy (General) CW:	(30 to 1000) MHz	0.30 dB	
	(1 to 2.2) GHz	0.32 dB	
	(2.2 to 4) GHz	0.61 dB	
	(4 to 13) GHz	1.2 dB	
RX Spurious Measurement Accuracy (Additional) CW:			
In Band	(0.5 to 2) GHz	0.33 dB	
GSM	(921 to 925) MHz	0.30 dB	
	(925 to 960) MHz	0.30 dB	
Spectrum Emission Mask CW	(0.5 to 2) GHz CW	0.27 dB	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
W-CDMA TRx/Performance Test System (ME7873F) ³ – (cont)			
Adjacent Channel Leakage Power Ratio (ACLR)	(0.5 to 2) GHz, Modulation/CW	0.43 dB	Signal analyzer, signal generator, power meter & power sensor, calibration receiver
Occupied Bandwidth (OBW) Modulation	(0.5 to 2) GHz	21 kHz	
Frequency Error Modulation	(0.5 to 2) GHz	0.02 Hz	
Error Vector Magnitude (EVM):	ULRMC12k	0.66 % of full scale	
(0.5 to 2) GHz Modulation	Pre1f	0.66 % of full scale	
Phase Error:	(0.5 to 2) GHz Modulation	0.23 °	
Peak Code Domain Error:	(0.5 to 2) GHz Modulation	0.12 dB	
DL Output Accuracy:			
(0.5 to 3) GHz Modulation:			
Downlink Power	(-30 to 0) dBm (-80 to -30) dBm; Ioc (MBMS)	0.32 dB 0.37 dB	
	(-120 to -80) dBm Blocking (In-Band), Spurious	0.45 dB	
	Max Input	0.26 dB	
Ior/Ioc (TRx):			
(0.5 to 3) GHz Modulation	DPCCH_Ec/Ioc Ior/Ioc Ioc	0.09 dB 0.09 dB 0.34 dB	

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
W-CDMA TRx/Performance Test System (ME7873F) ³ – (cont)			
Ior/Ioc (Perf):			
(0.5 to 3) GHz Modulation	Ior/Ioc(Static)	0.09 dB	Signal analyzer, signal generator, power meter & power sensor, calibration receiver
	Ior/Ioc(Static)[Sqrt(0.3 ² (Static) + 0.3 ² (Static))]	0.12 dB	
	Ioc	0.30 dB	
	Fading	0.09 dB	
	Ior/Ioc[Sqrt(0.3 ² (Static) + 0.5 ² (Fading))]	0.12 dB	
	Ior/Ioc[Sqrt(0.3 ² (Static) + 0.5 ² (Fading) + 0.5 ² (Fading))]	0.15 dB	
	Ior/Ioc[3000·Average]	0.10 dB	
Ior/Ioc (RRM Fading Test Case) PropSimC2:			
(0.5 to 3) GHz Modulation	Ioc	0.31 dB	
	Ior	0.31 dB	
	Ior1/Ior ²	0.09 dB	
Ior/Ioc (RRM Fading Test Case) MF6900A:			
(0.5 to 3) GHz Modulation	Ioc	0.28 dB	
	Ior	0.29 dB	
RRM Signal Output:			
(0.5 to 3) GHz Modulation	Ior, Ioc, RXLEV	0.28 dB	
	Ior/Ioc, Ior/Ior, Ioc/Ioc	0.09 dB	
	Ioc/RXLEV, Ioc/RXLEV (8.7.3A), Ior/Ior (Inter Band), Ioc/Ioc (Inter Band), Ioc/RXLEV (Ior & Ioc are Combined in Digital Baseband oSFS)	0.12 dB	
	RXLEV/RXLEV	0.39 dB	

Parameter/Equipment	Range	CMC ^{2, 4} (±)	Comments
W-CDMA TRx/Performance Test System (ME7873F) ³ – (cont)			
CW Interference	Blocking: (10 to 3000) MHz Blocking: (3 to 8) GHz Blocking: (8 to 13) GHz RX IM TX IM	0.26 dB 0.54 dB 1.1 dB 0.26 dB 0.26 dB	Signal analyzer, signal generator, power meter & power sensor, calibration receiver
Modulation Interference:	SG2->CpDSG->Isolator- >Antenna	0.29 dB	
(0.5 to 3) GHz Modulation	SG2->Isolator->Antenna	0.29 dB	
	Intermodulation Characteristics	0.26 dB	
GSM Interference:			
(0.5 to 3) GHz Modulation	Blocking Characteristics (Narrow Band)	0.29 dB	
	Intermodulation Characteristics (Narrow Band)	0.26 dB	

Parameter/Range	Frequency	CMC ^{2, 4} (±)	Comments
RF Conformance Test System (ME78xx ⁷) ³ –			
UL Measurement Accuracy:	Max Output, Min Output, Off Power, TX IM (UL), TX IM (IM)	0.37 dB	Signal analyzer, signal generator, power meter & power sensor
Carrier Aggregation	(0.5 to 3) GHz Modulation, CW	0.26 dB	
UL Measurement Accuracy:			
Max Output	Up to 3 GHz (3 to 4) GHz (4 to 6) GHz For Low Level WCDMA UL (5.4.1, 8.4.2.xx ⁷) (5.4.3, 5.5.1, 5.5.2)	0.30 dB 0.35 dB 0.38 dB 0.32 dB	
Frequency Error	(0.5 to 6) GHz Modulation	1.2 Hz	
Error Vector Magnitude (EVM)	(0.5 to 6) GHz Modulation	0.21 % of full scale	
Origin Offset	(0.5 to 3) GHz Modulation	0.44 dB	
In Band Emission	(0.5 to 6) GHz Modulation	0.27 dB	
In Band Emission for CA	(0.5 to 3) GHz Modulation	0.29 dB	
Occupied Bandwidth (OBW)	(0.5 to 6) GHz, CW	0.01 kHz	
Spectrum Emission Mask	(0.5 to 3) GHz Modulation, CW (3 to 4) GHz Modulation, CW (4 to 6) GHz Modulation, CW	0.27 dB 0.45 dB 0.37 dB	
Adjacent Channel Leakage Power Ratio (ACLR)	(0.5 to 4) GHz Modulation (4 to 6) GHz Modulation	0.30 dB 0.43 dB	
Spectrum Flatness	(0.5 to 6) GHz Modulation	0.60 dB	
Spurious, CW	(10 to 30) MHz (30 to 4000) MHz (4 to 13) GHz (13 to 19) GHz (19 to 26) GHz	0.29 dB 0.31 dB 0.48 dB 0.52 dB 0.60 dB	

Parameter/Equipment	Frequency	CMC ^{2, 4, 11} ($\pm$)	Comments
RF Conformance Test System (ME78xx ⁷) ³ (cont)			
DL Output Accuracy:			Signal analyzer, signal generator, power meter & power sensor
Bandwidth: 1.4 MHz	(0.5 to 3) GHz Modulation	0.35 dB	
Bandwidth: 20 MHz		0.33 dB	
DL Output Accuracy (RRM):			
LTE Absolute	(0.5 to 3) GHz Modulation, CW	0.29 dB	
AWGN Absolute			
W-CDMA Absolute		0.30 dB	
GSM Absolute		0.27 dB	
Memory Synthesizing Function Output		0.26 dB	
CDMA2000 Absolute		0.29 dB	
LTE / LTE Relative (InterFreq.), LTE / W-CDMA Relative, LTE / CDMA2000 Relative, CDMA2000 / AWGN Relative		0.41 dB	
LTE / GSM Relative		0.39 dB	
DC-HSDPA Ior/Ioc		0.10 dB	
TDS-CDMA Ior/Ioc		0.10 dB	
DL Output Accuracy:			
LA Absolute	Up to 3 GHz (3 to 4) GHz (4 to 6) GHz	0.32 dB 0.50 dB 0.59 dB	
CW Interference, CW:			
Out of Band	(1 to 10) MHz (10 to 3000) MHz (3 to 4) GHz (4 to 13) GHz	0.21 dB 0.27 dB 0.43 dB 0.50 dB	
Near Band	(4 to 13) GHz	1.1 dB	
For Intermodulation Characteristics	(400 to 3000) MHz (3 to 4) GHz (4 to 4.2) GHz (4.2 to 6) GHz	0.27 dB 0.43 dB 0.35 dB 0.42 dB	

Parameter/Equipment	Frequency	CMC ^{2, 4, 11} (±)	Comments
RF Conformance Test System (ME78xx ⁷) ³ (cont)			
Modulation Interference:			
(680 to 2700) MHz; (-46 to -15) dBm	(0.5 to 3) GHz Modulation	0.26 dB	Signal analyzer, signal generator, power meter & power sensor
UL Relative Power Measurement	LTE, MediaFLO, ATSC	0.35 dB	
Transmit OFF Power Measurement Accuracy	(0.5 to 3) GHz Modulation	0.23 dB	
Relative Carrier Leakage Power	(0.5 to 3) GHz	0.31 dB	
	(3 to 4.2) GHz	0.36 dB	
	(4.2 to 6) GHz	0.39 dB	
Interference Signal Output Accuracy		0.40 dB	
	(0.5 to 4) GHz		
Relative Level Measurement for LTE	(400 to 3000) MHz	0.34 dB	
	(3 to 4) GHz	0.52 dB	
	(4 to 4.2) GHz	0.60 dB	
	(4.2 to 6) GHz	0.70 dB	
DL Relative Accuracy:	(0.5 to 6) GHz	0.44 dB	
Ior/Ioc (CDMA2000) Ior/Iot(LTE)	(0.5 to 3) GHz	0.10 dB	
Ior/Ior, Ioc/Ioc (Intra-Band) Ior/Ioc (TD-SCDMA) LTE DL/AWGN	(0.5 to 3) GHz	0.13 dB	
Ior/Ior, Ioc/Ioc (Inter-Band) Ioc/RXLEV, RXLEV/RXLEV	(0.5 to 3) GHz	0.17 dB	
DPCCH Measurement Accuracy	(0.5 to 3) GHz	0.39 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 11} ($\pm$)	Comments ^{13, 14}
Power Level ^{12, 15} – Measure			
Absolute:			
For Spurious (20 to -20) dBm	(6 to 12.75) GHz (12.75 to 23.45) GHz (23.45 to 40.8) GHz (40.8 to 66) GHz (66 to 87) GHz	2.1 dB 2.1 dB 2.3 dB 4.0 dB 2.5 dB	Signal generator, power meter & power sensor; 3GPP TS38.521-2, 3GPP TS38.521-3, 3GPP TS38.523-1
For In-Band (20 to -20) dBm	(24.25 to 29.5) GHz (37 to 43.5) GHz	2.6 dB 3.2 dB	
Output Level:			
For In-Band (20 to -40) dBm	(24.25 to 29.5) GHz (37 to 43.5) GHz	2.6 dB 2.9 dB	

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 16} ($\pm$)	Comments
DC Voltage – Generate	1 mV 10 mV (22 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 220) V (220 to 1000) V	2.2 μ V 2.3 μ V 7.6 μ V/V + 24 μ V 5.1 μ V/V + 6.5 μ V 3.6 μ V/V + 48 μ V 5.1 μ V/V + 730 μ V 6.6 μ V/V + 22 mV	Calibrator
DC Voltage – Measure	1 mV (10 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	3.1 μ V 5.8 μ V/V + 2.2 μ V 4.7 μ V/V + 3.0 μ V 4.7 μ V/V + 7.5 μ V 7.0 μ V/V + 200 μ V 21 μ V/V + 3.8 mV	Multimeter
DC Current – Generate	(22 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 1) A	41 μ A/A + 6.6 nA 36 μ A/A + 26 nA 36 μ A/A + 0.26 μ A 46 μ A/A + 4.3 μ A 81 μ A/A + 0.14 mA	Calibrator

Parameter/Equipment	Range	CMC ^{2, 16} ($\pm$)	Comments
DC Current – Measure	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	24 μ A/A + 1.1 nA 24 μ A/A + 7.9 nA 24 μ A/A + 0.082 μ A 41 μ A/A + 1.1 μ A 130 μ A/A + 35 μ A	Multimeter
Resistance – Generate, Fixed Points	1 Ω 10 Ω 100 Ω 1 k Ω 10 k Ω 100 k Ω 1 M Ω 10 M Ω 100 M Ω	0.33 m Ω 0.43 m Ω 3.6 m Ω 14 m Ω 140 m Ω 1.5 Ω 24 Ω 730 Ω 61 k Ω	Calibrator
Resistance – Measure	(1 to 10) Ω (10 to 100) Ω (0.1 to 1) k Ω (1 to 10) k Ω (10 to 100) k Ω (0.1 to 1) M Ω (1 to 10) M Ω (10 to 100) M Ω (0.1 to 1) G Ω	18 $\mu\Omega/\Omega$ + 230 $\mu\Omega$ 14 $\mu\Omega/\Omega$ + 2.3 m Ω 12 $\mu\Omega/\Omega$ + 2.6 m Ω 12 $\mu\Omega/\Omega$ + 25 m Ω 12 $\mu\Omega/\Omega$ + 220 m Ω 18 $\mu\Omega/\Omega$ + 5.3 Ω 58 $\mu\Omega/\Omega$ + 180 Ω 580 $\mu\Omega/\Omega$ + 13 k Ω 6.0 m Ω/Ω + 810 k Ω	Multimeter

Parameter/Range	Frequency	CMC ^{2, 16} ($\pm$)	Comments
AC Voltage – Generate (22 to 220) mV	(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	110 μ V/V + 14 μ V 82 μ V/V + 14 μ V 140 μ V/V + 14 μ V 320 μ V/V + 21 μ V 660 μ V/V + 23 μ V 1.5 mV/V + 28 μ V 2.8 mV/V + 47 μ V	Calibrator

Parameter/Range	Frequency	CMC ^{2, 16} ($\pm$)	Comments
AC Voltage – Generate (cont.)			
(0.22 to 2.2) V	(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	91 μ V/V + 65 μ V 43 μ V/V + 49 μ V 68 μ V/V + 49 μ V 86 μ V/V + 57 μ V 340 μ V/V + 150 μ V 1.1 mV/V + 240 μ V 1.8 mV/V + 510 μ V	Calibrator
(2.2 to 22) V	(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	91 μ V/V + 430 μ V 43 μ V/V + 410 μ V 68 μ V/V + 420 μ V 84 μ V/V + 450 μ V 260 μ V/V + 730 μ V 1.1 mV/V + 2.1 mV 1.6 mV/V + 3.3 mV	
(22 to 220) V	(20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	91 μ V/V + 4.7 mV 53 μ V/V + 4.5 mV 81 μ V/V + 4.6 mV 160 μ V/V + 5.1 mV	
(220 to 700) V	50 Hz to 1 kHz	71 μ V/V + 5.7 mV	
AC Voltage – Measure			
(10 to 100) mV	(20 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	100 μ V/V + 5.9 μ V 100 μ V/V + 4.3 μ V 180 μ V/V + 4.3 μ V 360 μ V/V + 4.3 μ V 930 μ V/V + 4.3 μ V 3.5 mV/V + 13 μ V 12 mV/V + 13 μ V	Multimeter
(0.1 to 1) V	(20 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	81 μ V/V + 59 μ V 81 μ V/V + 43 μ V 170 μ V/V + 43 μ V 350 μ V/V + 43 μ V 930 μ V/V + 43 μ V 3.5 mV/V + 130 μ V 12 mV/V + 130 μ V	

Parameter/Range	Frequency	CMC ^{2, 16} ($\pm$)	Comments
AC Voltage – Measure (cont.)			
(1 to 10) V	(20 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	81 μ V/V + 670 μ V 81 μ V/V + 400 μ V 170 μ V/V + 530 μ V 350 μ V/V + 530 μ V 930 μ V/V + 600 μ V 3.5 mV/V + 1.3 mV 12 mV/V + 3.3 mV	Multimeter
(10 to 100) V	(20 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	240 μ V/V + 6.2 mV 240 μ V/V + 4.8 mV 240 μ V/V + 4.8 mV 410 μ V/V + 4.8 mV 1.4 mV/V + 4.8 mV	
(100 to 700) V	50 Hz to 1 kHz	470 μ V/V + 50 mV	
Linearity at 10 V _p			
(-40 to 0) dB	20 Hz to 100 kHz (100 to 300) kHz 300 kHz to 1 MHz	0.009 dB 0.037 dB 0.12 dB	Multimeter
	100 kHz to 15 MHz	0.097 dB	Attenuator
AC Current – Generate			
(2.2 to 22) mA	50 Hz to 1 kHz	110 μ A/A + 0.79 μ A	Calibrator
(22 to 220) mA	50 Hz to 1 kHz	110 μ A/A + 8.4 μ A	
(0.22 to 1) A	50 Hz to 1 kHz	250 μ A/A + 97 μ A	
AC Current – Measure			
(1 to 10) mA	(50 to 100) Hz 100 Hz to 1 kHz	700 μ A/A + 3.7 μ A 350 μ A/A + 2.6 μ A	Multimeter
(10 to 100) mA	(50 to 100) Hz 100 Hz to 1 kHz	700 μ A/A + 38 μ A 350 μ A/A + 26 μ A	
(0.1 to 1) A	(50 to 100) Hz 100 Hz to 1 kHz	930 μ A/A + 740 μ A 1.2 mA/A + 270 μ A	

Parameter/Range	Frequency	CMC ^{2, 5, 16} ($\pm$)	Comments
AC Phase – Measure (-180 to + 180)°	10 Hz to 100 kHz 100 kHz to 1 MHz (1 to 5) MHz	0.04° 0.06° 0.22°	Digital oscilloscope
AC Distortion – Measure	400 Hz, 1 kHz	0.12 %	Measuring receiver

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 4, 5, 16} ($\pm$)	Comments
RF Power – Generate ³ 1 mW	50 MHz	0.53 %	Reference oscillator
0 dBm	100 kHz to 5 GHz (5 to 12) GHz (12 to 14) GHz (14 to 18) GHz (18 to 25) GHz (25 to 40) GHz	0.08 dB 0.09 dB 0.09 dB 0.12 dB 0.14 dB 0.16 dB	Power meter & power sensor
(-10 to 0) dBm (-100 to -10) dBm	100 kHz to 10 MHz	0.08 dB 0.10 dB	
(0 to 20) dBm (-10 to 0) dBm (-100 to -10) dBm	(0.01 to 3) GHz	0.10 dB 0.07 dB 0.09 dB	Power meter & power sensor, measuring receiver, signal analyzer
(0 to 20) dBm (-10 to 0) dBm (-100 to -10) dBm	(3 to 5) GHz	0.12 dB 0.07 dB 0.08 dB	
(0 to 20) dBm (-10 to 0) dBm (-100 to -10) dBm	(5 to 12) GHz	0.16 dB 0.09 dB 0.10 dB	
(0 to 20) dBm (-10 to 0) dBm (-100 to -10) dBm	(12 to 18) GHz	0.17 dB 0.12 dB 0.13 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 16} (±)	Comments
RF Power – Measuring Equipment ³			
Power Sensor			
Correction Factor:			
0 dBm	100 kHz	1.6 %	Power meter & power sensor
	300 kHz	1.3 %	
	500 kHz	1.3 %	
	1 MHz	1.3 %	
	3 MHz	1.5 %	
	5 MHz	1.6 %	
	10 MHz	1.4 %	
	30 MHz	1.3 %	
	50 MHz	1.1 %	
	100 MHz	1.3 %	
	300 MHz	1.3 %	
	500 MHz	1.3 %	
	1 GHz	1.3 %	
	1.5 GHz	1.3 %	
	2 GHz	1.3 %	
	2.5 GHz	1.4 %	
	3 GHz	1.4 %	
	4 GHz	1.4 %	
	4.2 GHz	1.5 %	
	5 GHz	1.3 %	
	6 GHz	1.3 %	
	7 GHz	1.4 %	
	8 GHz	1.6 %	
	9 GHz	1.6 %	
	10 GHz	1.7 %	
	11 GHz	1.7 %	
	12 GHz	1.7 %	
	12.4 GHz	1.6 %	
	13 GHz	1.7 %	
	14 GHz	1.9 %	
	15 GHz	1.9 %	
	16 GHz	1.9 %	
	17 GHz	2.1 %	
	18 GHz	2.2 %	
	19 GHz	1.9 %	
	20 GHz	2.0 %	
	21 GHz	2.1 %	
	22 GHz	2.2 %	
	23 GHz	2.2 %	
	24 GHz	2.3 %	
	25 GHz	2.5 %	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 16} (±)	Comments
RF Power – Measuring Equipment ³ (cont)– Power Sensor Correction Factor:			
0 dBm	26 GHz 26.5 GHz 27 GHz 28 GHz 29 GHz 30 GHz 31 GHz 32 GHz 33 GHz 34 GHz 35 GHz 36 GHz 37 GHz 38 GHz 39 GHz 40 GHz	2.6 % 2.9 % 3.3 % 3.0 % 2.8 % 2.6 % 2.7 % 2.6 % 2.6 % 2.7 % 2.6 % 2.5 % 2.7 % 2.6 % 2.8 % 2.7 %	Power meter & power sensor
0 dBm	(0.1 to 1) MHz 1 MHz to 2 GHz (2 to 6) GHz (6 to 8) GHz (8 to 12) GHz (12 to 18) GHz	1.7 % 1.6 % 1.5 % 1.5 % 1.7 % 2.3 %	
Power Meter Linearity:			
(0 to 10) dBm	10 MHz to 6 GHz (6 to 12) GHz (12 to 18) GHz	3.9 % 6.4 % 7.1 %	Power meter & power sensor, step attenuator
(-50 to 0) dBm	10 MHz to 6 GHz (6 to 12) GHz (12 to 18) GHz	4.7 % 6.7 % 7.0 %	

Parameter/Range	Frequency	CMC ^{2, 4, 5, 16} ($\pm$)	Comments
Frequency Modulation – Generate Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (40 to 400) kHz Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (40 to 400) kHz	(0.25 to 10) MHz Rate: 20 Hz to 10 kHz (10 to 1300) MHz Rate: 20 Hz to 200 kHz (10 to 1300) MHz Rate: 50 Hz to 100 kHz	6.9 % + 1 Hz 3.9 % + 10 Hz 8.7 % + 1 Hz 6.6 % + 10 Hz 5.9 % + 100 Hz 6.5 % + 1 Hz 3.1 % + 10 Hz 1.4 % + 100 Hz	Measuring receiver
Frequency Modulation – Measuring Equipment Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (40 to 400) kHz Deviation: (0.3 to 4) kHz Deviation: (4 to 40) kHz Deviation: (40 to 400) kHz	(0.25 to 10) MHz Rate: 20 Hz to 10 kHz (10 to 1300) MHz Rate: 20 Hz to 200 kHz (10 to 1300) MHz Rate: 50 Hz to 100 kHz	7.0 % + 1 Hz 3.8 % + 10 Hz 8.8 % + 1 Hz 6.6 % + 10 Hz 5.9 % + 100 Hz 6.6 % + 1 Hz 3.2 % + 10 Hz 1.4 % + 100 Hz	Measuring receiver
Attenuation – Measure (0 to 90) dB (90 to 100) dB	10 MHz to 18 GHz	0.25 dB + M 0.35 dB + M	Measuring receiver
Attenuation – Measuring Equipment (0 to 80) dB 90 dB 100 dB (0 to 80) dB 90 dB 100 dB	10 MHz to 12 GHz (12 to 18) GHz	0.22 dB 0.32 dB 0.60 dB 0.38 dB 0.48 dB 1.1 dB	Step attenuator

Parameter/Range	Frequency	CMC ^{2, 4, 5, 16} (±)	Comments
Amplitude Modulation – Generate			
Depth: (5 to 40) % Depth: (40 to 90) %	(0.15 to 10) MHz Rate: 20 Hz to 10 kHz	4.3 % + 0.01 % of full scale 3.6 % + 0.1 % of full scale	Measuring receiver
Depth: (5 to 40) % Depth: (40 to 90) %	(0.15 to 10) MHz Rate: 50 Hz to 10 kHz	3.3 % + 0.01 % of full scale 2.5 % + 0.1 % of full scale	
Depth: (5 to 40) % Depth: (40 to 90) %	(10 to 1300) MHz Rate: 20 Hz to 100 kHz	7.1 % + 0.01 % of full scale 3.7 % + 0.1 % of full scale	
Depth: (5 to 40) % Depth: (40 to 90) %	(10 to 1300) MHz Rate: 50 Hz to 50 kHz	5.2 % + 0.01 % of full scale 1.5 % + 0.1 % of full scale	
Amplitude Modulation – Measuring Equipment			
Depth: (5 to 40) % Depth: (40 to 90) %	(0.15 to 10) MHz Rate: 20 Hz to 10 kHz	4.3 % + 0.01 % of full scale 3.6 % + 0.1 % of full scale	Measuring receiver
Depth: (5 to 40) % Depth: (40 to 90) %	(0.15 to 10) MHz Rate: 50 Hz to 10 kHz	3.4 % + 0.01 % of full scale 2.5 % + 0.1 % of full scale	
Depth: (5 to 40) % Depth: (40 to 90) %	(10 to 1300) MHz Rate: 20 Hz to 100 kHz	7.1 % + 0.01 % of full scale 3.7 % + 0.1 % of full scale	
Depth: (5 to 40) % Depth: (40 to 90) %	(10 to 1300) MHz Rate: 50 Hz to 50 kHz	5.3 % + 0.01 % of full scale 1.4 % + 0.1 % of full scale	
Spectrum Analyzer ⁸ –			
Standard Frequency Accuracy	10 MHz	2.4 µHz	Cesium standard & precision phase comparator
Displayed Frequency Accuracy	10 Hz to 1 GHz (1 to 40) GHz	1.3 Hz 1.3 Hz	Cesium standard & signal generator
Span Accuracy	10 kHz to 40 GHz	0.013 %	Cesium standard & signal generator

Parameter/Equipment	Frequency	CMC ^{2, 4} ($\pm$)	Comments
Spectrum Analyzer ⁸ – (cont)			
Frequency Response,	100 kHz	0.10 dB	Power meter & power sensor
Reference Level Accuracy,	300 kHz	0.09 dB	
Absolute Amplitude Accuracy	500 kHz	0.10 dB	
	1 MHz	0.10 dB	
	3 MHz	0.10 dB	
	5 MHz	0.10 dB	
	10 MHz	0.10 dB	
	30 MHz	0.09 dB	
	50 MHz	0.09 dB	
	100 MHz	0.09 dB	
	300 MHz	0.10 dB	
	500 MHz	0.10 dB	
	1 GHz	0.10 dB	
	1.5 GHz	0.10 dB	
	2 GHz	0.10 dB	
	2.5 GHz	0.11 dB	
	3 GHz	0.11 dB	
	4 GHz	0.11 dB	
	4.2 GHz	0.11 dB	
	5 GHz	0.11 dB	
	6 GHz	0.11 dB	
	7 GHz	0.11 dB	
	8 GHz	0.12 dB	
	9 GHz	0.12 dB	
	10 GHz	0.11 dB	
	11 GHz	0.11 dB	
	12 GHz	0.11 dB	
	12.4 GHz	0.14 dB	
	13 GHz	0.12 dB	
	14 GHz	0.12 dB	
	15 GHz	0.12 dB	
	16 GHz	0.12 dB	
	17 GHz	0.13 dB	
	18 GHz	0.13 dB	
	19 GHz	0.12 dB	
	20 GHz	0.13 dB	
	21 GHz	0.14 dB	
	22 GHz	0.14 dB	
	23 GHz	0.14 dB	
	24 GHz	0.15 dB	
	25 GHz	0.16 dB	
	26 GHz	0.17 dB	
	26.5 GHz	0.17 dB	
	27 GHz	0.17 dB	
	28 GHz	0.17 dB	
	29 GHz	0.18 dB	
	30 GHz	0.18 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Spectrum Analyzer ⁸ – (cont)			
Frequency Response, Reference Level Accuracy, Absolute Amplitude Accuracy	31 GHz 32 GHz 33 GHz 34 GHz 35 GHz 36 GHz 37 GHz 38 GHz 39 GHz 40 GHz (0.1 to 1) MHz 1 MHz to 2 GHz (2 to 6) GHz (6 to 8) GHz (8 to 12) GHz (12 to 18) GHz	0.20 dB 0.18 dB 0.16 dB 0.15 dB 0.15 dB 0.14 dB 0.16 dB 0.15 dB 0.16 dB 0.17 dB 0.12 dB 0.12 dB 0.12 dB 0.13 dB 0.15 dB 0.17 dB	Signal generator
Reference Level Accuracy, Absolute Amplitude Accuracy: (-100 to -10) dBm	(0.01 to 2) GHz (2 to 10) GHz (10 to 12) GHz (12 to 18) GHz	0.26 dB 0.26 dB 0.34 dB 0.39 dB	Power meter & power sensor, step attenuator
Scale Fidelity:			
(0 to 90) dB (90 to 100) dB	(0.01 to 2) GHz	0.22 dB 0.38 dB	Step attenuator
(0 to 90) dB (90 to 100) dB	(2 to 10) GHz	0.26 dB 0.47 dB	
(0 to 80) dB (80 to 90) dB (90 to 100) dB	(10 to 12) GHz	0.22 dB 0.32 dB 0.60 dB	
(0 to 80) dB (80 to 90) dB (90 to 100) dB	(12 to 18) GHz	0.38 dB 0.48 dB 1.1 dB	
Attenuator Switching Accuracy	10 kHz to 40 GHz	0.09 dB	
Bandwidth Switching Accuracy	10 kHz to 40 GHz	0.09 dB	
Bandwidth Accuracy	10 Hz to 50 MHz	3.5 %	

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Signal Generator –			
Standard Frequency Accuracy	10 MHz	2.4 µHz	Cesium standard & precision phase comparator
Frequency Accuracy	10 Hz to 1 MHz	0.012 Hz	Cesium standard & frequency counter
	(1 to 10) MHz	0.85 mHz	
	10 MHz	0.85 mHz	
	10 MHz to 1 GHz	0.075 Hz	Spectrum analyzer & step attenuator
	(1 to 10) GHz	0.14 Hz	
	(10 to 20) GHz	0.26 Hz	
	(20 to 30) GHz	0.37 Hz	
	(30 to 40) GHz	0.49 Hz	
Linearity:			
(-50 to 20) dBm	(0.01 to 18) GHz	0.31 dB	Power meter & power sensor
(-100 to -50) dBm		0.39 dB	
Absolute Level Accuracy:			
0 dBm	100 kHz to 5 GHz	0.08 dB	Power meter & power sensor, measuring receiver
	(5 to 12) GHz	0.09 dB	
	(12 to 14) GHz	0.09 dB	
	(14 to 18) GHz	0.12 dB	
	(18 to 25) GHz	0.14 dB	
	(25 to 40) GHz	0.16 dB	
(-10 to 0) dBm	100 kHz to 10 MHz	0.08 dB	
(-100 to -10) dBm		0.10 dB	
(0 to 20) dBm	(0.01 to 3) GHz	0.10 dB	
(-10 to 0) dBm		0.07 dB	
(-100 to -10) dBm		0.09 dB	
(0 to 20) dBm	(3 to 5) GHz	0.12 dB	
(-10 to 0) dBm		0.07 dB	
(-100 to -10) dBm		0.08 dB	

Parameter/Range	Frequency	CMC ^{2, 4, 5} (±)	Comments
Signal Generator – (cont)			
Absolute Level Accuracy:			
(0 to 20) dBm	(5 to 12) GHz	0.16 dB	Power meter & power sensor, measuring receiver
(-10 to 0) dBm		0.09 dB	
(-100 to -10) dBm		0.10 dB	
(0 to 20) dBm	(12 to 18) GHz	0.17 dB	
(-10 to 0) dBm		0.12 dB	
(-100 to -10) dBm		0.13 dB	
2nd & 3rd Harmonic:			
(0 to -70) dBc	(0.02 to 3) GHz	0.9 dB	Signal analyzer
(0 to -90) dBc	(3 to 13.5) GHz	1.7 dB	
(0 to -90) dBc	(13.5 to 18) GHz	2.9 dB	
FM Modulation Accuracy:			
Deviation: (0.3 to 4) kHz	(0.25 to 10) MHz	6.9 % + 1 Hz	Measuring receiver
Deviation: (4 to 40) kHz	Mod. Frequency: 20 Hz to 10 kHz	3.9 % + 10 Hz	
Deviation: (0.3 to 4) kHz	(10 to 1300) MHz	8.7 % + 1 Hz	
Deviation: (4 to 40) kHz	Mod. Frequency: 20 Hz to 200 kHz	6.6 % + 10 Hz	
Deviation: (40 to 400) kHz		5.9 % + 100 Hz	
Deviation: (0.3 to 4) kHz	(10 to 1300) MHz	6.5 % + 1 Hz	
Deviation: (4 to 40) kHz	Mod. Frequency: 50 Hz to 100 kHz	3.1 % + 10 Hz	
Deviation: (40 to 400) kHz		1.4 % + 100 Hz	
AM Modulation Accuracy			
Depth: (5 to 40) %	(0.15 to 10) MHz	4.3 % + 0.01 % of full scale	
Depth: (40 to 90) %	Rate: 20 Hz to 10 kHz	3.6 % + 0.1 % of full scale	
Depth: (5 to 40) %	(0.15 to 10) MHz	3.3 % + 0.01 % of full scale	
Depth: (40 to 90) %	Rate: 50 Hz to 10 kHz	2.5 % + 0.1 % of full scale	
Depth: (5 to 40) %	(10 to 1300) MHz	7.1 % + 0.01 % of full scale	
Depth: (40 to 90) %	Rate: 20 Hz to 100 kHz	3.7 % + 0.1 % of full scale	
Depth: (5 to 40) %	(10 to 1300) MHz	5.2 % + 0.01 % of full scale	
Depth: (40 to 90) %	Rate: 50 Hz to 50 kHz	1.5 % + 0.1 % of full scale	

Parameter/Range	Frequency	CMC ^{2, 16} ($\pm$)	Comments
Parameters for S_{11} , S_{12} , S_{21} , S_{22} —			
Reflection S_{11}/S_{22} Magnitude & Phase -Measure ⁹ :			One-port device Insertable devices only
(0.0001 to 0.5) lin (0.5 to 1) lin	(70 to 300) kHz	(0.007 to 0.011) lin (0.011 to 0.021) lin	Vector network analyzer calibration kit
(0.0001 to 0.03) lin (0.03 to 0.1) lin (0.1 to 0.2) lin (0.2 to 1) lin		(90 to 13) ° (13 to 4.2) ° (4.2 to 2.3) ° (2.3 to 0.82) °	
(0.0001 to 0.5) lin (0.5 to 1) lin	300 kHz to 18 GHz	(0.010 to 0.019) lin (0.019 to 0.034) lin	
(0.0001 to 0.03) lin (0.03 to 0.1) lin (0.1 to 0.2) lin (0.2 to 1) lin		(90 to 21) ° (21 to 7.4) ° (7.4 to 4.5) ° (4.5 to 2.0) °	
(0.0001 to 0.5) lin (0.5 to 1) lin	(18 to 40) GHz	(0.014 to 0.032) lin (0.032 to 0.059) lin	
(0.0001 to 0.03) lin (0.03 to 0.1) lin (0.1 to 0.2) lin (0.2 to 1) lin		(90 to 26) ° (26 to 11) ° (11 to 7.0) ° (7.0 to 5.0) °	

Parameter/Range	Frequency	CMC ^{2, 16} ($\pm$)	Comments
Transmission S_{12}/S_{21} , Magnitude & Phase-Measure ⁹			Non-reflective device Insertable devices only
(0 to -5) dB	(70 to 300) kHz	(0.062 to 0.039) dB (0.40 to 0.30) °	Vector network analyzer calibration kit
(-5 to -30) dB		0.039 dB 0.30 °	
(-30 to -35) dB		(0.039 to 0.044) dB (0.30 to 0.40) °	
(-35 to -60) dB		0.044 dB 0.40 °	
(-60 to -70) dB		(0.044 to 0.048) dB (0.40 to 0.45) °	
(-70 to -80) dB		(0.048 to 0.080) dB (0.45 to 0.50) °	
(0 to -5) dB	300 kHz to 18 GHz	(0.18 to 0.16) dB (1.8 to 1.6) °	
(-5 to -30) dB		0.16 dB 1.6 °	
(-30 to -35) dB		(0.16 to 0.17) dB (1.6 to 1.7) °	
(-35 to -80) dB		0.17 dB 1.7 °	
(0 to -5) dB	(18 to 40) GHz	(0.33 to 0.31) dB (3.4 to 3.3) °	
(-5 to -30) dB		0.31 dB 3.3 °	
(-30 to -35) dB		(0.31 to 0.32) dB (3.3 to 3.4) °	
(-35 to -80) dB		0.32 dB 3.4 °	

IV. Time & Frequency

Parameter/Equipment	Frequency	CMC ^{2, 11} ($\pm$)	Comments
Frequency – Measure			
High Stability Frequency Standard	10 MHz	2.4 μ Hz	Cesium standard & precision phase comparator
Frequency Generators	10 Hz to 1 MHz (1 to 10) MHz 10 MHz 10 MHz to 1 GHz (1 to 10) GHz (10 to 20) GHz (20 to 30) GHz (30 to 40) GHz	0.012 Hz 0.85 mHz 0.85 mHz 0.075 Hz 0.14 Hz 0.26 Hz 0.37 Hz 0.49 Hz	Cesium standard & frequency counter
Frequency – Measuring Equipment	10 Hz to 1 MHz (1 to 10) MHz 10 MHz to 1 GHz	0.058 Hz 0.058 Hz 0.17 Hz	Cesium standard & signal generator
Counters & Timers	(1 to 10) GHz (10 to 20) GHz (20 to 30) GHz (30 to 40) GHz 10 MHz	0.22 Hz 0.37 Hz 0.49 Hz 0.63 Hz 0.067 mHz	Cesium standard

¹ This laboratory offers commercial calibration and field calibration service.

² 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.

³ Field calibration service is available for this calibration. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the Calibration and Measurement Capability Uncertainty (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 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 Uncertainty does not include mismatch error due to connections of the device to other devices in actual use. Mismatch uncertainties, due to the reflection coefficient of the device to be calibrated, are to be included in the overall measurement uncertainty. The approach of determining expanded uncertainties at approximately the 95% level of confidence, (using a coverage factor of $k = 2$) is to be applied for this calculation as well.
- ⁵ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.
- ⁶ The coverage factor of $k = 2$ is used such that the level of confidence corresponds to approximately 95 %.
- ⁷ xx are suffix letters A to Z or number 0 to 9 for RF conformance test system options.
- ⁸ Includes other frequency selective level measuring equipment like Signal Analyzers
- ⁹ CMC for intermediate values of measurand can be found by calculation using Anritsu Corporation Software “Exact Uncertainty”, available on the Anritsu Corporation corporate web site.
- ¹⁰ This scope meets A2LA’s *P112 Flexible Scope Policy*.
- ¹¹ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.
- ¹² Some of the types of instruments calibrated under these parameters are Cell Phone Test System such as W-CDMA TRx/Performance Test System, RF Conformance Test System and 5G Conformance Test System.
- ¹³ For standards or methods listed below without a revision date, laboratories are expected to be competent in the use of the current version within one year of the date of publication of the standard test method or upon the date specified by the standard test method originator when the originator has implementation authority. When a superseded standard or method is required for an accredited test, the scope will include the superseded date/version.
- ¹⁴ Instruments are calibrated against standard’s specifications. These calibrations may also, at customer request, be based on conformance to the calibration requirements of various standards such as 3GPP TS34.121-2, 3GPP TS34.521-3 and 36521-3. Other standards may apply, and the customer should contact the lab for further information.
- ¹⁵ Each parameter shown in the calibration certificate, there is that the calculated parameters based on the indicated parameters defined in the scope. These are defined in the standards listed above, such as UL Measurement Accuracy, DL Output Accuracy and EIRP etc.
- ¹⁶ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC’s are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.



Accredited Laboratory

A2LA has accredited

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Kanagawa-Prf, 243-0032, JAPAN

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. 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 April 2017).



Presented this 28th day of July 2023.

A blue ink signature of Mr. Trace McInturff, written over a horizontal line.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3128.01
Valid to May 31, 2025
Revised August 22, 2023

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