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Electronic Test and Calibration Ltd

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DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC RESISTANCE			
Measurement	*At 10 A:*		
	100 µΩ to 1 mΩ	130 ppm	Other test currents may be used but with increased uncertainties.
	1 mΩ to 10 mΩ	42 ppm	
	At 1 A:		
	10 mΩ to 100 mΩ	37 ppm	
	100 mΩ to 1 Ω	33 ppm	
	From 10 V to 1 kV:		
	200 MΩ to 2 GΩ	0.031 %	
	2 GΩ to 20 GΩ	0.037 %	
	20 GΩ to 200 GΩ	0.042 %	
	200 GΩ to 2 TΩ	0.12 %	
	From 1 kV to 5 kV:		
	200 MΩ to 2 GΩ	0.15 %	
	2 GΩ to 20 GΩ	0.15 %	
	20 GΩ to 200 GΩ	0.16 %	
	200 GΩ to 2 TΩ	0.19 %	
Measurement and generation	0 Ω to 1 Ω	14 µΩ	
	1 Ω to 20 Ω	14 ppm	
	20 Ω to 200 Ω	9.9 ppm	
	200 Ω to 2 kΩ	9.9 ppm	
	2 kΩ to 20 kΩ	10 ppm	
	20 kΩ to 200 kΩ	14 ppm	
	200 kΩ to 2 MΩ	17 ppm	
	2 MΩ to 20 MΩ	20 ppm	
	20 MΩ to 200 MΩ	180 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC RESISTANCE (continued)			
Generation	100 μΩ to 2 mΩ	160 ppm	
	2 mΩ to 20 mΩ	45 ppm	
	20 mΩ to 200 mΩ	42 ppm	
	200 mΩ to 1 Ω	37 ppm	
	10 Ω	6.7 ppm	
	100 Ω	6.0 ppm	
	1 kΩ	6.0 ppm	
	10 kΩ	6.1 ppm	
	100 kΩ	6.3 ppm	
	1 MΩ	12 ppm	
	10 MΩ	14 ppm	
	100 MΩ	140 ppm	
	From 10 V to 1 kV:		
	200 MΩ to 2 GΩ	0.031 %	
	2 GΩ to 20 GΩ	0.037 %	
	20 GΩ to 200 GΩ	0.042 %	
	200 GΩ to 2 TΩ	0.12 %	
	From 1 kV to 5 kV:		
	200 MΩ to 2 GΩ	0.15 %	
	2 GΩ to 20 GΩ	0.15 %	
	20 GΩ to 200 GΩ	0.16 %	
	200 GΩ to 2 TΩ	0.19 %	
DC VOLTAGE			
Generation	0 mV to 200 mV	14 ppm + 0.12 μV	
	200 mV to 2 V	6.6 ppm	
	2 V to 20 V	6.3 ppm	
	20 V to 200 V	6.7 ppm	
	200 V to 1000 V	7.2 ppm	
	1 kV to 30 kV	0.14 %	
Measurement	0 mV to 200 mV	18 ppm + 0.16 μV	
	200 mV to 2 V	8.6 ppm	
	2 V to 20 V	8.4 ppm	
	20 V to 200 V	9.0 ppm	
	200 V to 1000 V	9.7 ppm	
	1 kV to 40 kV	0.14 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
DC CURRENT			
Generation	10 pA to 200 pA	0.056 %	
	200 pA to 2 nA	0.034 %	
	2 nA to 20 nA	0.029 %	
	20 nA to 200 nA	0.023 %	
	200 nA to 2 µA	0.019 %	
	2 µA to 20 µA	0.014 %	
	20 µA to 200 µA	11 ppm	
	200 µA to 2 mA	11 ppm	
	2 mA to 20 mA	12 ppm	
	20 mA to 200 mA	14 ppm	
	200 mA to 1 A	22 ppm	
	1 A to 20 A	46 ppm	
	20 A to 100 A	0.15 %	
Current clamp calibration	0 A to 20 A	0.25 % + 10 µA	Single turn
	0 A to 1000 A	0.34 % + 10 µA	10 or 50 turns
	1000 A to 5000 A	0.36 %	
Measurement	10 pA to 200 pA	0.056 %	
	200 pA to 2 nA	0.038 %	
	2 nA to 20 nA	0.034 %	
	20 nA to 200 nA	0.027 %	
	200 nA to 2 µA	0.023 %	
	2 µA to 20 µA	0.019 %	
	20 µA to 200 µA	14 ppm	
	200 µA to 2 mA	14 ppm	
	2 mA to 20 mA	16 ppm	
	20 mA to 200 mA	27 ppm	
	200 mA to 1 A	39 ppm	
	1 A to 20 A	46 ppm	
	20 A to 100 A	0.15 %	
	100 A to 250 A	0.17 %	
	250 A to 1000 A	0.31 %	
AC VOLTAGE	*100 mHz to 10 Hz*		
	V_{rms} 2.5 mV to 707 V		
	V_{pk} 1000 V maximum	0.15 % + 5.0 µV	
Generation	*10 Hz to 30 Hz*		
	200 mV to 2 V	78 ppm	
	2 V to 20 V	76 ppm	
	20 V to 200 V	85 ppm	
	30 Hz to 300 Hz		
	2 mV to 20 mV	330 ppm	
	20 mV to 200 mV	140 ppm	
	200 mV to 2 V	77 ppm	
	2 V to 20 V	77 ppm	
	20 V to 200 V	85 ppm	
	200 V to 1000 V	91 ppm	40 Hz minimum

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (continued)			
Generation (continued)	*300 Hz to 1 kHz*		
	2 mV to 20 mV	320 ppm	
	20 mV to 200 mV	120 ppm	
	200 mV to 2 V	74 ppm	
	2 V to 20 V	74 ppm	
	20 V to 200 V	82 ppm	
	200 V to 1000 V	91 ppm	
	1 kHz to 10 kHz		
	2 mV to 20 mV	330 ppm	
	20 mV to 200 mV	140 ppm	
	200 mV to 2 V	80 ppm	
	2 V to 20 V	80 ppm	
	20 V to 200 V	88 ppm	
	200 V to 1000 V	100 ppm	
	10 kHz to 30 kHz		
	2 mV to 20 mV	390 ppm	
	20 mV to 200 mV	220 ppm	
	200 mV to 2 V	130 ppm	
	2 V to 20 V	130 ppm	
	20 V to 200 V	130 ppm	
	200 V to 1000 V	140 ppm	
	30 kHz to 100 kHz		
	2 mV to 20 mV	480 ppm	
	20 mV to 200 mV	360 ppm	
	200 mV to 2 V	140 ppm	
	2 V to 20 V	160 ppm	
	20 V to 200 V	170 ppm	
	200 V to 700 V	470 ppm	
	100 kHz to 300 kHz		
	200 mV to 2 V	620 ppm	
	2 V to 20 V	620 ppm	
	300 kHz to 1 MHz		
	200 mV to 2 V	0.12 %	
	2 V to 20 V	0.13 %	
	At 50 Hz		
	1 kV to 7 kV	0.30 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (continued)			
Measurement	*10 Hz to 30 Hz*		
	200 mV to 2 V	110 ppm	
	2 V to 20 V	110 ppm	
	20 V to 200 V	120 ppm	
	30 Hz to 300 Hz		
	2 mV to 20 mV	480 ppm	
	20 mV to 200 mV	160 ppm	
	200 mV to 2 V	110 ppm	
	2 V to 20 V	110 ppm	
	20 V to 200 V	120 ppm	
	200 V to 1000 V	120 ppm	40 Hz minimum
	300 Hz to 1 kHz		
	2 mV to 20 mV	480 ppm	
	20 mV to 200 mV	140 ppm	
	200 mV to 2 V	100 ppm	
	2 V to 20 V	100 ppm	
	20 V to 200 V	120 ppm	
	200 V to 1000 V	120 ppm	
	1 kHz to 10 kHz		
	2.0 mV to 20 mV	490 ppm	
	20 mV to 200 mV	160 ppm	
	200 mV to 2 V	120 ppm	
	2 V to 20 V	120 ppm	
	20 V to 200 V	130 ppm	
	200 V to 1000 V	130 ppm	
	10 kHz to 30 kHz		
	2 mV to 20 mV	540 ppm	
	20 mV to 200 mV	260 ppm	
	200 mV to 2 V	190 ppm	
	2 V to 20 V	190 ppm	
	20 V to 200 V	200 ppm	
	200 V to 1000 V	220 ppm	
	30 kHz to 100 kHz		
	2 mV to 20 mV	620 ppm	
	20 mV to 200 mV	410 ppm	
	200 mV to 2 V	240 ppm	
	2 V to 20 V	250 ppm	
	20 V to 200 V	260 ppm	
	200 V to 700 V	510 ppm	
	100 kHz to 300 kHz		
	200 mV to 2 V	860 ppm	
	2 V to 20 V	860 ppm	
	300 kHz to 1 MHz		
	200 mV to 2 V	0.14 %	
	2 V to 20 V	0.15 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC VOLTAGE (continued)			
Measurement (continued)	*40 Hz to 60 Hz*		
	1 kV to 28 kV	0.30 %	
	60 Hz to 1 kHz		
	1 kV to 4 kV	1.0 %	
AC CURRENT			
Generation	*10 Hz to 300 Hz*		
	10 µA to 200 µA	190 ppm	
	200 µA to 2 mA	170 ppm	
	2 mA to 20 mA	170 ppm	
	20 mA to 200 mA	170 ppm	
	200 mA to 1 A	220 ppm	
	1 A to 10 A	290 ppm	
	300 Hz to 1 kHz		
	10 µA to 200 µA	170 ppm	
	200 µA to 2 mA	150 ppm	
	2 mA to 20 mA	150 ppm	
	20 mA to 200 mA	150 ppm	
	200 mA to 1 A	180 ppm	
	1 A to 10 A	260 ppm	
	1 kHz to 5 kHz		
	10 µA to 200 µA	240 ppm	
	200 µA to 2 mA	210 ppm	
	2 mA to 20 mA	190 ppm	
	20 mA to 200 mA	190 ppm	
	200 mA to 1 A	350 ppm	
	1 A to 10 A	500 ppm	
Current clamp calibration	*10 Hz to 5 kHz*		
	100 µA to 1 A	0.28 %	Single turn
	30 Hz to 5 kHz		
	1 A to 10 A	0.31 %	Single turn
	30 Hz to 100 Hz		
	3.2 A to 100 A	0.66 %	10 or 50 turns
	100 Hz to 440 Hz		
	3.2 A to 100 A	1.8 %	10 or 50 turns
Measurement	*10 Hz to 300 Hz*		
	10 µA to 200 µA	230 ppm	
	200 µA to 2 mA	210 ppm	
	2 mA to 20 mA	210 ppm	
	20 mA to 200 mA	210 ppm	
	200 mA to 1 A	250 ppm	
	1 A to 10 A	290 ppm	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
AC CURRENT (continued)			
Measurement (continued)	*300 Hz to 1 kHz*		
	10 µA to 200 µA	210 ppm	
	200 µA to 2 mA	200 ppm	
	2 mA to 20 mA	190 ppm	
	20 mA to 200 mA	190 ppm	
	200 mA to 1 A	220 ppm	
	1 A to 10 A	260 ppm	
	1 kHz to 5 kHz		
	10 µA to 200 µA	270 ppm	
	200 µA to 2 mA	240 ppm	
	2 mA to 20 mA	220 ppm	
	20 mA to 200 mA	230 ppm	
	200 mA to 1 A	370 ppm	
	1 A to 10 A	400 ppm	
AC HARMONICS AND DISTORTION			

NOTE

The total harmonic distortion of a repetitive waveform (THD) is often defined as the ratio of the RMS values of the harmonics with reference to that of the fundamental. This is referred to herein as THD_F:

$THD_F = \frac{\sqrt{\sum_{n=2}^{\infty} V_n^2}}{V_1}$, where V_1 is the RMS value of the fundamental and V_n is the RMS value of the nth harmonic.

Certain types of distortion analyser use a broad band voltmeter in conjunction with a notch filter. The total signal (including harmonics) is used as a "100 % reference"; the notch filter is then used to remove the fundamental and the residue is displayed as the "THD". This is referred to herein as THD_R, the subscript R referring to the RMS value of the reference voltage. THD_R is defined as:

$THD_R = \sqrt{\frac{\sum_{n=2}^{\infty} V_n^2}{\sum_{n=1}^{\infty} V_n^2}}$, where V is the RMS value of each spectral component.

It should be noted that THD_R cannot exceed 100 % as the total signal is used as the reference, whereas THD_F can have any value. At relatively low values, the two converge, e.g. if THD_F = 10 % then THD_R = 9.5 %. At higher values of THD the differences between the two can be very significant indeed.

For this reason the capabilities described overleaf distinguish clearly between the two definitions.

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
Generation of Harmonic Distortion, THD_R and THD_F	THD_R 0.006 % to 100 % THD_F 0.006 % to 1000 % *30 Hz to 20 kHz* *20 kHz to 50 kHz* *50 kHz to 100 kHz*	 0.62 % to 5.7 % 0.85 % to 5.8 % 1.7 % to 6.4 %	Fundamental: 3 mV to 300 V, 30 Hz to 20 kHz. Harmonic(s): 3 µV to 300 V. Not all combinations of voltage and frequency may be available.
Measurement of Harmonic Distortion, THD_R and THD_F	THD_R 0.00032 % to 100 % THD_F 0.00032 % to 1000 % *30 Hz to 100 kHz*	 0.73 % to 1.8 %	Fundamental: 3 mV to 300 V, 30 Hz to 20 kHz. Harmonic(s): 3 µV to 300 V.
Harmonic Amplitude Measurement and Generation	3 µV to 300 V *30 Hz to 100 kHz*	 0.90 % to 1.7 %	
Flicker Measurement and Generation	In accordance with EN61000-4-15	0.37 %	
CAPACITANCE			
Measurement and generation	*At 100 Hz:* 100 pF to 190 pF 190 pF to 350 pF 350 pF to 1 nF 1 nF to 1 µF 1 µF to 100 µF *At 1 kHz:* 10 pF to 15 pF 15 pF to 25 pF 25 pF to 100 pF 100 pF to 1 µF 1 µF to 100 µF *At 10 kHz:* 10 pF to 25 pF 25 pF to 70 pF 70 pF to 100 nF 100 nF to 1 µF	 0.60 % 0.26 % 0.17 % 0.080 % 0.10 % 0.62 % 0.32 % 0.24 % 0.080 % 0.10 % 0.32 % 0.24 % 0.080 % 0.085 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
INDUCTANCE			
Measurement and Generation	*At 100 Hz:*		
	100 µH to 250 µH	0.59 %	
	250 µH to 600 µH	0.25 %	
	600 µH to 1 mH	0.15 %	
	1 mH to 100 mH	0.11 %	
	100 mH to 1 H	0.27 %	
	At 1 kHz:		
	10 µH to 25 µH	0.59 %	
	25 µH to 60 µH	0.25 %	
	60 µH to 100 µH	0.14 %	
	100 µH to 150 µH	0.14 %	
	150 µH to 1 H	0.092 %	
	At 10 kHz:		
	10 µH to 20 µH	0.14 %	
	20 µH to 1 mH	0.099 %	
	1 mH to 10 mH	0.092 %	
	10 mH to 100 mH	0.13 %	
FREQUENCY MEASUREMENT			
Specific Values	10 MHz	1 in 10^{10}	Can be expressed as average periodic time (1/f) for repetitive waveforms.
Other Values	1 Hz to 1 GHz	12 in 10^9	
	1 GHz to 26.5 GHz	1.3 in 10^9	
TIME INTERVAL	11 ps to 1 ns	2.2 %	Single Event
	1 ns to 10 ns	220 ppm	
	10 ns to 100 ns	22 ppm	
	100 ns to 1 µs	12 ppm	
	1 µs to 100 µs	12 ppm	
	100 µs to 10^5 s	14 in 10^9	
ELECTRICAL SIMULATION OF TEMPERATURE			
Measurement and Generation			
Thermocouple Simulation			
Type K	-270 °C to +1372 °C	0.12 °C to 0.30 °C	Excluding cold junction compensation
Type J	-210 °C to +1200 °C	0.12 °C to 0.23 °C	
Type E	-270 °C to +1000 °C	0.12 °C to 0.22 °C	
Type N	-270 °C to +1300 °C	0.12 °C to 0.27 °C	
Type T	-270 °C to +400 °C	0.12 °C to 0.22 °C	
Type S	0 °C to 1768 °C	0.18 °C to 0.29 °C	
Type R	0 °C to 1768 °C	0.17 °C to 0.28 °C	
Type B	0 °C to 1820 °C	0.19 °C to 0.34 °C	
Thermocouple CJC	Ambient (23 °C)	0.13 °C	
PRT Simulation	-200 °C to 0 °C	0.027 °C to 0.049 °C	
	0 °C to 400 °C	0.049 °C to 0.12 °C	
	400 °C to 850 °C	0.12 °C to 0.21 °C	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF POWER			50 Ω systems only
Specific value	1 mW *50 MHz*	 0.79 %	
Other values (measurement and generation)	-60 dBm to -50 dBm *9 kHz to 20 kHz* *20 kHz to 1 MHz* *1 MHz to 10 MHz* -50 dBm to +20 dBm *9 kHz to 20 kHz* *20 kHz to 1 MHz* *1 MHz to 10 MHz* -62 dBm to -20 dBm *10 MHz to 50 MHz* *50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 10 GHz* *10 GHz to 15 GHz* *15 GHz to 18 GHz* -20 dBm to +20 dBm *10 MHz to 50 MHz* *50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 10 GHz* *10 GHz to 15 GHz* *15 GHz to 18 GHz*	 3.9 % 3.8 % 3.9 % 1.7 % 1.5 % 1.7 % 2.1 % 1.7 % 2.1 % 2.8 % 3.1 % 3.1 % 1.7 % 1.5 % 1.7 % 2.0 % 2.1 % 2.2 %	
Other values (measurement only)	+20 dBm to +55 dBm *9 kHz to 20 kHz* *20 kHz to 1 MHz* *1 MHz to 10 MHz* +20 dBm to +44 dBm *10 MHz to 50 MHz* *50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 10 GHz* *10 GHz to 15 GHz* *15 GHz to 18 GHz* +44 dBm to +55 dBm *10 MHz to 300 MHz* *300 MHz to 1.5 GHz* *1.5 GHz to 4 GHz* *4 GHz to 7 GHz* *7 GHz to 10 GHz* *10 GHz to 12.5 GHz*	 2.1 % 1.9 % 2.1 % 2.1 % 1.9 % 2.2 % 2.7 % 3.3 % 3.6 % 2.8 % 2.5 % 3.6 % 5.4 % 5.6 % 6.9 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF POWER (continued)			
Other values (generation only)	+20 dBm to +50 dBm		
	10 kHz to 20 kHz	2.1 %	
	20 kHz to 1 MHz	1.9 %	
	1 MHz to 20 MHz	2.1 %	
	+20 dBm to +53 dBm		
	20 MHz to 100 MHz	2.1 %	
	100 MHz to 1 GHz	2.8 %	
	+20 dBm to +40 dBm		
	1 GHz to 3 GHz	1.8 %	
RF Calibration Factor (Power Sensor Calibration)	*100 kHz to 0.5 MHz*	0.60 %	50 Ω systems only. Nominal level +10 dBm.
	0.5 MHz to 1 MHz	0.70 %	
	1 MHz to 5 MHz	0.70 %	
	5 MHz to 10 MHz	0.70 %	
	10 MHz to 50 MHz	1.5 %	50 Ω systems only. Nominal level 0 dBm.
	50 MHz to 1 GHz	0.80 %	
	1 GHz to 5 GHz	1.0 %	
	5 GHz to 10 GHz	1.6 %	
	10 GHz to 15 GHz	1.6 %	
	15 GHz to 18 GHz	1.8 %	
	10 MHz to 50 MHz	1.4 %	50 Ω systems only. Nominal level -30 dBm.
	50 MHz to 1.0 GHz	0.90 %	
	1 GHz to 5 GHz	1.1 %	
	5 GHz to 10 GHz	1.8 %	
	10 GHz to 15 GHz	2.0 %	
	15 GHz to 18 GHz	2.2 %	
RF VOLTAGE	200 µV to 1 mV		50 Ω systems only
	9 kHz to 20 kHz	1.0 %	
	20 kHz to 1 MHz	0.92 %	
	1 MHz to 100 MHz	1.0 %	
	100 MHz to 1 GHz	1.6 %	
	1 GHz to 1.5 GHz	2.4 %	
	1 mV to 10 mV		
	9 kHz to 20 kHz	0.95 %	
	20 kHz to 1 MHz	0.82 %	
	1 MHz to 100 MHz	0.93 %	
	100 MHz to 1 GHz	1.6 %	
	1 GHz to 1.5 GHz	2.4 %	
	10 mV to 1 V		
	9 kHz to 20 kHz	0.85 %	
	20 kHz to 1 MHz	0.71 %	
	1 MHz to 100 MHz	0.82 %	
	100 MHz to 1 GHz	1.5 %	
	1 GHz to 1.5 GHz	2.4 %	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF VOLTAGE (continued)	1 V to 10 V		
	9 kHz to 20 kHz	0.85 %	
	20 kHz to 1 MHz	0.71 %	
	1 MHz to 100 MHz	0.82 %	
	100 MHz to 1 GHz	1.5 %	
	1 GHz to 1.5 GHz	2.4 %	
VOLTAGE REFLECTION COEFFICIENT	*5 MHz to 1 GHz*		50 Ω systems only
	0.00 to 0.05	0.016	
	0.05 to 0.1	0.019	
	0.1 to 0.2	0.030	
	0.2 to 0.7	0.090	
	0.7 to 1.0	0.16	
	1 GHz to 2 GHz		
	0.00 to 0.05	0.022	
	0.05 to 0.1	0.023	
	0.1 to 0.2	0.029	
	0.2 to 0.7	0.077	
	0.7 to 1.0	0.11	
	2 GHz to 5 GHz		
	0.00 to 0.05	0.021	
	0.05 to 0.1	0.034	
	0.1 to 0.2	0.065	
	0.2 to 0.7	0.22	
	0.7 to 1.0	0.32	
	5 GHz to 10 GHz		
	0.00 to 0.05	0.026	
	0.05 to 0.1	0.028	
	0.1 to 0.2	0.038	
	0.2 to 0.7	0.11	
	0.7 to 1.0	0.14	
	10 GHz to 15 GHz		
	0.00 to 0.05	0.033	
	0.05 to 0.1	0.035	
	0.1 to 0.2	0.042	
	0.2 to 0.7	0.093	
	0.7 to 1.0	0.13	
	15 GHz to 18 GHz		
	0.00 to 0.05	0.035	
	0.05 to 0.1	0.038	
	0.1 to 0.2	0.050	
	0.2 to 0.7	0.13	
	0.7 to 1.0	0.18	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks

AUTOMATIC NETWORK ANALYSER SYSTEM

VOLTAGE TRANSMISSION COEFFICIENT MAGNITUDE AND PHASE

The CMCs are for 50Ω coaxial systems fitted with Type N, 3.5 mm, 2.92 mm or 2.4 mm connectors over the frequency ranges as specified below. The CMCs are presented in dB terms for magnitude and in degrees for phase.

Type N systems	0 dB	to	40 dB	40 dB	to	50 dB	50 dB	to	60 dB	60 dB	to	70 dB
10 MHz to 100 MHz												
Magnitude	0.085	to	0.11	0.090	to	0.22	0.092	to	0.64	0.11	to	2.0
Phase	0.36	to	0.48	0.41	to	1.4	0.43	to	4.2	0.57	to	13
100 MHz to 1 GHz												
Magnitude	0.085	to	0.11	0.090	to	0.22	0.090	to	0.11	0.090	to	0.21
Phase	0.36	to	0.48	0.41	to	0.48	0.42	to	0.57	0.45	to	1.3
1 GHz to 12 GHz												
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.090	0.090	to	0.091
Phase	0.45	to	1.5	0.48	to	1.5	0.48	to	1.5	0.48	to	1.5
12 GHz to 18 GHz												
Magnitude	0.085	to	0.11	0.090	to	0.090	0.090	to	0.090	0.090	to	0.090
Phase	1.5	to	2.0	1.5	to	2.0	1.5	to	2.0	1.5	to	2.0

3.5 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB
50 MHz to 1 GHz									
Magnitude	0.085	to	0.091	0.090	to	0.20	0.090	to	0.56
Phase	0.36	to	0.55	0.42	to	1.2	0.45	to	3.7
1 GHz to 12 GHz									
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.091
Phase	0.45	to	1.5	0.48	to	1.5	0.49	to	1.5
12 GHz to 26.5 GHz									
Magnitude	0.085	to	0.090	0.090	to	0.090	0.090	to	0.090
Phase	1.5	to	2.8	1.5	to	2.8	1.5	to	2.8

2.92 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB
50 MHz to 100 MHz									
Magnitude	0.057	to	0.066	0.063	to	0.19	0.064	to	0.56
Phase	0.36	to	0.42	0.41	to	1.2	0.57	to	3.7
100 MHz to 26.5 GHz									
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.066
Phase	0.36	to	1.9	0.41	to	1.9	0.44	to	1.9
26.5 GHz to 40 GHz									
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.071
Phase	1.9	to	2.6	1.9	to	2.6	1.9	to	2.6

2.4 mm systems	0 dB	to	40 dB (50 dB)	40 dB (50 dB)	to	60 dB	60 dB	to	70 dB
50 MHz to 1 GHz									
Magnitude	0.057	to	0.066	0.063	to	0.19	0.064	to	0.56
Phase	0.36	to	0.55	0.42	to	1.2	0.44	to	3.7
1 GHz to 5 GHz									
Magnitude	0.057	to	0.063	0.063	to	0.064	0.064	to	0.066
Phase	0.41	to	0.66	0.45	to	0.67	0.45	to	0.67
5 GHz to 26.5 GHz									
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.070
Phase	0.64	to	1.9	0.66	to	1.9	0.67	to	1.9
26.5 GHz to 40 GHz									
Magnitude	0.057	to	0.063	0.063	to	0.064	0.063	to	0.071
Phase	1.9	to	2.6	1.9	to	2.6	1.9	to	2.6

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks

AUTOMATIC NETWORK ANALYSER SYSTEM

VOLTAGE REFLECTION COEFFICIENT MAGNITUDE

The CMCs are for 50Ω coaxial systems fitted with Type N, 3.5 mm, 2.92 mm or 2.4 mm connectors over the frequency ranges as specified below. The CMCs are presented in VRC terms.

Commector type	Frequency	VRC range 0.0 to 0.2			VRC range 0.2 to 1.0		
Type N	10 MHz to 1 GHz	0.0061	to	0.0062	0.0062	to	0.012
	1 GHz to 12 GHz	0.0061	to	0.0078	0.0062	to	0.017
	12 GHz to 18 GHz	0.0077	to	0.0078	0.0077	to	0.018
3.5 mm	50 MHz to 1 GHz	0.00050	to	0.0010	0.00080	to	0.0015
	1 GHz to 12 GHz	0.00080	to	0.0020	0.0010	to	0.0028
	12 GHz to 26.5 GHz	0.0019	to	0.0024	0.0019	to	0.0037
2.92 mm	50 MHz to 1 GHz	0.0072	to	0.0073	0.0075	to	0.019
	1 GHz to 26.5 GHz	0.0072	to	0.018	0.0075	to	0.029
	26.5 GHz to 40 GHz	0.012	to	0.015	0.011	to	0.029
2.4 mm	50 MHz to 1 GHz	0.0019	to	0.0023	0.0020	to	0.0045
	1 GHz to 26.5 GHz	0.0023	to	0.0031	0.0023	to	0.0069
	26.5 GHz to 40 GHz	0.0031	to	0.0037	0.0031	to	0.0084

VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180°			
Type N systems			
VRC 0.0000 to 0.0003	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	175° to 180° 175° to 180° 180°	
VRC 0.0003 to 0.0005	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	87° to 175° 87° to 180° 109° to 180°	
VRC 0.0005 to 0.001	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	70° to 87° 70° to 110° 87° to 110°	
VRC 0.001 to 0.01	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	35° to 70° 35° to 88° 44° to 88°	
VRC 0.01 to 0.1	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	3.5° to 70° 3.4° to 44° 4.4° to 44°	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180° (continued)			
Type N systems (continued)			
VRC 0.1 to 1	*10 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 18 GHz*	0.69° to 3.5° 0.69° to 4.4° 1.0° to 4.4°	
3.5 mm systems			
VRC 0.0000 to 0.0001	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	103° to 180° 138° to 180° 180°	
VRC 0.0001 to 0.0005	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	32° to 139° 49° to 180° 105° to 180°	
VRC 0.0005 to 0.001	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	32° to 49° 49° to 180° 105° to 106°	
VRC 0.001 to 0.01	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	2.7° to 49° 4.6° to 105° 10° to 131°	
VRC 0.01 to 0.1	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	0.30° to 4.6° 0.48° to 10° 1.0° to 10°	
VRC 0.1 to 1	*50 MHz to 1 GHz* *1 GHz to 12 GHz* *12 GHz to 26.5 GHz*	0.083° to 0.28° 0.083° to 0.53° 0.16° to 0.66°	
2.92 mm systems			
VRC 0.000 to 0.003	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	137° to 180° 136° to 180° 180° 180°	
VRC 0.003 to 0.004	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	103° to 137° 103° to 193° 145° to 180° 175° to 180°	
VRC 0.004 to 0.005	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	82° to 103° 82° to 145° 116° to 177° 140° to 177°	
VRC 0.005 to 0.01	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	41° to 82° 41° to 116° 58° to 142° 70° to 142°	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
VOLTAGE REFLECTION COEFFICIENT PHASE, 0° to ±180° (continued)			
2.92 mm systems (continued)			
VRC 0.01 to 0.1	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	4.1° to 41° 4.1° to 58° 5.8° to 71° 7.0° to 71°	
VRC 0.1 to 1	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	1.1° to 4.1° 1.1° to 5.8° 1.2° to 7.0° 1.6° to 7.0°	
2.4 mm systems			
VRC 0.000 to 0.001	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	107° to 180° 130° to 180° 170° to 180° 176° to 180°	
VRC 0.001 to 0.002	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	52° to 130° 64° to 177° 84° to 176° 87° to 180°	
VRC 0.002 to 0.003	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	35° to 64° 43° to 88° 56° to 86° 58° to 107°	
VRC 0.003 to 0.004	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	27° to 43° 32° to 58° 42° to 58° 44° to 71°	
VRC 0.004 to 0.005	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	21° to 32° 25° to 44° 33° to 44° 35° to 53°	
VRC 0.005 to 0.01	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	10° to 25° 13° to 35° 17° to 35° 17° to 43°	
VRC 0.01 to 0.1	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	1.0° to 13° 1.3° to 17° 1.7° to 17° 2.1° to 21°	
VRC 0.1 to 1	*50 MHz to 1 GHz* *1 GHz to 5 GHz* *5 GHz to 26.5 GHz* *26.5 GHz to 40 GHz*	0.25° to 1.3° 0.25° to 1.8° 0.36° to 1.7° 0.38° to 2.1°	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF ATTENUATION			50 Ω systems only
Tuned receiver method	0 dB to 30 dB		
	9 kHz to 100 kHz	0.032 dB	
	100 kHz to 10 MHz	0.032 dB	
	10 MHz to 50 MHz	0.032 dB	
	50 MHz to 1 GHz	0.051 dB	
	1 GHz to 5 GHz	0.055 dB	
	5 GHz to 10 GHz	0.087 dB	
	10 GHz to 15 GHz	0.12 dB	
	15 GHz to 18 GHz	0.13 dB	
	30 dB to 60 dB		
	9 kHz to 100 kHz	0.045 dB	
	100 kHz to 10 MHz	0.045 dB	
	10 MHz to 50 MHz	0.045 dB	
	50 MHz to 1 GHz	0.072 dB	
	1 GHz to 5 GHz	0.079 dB	
	5 GHz to 10 GHz	0.12 dB	
	10 GHz to 15 GHz	0.16 dB	
	15 GHz to 18 GHz	0.18 dB	
	60 dB to 70 dB		
	9 kHz to 100 kHz	0.055 dB	
	100 kHz to 10 MHz	0.055 dB	
	10 MHz to 50 MHz	0.055 dB	
	50 MHz to 1 GHz	0.088 dB	
	1 GHz to 5 GHz	0.097 dB	
	5 GHz to 10 GHz	0.14 dB	
	10 GHz to 15 GHz	0.20 dB	
	15 GHz to 18 GHz	0.22 dB	
	70 dB to 80 dB		
	9 kHz to 100 kHz	0.080 dB	
	100 kHz to 10 MHz	0.056 dB	
	10 MHz to 50 MHz	0.056 dB	
	50 MHz to 1 GHz	0.088 dB	
	1 GHz to 5 GHz	0.097 dB	
	5 GHz to 10 GHz	0.15 dB	
	10 GHz to 15 GHz	0.20 dB	
	15 GHz to 18 GHz	0.22 dB	
	80 dB to 90 dB		
	9 kHz to 100 kHz	0.13 dB	
	100 kHz to 10 MHz	0.067 dB	
	10 MHz to 50 MHz	0.063 dB	
	50 MHz to 1 GHz	0.093 dB	
	1 GHz to 5 GHz	0.10 dB	
	5 GHz to 10 GHz	0.15 dB	
	10 GHz to 15 GHz	0.23 dB	
	15 GHz to 18 GHz	0.24 dB	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF ATTENUATION (continued)			50 Ω systems only
Tuned receiver method (continued)	90 dB to 100 dB		
	9 kHz to 100 kHz	0.29 dB	
	100 kHz to 10 MHz	0.14 dB	
	10 MHz to 50 MHz	0.12 dB	
	50 MHz to 1 GHz	0.15 dB	
	1 GHz to 5 GHz	0.16 dB	
	5 GHz to 10 GHz	0.22 dB	
	10 GHz to 15 GHz	0.35 dB	
	15 GHz to 18 GHz	0.37 dB	
	100 dB to 110 dB		
	9 kHz to 100 kHz	0.67 dB	
	100 kHz to 10 MHz	0.48 dB	
	10 MHz to 50 MHz	0.33 dB	
	50 MHz to 1 GHz	0.34 dB	
	1 GHz to 5 GHz	0.36 dB	
	5 GHz to 10 GHz	0.39 dB	
	10 GHz to 15 GHz	0.76 dB	
	15 GHz to 18 GHz	1.3 dB	
Power meter method	0 dB to 25 dB		
	9 kHz to 20 kHz	0.050 dB	
	20 kHz to 1 MHz	0.029 dB	
	1 MHz to 10 MHz	0.025 dB	
	10 MHz to 50 MHz	0.032 dB	
	50 MHz to 1 GHz	0.030 dB	
	1 GHz to 5 GHz	0.033 dB	
	5 GHz to 10 GHz	0.046 dB	
	10 GHz to 15 GHz	0.060 dB	
	15 GHz to 18 GHz	0.061 dB	
	25 dB to 60 dB		
	9 kHz to 20 kHz	0.053 dB	
	20 kHz to 1 MHz	0.035 dB	
	1 MHz to 10 MHz	0.032 dB	
	10 MHz to 50 MHz	0.032 dB	
	50 MHz to 1 GHz	0.031 dB	
	1 GHz to 5 GHz	0.035 dB	
	5 GHz to 10 GHz	0.054 dB	
	10 GHz to 15 GHz	0.078 dB	
	15 GHz to 18 GHz	0.078 dB	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
RF ATTENUATION (continued)			50 Ω systems only
Power meter method (continued)	60 dB To 70 dB		
	9 kHz to 20 kHz	0.24 dB	
	20 kHz to 1 MHz	0.23 dB	
	1 MHz to 10 MHz	0.23 dB	
	10 MHz to 50 MHz	0.12 dB	
	50 MHz to 1 GHz	0.12 dB	
	1 GHz to 5 GHz	0.12 dB	
	5 GHz to 10 GHz	0.13 dB	
	10 GHz to 15 GHz	0.14 dB	
	15 GHz to 18 GHz	0.14 dB	
FREQUENCY MODULATION	0 Hz to 40 kHz	2.6 % + 2.0 Hz	Carrier frequency range 250 kHz to 10 MHz; modulation frequency range 20 Hz to 10 kHz
	0 Hz to 400 kHz	1.6 % + 16 Hz	Carrier frequency range 10 MHz to 1.3 GHz; modulation frequency range 20 Hz to 200 kHz
AMPLITUDE MODULATION			Ranges and uncertainties are shown in terms of modulation index
	0 to 0.05	4.3 % + 0.00020	Carrier frequency range 150 kHz to 10 MHz; modulation frequency range 20 Hz to 10 kHz.
	0.05 to 0.3	3.1 % + 0.00020	
	0.3 to 0.5	2.8 % + 0.0020	
	0.5 to 0.9	2.6 % + 0.0020	
	0 to 0.05	3.7 % + 0.00020	Carrier frequency range 10 MHz to 1.3 GHz; modulation frequency range 20 Hz to 100 kHz.
	0.05 to 0.3	3.7 % + 0.00020	
	0.3 to 0.5	1.8 % + 0.0020	
	0.5 to 0.9	1.6 % + 0.0020	
PHASE MODULATION	0 radian to 400 radian	3.7 % + 0.0020 radian	Carrier frequency range 10 MHz to 1.3 GHz; modulation frequency range 20 Hz to 20 kHz
RF INTERMODULATION PRODUCTS	0 dB to -80 dB		
	10 kHz to 110 MHz	0.94 dB	
	110 MHz to 18 GHz	1.9 dB	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
PULSE TRANSITION TIME	1 ns to 1 s	2.9 %	For the calibration of Waveform Generators
PULSE WIDTH	1 ns to 1 s	1.2 %	
VOLTAGE AMPLITUDE	0.1 kV to 6.6 kV	3.0 %	
ELECTROSTATIC VOLTAGE	0.1 kV to 30 kV	1.0 %	Fieldmeters for measuring charged surfaces
HIGH IMPEDANCE CONTACT VOLTAGE	0.1 kV to 30 kV	0.70 %	Electrostatic voltmeter and other high resistance voltmeters for measuring charged surfaces
ELECTROSTATIC DISCHARGE GENERATORS			
Air discharge voltage Pulse transition time Peak current Decay current	0.5 kV to 30 kV 500 ps to 50 ns 0.1 A to 30 A 0.1 A to 30 A	0.73 % 2.2 % 3.7 % 5.0 %	EN61000-4-2:2009 EN61000-4-2:1995 ISO10605:2008 EN61340-3-1:2007 MIL-STD-331C:2005 Corr 1:2009 (Personnel) EIA/JES22-A114-B June 2000 EIA/JES22-A115-A October 1997 The measurement bandwidth is the lowest specified by the associated standard.
BURST TRANSIENT GENERATOR CHARACTERISTICS			
Transition time Pulse width Burst duration Burst period Frequency Peak voltage	3.5 ns to 50 s 10 ns to 100 ns 100 µs to 100 ms 1 ms to 1 s 1 kHz to 1 MHz 0.1 kV to 5 kV	0.91 % 0.91 % 0.91 % 0.14 % 0.91 % 2.6 %	For the calibration of Electrical Fast Transient generators and CDNs to 61000-4-4
SURGE PULSE CHARACTERISTICS			
Risetime and falltime Pulse width Repetition rate Phase angle Voltage amplitude Current amplitude	0.1 µs to 1.0 s 0.6 µs to 1.0 ms 1.0 s to 100 s 0° to 360° 0.25 kV to 6.6 kV 0.2 kA to 3.3 kA	2.3 % 1.5 % 0.030 % 1.3° 2.6 % 2.9 %	For the calibration of Surge generators to 61000-4-5
RF IMPEDANCE	5 Ω to 60 Ω *9.0 kHz to 30 MHz*	4.6 %	For impedance calibration of line impedance stabilisation networks (LISNs)

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
IMPULSE GENERATOR MEASUREMENTS	50 dBµV to 110 dBµV		
	9 kHz to 30 MHz	0.55 dB	
	30 MHz to 300 MHz	0.53 dB	
	300 MHz to 1 GHz	0.55 dB	
IMPULSE GENERATION			
Absolute and relative amplitude	50 dBµV to 110 dBµV		
	9 kHz to 150 kHz	0.25 dB	
Absolute amplitude	50 dBµV to 110 dBµV		
	150 kHz to 30 MHz	0.80 dB	
	30 MHz to 300 MHz	1.1 dB	
	300 MHz to 1 GHz	1.6 dB	
Relative amplitude	50 dBµV to 110 dBµV		
	150 kHz to 30 MHz	0.50 dB	
	30 MHz to 300 MHz	0.60 dB	
	300 MHz to 1 GHz	0.90 dB	
VOLTAGE DIPS, SHORT INTERRUPTIONS VOLTAGE VARIATIONS GENERATORS			
Dip RMS Voltage	1 V to 400 V	2.3 %	
Voltage Variations	1 V to 400 V	3.5 %	
Interruptions Overshoot Voltage	25 % to 100 %	3.5 %	
Transition rise and fall time	1 us to 1 s	3.0 %	
Phase Angle	0° to 360°	11°	
Damped Oscillatory Generators			
Voltage	100 V to 6.6 kV		
	Frequency ≤1 MHz	2.1 %	
	Frequency 1 MHz to 50 MHz	2.9 %	
Ringwave Current	1 A to 400 A	2.8 %	
Oscillatory Wave Current	1 A to 150 A	3.6 %	
Impedance	5 Ω to 500 Ω	4.6 %	
Transition time	1 ns to 10 µs	0.91 %	
Frequency	10 kHz to 100 MHz	0.91 %	
Repetition Rate	100 µs to 1 s	0.91 %	
Burst Duration	1 ms to 5 s	0.91 %	
Burst Period	1 ms to 1 s	0.14 %	
Phase	0° to 360°	3.3°	

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks
ANTENNA MEASUREMENTS			
Monopole Antenna Antenna Factor	20 Hz to 30 MHz 30 MHz to 100 MHz	1.4 dB/m 1.6 dB/m	Equivalent capacitance method.
Antenna Factor and Apparent Gain			Best capability using the three antenna method or by comparison with similar antennas using the standard antenna method.
Biconical and Broad Band Dipoles	20 MHz to 300 MHz 300 MHz to 1.0 GHz	1.5 dB (1.8 dB at 1 m) 1.5 dB (1.8 dB at 1 m)	Measurement distance 10 m, 3 .0 m and 1.0 m.
Log Periodic	80 MHz to 18.0 GHz	1.5 dB (1.6 dB at 1 m)	Measurement distances 3.0 m and 1.0 m; calculated results for 10 m and for Free Space.
Bilog and hybrid antennas	20 MHz to 18.0 GHz	1.5 dB (1.8 dB at 1 m)	Measurement distances 3.0 m and 1.0 m; calculated results for 10 m and for Free Space.
Horn Antennas	200 MHz to 1.0 GHz 1.0 GHz to 18.0 GHz 18.0 to 26.5 GHz	1.5 dB 1.5 dB 1.5 dB	Horn measurement at 3.0 m and 1.0 m.
Voltage Reflection Coefficient	30 MHz to 1.0 GHz 1.0 GHz to 18.0 GHz	0.090 0.129	
END			

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest uncertainty of measurement that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors. The CIPM-ILAC definition of the CMC is as follows:

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e. one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples, and an indication of how they are to be interpreted, are shown below.

DC voltage, 100 mV to 1 V: 0.0025 % + 5.0 µV:

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

Hydraulic pressure, 0.5 MPa to 140 MPa: 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is 0.0036 %·p + ($0.12 \cdot 10^{-6} \cdot p \cdot 10^{-6}$) + 4.0 Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.