

CERTIFICATE OF RECOGNITION

JEL Limited

Technical Center: 3032 Nakabyo, Abiko-shi, Chiba-ken zip 270-1121 Japan

Abiko Test Site: 2971 Nakabyo, Abiko-Shi, Chiba-Ken zip 270-1121 Japan

has been recognized to carry out product tests under supervision of TÜV NORD. It has successfully demonstrated capability to conduct product test according to

**Product Testing Standards as listed in
the Scope of Authorization on the attachment to this certificate**

An assessment of the facility was conducted by TÜV NORD assessors according to the TÜV NORD requirements for "Test Facility Recognition Criteria" with reference to

ISO/IEC 17025

Certificate No.: TNTW1602R-02

Valid until: 24.09.2019

TÜV NORD
Taiwan Taichung, 25.09.2018


Product Certification


Assessor

Attachment to

CERTIFICATE OF RECOGNITION

Scope of Authorization for

JEL Limited

Technical Center: 3032 Nakabyo, Abiko-shi, Chiba-ken zip 270-1121 Japan

Abiko Test Site: 2971 Nakabyo, Abiko-Shi, Chiba-Ken zip 270-1121 Japan

Standards

Listed in the American Association for laboratory Accreditation (A2LA) Certification of Accreditation, Accreditation Certificate Number : 0952.04 and 0952.01 both
And also listed in the DAkks (Deutsche Akkreditierungsstelle GmbH) accreditation certificate D-PL-12156-01-00

Or see the scope pages as appendix of Calibration and EMC scope page respectively for details.

Certificate No.: TNTW1602R-02

Taiwan Taichung, 25.09.2018
Country, Date


Product Certification

Scope of EMC testing

CISPR 11 / EN 55011 / AS/NZS CISPR 11
ICES-003

CISPR 14-1 / EN55014-1 / AS/NZS CISPR 14-1 J55014-1
CISPR 14-2 / EN 55014-2

CISPR 22 /EN 55022 / AS/NZS CISPR 22
CISPR 32 /EN 55032 / AS/NZS CISPR 32
CAN/CSA-CEI/IEC CISPR 22
CFR 47 FCC Part 15, Subpart B (using ANSI C63.4, ICES-003
VCCI V-3 (up to 6 GHz) J55022

CISPR 24 / EN 55024

IEC/EN/JIS C 61000-3-2;
IEC/EN 61000-3-3
IEC/EN 61000-3-11
IEC/EN 61000-3-12

IEC/EN 61000-6-1
IEC/EN 61000-6-2
IEC/EN 61000-6-3;
IEC/EN 61000-6-4;

IEC/EN 60601-1-2
IEC/EN 61326-1
IEC/EN 61326-2-1
IEC/EN 61326-2-2
IEC/EN 61326-2-3
CISPR 35/EN 55035
ETSI EN 301 489-1, ETSI EN 301 489-3, ETSI EN 301 489-6, ETSI EN 301 489-17

EN 50130-4

Scope of calibration

I. Electrical – DC/Low Frequency

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
AC Voltage –			
(1.0 to 2.2) mV	50 Hz to 10 kHz	0.62 %	Fluke 5720A
(2.2 to 22) mV	50 Hz to 10 kHz	0.21 %	
(22 to 220) mV	50 Hz to 10 kHz	0.084 %	
(0.22 to 2.2) V	20 Hz to 100 kHz	0.054 %	
(2.2 to 22) V	20 Hz to 100 kHz	0.064 %	
(22 to 220) V	20 Hz to 100 kHz	0.26 %	
(220 to 1000) V	50 Hz to 1 kHz	0.18 %	

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
AC Current –			
(100 to 220) uA	(50 Hz to 60Hz)	0.11 %	Fluke 5720A
(0.22 to 220) mA	(50 Hz to 60Hz)	0.065 %	
(0.22 to 2.2) A	(50 Hz to 60Hz)	0.58 %	
1 mA to 60 A	(50, 60, 400, 800) Hz	0.22 %	Yokogawa 255800-1/B

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
DC Voltage –	(1 to 220) mV (0.22 to 2.2) V (2.2 to 1000) V	0.0029 % 0.0010 % 0.0053 %	Fluke 5720A
DC Current –	10 µA to 2.2 A 12 µA to 36 A	0.040 % 0.27 %	Fluke 5720A Yokogawa 256042-1/B
Resistance –	(0.1 to 1111.21) Ω 0 Ω	0.52 % 100 µΩ	Yokogawa 2793 01 Fluke 5720A
	1 kΩ to 111.11 MΩ	0.23 %	Yokogawa 2793 03 Fluke 5720A

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
Oscilloscope –			
DC Output	DC	0.020 %	Agilent 34401A
AC Output	DC to 2 GHz	0.028 %	Agilent 34401A
Time Interval Accuracy	DC to 2 GHz	0.23 %	Rohde & Schwarz SMY02
Input Impedance	DC to 2 GHz	0.45 %	Agilent 34401A
DC Voltage Measurement Accuracy	DC	1.3 %	Agilent 34401A
Bandwidth	DC to 2 GHz	0.31 dB	Rohde & Schwarz SMY02, power sensor E9304A and power meter E4417A
Trigger Sensitivity	DC to 2 GHz	1.6 %	Rohde & Schwarz SMY02
Zero Error	DC to 2 GHz	7.0 %	Agilent 34401A
Offset Gain	DC to 2 GHz	0.12 %	
DC Gain	DC	0.12 %	

II. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor – Biconical Antennas			
10 Meters	(30 to 300) MHz	0.59 dB	ANSI C63.5:2017 using standard site method w/ HP 4396A and HP 87512A
10 Meters	(30 to 300) MHz	1.1 dB	ANSI C63.5:2017 using reference antenna method w/ R&S SMY02

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor – (cont)			
Biconical Antennas			
(3 and 10) Meters	(30 to 300) MHz (300 to 1000) MHz	1.2 dB 2.5 dB	ANSI C63.5: 1998 using standard site method w/ HP 4396A and Agilent 87512A
10 Meters	(30 to 300) MHz (300 to 1000) MHz	1.2 dB 2.5 dB	ANSI C63.5:2006 using standard site method and reference antenna methods w/ HP 4396A, Agilent 87512A and R&S SMY02
Log Periodic Antennas			
10 Meters	(200 to 1000) MHz	0.88 dB	ANSI C63.5:2017 using standard site method w/ HP 4396A and HP 87512A
10 Meters	(300 to 1000) MHz	1.3 dB	ANSI C63.5:2017 using reference antenna method w/ R&S SMY02
(3 and 10) Meters	(200 to 1000) MHz	3.2 dB	ANSI C63.5: 1998 using standard site method w/ HP 4396A and Agilent 87512A
10 Meters	(200 to 1000) MHz	3.2 dB	ANSI C63.5:2006 using standard site method and Reference antenna method w/ HP 4396A and Agilent 87512A
10 Meters	(300 to 1000) MHz	1.0 dB	ANSI C63.5: 1998, 2006 using reference antenna method w/ R&S SMY02

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Factor – (cont)			
Dipole Antenna			
10 Meters	(30 to 300) MHz (300 to 1000) MHz	0.91 dB 1.0 dB	ANSI C63.5:2017 using reference antenna method with R&S SMY02
10 Meters	(30 to 300) MHz (300 to 1000) MHz	1.3 dB 1.4 dB	ANSI C63.5: 1998, 2006 using reference antenna method w/ R&S SMY02
Horn Antennas	(1 to 18) GHz	1.4 dB	ANSI C63.5:2017 using standard site method w/ Agilent N5230A
	(1 to 18) GHz	2.1 dB	ANSI C63.5: 1998, 2006 using Standard Site method and Reference antenna method w/ Agilent E4446A, Agilent E8257D
Monopole Antenna	(1 to 18) GHz	2.3 dB	w/ AgilentN5230A
	100 kHz to 50 MHz	2.5 dB	CISPR 25:2008, CISPR 16-1-4:2010 and A1:2012, CISPR 16-1- 6:2014 ECSCM w/ R&S, ESHS10 and ESVS10 and SMY02
Antenna Balance –			
Biconical Antennas	(30 to 300) MHz	0.50 dB	CISPR 16-1-4:2010 and A1:2012, CISPR 16-1- 6:2014 ANSI C63.5:2006, IEEE291:1991 w/ Agilent 4396A, Agilent 87512A and Agilent 8753D

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Antenna Cross-Polarization – Log.Per. Antennas	(200 to 1000) MHz	0.60 dB	CISPR 16-1-4:2010 and A1:2012, CISPR 16-1-6:2014 ANSI C63.5:2006, IEEE291:1991 w/ Agilent 4396A, Agilent 87512A and Agilent 8753D
Horn Antennas	(1 to 18) GHz	0.80 dB	CISPR 16-1-4 2007, A1 2007 CISPR 16-1-6:2014, ANSI C63.5:2006 IEEE291:1991 w/ Agilent E4446A, Agilent E8257D
	(1 to 18) GHz	2.1 dB	CISPR 16-1-4 2007, A1 2007 CISPR 16-1-6:2014 ANSI C63.5:2006 IEEE291:1991 w/ Agilent N5230A
LISN –			
Impedance	9 kHz to 30 MHz 30 kHz to 1 GHz	3.0 % 0.98 %	CISPR 16-1-2:2014, CISPR 16-4-1:2009, CISPR 16-4-2:2011 and A1:2014, CISPR 16-4-3:2004 and A1:2006, CISPR 16-4-4:2007, ANSI C63.4:2014 using Agilent 4395A, Agilent 87512A and Agilent 85032B
Phase	9 kHz to 30 MHz	0.51 °	
Decoupling Factor	9 kHz to 1 GHz	1.7 dB	
Voltage Division Factor	9 kHz to 30 MHz 30 kHz to 1 GHz	0.12 dB 0.34 dB	
VSWR	9 kHz to 30 MHz	2.1 %	

Parameter/Equipment	Frequency	CMC ² (±)	Comments
ISN (Impedance Stabilization Network) –			
Termination Impedance	(0.1 to 80) MHz	0.35 Ω	CISPR 22:2008, EN 55022:2010, HP 4396A w/ Agilent 85046B, 4395A w/ 87512A, 85032B Type N calibration kit CISPR 22:2008, EN 55022:2010 with HP 8753D
Phase of Basic Network for Asymmetric Disturbance	(0.1 to 80) MHz	0.74 °	
Voltage Division Factor	(0.1 to 80) MHz	0.76 dB	
Insertion Loss	(0.1 to 80) MHz	0.76 dB	
Decoupling Attenuation	(0.1 to 80) MHz	0.70 dB	
Longitudinal Conversion Loss (LCL)	(0.1 to 80) MHz	0.73 dB	
Asymmetric Attenuation	(0.1 to 80) MHz	1.4 dB	
Amplifier –			
Gain	30 kHz to 3 GHz	0.60 dB	HP 8753D
	(2 to 18) GHz	1.1 dB	Agilent E8257D and Agilent E4418A w/ Agilent E4412A
Linearity	30 kHz to 3 GHz	2.0 dB	HP 8753D
	(2 to 18) GHz	1.4 dB	Agilent E8257D and Agilent E4418A w/ Agilent E4412A
Harmonic Distortion	100 kHz to 1.8 GHz	1.8 dB	Agilent E4446A
Absorbing Clamp –			
Clamp Factor	(30 to 300) MHz (300 to 1000) MHz	2.9 dB 3.0 dB	Ordinal method CISPR 16-1-3:2004, CISPR 16-1-3, Corrigendum 1:2006
Clamp Factor	(30 to 300) MHz (300 to 1000) MHz	1.8 dB 2.1 dB	
Decoupling Factor DF	(30 to 300) MHz	0.57 dB	
Decoupling Factor DR	(30 to 300) MHz	0.58 dB	

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
Capacitive Voltage Probe – Pulse Response	100 kHz to 30 MHz	0.83 dB	CISPR 16-1-2:2014, ANSI C63.4:2014, CISPR 16-1-1:2015 w/ IGUU2916
Relative Pulse Response	100 kHz to 30 MHz	1.1 dB	Network analyzer 4396A and 85046A
CW Response (Voltage Division Factor)	100 kHz to 30 MHz	1.3 dB	
Decoupling	100 kHz to 30 MHz	0.44 dB	Generator and receiver SMY02 and FCKL1528
	100 kHz to 30 MHz	1.9 dB	Network analyzer 8753D
	100 kHz to 30 MHz	1.9 dB	Generator and receiver SMY02 and FCKL1528
CDN – Coupling Factor	100 kHz to 230 MHz	0.87 dB	IEC 61000-4-6: 2013, EN 61000-4-6:2014, HP 4396A and Agilent 85046A and Agilent 85032B Type N calibration kit
Impedance	100 kHz to 230 MHz	1.1 %	
EFT/Burst Generator –			IEC 61000-4-4:2012 w/ DSO80204B oscilloscope
Peak Voltage	250 V to 5 kV	2.8 %	
Rise Time	5 ns	5.8 %	
Pulse Duration	50 ns	1.2 %	
Pulse Repetition Frequency	(5 to 100) kHz	0.50 %	
Burst Period	300 ms	0.20 %	
Burst Duration	15 ms	0.80 %	
	0.75 ms	0.80 %	

Parameter/Equipment	Range	CMC ² (±)	Comments
CISPR Pulse Generator⁶			
– Impulse Area	Band A Band B Band C and D	47 nVs 1.1 nVs 0.18 nVs	Agilent 86100C w/ Agilent 86112A (uncertainty based on Schwarzbeck IGUU 2916)
Impulse Bandwidth	Band A Band B Band C and D	3.7 ns 0.015 ns 0.020 ns	
Null Point Frequency	Band A Band B Band C and D	0.046 MHz 3.5 MHz 41 MHz	Agilent E4446A (uncertainty based on Schwarzbeck IGUU 2916)
Flatness of Spectrum Amplitude	Band A Band B Band C and D	0.45 dB 0.45 dB 0.57 dB	Agilent E4446A (uncertainty based on Schwarzbeck IGUU 2916)
Pulse Repetition Frequency	Band A Band B Band C and D	0.000 50 Hz 0.000 90 Hz 0.000 75 Hz	Agilent 53132A and Symmetricom 8040C (uncertainty based on Schwarzbeck IGUU 2916)
Source Errors for Sinewave Output for CISPR Checks (@ 60 dB μ V)	(1, 10, and 100) MHz	0.11 dB	Agilent E4417A w/ Agilent E9304A (uncertainty based on Schwarzbeck IGUU 2916)

Parameter/Equipment	Range	CMC ² (±)	Comments
EMI Receiver ⁴ – Input Impedance	Band A	0.75 dB	CISPR16-1-1:2010 and A1:2010, CISPR16-1-1:2015, CISPR16-4-2:2011 and A1:2014, ANSI C63.2:1996, HP 4396A and HP 85032B HP 4395A and HP 87512A Type N calibration kit, Agilent 11692D and Agilent 773D
	Band B	0.75 dB	
	Band C	1.2 dB	
	Band D	1.2 dB	
	Band E	1.3 dB	
Pulse Response	Band A	0.80 dB	Schwarzbeck IGUU2916
	Band B	0.80 dB	
	Band C	0.77 dB	
	Band D	0.77 dB	
Relative Pulse Response	Band A	0.55 dB	
	Band B	0.35 dB	
	Band C	0.61 dB	
	Band D	0.61 dB	
Sine-Wave Accuracy	Band A	0.67 dB	R&S SMY02 w/ HP 437B and HP 8482A
	Band B	0.67 dB	
	Band C	0.67 dB	Agilent E8257D
	Band D	0.67 dB	
	Band E	0.72 dB	
Selectivity, 6 dB Bandwidth	Band A	2.0 Hz	R&S SMY02
	Band B	0.11 kHz	Agilent E8257D
	Band C	0.22 kHz	
	Band D	0.22 kHz	
	Band E	2.9 kHz	
Intermediate Frequency Rejection Ratio	Band A	0.96 dB	R&S SMY02 and Agilent E8257D
	Band B	0.96 dB	
	Band C	1.2 dB	Agilent E8257D
	Band D	1.2 dB	
	Band E	1.9 dB	
Image Frequency Rejection Ratio	Band A	0.87 dB	R&S SMY02
	Band B	0.87 dB	Agilent E8257D
	Band C	0.87 dB	
	Band D	0.87 dB	
	Band E	1.9 dB	

Parameter/Equipment	Range	CMC ² (±)	Comments
EMI Receiver⁴ – (cont)			
Spurious Frequency Rejection Ratio	Band A	1.8 dB	R&S SMY02
	Band B	1.8 dB	
	Band C	1.3 dB	Agilent E8257D
	Band D	1.3 dB	
	Band E	1.9 dB	
Peak Detector Verification	Band A	0.74 dB	Schwarzbeck IGUU2916
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
Average Detector Verification	Band A	0.74 dB	
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
RMS Detector Verification	Band A	0.74 dB	
	Band B	0.74 dB	
	Band C	0.74 dB	
	Band D	0.74 dB	
Response to Intermittent, Unsteady and Drifting Narrowband Disturbances	Band A	0.64 dB	R&S SMY02
	Band B	0.64 dB	
	Band C	0.72 dB	
	Band D	0.72 dB	
Impulse Bandwidth Measurement (EMI Receiver and Spectrum Analyzer)	< 1 MHz 1 MHz resolution bandwidth	3.1 kHz	Agilent 81101A
Input Impedance on CISPR Band E	(1 to 18) GHz	2.1 dB	Network analyzer N5230A CISPR 16-1-1:2015

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
Signal Generator – Frequency Accuracy	9 kHz to 1 GHz	0.59 x 10 ⁻⁷ %	Agilent 53132A and Symmetricom 8040C
	(1 to 18) GHz	1.0 x 10 ⁻⁸ %	Agilent 53152A and Symmetricom 8040C
	(18 to 40) GHz	7.8 x 10 ⁻⁹ %	Agilent 53152A and Symmetricom 8040C
Reference Frequency Accuracy	10 MHz	7.9 x 10 ⁻⁹ %	Agilent 53132A and Symmetricom 8040C
Level Accuracy	9 kHz to 1 GHz	0.84 dB	Agilent 53132A and Symmetricom 8040C
	(1 to 18) GHz	0.50 dB	Agilent E4417A w/ E9304A
	(≥-30 dBm)	1.1 dB	HP 437B w/ HP 8481A
	(<-30 dBm)	1.4 dB	Agilent E4417A w/ 8487A
AM Depth	(18 to 40) GHz	1.4 dB	Agilent E4446A
	(1 to 100) %	1.9 %	Agilent E4446A
Attenuator Setting Accuracy	9 kHz to 1 GHz	1.9 dB	Agilent E4446A
	(1 to 18) GHz	1.6 dB	Agilent E4446A
	(18 to 40) GHz	1.9 dB	Agilent E4446A
Harmonic Distortion	9 kHz to 1 GHz	1.7 dB	Agilent E4446A
	(1 to 18) GHz	1.9 dB	Agilent E4446A
AM Frequency	(18 to 40) GHz	3.0 dB	Agilent E4446A
	20 Hz to 100 kHz	0.059 %	Agilent E4446A

Insertion Loss – (0 to 80) dB (0 to 130) dB	9 kHz to 500 MHz	0.48 dB	HP 4395A, HP 87512A
	30 kHz to 3 GHz	0.67 dB	HP 8753D, HP 4396A 85032B (assuming no mismatch at input and output of EUT)
	(3 to 18) GHz	0.060 dB	Power sensor E4412A and power meter E4418A
	(18 to 40) GHz	2.3 dB	Power sensor 8487A and power meter E4417A

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
Spectrum Analyzer –			
10 MHz Output Frequency Accuracy	10 MHz	0.10 Hz	Rubidium oscillator, counter
10 MHz Reference Frequency Accuracy	10 MHz	0.10 Hz	
Marker Readout Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.20 % 0.50 %	Synthesized generator
Frequency Span Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.47 % 0.70 %	
Frequency Readout Accuracy	DC to 40 GHz	1.2 %	
Noise Sidebands	DC to 26.5 GHz (>26.5 to 40) GHz	0.20 dB/Hz 1.0 dB/Hz	
Spurious Responses	DC to 40 GHz	2.3 dB	
Residual FM	DC to 26.5 GHz (>26.5 to 40) GHz	0.70 dB 0.80 dB	
Display Scale Fidelity	DC to 26.5 GHz (>26.5 to 40) GHz	0.57 dB 0.12 dB	Synthesized generator, step attenuators
Input Attenuation Switching Uncertainty	DC to 26.5 GHz (>26.5 to 40) GHz	0.61 dB 0.41 dB	
Reference Level Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.92 dB 0.10 dB	Synthesized generator, power meter w/sensor, step attenuators
Resolution Bandwidth Switching Uncertainty	DC to 26.5 GHz	0.14 dB	Synthesized generator, attenuator
Absolute Amplitude Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	1.0 dB 0.31 dB	Power meter w/ sensor, splitter, attenuator
Resolution Bandwidth Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	0.40 dB 1.0 dB	Synthesized generator, power meter w/sensor, splitter

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments	
Spectrum Analyzer – (cont)	Residual Response	DC to 26.5 GHz (>26.5 to 40) GHz	0.40 dB 0.26 dB	Termination
	Displayed Average Noise Level	DC to 26.5 GHz (>26.5 to 40) GHz	0.26 dB 4.4 dB	Terminations
	Frequency Response/Flatness	DC to 26.5 GHz (>26.5 to 40) GHz	0.52 dB 1.1 dB	Synthesized generator, power meter with sensor
	Tracking Generator Level Flatness	DC to 26.5 GHz (>26.5 to 40) GHz	0.50 dB 0.10 dB	
	Overall Absolute Amplitude Accuracy	DC to 26.5 GHz (>26.5 to 40) GHz	1.1 dB 0.31 dB	Synthesized generator, power meter w/ sensor, step attenuators
Click Generator –	QP Amplitude	150 kHz to 30 MHz	2.1 dB	Agilent DSO80204B
	Click Duration	150 kHz to 30 MHz	1.1 %	
Click Analyzer –	QP Amplitude	150 kHz to 30 MHz	4.5 dB	MEB TSG-1
	Click Duration	150 kHz to 30 MHz	2.5 %	
S-Parameter Test Set	– Directivity	9 kHz to 6 GHz	0.58 dB	
	Switch Repeatability	9 kHz to 6 GHz	1.2 dB	
Pre Amplifier –	Gain	10 MHz to 18 GHz (18 to 40) GHz	1.7 dB 2.9 dB	Network analyzer N5230A
	Linearity	10 MHz to 18 GHz (18 to 40) GHz	2.5 dB 2.9 dB	Network analyzer N5230A

Parameter/Equipment	Frequency	CMC ² (±)	Comments
Power Amplifier –			
Gain	10 MHz to 18 GHz	2.3 dB	With N5230A
Linearity	10 MHz to 18 GHz	2.3 dB	
Network Analyzer –			
Frequency Accuracy	9 kHz to 6 GHz (6 to 40) GHz	0.013 x 10 ⁻⁶ 1.7 x 10 ⁻⁸	
Level Accuracy	9 kHz to 6 GHz	0.25 dB	
Level Flatness	9 kHz to 6 GHz	0.25 dB	
Level Accuracy / Level Flatness	(6 to 40) GHz	1.0 dB	
Power Linearity	9 kHz to 6 GHz (6 to 40) GHz	0.56 dB 1.1 dB	
Harmonics	9 kHz to 6 GHz	0.43 dB	
Noise Level / Input Cross Talk	9 kHz to 6 GHz	2.0 dB	
Noise Level	(6 to 40) GHz	3.7 dB	
Input Impedance	9 kHz to 6 GHz (6 to 40) GHz	1.2 dB 2.3 dB	
Absolute Amplitude Accuracy	9 kHz to 6 GHz	0.46 dB	
Dynamic Accuracy Magnitude Ratio	9 kHz to 6 GHz	0.50 dB	
Phase	9 kHz to 6 GHz	3.9 °	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
Coaxial Cable – Cable Loss	9 kHz to 10 MHz 10 MHz to 18 GHz (18 to 40) GHz	0.48 dB 1.7 dB 2.9 dB	4395A, 87512A Network analyzer N5230A
Attenuator – Attenuation VSWR	9 kHz to 10 MHz 10 MHz to 18 GHz (18 to 40) GHz 10 MHz to 18 GHz	0.48 dB 1.7 dB 2.9 dB 1.8 dB	4395A, 87512A Network analyzer N5230A
ESD Simulator – Rise Time / Fall Time Peak Current, Current at 30/60 ns	(0.5 to 1.2) ns (1 to 15) kV	0.031 ns 2.4 %	IEC 61000-4-2:2008 ISO 10605
DIP/Interruption Simulator – Output Voltage – (0 to 500) V _(rms) Repetition Time – 10 s Event Time – (0 to 500) ms Phase Shifting – (0 to 360) ^o Rising Time/Falling Time – (1 to 5) μs Overshoot and Undershoot Voltage – Less than 5 % of Rated Voltage (Ut)	DC to 400 Hz DC to 400 Hz DC to 400 Hz DC to 400 Hz DC to 400 Hz DC to 400 Hz	0.61 % 0.39 % 0.91 % 0.29 ^o 2.9 % 3.0 %	IEC 61000-4-11:2004

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
Capacitive Clamp –			
Peak Voltage	2 kV (set voltage)	3.9 %	IEC 61000-4-4:2012
Rise time	5 ns	5.8 %	
Pulse Duration	50 ns	1.2 %	
AC Power Source –			
Frequency Accuracy	DC to 800 Hz	0.26 %	HP 34401A NF E-2001B Agilent DOS6102A
Voltage Accuracy	(1 to 700) V	0.47 %	
Distortion	20 Hz to 20 kHz	3.6 %	
In-Rush Current	10 kVA (par Phase)	0.83 %	
Supplying Capacity	10 kVA	2.1 %	
DC Power Source –			
Output Voltage Accuracy	1 mV to 1000 V	0.26 %	HP 34401A
Voltage Drop	DC	0.70 %	HP 3458A
Noise Level	DC	6.4 %	
Output Current Accuracy	100 µA to 3A	0.23 %	

Parameter/Equipment	Frequency	CMC ^{2, 5} (±)	Comments
Audio Generator / Function Generator –			
Frequency Accuracy Sine Wave	1 Hz to 2 MHz	0.023 %	53152A, 53132A HP
Amplitude Accuracy Sine Wave	3 Hz to 300 kHz	0.50 %	3458A, E9304A, and E4417A
Distortion Sine Wave	20 Hz to 20 kHz	3.5 %	Levear VP-7727D
Rise/Fall Time Square and Triangle Form Wave	DC to 2 MHz	0.91 ns	DSO6102A
Voltage Accuracy	DC to 2 MHz	3.0 %	HP 3458A
Duty Cycle	DC to 2 MHz	0.30 %	DSO6102A
Open Area Test Site –			
Site Attenuation	(30 to 300) MHz 300 MHz to 1 GHz	1.6 dB 1.5 dB	ANSI C63.5:2006
Site VSWR	(1 to 18) GHz	2.5 dB	CISPR 16-1-4
Current Probe –			
Transfer Impedance	100 kHz to 230 MHz	0.40 dB	CISPR 16-1-2:2014
	0.1 MHz to 1 GHz	1.2 dB	CISPR 16-1-2:2014
	(1.0 to 2.1) GHz	1.9 dB	CISPR 16-1-2:2014
Television Analyzer –			
Field Strength	300 MHz to 1 GHz	1.4 dB	Antennae, power meter w/sensor, spectrum analyzer, signal generator

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
ESD Target – Flatness of Measurement Chain	30 kHz to 3 GHz	1.2 dB	IEC 61000-4-2:2008, ISO 10605:2008, 8753D N5230A
	10 MHz to 4 GHz	1.7 dB	
	Input Resistance	DC	
Directional Couplers – Coupling Factor	9 kHz to 1 GHz (1 to 18) GHz (18 to 40) GHz	1.4 dB 1.8 dB 3.0 dB	4395A, 8753D, N5230A
Insertion loss	9 kHz to 1 GHz (1 to 18) GHz (18 to 40) GHz	1.3 dB 1.7 dB 2.9 dB	
VSWR	9 kHz to 1 GHz (1 to 18) GHz	0.55 dB 1.8 dB	
Directivity	9 kHz to 1 GHz (1 to 18) GHz (18 to 40) GHz	1.3 dB 1.9 dB 3.2 dB	
Coil – Magnetic Field Level	(40 to 800) Hz	0.41 %	Yokogawa 2558 EMCO HI-3624A
Power Sensor – VSWR	DC to 3 GHz (3 to 18) GHz	0.85 % 1.3 %	HP 8753D, Agilent E8257D, Agilent E4418A, Agilent E4412A, Agilent 11692D
Insertion Loss on Passage Typed Power Sensor	9 kHz to 1 GHz	0.47 dB	
	(1 to 18) GHz	1.7 dB	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
Power Sensor – (cont)			
Level Accuracy			
-60 dBm to 0 dBm	9 kHz to 10 MHz	4.7 %	HP 8753D, Agilent E8257D, Agilent E4418A, Agilent E4412A, Agilent 11692D
-70 dBm to 0 dBm	10 MHz to 4 GHz (4 to 6) GHz	5.1 % 5.7 %	
-30 dBm to 0 dBm	(6 to 18) GHz	6.8 %	
-70 dBm to -30 dBm	(18 to 26.5) GHz	6.3 %	
Calibration Factor	(26.5 to 40) GHz	12 %	
	(18 to 26.5) GHz	6.6 %	
	(26.5 to 40) GHz	18 %	
	9 kHz to 4 GHz (4 to 6) GHz (6 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz	3.7 % 5.0 % 5.8 % 8.9 % 11 %	
Power Meter –			
Zero Carryover	50 MHz	0.34 %	Keysight 11683A
Instrument Accuracy	50 MHz	0.34 %	
Reference Power	50 MHz	0.59 %	Keysight 478A option H76

III. Time & Frequency

Parameter/Equipment	Range	CMC ^{2, 5} ()	Comments
Frequency	0.1 Hz to 2 MHz	0.023 %	NF 1915

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- 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 For Reflection Coefficient calibrations, CMCs are based on a 1 port device measurement.
 - 5 For the calibrations noted, CMCs are based on R&S ESHS10 and R&S ESVS10.
 - 6 In the statement of CMC, the value is defined as the percentage of reading unless otherwise noted.
 - 7 For CISPR Pulse Generator calibrations, CMCs are based on Schwarzbeck IGUU 2916.