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WATERS GTS1



MICRO PRECISION CALIBRATION PTE LTD
BLOCK 5008 ANG MO KIO AVENUE 5 #07-02/03
TECHPLACE II SINGAPORE 569874
65 67484384



Certificate of Calibration

Date: April 21, 2020

Cert No. 551220083577902

Customer:

WATERS PACIFIC PTE LTD

1 SCIENCE PARK ROAD, #02-08 THE CAPRICORN
SINGAPORE SCIENCE PARK II
SINGAPORE 117528

Work Order #: SG-11014090

MPC Control #: MY44046858

Serial Number: MY44046858

Asset ID: 91773

Department: N/A

Gage Type: FUNCTION / ARBITRARY WAVEFORM GENERATOR

Performed By: DIVIEERNRAJ CHANDRAN

Manufacturer: AGILENT

Received Condition: IN TOLERANCE

Model Number: 33220A

Returned Condition: IN TOLERANCE

Size: N/A

Cal. Date: April 21, 2020

Temp/RH: 22°C / 50 %

Cal. Interval: 12 MONTHS

Location: Calibration performed at MPC facility

Cal. Due Date: April 21, 2021

Calibration Notes:

Performance test passed. See attached data (3 Pages).

Calibration performed for PT Surya Teknologi.

Standards Used to Calibrate Equipment

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
CA8094	MULTIMETER	3458A	2823A25888	HEWLETT PACKARD	Jan 10, 2021	1-12015829011-1
CA8201	225MHZ UNIVERSAL COUNTER	53132A	MY40004745	AGILENT	May 4, 2020	551220082996309
CA8283	EPM SERIES POWER METER	E4419B	GB40202469	AGILENT	May 30, 2020	551220083039723
DH1020	AVERAGE POWER SENSOR	E9304A	MY52310009	AGILENT	Dec 25, 2020	1-12059623740-1

Procedures Used in this Event

Procedure Name	Description
AGILENT 33220A Rev. 4	20 MHz Waveform Generator, Agilent 33220A, Edition 4, May-01-2012

Calibrating Technician:

DIVIEERNRAJ CHANDRAN

QC Approval:

JUN CALIMAG

Statements of Pass or Fail Conformance: The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:03/2009. All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/NCCL Z540.3-2006.

The status of compliance with the acceptance criteria is reported as:

PASS - Compliant with specification.

FAIL - Not compliant with specification.

FAIL² - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.

PASS² - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.

The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated. This calibration report complies with ISO/IEC 17025:2017 and ANSI/NCCL Z540.3 Method 6-Guard Bands based on Test Uncertainty Ratio. Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. The information on this report pertains only to the instrument identified, this may not be reproduced in part or in a whole without the prior written approval of the issuing MP Calibration Laboratory.



Calibration Report of Agilent 33220A Function / Arbitrary Waveform Generator

MPC Control #:	MY44046858	Serial Number:	MY44046858
Asset ID:	91773	Calibration Date:	April 21, 2020

Internal Timebase Verification

Sine Wave @ 1.00 Vpp Amplitude

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty ($\pm$)
Output Frequency	10.000000 MHz	9.999800 MHz	9.999996 MHz	9.999996 MHz	10.000200 MHz	PASS	0.00000057 MHz

AC Amplitude (high-impedance) Verification

with OUT TERM set at HIGH Z; sinewave

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty ($\pm$)
Sine Wave / 1.00 kHz	0.02000 Vrms	0.01909 Vrms	0.02001 Vrms	0.02001 Vrms	0.02091 Vrms	PASS	0.000021 Vrms
Sine Wave / 1.00 kHz	0.06700 Vrms	0.06562 Vrms	0.06694 Vrms	0.06694 Vrms	0.06838 Vrms	PASS	0.000025 Vrms
Sine Wave / 1.00 kHz	0.20000 Vrms	0.19729 Vrms	0.19988 Vrms	0.19988 Vrms	0.20271 Vrms	PASS	0.00021 Vrms
Sine Wave / 1.00 kHz	0.67000 Vrms	0.66259 Vrms	0.66939 Vrms	0.66939 Vrms	0.67741 Vrms	PASS	0.00025 Vrms
Sine Wave / 1.00 kHz	2.00000 Vrms	1.97930 Vrms	1.99958 Vrms	1.99958 Vrms	2.02070 Vrms	PASS	0.0021 Vrms
Sine Wave / 1.00 kHz	7.00000 Vrms	6.92930 Vrms	6.99261 Vrms	6.99261 Vrms	7.07070 Vrms	PASS	0.0025 Vrms
Square Wave / 1.00 kHz	0.90000 Vrms	0.89000 Vrms	0.90016 Vrms	0.90016 Vrms	0.91000 Vrms	PASS	0.00026 Vrms

Low Frequency Flatness Verification

with OUT TERM set at HIGH Z; sinewave

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty ($\pm$)
100 kHz	0.67000 Vrms	0.66330 Vrms	0.67107 Vrms	0.67107 Vrms	0.67670 Vrms	PASS	0.00065 Vrms
100 kHz	2.00000 Vrms	1.98000 Vrms	2.00329 Vrms	2.00329 Vrms	2.02000 Vrms	PASS	0.0034 Vrms
100 kHz	7.00000 Vrms	6.93000 Vrms	7.01280 Vrms	7.01280 Vrms	7.07000 Vrms	PASS	0.0068 Vrms



Calibration Report of Agilent 33220A Function / Arbitrary Waveform Generator

MPC Control #: MY44046858	Serial Number: MY44046858
Asset ID: 91773	Calibration Date: April 21, 2020

Flatness Verification

0 dB Range; Referenced to 1 kHz

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 kHz	0.000 dB	-0.100 dB	0.000 dB	0.000 dB	0.100 dB	PASS	0.068 dB
200 kHz	0.000 dB	-0.150 dB	-0.009 dB	-0.009 dB	0.150 dB	PASS	0.068 dB
0.5 MHz	0.000 dB	-0.150 dB	-0.020 dB	-0.020 dB	0.150 dB	PASS	0.068 dB
2.0 MHz	0.000 dB	-0.150 dB	-0.063 dB	-0.063 dB	0.150 dB	PASS	0.068 dB
3.0 MHz	0.000 dB	-0.150 dB	-0.080 dB	-0.080 dB	0.150 dB	PASS	0.068 dB
4.0 MHz	0.000 dB	-0.150 dB	-0.040 dB	-0.040 dB	0.150 dB	PASS	0.068 dB
5.0 MHz	0.000 dB	-0.150 dB	-0.044 dB	-0.044 dB	0.150 dB	PASS	0.068 dB
8.0 MHz	0.000 dB	-0.300 dB	-0.071 dB	-0.071 dB	0.300 dB	PASS	0.068 dB
10.0 MHz	0.000 dB	-0.300 dB	-0.078 dB	-0.078 dB	0.300 dB	PASS	0.068 dB
12.5 MHz	0.000 dB	-0.300 dB	-0.070 dB	-0.070 dB	0.300 dB	PASS	0.068 dB
14.0 MHz	0.000 dB	-0.300 dB	-0.086 dB	-0.086 dB	0.300 dB	PASS	0.068 dB
16.0 MHz	0.000 dB	-0.300 dB	-0.087 dB	-0.087 dB	0.300 dB	PASS	0.068 dB
17.5 MHz	0.000 dB	-0.300 dB	-0.088 dB	-0.088 dB	0.300 dB	PASS	0.068 dB
20.0 MHz	0.000 dB	-0.300 dB	-0.102 dB	-0.102 dB	0.300 dB	PASS	0.068 dB

10 dB Range; Referenced to 1 kHz

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty (±)
100 kHz	0.000 dB	-0.100 dB	0.000 dB	0.000 dB	0.100 dB	PASS	0.068 dB
200 kHz	0.000 dB	-0.150 dB	-0.011 dB	-0.011 dB	0.150 dB	PASS	0.068 dB
0.5 MHz	0.000 dB	-0.150 dB	-0.021 dB	-0.021 dB	0.150 dB	PASS	0.068 dB
2.0 MHz	0.000 dB	-0.150 dB	-0.062 dB	-0.062 dB	0.150 dB	PASS	0.068 dB
3.0 MHz	0.000 dB	-0.150 dB	-0.080 dB	-0.080 dB	0.150 dB	PASS	0.068 dB
4.0 MHz	0.000 dB	-0.150 dB	-0.044 dB	-0.044 dB	0.150 dB	PASS	0.068 dB
5.0 MHz	0.000 dB	-0.150 dB	-0.042 dB	-0.042 dB	0.150 dB	PASS	0.068 dB
8.0 MHz	0.000 dB	-0.300 dB	-0.066 dB	-0.066 dB	0.300 dB	PASS	0.068 dB
10.0 MHz	0.000 dB	-0.300 dB	-0.078 dB	-0.078 dB	0.300 dB	PASS	0.068 dB
12.5 MHz	0.000 dB	-0.300 dB	-0.075 dB	-0.075 dB	0.300 dB	PASS	0.068 dB
14.0 MHz	0.000 dB	-0.300 dB	-0.097 dB	-0.097 dB	0.300 dB	PASS	0.068 dB
16.0 MHz	0.000 dB	-0.300 dB	-0.107 dB	-0.107 dB	0.300 dB	PASS	0.068 dB
17.5 MHz	0.000 dB	-0.300 dB	-0.098 dB	-0.098 dB	0.300 dB	PASS	0.068 dB
20.0 MHz	0.000 dB	-0.300 dB	-0.115 dB	-0.115 dB	0.300 dB	PASS	0.068 dB



Calibration Report of Agilent 33220A Function / Arbitrary Waveform Generator

MPC Control #:	MY44046858	Serial Number:	MY44046858
Asset ID:	91773	Calibration Date:	April 21, 2020

20 dB Range; Referenced to 1 kHz

Function Tested	Nominal	Lower Limit	As Found	As Left	Upper Limit	Result	Uncertainty ($\pm$)
100 kHz	0.000 dB	-0.100 dB	0.000 dB	0.000 dB	0.100 dB	PASS	0.068 dB
200 kHz	0.000 dB	-0.150 dB	-0.011 dB	-0.011 dB	0.150 dB	PASS	0.068 dB
0.5 MHz	0.000 dB	-0.150 dB	-0.021 dB	-0.021 dB	0.150 dB	PASS	0.068 dB
2.0 MHz	0.000 dB	-0.150 dB	-0.056 dB	-0.056 dB	0.150 dB	PASS	0.068 dB
3.0 MHz	0.000 dB	-0.150 dB	-0.080 dB	-0.080 dB	0.150 dB	PASS	0.068 dB
4.0 MHz	0.000 dB	-0.150 dB	-0.039 dB	-0.039 dB	0.150 dB	PASS	0.068 dB
5.0 MHz	0.000 dB	-0.150 dB	-0.038 dB	-0.038 dB	0.150 dB	PASS	0.068 dB
8.0 MHz	0.000 dB	-0.300 dB	-0.065 dB	-0.065 dB	0.300 dB	PASS	0.068 dB
10.0 MHz	0.000 dB	-0.300 dB	-0.079 dB	-0.079 dB	0.300 dB	PASS	0.068 dB
12.5 MHz	0.000 dB	-0.300 dB	-0.084 dB	-0.084 dB	0.300 dB	PASS	0.068 dB
14.0 MHz	0.000 dB	-0.300 dB	-0.104 dB	-0.104 dB	0.300 dB	PASS	0.068 dB
16.0 MHz	0.000 dB	-0.300 dB	-0.111 dB	-0.111 dB	0.300 dB	PASS	0.068 dB
17.5 MHz	0.000 dB	-0.300 dB	-0.110 dB	-0.110 dB	0.300 dB	PASS	0.068 dB
20.0 MHz	0.000 dB	-0.300 dB	-0.013 dB	-0.013 dB	0.300 dB	PASS	0.068 dB

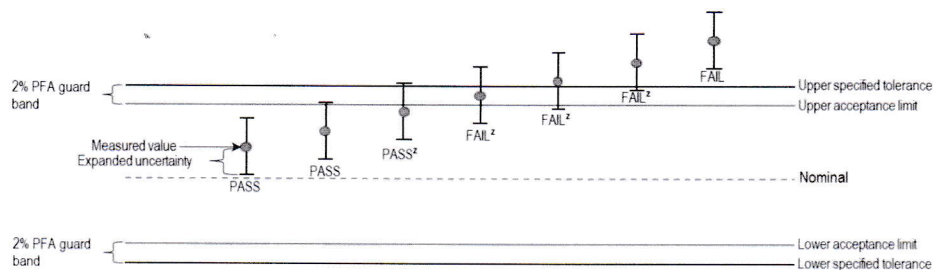
Statements of Pass or Fail Conformance

The uncertainty of measurement has been taken into account when determining compliance with specification, as per ILAC-G8:03/2009.

All measurements and test results guard banded to ensure the probability of false-accept does not exceed 2% in compliance with ANSI/NCSL Z540.3-2006.

The status of compliance with the acceptance criteria is reported as:

- PASS** - Compliant with specification
- FAIL** - Not compliant with specification.
- FAIL^z** - The measured value is not within the acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% is within the specified tolerance.
- PASS^z** - The measured value is within acceptance limits. However, a portion of the expanded uncertainty of measurement at 95% exceeds the specified tolerance.



Acceptance limits for $\leq 2\%$ probability of false accept (PFA) guard band

The expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%, unless otherwise stated.

This calibration report complies with ISO/IEC 17025:2017 and ANSI/NCSL Z540.3 Method 6-Guard Bands based on Test Uncertainty Ratio.

- End of Calibration Report -