



MICRO PRECISION CALIBRATION PTE LTD  
BLOCK 5008 ANG MO KIO AVENUE 5 #07-04  
TECHPLACE II SINGAPORE 569874  
65 67484384



## Certificate of Calibration

Date: July 12, 2018

Cert No. 551220081458462

**Customer:**

VENTURE CORPORATION LIMITED  
5006 ANG MO KIO AVE 5 #01-10  
TECHPLACE II, SINGAPORE 569873

Work Order #: SG-11008385

MPC Control #: MY44015802  
Asset ID: NA  
Gage Type: FUNCTION / ARBITRARY WAVEFORM GENERATOR  
Manufacturer: AGILENT  
Model Number: 33220A  
Size: N/A  
Temp/RH: 22.5°C / 48 %  
Location: Calibration performed at Customer's facility

Serial Number: MY44015802  
Department: N/A  
Performed By: SENGTHYE CHEW  
Received Condition: IN TOLERANCE  
Returned Condition: IN TOLERANCE  
Cal. Date: July 12, 2018  
Cal. Interval: 12 MONTHS  
Cal. Due Date: July 12, 2019

**Calibration Notes:**

Please refer to the attached calibration data. (2 page).

### Standards Used to Calibrate Equipment

| I.D.   | Description.             | Model  | Serial     | Manufacturer    | Cal. Due Date | Traceability #  |
|--------|--------------------------|--------|------------|-----------------|---------------|-----------------|
| CA8201 | 225MHZ UNIVERSAL COUNTER | 53132A | MY40004745 | AGILENT         | May 4, 2019   | 551220081351492 |
| AP4205 | MULTIMETER               | 3458A  | 2823A17096 | HEWLETT PACKARD | Oct 10, 2018  | 512200813159474 |
| CC1000 | POWER METER              | E4419B | GB43311500 | AGILENT         | Sep 14, 2018  | 512200813028822 |
| DH1020 | AVERAGE POWER SENSOR     | E9304A | MY52310009 | AGILENT         | Mar 16, 2019  | 512200813300943 |

### Procedures Used in this Event

| Procedure Name | Description                                             |
|----------------|---------------------------------------------------------|
| AGILENT 33220A | 20 MHz Waveform Generator Service Guide, PN 33220-90012 |

Calibrating Technician:

  
SENGTHYE CHEW

QC Approval:

  
JULES PHILIPPE AGPANGAN

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k=2$ , which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO/IEC 17025:2005, ANSI/NC SL Z540-1-1994, ANSI/NC SL Z540.3-2006, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

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. The information on this report, pertains only to the instrument identified.

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. This report may not be reproduced in part or in a whole without the prior written approval of the issuing MPC lab.



## Agilent 33220A Function / Arbitrary Waveform Generator

Procedure: AGILENT 33220A  
 ID Number: MY44015802  
 Asset Number: NA

Order Number: SG-11008385  
 Serial Number: MY44015802  
 Calibration Date: July 12, 2018

### Internal Timebase Verification

#### Frequency in MHz

| Parameter | Nominal Value | Lower Limit  | As Found     | As Left      | Upper Limit   | Result | Uncertainty ( ± ) |
|-----------|---------------|--------------|--------------|--------------|---------------|--------|-------------------|
| Frequency | 10.000000 MHz | 9.999800 MHz | 9.999896 MHz | 9.999896 MHz | 10.000200 MHz | PASS   | 0.00000057 MHz    |

### AC Amplitude (High Impedance) Accuracy

#### with OUT TERM set at HIGH Z; sinewave

| Frequency       | Nominal Value | Lower Limit  | As Found     | As Left      | Upper Limit  | Result | Uncertainty ( ± ) |
|-----------------|---------------|--------------|--------------|--------------|--------------|--------|-------------------|
| 1 kHz           | 0.02000 Vrms  | 0.01909 Vrms | 0.01998 Vrms | 0.01998 Vrms | 0.02091 Vrms | PASS   | 0.0000092 Vrms    |
| 1 kHz           | 0.06700 Vrms  | 0.06562 Vrms | 0.06694 Vrms | 0.06694 Vrms | 0.06838 Vrms | PASS   | 0.000017 Vrms     |
| 1 kHz           | 0.20000 Vrms  | 0.19729 Vrms | 0.19987 Vrms | 0.19987 Vrms | 0.20271 Vrms | PASS   | 0.000038 Vrms     |
| 1 kHz           | 0.67000 Vrms  | 0.66259 Vrms | 0.66872 Vrms | 0.66872 Vrms | 0.67741 Vrms | PASS   | 0.00011 Vrms      |
| 1 kHz           | 2.00000 Vrms  | 1.97930 Vrms | 2.00092 Vrms | 2.00092 Vrms | 2.02070 Vrms | PASS   | 0.00033 Vrms      |
| 1 kHz           | 7.00000 Vrms  | 6.92930 Vrms | 7.00256 Vrms | 7.00256 Vrms | 7.07070 Vrms | PASS   | 0.0019 Vrms       |
| 1 kHz / Sq Wave | 0.90000 Vrms  | 0.89000 Vrms | 0.90144 Vrms | 0.90144 Vrms | 0.91000 Vrms | PASS   | 0.00015 Vrms      |

### Low Frequency Flatness Accuracy

#### with OUT TERM set at HIGH Z; sinewave

| Frequency | Nominal Value | Lower Limit  | As Found     | As Left      | Upper Limit  | Result | Uncertainty ( ± ) |
|-----------|---------------|--------------|--------------|--------------|--------------|--------|-------------------|
| 100 kHz   | 0.67000 Vrms  | 0.66330 Vrms | 0.67044 Vrms | 0.67044 Vrms | 0.67670 Vrms | PASS   | 0.00024 Vrms      |
| 100 kHz   | 2.00000 Vrms  | 1.98000 Vrms | 1.99904 Vrms | 1.99904 Vrms | 2.02000 Vrms | PASS   | 0.00057 Vrms      |
| 100 kHz   | 7.00000 Vrms  | 6.93000 Vrms | 7.00991 Vrms | 7.00991 Vrms | 7.07000 Vrms | PASS   | 0.012 Vrms        |

### Flatness

#### 0 dB Range; Referenced to 1kHz

| Frequency  | Nominal Value | Lower Limit | As Found  | As Left   | Upper Limit | Result | Uncertainty ( ± ) |
|------------|---------------|-------------|-----------|-----------|-------------|--------|-------------------|
| 100.00 kHz | 0.000 dB      | -0.100 dB   | 0.000 dB  | 0.000 dB  | 0.100 dB    | PASS   | 0.068 dB          |
| 200.00 kHz | 0.000 dB      | -0.150 dB   | -0.040 dB | -0.040 dB | 0.150 dB    | PASS   | 0.068 dB          |
| 0.50 MHz   | 0.000 dB      | -0.150 dB   | 0.050 dB  | 0.050 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 2.00 MHz   | 0.000 dB      | -0.150 dB   | 0.054 dB  | 0.054 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 3.00 MHz   | 0.000 dB      | -0.150 dB   | -0.063 dB | -0.063 dB | 0.150 dB    | PASS   | 0.068 dB          |
| 4.00 MHz   | 0.000 dB      | -0.150 dB   | -0.073 dB | -0.073 dB | 0.150 dB    | PASS   | 0.068 dB          |
| 5.00 MHz   | 0.000 dB      | -0.150 dB   | -0.075 dB | -0.075 dB | 0.150 dB    | PASS   | 0.068 dB          |
| 8.00 MHz   | 0.000 dB      | -0.300 dB   | -0.115 dB | -0.115 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 10.00 MHz  | 0.000 dB      | -0.300 dB   | -0.129 dB | -0.129 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 12.50 MHz  | 0.000 dB      | -0.300 dB   | -0.145 dB | -0.145 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 14.00 MHz  | 0.000 dB      | -0.300 dB   | -0.159 dB | -0.159 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 16.00 MHz  | 0.000 dB      | -0.300 dB   | -0.172 dB | -0.172 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 17.50 MHz  | 0.000 dB      | -0.300 dB   | -0.173 dB | -0.173 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 20.00 MHz  | 0.000 dB      | -0.300 dB   | -0.179 dB | -0.179 dB | 0.300 dB    | PASS   | 0.068 dB          |



## Agilent 33220A Function / Arbitrary Waveform Generator

Procedure: AGILENT 33220A  
 ID Number: MY44015802  
 Asset Number: NA

Order Number: SG-11008385  
 Serial Number: MY44015802  
 Calibration Date: July 12, 2018

### 10 dB Range; Referenced to 1 kHz

| Frequency  | Nominal Value | Lower Limit | As Found  | As Left   | Upper Limit | Result | Uncertainty ( ± ) |
|------------|---------------|-------------|-----------|-----------|-------------|--------|-------------------|
| 100.00 kHz | 0.000 dB      | -0.100 dB   | 0.000 dB  | 0.000 dB  | 0.100 dB    | PASS   | 0.068 dB          |
| 200.00 kHz | 0.000 dB      | -0.150 dB   | 0.015 dB  | 0.015 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 0.50 MHz   | 0.000 dB      | -0.150 dB   | 0.035 dB  | 0.035 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 2.00 MHz   | 0.000 dB      | -0.150 dB   | 0.047 dB  | 0.047 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 3.00 MHz   | 0.000 dB      | -0.150 dB   | 0.052 dB  | 0.052 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 4.00 MHz   | 0.000 dB      | -0.150 dB   | 0.059 dB  | 0.059 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 5.00 MHz   | 0.000 dB      | -0.150 dB   | 0.063 dB  | 0.063 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 8.00 MHz   | 0.000 dB      | -0.300 dB   | -0.167 dB | -0.167 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 10.00 MHz  | 0.000 dB      | -0.300 dB   | -0.178 dB | -0.178 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 12.50 MHz  | 0.000 dB      | -0.300 dB   | -0.181 dB | -0.181 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 14.00 MHz  | 0.000 dB      | -0.300 dB   | -0.185 dB | -0.185 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 16.00 MHz  | 0.000 dB      | -0.300 dB   | -0.191 dB | -0.191 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 17.50 MHz  | 0.000 dB      | -0.300 dB   | -0.189 dB | -0.189 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 20.00 MHz  | 0.000 dB      | -0.300 dB   | -0.192 dB | -0.192 dB | 0.300 dB    | PASS   | 0.068 dB          |

### 20 dB Range; Referenced to 1 kHz

| Frequency  | Nominal Value | Lower Limit | As Found  | As Left   | Upper Limit | Result | Uncertainty ( ± ) |
|------------|---------------|-------------|-----------|-----------|-------------|--------|-------------------|
| 100.00 kHz | 0.000 dB      | -0.100 dB   | 0.000 dB  | 0.000 dB  | 0.100 dB    | PASS   | 0.068 dB          |
| 200.00 kHz | 0.000 dB      | -0.150 dB   | 0.015 dB  | 0.015 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 0.50 MHz   | 0.000 dB      | -0.150 dB   | 0.029 dB  | 0.029 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 2.00 MHz   | 0.000 dB      | -0.150 dB   | 0.039 dB  | 0.039 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 3.00 MHz   | 0.000 dB      | -0.150 dB   | 0.051 dB  | 0.051 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 4.00 MHz   | 0.000 dB      | -0.150 dB   | 0.066 dB  | 0.066 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 5.00 MHz   | 0.000 dB      | -0.150 dB   | 0.072 dB  | 0.072 dB  | 0.150 dB    | PASS   | 0.068 dB          |
| 8.00 MHz   | 0.000 dB      | -0.300 dB   | -0.098 dB | -0.098 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 10.00 MHz  | 0.000 dB      | -0.300 dB   | -0.171 dB | -0.171 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 12.50 MHz  | 0.000 dB      | -0.300 dB   | -0.177 dB | -0.177 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 14.00 MHz  | 0.000 dB      | -0.300 dB   | -0.185 dB | -0.185 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 16.00 MHz  | 0.000 dB      | -0.300 dB   | -0.189 dB | -0.189 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 17.50 MHz  | 0.000 dB      | -0.300 dB   | -0.179 dB | -0.179 dB | 0.300 dB    | PASS   | 0.068 dB          |
| 20.00 MHz  | 0.000 dB      | -0.300 dB   | -0.185 dB | -0.185 dB | 0.300 dB    | PASS   | 0.068 dB          |