

Certificate of Calibration

Date: July 12, 2018

Cert No. 551220081458462

Customer:

GES SINGAPORE PTE LTD
28 MARSILING LANE
SINGAPORE 739152

Work Order #: SG-11008385

MPC Control #:	MY44015802	Serial Number:	MY44015802
Asset ID:	NA	Department:	N/A
Gage Type:	FUNCTION / ARBITRARY WAVEFORM GENERATOR	Performed By:	SENGTHYE CHEW
Manufacturer:	AGILENT	Received Condition:	IN TOLERANCE
Model Number:	33220A	Returned Condition:	IN TOLERANCE
Size:	N/A	Cal. Date:	July 12, 2018
Temp/RH:	22.5°C / 48 %	Cal. Interval:	12 MONTHS
Location:	Calibration performed at Customer's facility	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

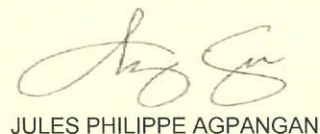
Procedure Name	Description
AGILENT 33220A	20 MHz Waveform Generator Service Guide, PN 33220-90012

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/NCCL Z540-1-1994, ANSI/NCCL 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