MICRO PRECISION CALIBRATION, INC.
22835 INDUSTRIAL PLACE
GRASS VALLEY CA 95949
530-268-1860

# Certificate of Calibration

ACCREDITED ISO/IEC 17025 CALIBRATION LABORATORY AC-1969.00

**Date: Aug 3, 2020** **Cert No. 551220083746791**

**Customer:**
SAMPLE COMPANY

Work Order #: SAMPLE

| | | | |
|---|---|---|---|
| MPC Control #: | 0258964 | Serial Number: | 0258964 |
| Asset ID: | NONE | Department: | N/A |
| Gage Type: | DIGITAL MULTIMETER | Performed By: | DANNY BOY B. BUTIAL |
| Manufacturer: | AGILENT | Received Condition: | IN TOLERANCE |
| Model Number: | 34401A | Returned Condition: | IN TOLERANCE |
| Size: | 10MHZ | Cal. Date: | July 01, 2020 |
| Temp/RH: | 23.0°C / 40.0% | Cal. Interval: | 12 MONTHS |
| Location: | Calibration performed at MPC facility | Cal. Due Date: | July 01, 2021 |

**Calibration Notes:**

## Standards Used to Calibrate Equipment

| I.D. | Description. | Model | Serial | Manufacturer | Cal. Due Date | Traceability # |
|---|---|---|---|---|---|---|
| PH1405 | MULTI-PRODUCT CALIBRATOR | 5520A | 7575006 | FLUKE | Sep 10, 2020 | 551220083204793 |
| AL4394 | DIGITAL MULTIMETER | 3458A | 2823A09832 | AGILENT | Aug 1, 2020 | 551220083719099 |

## Procedures Used in this Event

| Procedure Name | Description |
|---|---|
| MPCCAL Rev. 00 | MPC Automated Procedure |

Calibrating Technician: D. BUTIAL
DANNY BOY B. BUTIAL

QC Approval:
Rick Hernandez

**STATEMENTS OF PASS OR FAIL CONFORMANCE**: The uncertainty of measurement has been taken into account when determining compliance with specification. 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 and in case without guard banded the probability of false-accept depending on test uncertainty ratio.

**THE CALIBRATION REPORT STATUS:**
**PASS**- Term used when compliance statement is given, and the measurement result is PASS.
**PASS$^{Z}$**- Term used when compliance statement is given, and the measurement result is conditional passed or PASS$^{Z}$.
**FAIL**- Term used when compliance statement is given, and the measurement result is FAIL.
**FAIL$^{Z}$**- Term used when compliance statement is given, and the measurement result is conditional failed or FAIL$^{Z}$.
**REPORT OF VALUE** - Term used when reported measurement is not requiring compliance statement in report.
**ADJUSTED**- When adjustments are made to an instrument which changes the value of measurement from what was measured as found to new value as left.
**LIMITED** - When an instrument fails calibration but is still functional in a limited manner.

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. 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.

# T. O. 33K4-4-471-1

TECHNICAL MANUAL

# CALIBRATION PROCEDURE

# FOR

# SOURCE MODULE

# 83555A

(HEWLETT-PACKARD)



Published under Authority of the Secretary of the Air Force

**15 SEPTEMBER 1993**

**SOURCE MODULE**

**83555A**

**(HEWLETT-PACKARD)**

1 **CALIBRATION DESCRIPTION:**

*Table 1.*

| Test Instrument (TI) Characteristics | Performance Specifications | Test Method |
|---|---|---|
| Input Frequency | Range: 11.00 to 16.67 GHz<br>Accuracy: N/A | Not Calibrated |
| Output Frequency | Range: 33.0 to 50.0 GHz<br>Accuracy: N/A | Not Calibrated |
| Input Power | Range: +17 to +27 dBm<br>Accuracy: N/A | Not Calibrated |
| Maximum Leveled Power | Range: 33.0 to 50.0 GHz<br>Accuracy: +3 dBm | Measured with a Power Meter and Sensor |
| Power Flatness | Range: 33.0 to 50.0 GHz<br>Accuracy: ±1.5 dB | Measured with a Power Meter and Sensor |
| Power Level Accuracy | Range: 33.0 to 50.0 GHz<br>Accuracy: ±2 dB | Measured with a Power Meter and Sensor |

2 **EQUIPMENT REQUIREMENTS:**

| | Noun | Minimum Use Specifications | Calibration Equipment | Sub-Item |
|---|---|---|---|---|
| 2.1 | SWEEP OSCILLATOR w/PLUG-IN | Range: 11.00 to 16.67 GHz<br>Accuracy: ±1.5 dB | Hewlett-Packard 8350B w/83550A | H-P 83623A |
| 2.2 | POWER METER | Range: 0 to 10 mW<br>Accuracy: ±1.2% | Hewlett-Packard 436A | |

| | Noun | Minimum Use Specifications | Calibration Equipment | Sub-Item |
|---|---|---|---|---|
| 2.3 | POWER SENSOR | Range: 33.0 to 50.0 GHz<br><br>Accuracy:<br>±4.5% at 33 GHz;<br>±4.0% at 35 GHz;<br>±4.2% at 40 GHz;<br>±4.4% at 44.5 GHz;<br>±4.4% at 45 GHz;<br>±4.7% at 50 GHz | Hewlett-Packard Q8486A | |

3 **PRELIMINARY OPERATIONS:**

3.1 Review and become familiar with the entire procedure before beginning calibration process.

**WARNING**

Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power.

3.2 Connect TI and test equipment to appropriate power source and allow at least 1 hour warm-up.

3.3 The SQ MOD control must be OFF during the entire calibration procedure. This function, if engaged, will adversely affect the accuracy of the calibration.

4 **CALIBRATION PROCESS:**

**NOTE**

Unless otherwise specified, verify the results of each test and take corrective action wherever the test requirement is not met, before proceeding.

4.1 **MAXIMUM LEVELED POWER CALIBRATION:**

4.1.1 Connect RF Plug-In RF OUTPUT to TI RF INPUT connector. Connect Source Module Interface Cable between RF Plug-In to TI Source Module Interface connector.

**NOTE**

Set Sweep Oscillator Power to OFF when connecting or disconnecting Source Module from Sweep Oscillator.

4.1.2 Set Power Switches to ON.

4.1.3 On Sweep Oscillator press INSTR PRESET, select Internal Leveling mode and set Power for maximum power out. The unleveled light should be ON.

4.1.4 Set Sweep Oscillator SWEEP to MANUAL, START Frequency at 33.0 GHz and STOP Frequency at 50.0 GHz.

4.1.5 Standardize Power Meter in dBm mode and set the Calibration Factor to 100. Connect the Power Sensor to TI RF OUTPUT waveguide connector.

4.1.6 Slowly tune the Oscillator Frequency/Time control across the entire frequency band and find the lowest power point.

4.1.7 At the lowest power point, adjust the Oscillator Power control until the unleveled light turns OFF.

4.1.8 Slowly tune the Oscillator Frequency/Time control. The unleveled light should stay OFF across the entire frequency band.

4.1.9 If the unleveled light turns ON, stop at the frequency where the light turned on and adjust the Oscillator Power Level until the unleveled light turns OFF.

4.1.10 Repeat steps 4.1.8 and 4.1.9 until the unleveled light stays OFF across the entire frequency band.

4.1.11 When the unleveled light stays OFF across the entire band, find the minimum power point and stop at this frequency.

4.1.12 At this minimum power point set the Power Meter Calibration Factor to the corresponding value on the Power Sensor Calibration Factor Chart for this frequency.

4.1.13 The measured power displayed on the Power Meter must be +3 dBm or greater.

4.2 **POWER FLATNESS CALIBRATION:**

4.2.1 On Sweep Oscillator press INSTR PRESET, select Internal Leveling mode and set Output Power for +3 dBm.

4.2.2 Set Sweep Oscillator SWEEP to MANUAL, START Frequency at 33.0 GHz and STOP Frequency at 50.0 GHz.

4.2.3 Standardize Power Meter in the dBm mode and set the Calibration Factor to 100.

4.2.4 Slowly tune the Oscillator Frequency/Time control across the entire frequency band and observing the reading on the Power Meter find the lowest power point.

4.2.5 At this minimum power point set the Power Meter Calibration Factor to the corresponding value on the Power Sensor Calibration Factor Chart for this frequency.

4.2.6 Adjust Sweep Oscillator Output Power for a reading of +3 dBm on the Power Meter.

4.2.7 Slowly tune the Oscillator Frequency/Time across the entire frequency band while observing the Power Meter reading.

4.2.8 The measured power displayed on the Power Meter must not exceed +6.0 dBm.

4.3 **POWER LEVEL ACCURACY CALIBRATION:**

4.3.1 On Sweep Oscillator press INSTR PRESET, select Internal Leveling mode and set Output Power for +3 dBm.

4.3.2 Set Sweep Oscillator SWEEP to MANUAL, START Frequency at 33.0 GHz and STOP Frequency at 50.0 GHz.

4.3.3 Standardize Power Meter in the dBm mode and set the Calibration Factor to 100.

4.3.4 Slowly tune the Oscillator Frequency/Time control across the entire frequency band and observing the Power Meter reading find the lowest power point.

4.3.5 At this minimum power point set the Power Meter Calibration Factor to the corresponding value on the Power Sensor Calibration Factor Chart for this frequency.

4.3.6 The measured power displayed on the Power Meter must be +1.0 dBm or greater.

4.3.7 Slowly tune the Oscillator Frequency/Time control across the entire frequency band and observing the reading on the Power Meter find the maximum power point.

4.3.8 At this maximum power point set the Power Meter Calibration Factor to the corresponding value on the Power Sensor Calibration Factor Chart for this frequency.

4.3.9 The measured power displayed on the Power Meter must be less than +5.0 dBm.

4.3.10 Repeat steps 4.3.1 through 4.3.9 for the power levels in the Applied column of Table 2. The measured power displayed on the Power Meter must be within the corresponding Power Limits column of Table 2.

*Table 2.*

| Applied Power (dBm) | Power Limits (dBm) |
|---|---|
| +1.0 | -1.0 to +3.0 |
| -1.0 | -3.0 to +1.0 |
| -3.0 | -5.0 to -1.0 |
| -5.0 | -7.0 to -3.0 |

4.3.11 Set all POWER switches to OFF, disconnect and secure all equipment.

CALIBRATION PERFORMANCE TABLE

Maximum Leveled Power Calibration

| Range (GHz) | Applied (GHz) | Limits (dBm) |
|---|---|---|
| 33.0 to 50.0 | 33.0 to 50.0 | +3.0 |

Power Flatness Calibration

| Range (GHz) | Applied (GHz) | Limits (dB) |
|---|---|---|
| 33.0 to 50.0 | 33.0 to 50.0 | ±1.5 |

CALIBRATION PERFORMANCE TABLE *(Cont.)*

Power Level Accuracy Calibration

| Range (GHz) | Applied (dBm) | Limits (dBm) |
|---|---|---|
| 33.0 to 50.0 | +1.0 | -1.0 to +3.0 |
| | -1.0 | -3.0 to +1.0 |
| | -3.0 | -5.0 to -1.0 |
| | -5.0 | -7.0 to -3.0 |