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Model 3390
50 MHz Arbitrary Waveform / Function Generator

Verification and Adjustment Manual

3390-905-01 Rev. B / May 2016

3390-905-01

A Greater Measure of Confidence

KEITHLEY
A Tektronix Company

Model 3390

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Verification and Adjustment Manual

Cleveland, Ohio, U.S.A.

Document number: 3390-905-01 Rev. B / May 2016

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Safety precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley Instruments products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a  screw is present, connect it to protective earth (safety ground) using the wire recommended in the user documentation.

The  symbol on an instrument means caution, risk of danger. The user must refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The  symbol on an instrument means caution, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.

The  symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The  symbol indicates a connection terminal to the equipment frame.

If this  symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F) ; and pollution degree 1 or 2.

To clean an instrument, use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of March 2016.

Table of Contents

Section 1

Verification procedures

In this section:

Verification and adjustment procedures

This manual contains procedures for verification and adjustment of the Keithley Instruments 3390.

The instrument features closed-case electronic calibration. Internal mechanical adjustments are not required. The instrument calculates correction factors based upon the input reference value you set. The new correction factors are stored in nonvolatile memory until the next adjustment is performed. Nonvolatile FLASH calibration memory does not change when power has been off or after a remote interface reset.

Verification interval

The instrument should be verified and adjusted on a regular interval determined by the measurement accuracy requirements of your application. For most applications, verification and adjustment is adequate for a 1-year interval. Only if the instrument is adjusted at regular verification and adjustment intervals are the accuracy specifications warranted.

Recommended adjustment

Whatever verification interval you select, Keithley Instruments recommends that complete readjustment should always be performed at the verification interval. This will assure that the Keithley Instruments 3390 will remain within specification for the next verification interval. This criterion for readjustment best provides long-term stability. Performance data measured, using this method, can be used to extend future calibration intervals.

Recommended test equipment

The table below identifies the recommended equipment needed for completing the verification and adjustment procedures. In the case that the instrument listed is not available, you may substitute it for an instrument with similar specifications.

Recommended equipment	Description	Requirements
Keysight 3458A	8-1/2 Digit Multimeter	AC volts, true RMS, AC coupled, accuracy: ±0.02 % to 1 MHz DC volts, accuracy: 50 ppm, resolution: 100 µV Resistance, offset-compensated, accuracy: ±0.1 Ω
Keysight 53132A	Universal counter	Accuracy: 0.1 ppm
Keysight E4418B	Power meter	100 KHz to 100 MHz 1 µW to 100 mW (–30 dBm to +20 dBm) Accuracy: 0.02 dB, resolution: 0.01 dB
Keysight 8482A	Power sensor	100 KHz to 100 MHz 1 µW to 100 mW (–30 dBm to +20 dBm)
Cable	BNC to BNC cable	2 set
Cable	T-type BNC connector (female/male/female)	1 set
Cable	BNC female to double stacking banana plug	1 set
Cable	Adapter-coaxial straight female-bnc male-n 50 Ω	1 set
Cable	Adapter-coaxial straight male-bnc female-n 50 Ω	1 set

Optimal test conditions

All procedures should comply with the following conditions for optimum performance:

Assure that the calibration ambient temperature is stable and between 21 °C and 25 °C (23 °C ±2 °C).

- Assure ambient relative humidity is less than 80 %.
- Allow a 1-hour warm-up period before verification or adjustment.
- The measurement cable length needs to be as short as possible and consistent with the impedance requirements.
- Only use a 50 Ω cable.

Verification tests

Use the performance verification tests to verify the measurement performance of the instrument. The performance verification tests are based upon the instrument's specifications.

Self Test

A brief memory self test is automatically completed when the instrument is powered on. This limited test assures that the instrument is operational.

1. Press **Utility** on the front panel.
2. Select the **Self Test** softkey from the "Test/Cal" submenu.

When you release the key, the instrument will perform the self test procedure. The self test will complete in approximately five seconds.

- If the self test is successful, "Self Test Passed" is displayed.
- If the self test fails, "Self Test Failed" and an error number are displayed.

Performance verification tests

The performance verification tests are recommended as acceptance tests when you first receive the instrument. The acceptance test results should be compared against the instrument specifications. Repeat the performance verification tests at each calibration interval after acceptance. If the instrument fails performance verification, adjustment or repair is required.

Amplitude and flatness verification procedures

Measurements taken during the AC amplitude (high-impedance) verification procedure are used as reference measurements in the flatness verification procedures. Additional reference measurements and calculated references are utilized in flatness verification procedures. Record these reference measurements and perform the calculations use the table below .

Use a digital multimeter (DMM) and power meter to complete the flatness verification procedures. To correct the difference between the DMM and power meter measurements, you must set the power meter with 0.00 dB level to the DMM at 1 KHz.

The flatness error of the DMM at 100 KHz must be applied in order to set the 0.00 dB reference.

The instrument internally corrects the difference between the high-Z input of the DMM and the 50 Ω input of the power meter while setting the output level.

Allow the reference measurements to convert from V_{RMS} (provided by the DMM) to dBm (provided by the power meter).

For the conversion from V_{RMS} (high-Z) to dBm (at 50 Ω), use the equation below.

Power (dBm) = 10 x log(5.0 x V_{RMS}2)

Flatness measurements for the –10 db, –20 dB, and –30 dB attenuator ranges are verified during the 0 dB verification procedure. No separate verification is given for these ranges.

Amplitude and flatness verification worksheet

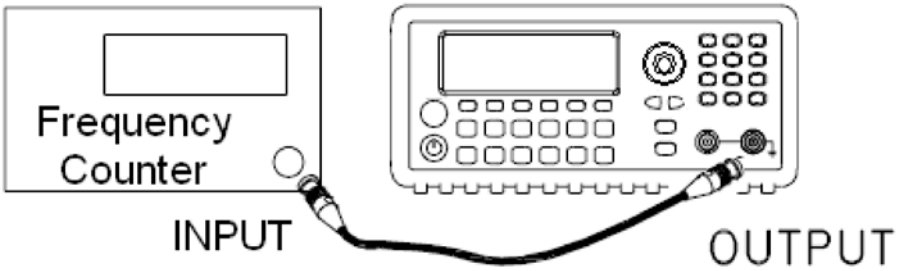
Enter the following measurements	
1 KHz_0dB_reference	V_{RMS}
1 KHz_10dB_reference	V_{RMS}
1 KHz_20dB_reference	V_{RMS}
Calculation of the dBm value of the RMS voltage	
1 KHz_0dB_reference_dBm	10 × log(5.0 x 1KHz_0dB_reference2) dBm
1 KHz_10dB_reference_dBm	10 × log(5.0 x 1KHz_10dB_reference2) dBm
1 KHz_20dB_reference_dBm	10 × log(5.0 x 1KHz_20dB_reference2) dBm
Enter the following measurements	
100 KHz_0dB_reference	V_{RMS}
100 KHz_10dB_reference	V_{RMS}
100 KHz_20dB_reference	V_{RMS}
Calculation of the dBm value of the RMS voltage	
100 KHz_0dB_reference_dBm	10 × log(5.0 x 1KHz_0dB_reference2) dBm
100 KHz_10dB_reference_dBm	10 × log(5.0 x 1KHz_10dB_reference2) dBm
100 KHz_20dB_reference_dBm	10 × log(5.0 x 1KHz_20dB_reference2) dBm
Calculation of the offset values	
100 kHz_0dB_offset	100 KHz_0dB_reference_dBm – 1KHz_0dB_reference_dBm dBm
100 kHz_10dB_offset	100 KHz_10dB_reference_dBm – 1KHz_10dB_reference_dBm dBm
100 kHz_20dB_offset	100 KHz_20dB_reference_dBm – 1KHz_20dB_reference_dBm dBm

Internal timebase verification

This test verifies the output frequency accuracy of the 3390. A single generated frequency provides all of the output frequencies.

1. Connect a frequency counter as shown below (the frequency counter input should be terminated at 50 Ω).

Figure 1: Frequency counter connection



2. Set the instrument to the output (found in the table below) and measure the output frequency. Be sure the instrument output is enabled.

Keithley Instruments 3390			**Measurement**	
Function	**Amplitude**	**Frequency**	**Nominal**	**Error***
Sine Wave	1.00 V_{pp}	10.000,000,0 MHz	10.000 MHz	± 200 Hz

*The error is ±100 Hz within 90 days of calibration, or ±200 Hz within one year.

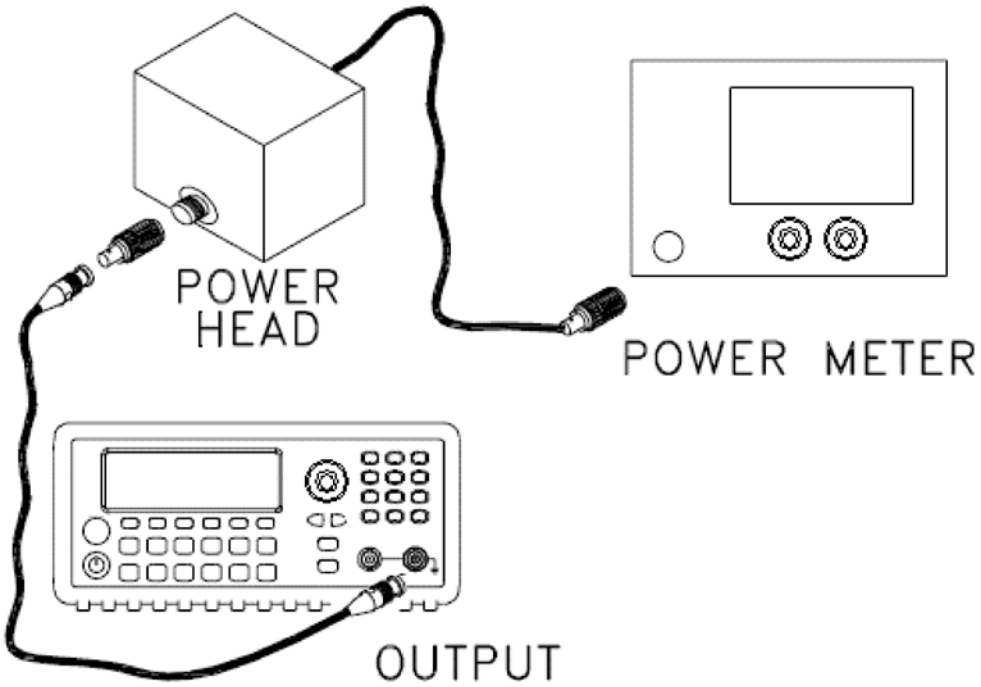
3. Compare the measured frequency to the test limits shown in the table.

AC amplitude verification for high impedance

This procedure checks the AC amplitude output accuracy at a frequency of 1 kHz, and establishes reference measurements for the higher frequency flatness verification procedures.

1. Set the DMM to measure V_{RMS} volts. Connect the DMM as shown below.

Figure 2: Power meter conenctions



2. Set the outputs (found in the table below) and measure the output voltage with the DMM. Press **Utility** to set the output impedance to high–Z. Assure that the output is enabled.

Keithley Instruments 3390				**Measurement**	
Output setup	Function	Frequency	Amplitude	Nominal	Error*
High Z	Sine wave	1.000 KHz	20.0 mV_{RMS}	0.020 V_{RMS}	±0.00091 V_{RMS}
High Z	Sine wave	1.000 KHz	67.0 mV_{RMS}	0.067 V_{RMS}	±0.00138 V_{RMS}
High Z	Sine wave	1.000 KHz	200.0 mV_{RMS}	0.200 V_{RMS}	±0.00271 V_{RMS}
High Z	Sine wave	1.000 KHz	670.0 mV_{RMS}	0.670 V_{RMS}**	±0.00741 V_{RMS}
High Z	Sine wave	1.000 KHz	2.000 mV_{RMS}	2.000 V_{RMS}***	±0.0207 V_{RMS}
High Z	Sine wave	1.000 KHz	7.000 mV_{RMS}	7.000 V_{RMS}****	±0.0707 V_{RMS}
High Z	Sine wave	1.000 KHz	9.000 mV_{RMS}	0.900 V_{RMS}	±0.0100 V_{RMS}

* Based on 1 % setting ±1 mV_{pp} (50 Ω) which is converted to V_{RMS} for high-Z.
** Enter the measured value on the worksheet as 1 KHz_0dB_reference.
*** Enter the measured value on the worksheet as 1 kHz_10dB_reference.
**** Enter the measured value on the worksheet as 1 kHz_20db_reference.

3. Compare the measured voltage to the test limits shown in the table.

Low frequency flatness verification

This procedure checks the AC amplitude flatness at 100 KHz using the reference measurements recorded in the Amplitude and Flatness Verification Worksheet. An error value is established by these measurements and used to set the power meter reference. The transfer measurements are changed to the frequency of 100 KHz using the DMM and the power meter.

1. Set the DMM to measure AC volts. Connect the DMM. This process is shown on the previous page.
2. Set each output of the instrument (shown in the table below) and measure the output voltage with the DMM. Press **Utility** to set the output impedance to high-Z. Be sure the output is enabled.

Keithley Instruments 3390				**Measurement**	
Output setup	Function	Frequency	Amplitude	Normal	Error
High Z	Sine wave	100.000 KHz	670.0 mV_{RMS}	0.670 V_{RMS}*	± 0.0067 V_{RMS}
High Z	Sine wave	100.000 KHz	2.000 mV_{RMS}	2.000 V_{RMS}**	± 0.020 V_{RMS}
High Z	Sine wave	100.000 KHz	7.000 mV_{RMS}	7.000 V_{RMS}***	± 0.070 V_{RMS}

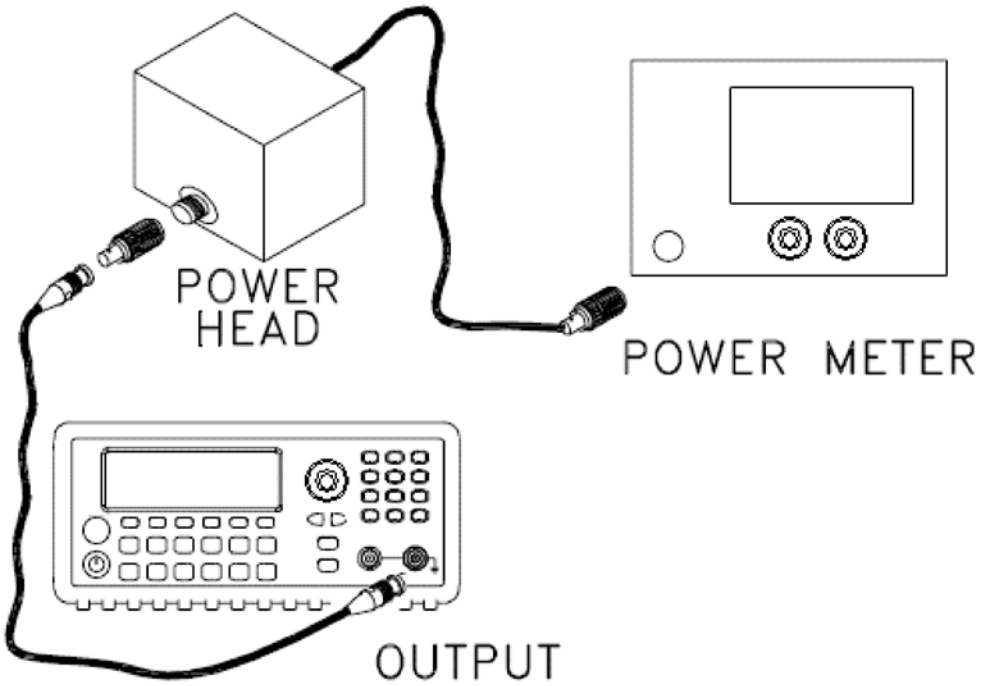
* Enter the measured value on the worksheet as 100 kHz_0dB_reference.
** Enter the measured value on the worksheet as 100 kHz_10dB_reference.
*** Enter the measured value on the worksheet as 100 kHz_20dB_reference.

3. Compare the measured voltage to the test limits shown in the table.
4. All the required measurements on the worksheet have been recorded. Complete the worksheet by calculating all the indications.

Checking 0 dB range flatness

This test checks the high frequency AC amplitude flatness above 100 KHz on the 0 dB attenuator range. Flatness is relative to 1 KHz.

Figure 3: Power meter connections



Connect the power meter to measure the output amplitude of the instrument as shown below.

1. Set up the function generator with the following parameters.
   - Output impedance: 50 Ω by pressing **Utility** and select **Output setup**.
   - Waveform: Sine
   - Frequency: 100 KHz
   - Amplitude: 3.51 dBm
2. Make sure that the output is enabled.
3. Set the current reading as the reference value on the power meter using the relative power function. This can lead you to compare future measurement results in dB.
4. Set the power meter offset to equal the 100 KHz_0dB_offset value which was calculated previously. This sets the power meter to directly read the flatness error specification relative to 1 KHz. 100 KHz_0dB_offset is calculated on the Amplitude and Flatness Verification Worksheet.
5. Set the 3390 to each output described in the following table and measure the output amplitude with the power meter (the relative measurement in dB.)

Keithley Instruments 3390				**Measurement**	
Output setup	Function	Amplitude	Frequency	Nominal	Error
50 Ω	Sine wave	+2 dBm	100.000 KHz	0 dB	±0.1 dB
50 Ω	Sine wave	+2 dBm	500.000 KHz	0 dB	±0.15 dB
50 Ω	Sine wave	+2 dBm	1.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+2 dBm	5.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+2 dBm	10.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+2 dBm	15.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+2 dBm	17.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+2 dBm	20.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+2 dBm	25.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+2 dBm	29.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+2 dBm	37.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+2 dBm	47.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+2 dBm	50.000 MHz	0 dB	±0.5 dB

6. Compare the measured output to the test limits shown in the table.

Checking +10 dB range flatness

This procedure checks the high frequency AC amplitude flatness above 100 KHz on the +10 dB attenuator range. Flatness is relative to 1 KHz.

1. Connect the power meter to measure the output amplitude of the instrument.
2. To set up the function generator press **Utility,** select **Output setup**, and make the following settings:
   - Output impedance: 50 Ω
   - Waveform: Sine
   - Frequency: 100 KHz
   - Amplitude: 13 dBm
3. Make sure that the output is enabled.
4. On the power meter, use the Relative Power function to set the current reading as the reference value. This allows you to compare future measurement results in dB.
5. Set the power meter offset to equal the 100kHz_10dB_offset value previously calculated. This sets the power meter to read the flatness error specification relative to 1 kHz. 100kHz_10dB_offset is calculated on the Amplitude and Flatness Verification Worksheet.
6. Set the 3390 to each output described in the table below and measure the output amplitude with the power meter (the relative measurement in dB).

Keithley Instruments 3390				**Measurement**	
Output setup	Function	Amplitude	Frequency	Nominal	Error
50 Ω	Sine wave	+12 dBm	100.000 KHz	0 dB	±0.1 dB
50 Ω	Sine wave	+12 dBm	500.000 KHz	0 dB	±0.15 dB
50 Ω	Sine wave	+12 dBm	1.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+12 dBm	5.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+12 dBm	10.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+12 dBm	15.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+12 dBm	17.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+12 dBm	20.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+12 dBm	25.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+12 dBm	29.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+12 dBm	37.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+12 dBm	47.000 MHz	0 dB	±.5 dB
50 Ω	Sine wave	+12 dBm	50.000 MHz	0 dB	±0.5 dB

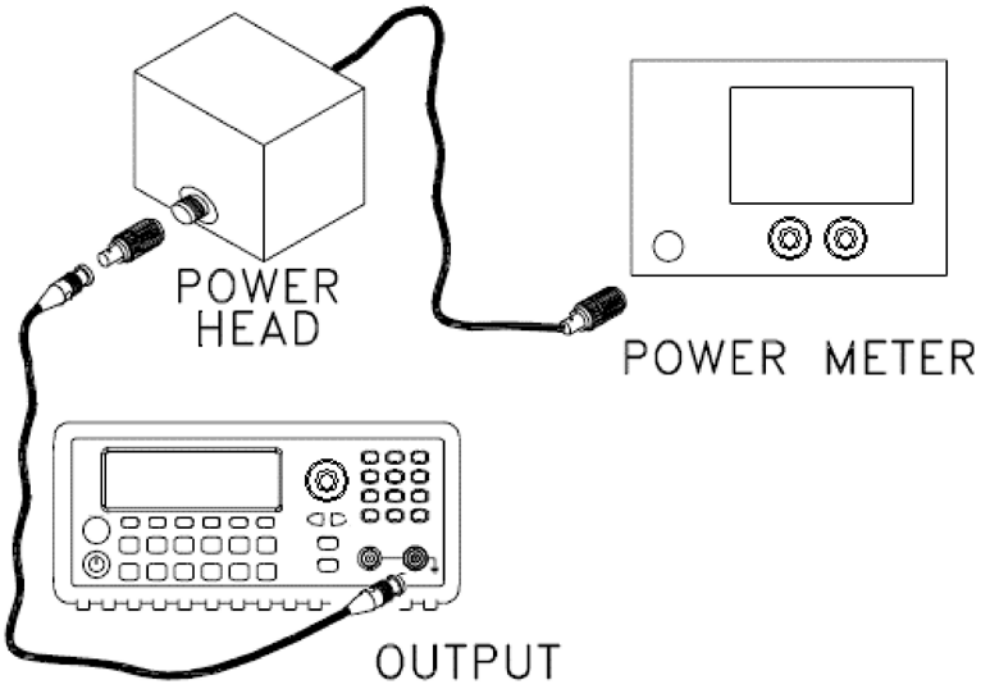
7. Compare the measured output to the test limits shown in the table.

Checking +20 db range flatness

This procedure checks the high frequency AC amplitude flatness above 100 kHz on the +20 dB attenuator range. Flatness is relative to 1 kHz.

1. Connect the power meter to measure the output voltage of the instrument as shown below.

Figure 4: Power meter connections



NOTE

Most power meters will require an attenuator or special power head to measure the +20 dB output.

2. Set up the function generator as follows:
   - Output impedance: 50 Ω by pressing **Utility** and select **Output setup**.
   - Waveform: Sine
   - Frequency: 100 KHz
   - Amplitude: 23.90 dBm
3. Make sure that the output is enabled.
4. Use the **Relative Power** function on the power meter to set the current reading as the reference value. This will allow you to compare future measurement results in dB.
5. Set the power meter offset to equal the 100kHz_20dB_offset value previously calculated. This sets the power meter to read the flatness error specification relative to 1 kHz. 100kHz_20dB_offset is calculated on the Amplitude and Flatness Verification Worksheet.
6. Set the 3390 to each output described in the table below and measure the output amplitude with the power meter.

Keithley Instruments 3390				**Measurement**	
Output setup	Function	Amplitude	Frequency	Nominal	Error
50 Ω	Sine wave	+18 dBm	100.000 KHz	0 dB	±0.1 dB
50 Ω	Sine wave	+18 dBm	500.000 KHz	0 dB	±0.15 dB
50 Ω	Sine wave	+18 dBm	1.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+18 dBm	5.000 MHz	0 dB	±0.15 dB
50 Ω	Sine wave	+18 dBm	10.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+18 dBm	15.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+18 dBm	17.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+18 dBm	20.000 MHz	0 dB	±0.3 dB
50 Ω	Sine wave	+18 dBm	25.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+18 dBm	29.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+18 dBm	37.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+18 dBm	47.000 MHz	0 dB	±0.5 dB
50 Ω	Sine wave	+18 dBm	50.000 MHz	0 dB	±0.5 dB

7. Compare the measured output to the test limits shown in the table.

Verification and adjustment security

This feature allows the user to enter a security code to prevent accidental or unauthorized adjustments of the instrument. When you first receive your instrument, it is secured. Before you adjust the instrument, unsecure it by inputting the correct security code.

- The security code is set to KY3390 when the instrument is shipped from the factory. The security code is stored in nonvolatile memory, and it does not change after the instrument is powered off, Factory Reset (`*RST` command), or Instrument Preset (`SYSTem:PRESet` command).
- In the event that the initial security code, KY3390, has been changed, and the new security code word has been lost, use the master security code word, CAL5710. This code word will always provide access to the calibration mode.

The following SCPI commands enable and disable the calibration mode and allow the user to set a new security code:

`CALibration:SECure:STATe {OFF|ON},<code>`	Enables and disables the calibration mode.
`CALibration:SECure:CODE <new code>`	Creates a new security code word.
`CALibration:SECure:STATe?`	Queries the calibration security state.

NOTE

The new security code may contain up to twelve alphanumeric characters. The first character must be a letter, but the remaining characters may be letters, numbers, or an underscore. It is unnecessary to use all twelve characters.

Verification procedure and verification item adjustment tests

1. self test
2. 2-5 : Freq_10MHz

```
{
: less
: more
: near
: true
}
```

3. : ADC_2V
4. : Self-Cal

```
{
Vos & SinVos
SqrVos
VosOneV
SqrZero & SqrTwoV
}
```

5. 8 - 27 : AC Ampl

```
{
8 - 11      : SinZero & SinTwoV
12 - 13     : -30dBm
14 - 15     : -20dBm
16 - 17     : -10dBm
18 - 19     : 0dBm
20 - 21     : -10dBmA
22 - 23     : 0dBmA
24 - 25     : +10dBm
26 - 27     : +20dBm
}
```

6. 28 – 102 : Flatness

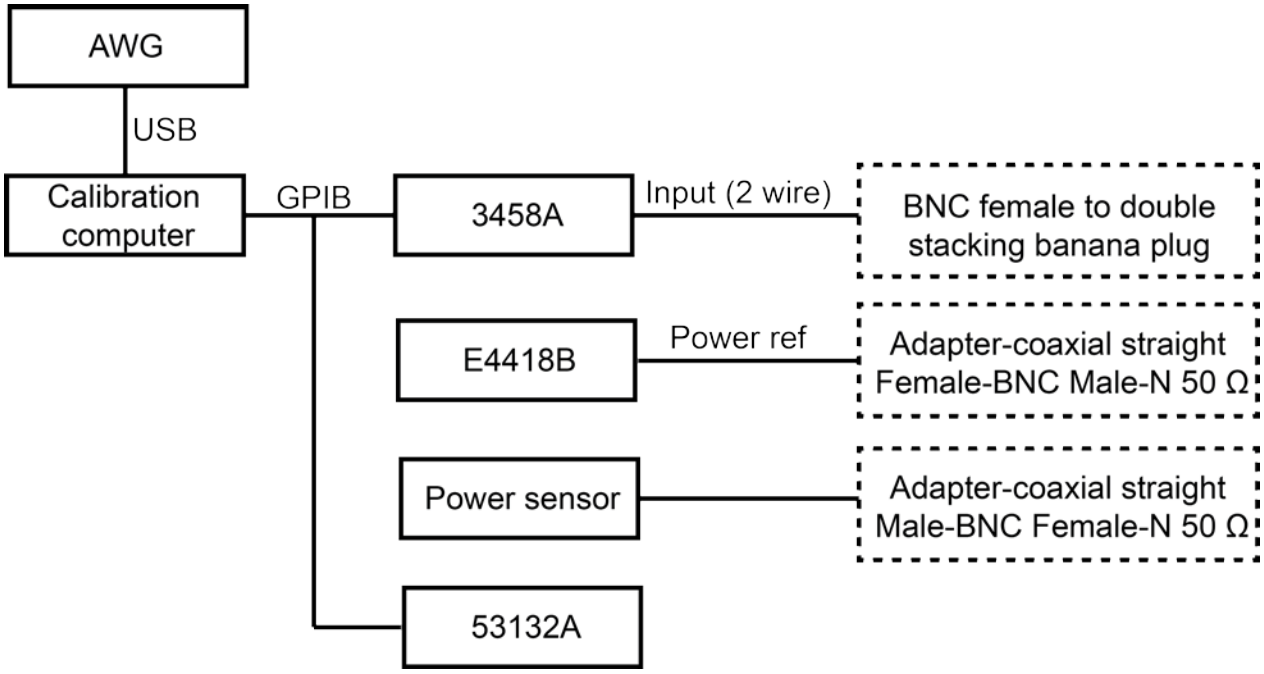
```
{
28 - 52     : 0dBm
53 - 77     : +10dBm
78 – 102    : +20dBm
}
```

Equipment setup

Required equipment

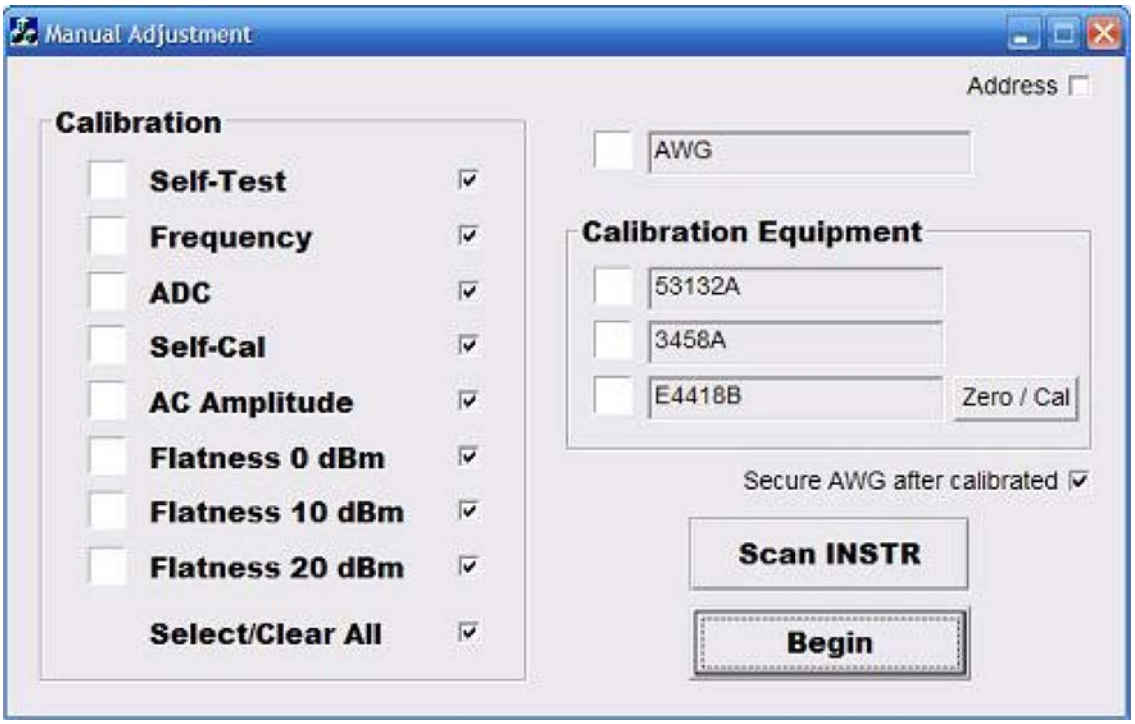
Brand	Equipment	Description	Qty
Keysight	3458A	8-1/2 Digit Multimeter	1
Keysight	53132A	Universal counter	1
Keysight	E4418B	Power meter	1
Keysight	8482A	Power sensor	1
		BNC cable	2
		BNC	1
		BNCH female to double stacking banana plug	1
		Adapter-coaxial straight female-bnc male-n 50 Ω	1
		Adapter-coaxial straight male-bnc female-n 50 Ω	1

Figure 5: Calibration connections



ManualAdjustment.exe: Software interface introduction

Figure 6: ManualAdjustment.exe software interface



- **Scan INSTR:** Scan all of the connected equipment to see if all of the required instruments are set.
- **Zero/Cal:** Power sensor calibration. Connect the power sensor to the POWER REF of E4418B and then execute.
- **Begin:** Execute the manual calibration.
- **Address:** Show the address of each piece of calibration equipment.

Figure 7: ManualAdjustment.exe calibration address box

- **Secure AWG after adjusted:** Lock the manual calibration function after calibration is complete.
- Calibration completed.

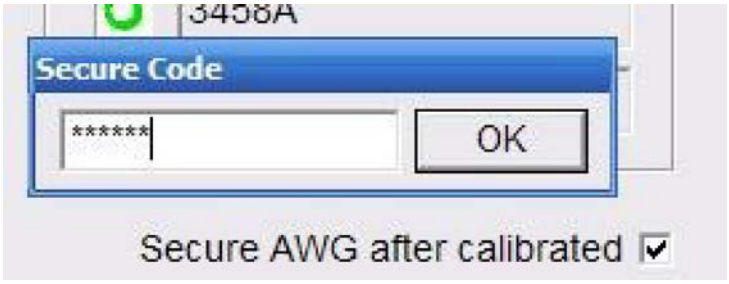
ManualAdjustment.exe: Software operation

1. Click **Begin** to execute the manual calibration. If the AWG manual calibration function is locked, enter the correct secure code.

NOTE

Most power meters require an attenuator or special power head to measure the +20 dB output. The default security code uses "Model Name" (the first letter must be an alphabetic character). If the first letter of "Model Name" is not alphabetic, the system will pick the first and last letter of the company name for the header, plus "Model Name." For example, the Keithley 3390 would be "KY3390".

Figure 8: ManualAdjustment.exe secure code box

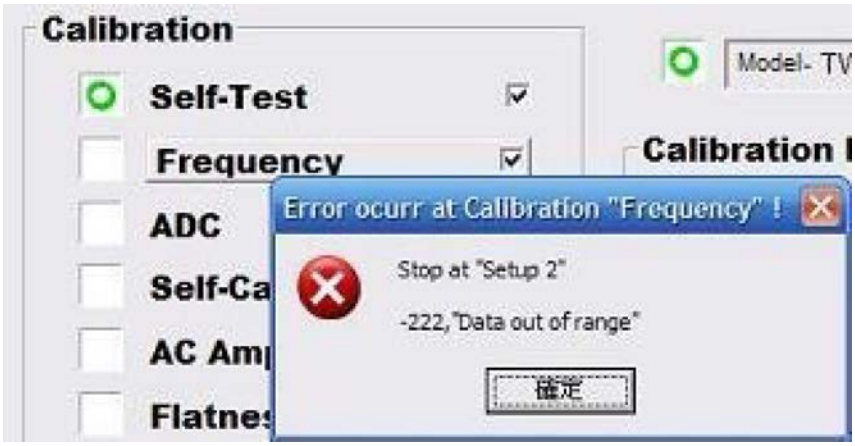


2. Follow the instructions on the Manual Adjustment dialog box to correctly connect the cable.

Figure 9: ManualAdjustment.exe connect AWG output table

3. An error message will display as shown below, during an calibration error.

Figure 10: ManualAdjustment.exe calibration error occur box



4. If **Secure AWG after calibrated** was checked, the manual adjustment function will be locked by the secure code after calibration is completed.

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