

CALIBRATION PROCEDURE

PXIe-5698

26.5 GHz PXI RF Amplifier

This document contains the verification and adjustment procedures for the PXIe-5698. See ni.com/calibration for more information about calibration solutions.

The procedures in this document are for the PXIe-5698 only. Refer to the *PXIe-5668 Calibration Procedure* document to calibrate the PXIe-5668 with the PXIe-5698. NI warrants the PXIe-5668 and PXIe-5698 to meet their published specifications if the individual modules are calibrated and operating within specifications. Consult the *Letter of Conformance* for more information about RF system calibration at ni.com/manuals.

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Software

Calibrating the PXIe-5698 requires you to install the following software on the calibration system:

- NI-RFSA 15.6 or later
- NI Spectral Measurements Toolkit 2.5 or later

You can download all required software from ni.com/downloads.

The software supports programming the calibration procedures in the LabVIEW, C, and LabWindows™/CVI™ application development environments (ADEs). When you install the software, you need to install support only for the ADE that you intend to use.

Documentation

You can consult the following documents as you perform the calibration procedure:

- *PXIe-5698 Getting Started Guide*
- *PXIe-5698 Specifications*
- *PXIe-5668 Getting Started Guide*
- *PXIe-5668 Specifications*
- *NI RF Vector Signal Analyzers Help*, (includes LabVIEW VI and C/CVI programming references)

You might also find the following documents helpful:

- *PXIe-5653 Calibration Procedure*
- *PXIe-5624 Calibration Procedure*

The latest versions of these documents are available on ni.com/manuals.

Calibration Cycle

The measurement accuracy requirements of your application determine how often you should calibrate your device. NI recommends that you perform a complete calibration for the PXIe-5698 at least once every two years. You can reduce this calibration interval based on the accuracy demands of your application.

Test Equipment

Table 1 lists the equipment NI recommends for the performance verification and adjustment procedures. If the recommended equipment is not available, select a substitute using the minimum requirements listed in Table 1.

Table 1. Recommended Equipment for PXIe-5698 Calibration

Equipment	Recommended Models	Where Used	Requirements
Power meter	Anritsu ML2438A	All procedures	Display resolution: ≤ 0.01 dB Settle % per reading: 0.10% Instrumentation accuracy: $\leq \pm 0.5\%$ Reference power uncertainty: 1.2%/year Reference output VSWR: $< 1.04 : 1$
Powersensors (x2)	Anritsu SC7413	All procedures	Power range: -55 dBm to -20 dBm Frequency range: 10 MHz to 26.5 GHz Input VSWR: <150 MHz $< 1.17 : 1$ 150 MHz to < 2 GHz $< 1.08 : 1$ 2 GHz to < 12.4 GHz $< 1.16 : 1$ 12.4 GHz to < 18 GHz $< 1.21 : 1$ 18 GHz to < 26.5 GHz $< 1.29 : 1$ Linearity: <18 GHz $< 1.8\%$ 18 GHz to < 26.5 GHz $< 2.5\%$ Calibration factor uncertainty (2 σ): refer to Appendix B: Power Sensor Calibration Factor Uncertainty
RF source	Anritsu MG3694C Options 2B, 4, and 28B	All procedures	Frequency range: 10 MHz to 26.5 GHz Level power: -15 dBm Harmonics: 10 MHz to ≤ 100 MHz < -40 dBc >100 MHz to ≤ 2.2 GHz < -50 dBc >2.2 GHz to 26.5 GHz < -30 dBc Nonharmonic spurious: 10 MHz to ≤ 2.2 GHz < -60 dBc >2.2 GHz to ≤ 26.5 GHz ≤ -60 dBc
PXI Express chassis	PXIe-1075 or PXIe-1085	All procedures	—
PXI Express controller	PXIe-8133 or PXIe-8135	All procedures	—

Table 1. Recommended Equipment for PXIe-5698 Calibration (Continued)

Equipment	Recommended Models	Where Used	Requirements
Spectrum analyzer	PXIe-5668, 26.5 GHz variant with the 765 MHz instantaneous bandwidth	Gain	Frequency range: 10 MHz to 26.5 GHz Reference level: -50 dBm to 0 dBm Amplitude accuracy: ± 1.5 dB
2.92 mm (m)-to-2.92 mm (m) cables (x3)	—	—	Frequency range: 10 MHz to 26.5 GHz Insertion loss: ≤ 5 dB at 26.5 GHz Impedance: 50 Ω Length: ≤ 24 in.
2.92 mm (m)-to-2.92 mm (m) adapter	Anritsu K220B	—	Frequency range: 10 MHz to 26.5 GHz Impedance: 50 Ω VSWR: 10 MHz to 26.5 GHz..... $< 1.12 : 1$
Attenuator	Anritsu 41KC-20	—	Frequency range: 10 MHz to 26.5 GHz Attenuation: 20 dB (nominal) Power rating: 2 W average Impedance: 50 Ω VSWR: 10 MHz to 12 GHz $\leq 1.10 : 1$ 12 GHz to 18 GHz..... $\leq 1.15 : 1$ 18.0 GHz to 26.5 GHz..... $\leq 1.18 : 1$
Power splitter (two-resistors type)	Weinschel 1534	—	Frequency range: 10 MHz to 26.5 GHz Insertion loss: ≤ 10.5 dB (6 dB, nominal) Power rating: 1 W Output VSWR: $\leq 1.35 : 1$ Note: Ensure that the equivalent splitter output SWR meets the above requirement between 10 MHz and 26.5 MHz.
Torque wrench	NI 781615-01	—	1 N · m (9 lb · in.)

Test Conditions

The following setup and environmental conditions are required to ensure the PXIe-5698 meets published specifications:

- Keep cabling as short as possible. Long cables and wires act as antennas, picking up extra noise that can affect measurements.
- Verify that all connections, including front panel connections and screws, are secure.
- Use an appropriate torque wrench or torque screwdriver and SMA driver bit to tighten all module RF connectors (SMA or 2.92 mm). NI recommends use of $1 \text{ N} \cdot \text{m}$ ($9 \text{ lb} \cdot \text{in.}$).
- Maintain an ambient temperature of $23 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$.
- Keep relative humidity between 10% and 90%, noncondensing.
- Ensure that the PXI Express chassis fan speed is set to HIGH, that the fan filters, if present, are clean, and that the empty slots contain filler panels. For more information about maintaining adequate air circulation in your PXI/PXI Express chassis, refer to the *Maintained Forced-Air Cooling Note to Users* document available at ni.com/manuals.
- Allow a warm-up time of at least 30 minutes after the chassis is powered on and the NI-RFSA is loaded and recognizes the PXIe-5698. The warm-up time ensures that the PXIe-5698 and test instrumentation are at a stable operating temperature.
- In each verification procedure, insert a delay between configuring all devices and acquiring the measurement. This delay may need to be adjusted depending on the instruments used but should always be at least 1,000 ms for the first iteration, and 100 ms for each other iteration.
- Lock all test equipment to the REF OUT signal on the back of the PXI Express chassis.

Initial Setup

Refer to the *PXIe-5698 Getting Started Guide* for information about how to install the software and hardware and how to configure the device in Measurement & Automation Explorer (MAX).

Characterization

Use the measured response of the test system during verification tests.

The power splitter and attenuation response is measured at the RF input frequencies used in the verification tests.



Notice The connectors on the PXIe-5698 and test equipment are fragile. Carefully perform the steps in these procedures to prevent damaging any DUTs or test equipment.

Zeroing and Calibrating the Power Sensor

1. Connect channel A of the power meter to power sensor A.
2. Connect channel B of the power meter to power sensor B.
3. Zero and calibrate the power sensors using the built-in functions in the power meter.

Characterizing the RF Source Power



Note Zero and calibrate the power sensor prior to starting this procedure using the [Zeroing and Calibrating the Power Sensor](#) section of this document.

Splitter Assembly Characterization Factor

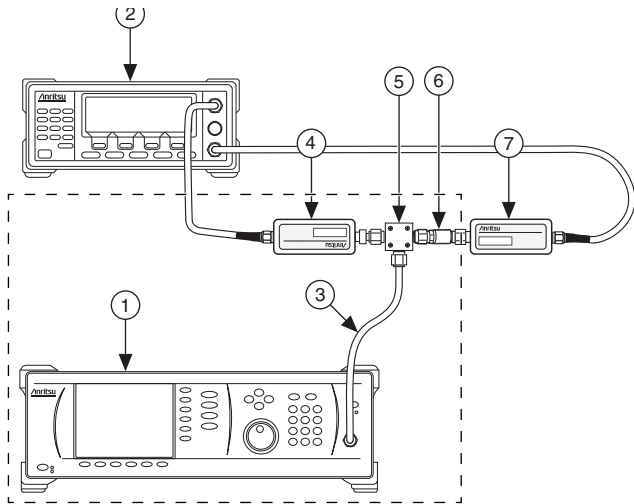
Designate one of the two outputs of the power splitter as the reference output 1. Consistently use the same output as the reference output throughout the characterization and verification procedures.

1. Connect the RF source output to the power splitter input using the 2.92 mm (m)-to-2.92 mm (m) cable.
2. Connect power sensor A to the power splitter reference output.
3. Connect the other power splitter output to the power sensor B using the 20 dB attenuator. Refer to Figure 1 for a diagram of the completed equipment setup.



Note Do not disassemble the characterization splitter assembly fixture within the dashed line. If any part is taken apart, it must be re-characterized.

Figure 1. Splitter Assembly Characterization Factor Equipment Setup



1	RF Source	5	Power Splitter
2	Power Meter	6	20 dB Attenuator
3	2.92 mm (m)-to-2.92 mm (m) Cable	7	Power Sensor B
4	Power Sensor A		

4. Set the RF source frequency to the first frequency from Table 4 in [Appendix A: PXIe-5698 Configuration Table](#).

5. Set the RF source power to -15 dBm.
6. Wait for the power sensors readings to stabilize. Take a reading on assembly fixture output 1 with power sensor A and on splitter assembly fixture output 2 with power sensor B. Record power sensor A reading as *Power Sensor A₁* and power sensor B reading as *Power Sensor B₁*.
7. Calculate the Splitter Characterization Factor at each RF frequency in Table 4 using the following formula:

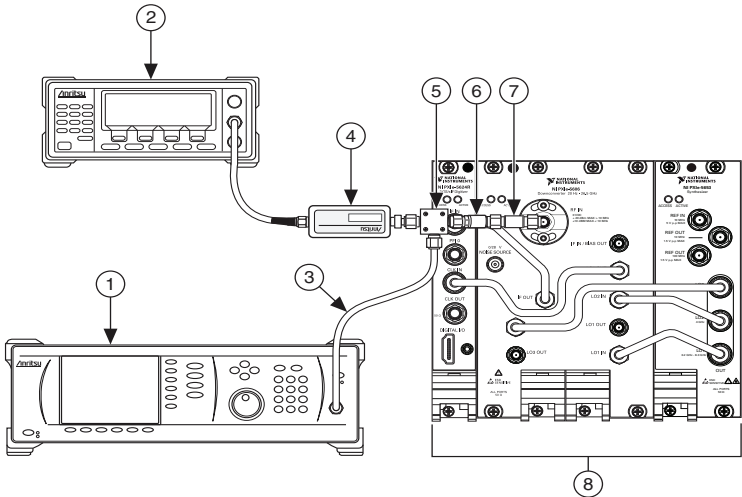
$$\text{Splitter Assembly Characterization Factor} = \text{Power Sensor B}_1 - \text{Power Sensor A}_1$$

8. Repeat steps 4 to 7 for all remaining frequencies from Table 4.
9. Carefully disconnect Power Sensor B from the assembly to avoid disturbing the other assembly connections.

Spectrum Analyzer Characterization

1. Connect the characterization splitter assembly fixture to the NI 5668R RF IN connector using the 2.92 mm (m)-to-2.92 mm (m) adapter. Refer to Figure 2 for a diagram of the completed equipment setup.

Figure 2. RF Source Power and Receiver (with Splitter and Attenuator) Characterization Equipment Setup



1 RF Source	5 Power Splitter
2 Power Meter	6 20 dB Attenuator
3 2.92 mm (m)-to-2.92 mm (m) Cable	7 2.92 mm (m)-to-2.92 mm (m) Adapter
4 Power Sensor A	8 PXIe-5668 Spectrum Analyzer

2. Set the RF source power to -15 dBm.
3. Create a new session for the PXIe-5668.

4. Configure the PXIe-5668 according to the following fixed property settings. These settings remain unchanged during the test:
 - Acquisition Type: Spectrum
 - Averaging Mode: RMS averaging
 - Reference Level: -5
 - RF Attenuator: 10
 - Mechanical Attenuation: 10
 - Number of Averages: 10
 - Digital IF Equalization Enabled: False
 - Digitizer Dither Enabled: Enabled
 - Channel Coupling: AC coupled
 - Span: 100 kHz
 - Resolution Bandwidth: 1 kHz
 - Preamp Enabled: Disabled
 - Device Instantaneous Bandwidth: 300 kHz
 - Preselector enabled: Disabled
5. Set the PXIe-5668 center frequency and the RF source frequency according to the first row of Table 4 in [Appendix A: PXIe-5698 Configuration Table](#).
6. Commit the PXIe-5668 settings to hardware.
7. Wait for the power sensor reading to stabilize and take a reading of the splitter assembly fixture output 1 with power sensor A. Record the reading as *Power Sensor A₂*.
8. Read the PXIe-5668 power spectrum and record the peak value of the spectrum as *PXIe-5668 Power₂*.
9. Calculate the *Spectrum Analyzer Characterization Factor* at each RF frequency in Table 4, using the following formula:

$$\text{Spectrum Analyzer Characterization Factor} =$$

$$\text{Power Sensor } A_2 + \text{Splitter Assembly Characterization Factor} - \text{PXIe-5668 Power}_2$$

10. Repeat steps 5 to 9 for all remaining frequencies in Table 4.
11. Close the PXIe-5668 session.

As-Found and As-Left Limits

The as-found limits are the published specifications for the PXIe-5698. NI uses these limits to determine whether the PXIe-5698 meets the device specifications when it is received for calibration.

The as-left limits are equal to the published NI specifications for the PXIe-5698, less guard bands for measurement uncertainty, temperature drift, and drift over time. NI uses these limits to determine whether the PXIe-5698 meets the device specifications over its calibration interval.

Verification

The performance verification procedures assume that adequate traceable uncertainties are available for the calibration references. In the event of a failure during the verification of the PXIe-5698, return the PXIe-5698 module to NI for calibration and adjustment.

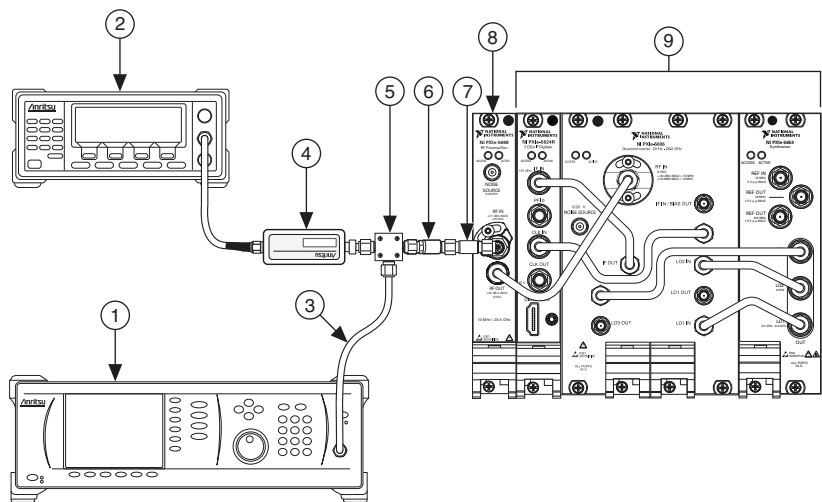
Verifying Minimal Gain, Preamplifier Disabled



Note Prior to starting this procedure, ensure that you have completed the *Splitter Assembly Characterization Factor* and *Spectrum Analyzer Characterization* procedures successfully and that the correction data is available.

1. Connect the PXIe-5698 RF OUT connector to the PXIe-5668 RF IN connector.
2. Connect the characterization splitter assembly fixture output to the PXIe-5698 RF IN connector. Refer to Figure 3 for a diagram showing the completed equipment setup.

Figure 3. Adjustment Setup for Insertion Loss and RF Gain



- | | |
|------------------------------------|--------------------------------------|
| 1 RF Source | 6 20 dB Attenuator |
| 2 Power Meter | 7 2.92 mm (m)-to-2.92 mm (m) Adapter |
| 3 2.92 mm (m)-to-2.92 mm (m) Cable | 8 PXIe-5698 RF Amplifier |
| 4 Power Sensor A | 9 PXIe-5668 Spectrum Analyzer |
| 5 Power Splitter | |

3. Set the RF source power to -15 dBm.
4. Create a new session for the PXIe-5668.
5. Create a new session for the PXIe-5698.
6. Configure the PXIe-5668 according to the following fixed property settings. These settings remain unchanged during the procedure:

- Acquisition Type: Spectrum
- Averaging Mode: RMS averaging
- Reference Level: -5
- RF Attenuation: 10
- Mechanical Attenuation: 10
- Number of Averages: 10
- Digital IF Equalization Enabled: False
- Digitizer Dither Enabled: Enabled
- Channel Coupling: AC coupled
- Span: 100 kHz
- Resolution Bandwidth: 1 kHz
- Preamp Enabled: Disabled
- Device Instantaneous Bandwidth: 300 kHz
- Preselector enabled: Disabled

- Configure the PXIe-5698 Preamp Enabled fixed property settings to **Disabled**.
- Set the PXIe-5668 and PXIe-5698 center frequency and the RF source frequency according to the first row in Table 4.
- Commit the PXIe-5668 settings to hardware.
- Commit the PXIe-5698 settings to hardware.
- Wait for the power sensor reading to stabilize and take a reading of the splitter assembly fixture output 1 with power sensor A. Record the reading as *Power Sensor A₃*.
- Read the PXIe-5668 power spectrum. Record the peak value of the spectrum as *PXIe-5668 Power₃*.
- Calculate the *PXIe-5698 Minimal Gain Preamplifier Disabled* at each RF frequency using the following formula:

$$PXIe-5698 \text{ Minimal Gain Preamplifier Disabled} = PXIe-5668 \text{ Power}_3 + \text{Spectrum Analyzer Characterization Factor} - \text{Power sensor } A_3 - \text{Splitter Characterization Factor}$$

- Repeat steps 7 to 12 for all remaining frequencies in Table 4.
- Compare the *PXIe-5698 Minimal Gain Preamplifier Disabled* to the verification limits in Table 2.

Table 2. PXIe-5698 Gain Verification Test Limits (Preamplifier Disabled)

Frequency	As-Found Limits (dB)	As-Left Limits (dB)
≥10 MHz to 300 MHz	≥-0.8	≥-0.59
>300 MHz to 2 GHz	≥-1.0	≥-0.80
>2 GHz to 3.6 GHz	≥-1.0	≥-0.78
>3.6 GHz to 6 GHz	≥-1.3	≥-1.1

Table 2. PXIe-5698 Gain Verification Test Limits (Preamplifier Disabled)

Frequency	As-Found Limits (dB)	As-Left Limits (dB)
>6 GHz to 9 GHz	≥ -1.4	≥ -1.2
>9 GHz to 14 GHz	≥ -2.0	≥ -1.7
>14 GHz to 24 GHz	≥ -2.3	≥ -1.9
>24 GHz to 26.5 GHz	≥ -2.6	≥ -2.2

16. Close the PXIe-5698 session.

17. Close the PXIe-5668 session.

Verifying Minimal Gain, Preamplifier Enabled



Note Prior to starting this procedure, ensure that you have completed the [Splitter Assembly Characterization Factor](#) and [Spectrum Analyzer Characterization](#) procedures successfully and that the correction data is available.

1. Connect the characterization splitter assembly fixture output to the PXIe-5698 RF IN connector. Refer to Figure 3 for a diagram showing the completed equipment setup.
2. Set the RF source power to -15 dBm.
3. Create a new session for the PXIe-5668.
4. Create a new session for the PXIe-5698.
5. Configure the PXIe-5668 according to the following fixed property settings. These settings remain unchanged during the test:
 - Acquisition Type: Spectrum
 - Averaging Mode: RMS averaging
 - Reference Level: -5
 - RF Attenuation: 10
 - Mechanical Attenuation: 10
 - Number of Averages: 10
 - Digital IF Equalization Enabled: False
 - Digitizer Dither Enabled: Enabled
 - Channel Coupling: AC coupled
 - Span: 100 kHz
 - Resolution Bandwidth: 1 kHz
 - Preamp Enabled: Disabled
 - Device Instantaneous Bandwidth: 300 kHz
 - Preselector enabled: Disabled
6. Configure the PXIe-5698 Preamp Enabled fixed property settings to **Enabled**.

7. Set the PXIe-5668 and PXIe-5698 center frequency and the RF source frequency according to the first row in Table 4.
8. Commit the PXIe-5668 settings to hardware.
9. Commit the PXIe-5698 settings to hardware.
10. Wait for the power sensor reading to stabilize and take a reading of the splitter assembly fixture output 1 with power sensor A. Record this reading as *Power Sensor A₄*.
11. Read the PXIe-5668 power spectrum. Record the peak value of the spectrum as *PXIe-5668 Power₄*.
12. Calculate *PXIe-5698 Minimum Gain Preamplifier Enabled* at each RF frequency using following formula:

$$PXIe-5698 \text{ Minimal Gain Preamplifier Enabled} = PXIe-5668 \text{ Power}_4 + \text{Spectrum Analyzer Characterization Factor} - \text{Power sensor } A_4 - \text{Splitter Characterization Factor}$$
13. Repeat steps 7 to 12 for all remaining frequencies in Table 4.
14. Compare the *PXIe-5698 Minimum Gain Preamplifier Enabled* to the verification limits in Table 3.

Table 3. Gain Verification Test Limits (Preamplifier Enabled)

Frequency	As-Found Limits (dB)	As-Left Limits (dB)
≥10 MHz to 200 MHz	≥23	≥23.22
>200 MHz to 1 GHz	≥32	≥32.22
>1 GHz to 2 GHz	≥32	≥32.22
>2 GHz to 3 GHz	≥29	≥29.25
>3 GHz to 3.6 GHz	≥26	≥26.25
>3.6 GHz to 6 GHz	≥23	≥23.31
>6 GHz to 9 GHz	≥20	≥20.31
>9 GHz to 14 GHz	≥16	≥16.37
>14 GHz to 20 GHz	≥13	≥13.52
>20 GHz to 24 GHz	≥11	≥11.59
>24 GHz to 26.5 GHz	≥10	≥10.59

15. Close the PXIe-5698 session.
16. Close the PXIe-5668 session.

If the gain verification procedures determines that the PXIe-5698 is outside its limits, refer to [NI Services](#) for information about support resources or service requests.

Adjustment

This section describes the steps needed to adjust the PXIe-5698. Following the adjustment procedure automatically updates the calibration date and temperature in the EEPROM of the PXIe-5698.

When adjusting gain with preamplifier disabled, the RF frequency passes through the bypass path. When adjusting gain with preamplifier enabled, the RF frequency is swept through the preamplifier paths. The PXIe-5668 measures the power output through the PXIe-5698 RF OUT terminal to determine the overall gain of the PXIe-5698. The spectrum analyzer and power meter provide the information needed to calculate gain through the PXIe-5698.

Use the NI-RFSA calibration API for the following adjustment procedures. Using RF list mode on the RF signal generator improves the measurement speed. NI-RFSA calibration API stores the results in the EEPROM.



Note NI recommends a complete adjustment of your device to renew the calibration interval.

Adjustment stores calibration constants for the following PXIe-5698 specifications:

- Absolute Amplitude Accuracy of bypass path when preamplifier is disabled.
- Absolute Amplitude Accuracy of preamplifier path gain when preamplifier is enabled for frequencies 10 MHz to ≤ 26.5 GHz.

The calibration constants of the PXIe-5698 are only used when it is part of the PXIe-5668 system to perform measurements using the preamplifier.

Adjusting Minimal Gain, Preamplifier Disabled



Note Prior to starting this procedure, ensure that you have completed the [Splitter Assembly Characterization Factor](#) and [Spectrum Analyzer Characterization](#) procedures successfully and that the correction data is available.

1. Create and initialize an external calibration session using the appropriate password. The default password for password-protected operations is NI.
2. Connect the characterization splitter assembly fixture to the PXIe-5698 RF IN connector using the 2.92 mm (m)-to-2.92 mm (m) adapter. Refer to Figure 3 for a diagram of the completed equipment setup.
3. Set the RF source power to -15 dBm.
4. Create a new session for the PXIe-5668.
5. Create a new session for the PXIe-5698.
6. Configure the PXIe-5668 according to the following fixed property settings. These settings remain unchanged during the procedure:
 - Acquisition Type: Spectrum
 - Averaging Mode: RMS averaging

- Reference Level: -5
 - RF Attenuation: 10
 - Mechanical Attenuation: 10
 - Number of Averages: 10
 - Digital IF Equalization Enabled: False
 - Digitizer Dither Enabled: Enabled
 - Channel Coupling: AC coupled
 - Span: 100 kHz
 - Resolution Bandwidth: 1 kHz
 - Preamp Enabled: Disabled
 - Device Instantaneous Bandwidth: 300 kHz
 - Preselector enabled: Disabled
7. Configure the PXIe-5698 Preamp Enabled fixed property settings to **Disabled**.
 8. Set the PXIe-5668 and PXIe-5698 center frequency and the RF source frequency according to the first row in Table 4.
 9. Commit the PXIe-5668 settings to hardware.
 10. Commit the PXIe-5698 settings to hardware.
 11. Wait for the power sensor reading to stabilize and take a reading of the splitter assembly fixture output 1 with power sensor A. Recording the reading as *Power Sensor A₅*.
 12. Read the PXIe-5668 power spectrum. Record the peak value of the spectrum as *PXIe-5668 Power₅*.
 13. Calculate the *PXIe-5698 Minimal Gain Preamplifier Disabled* at current RF frequency using the following formula:

$$PXIe-5698 \text{ Minimal Gain Preamplifier Disabled} = PXIe-5668 \text{ Power}_5 + \text{Spectrum Analyzer Characterization Factor} - \text{Power sensor } A_5 - \text{Splitter Characterization Factor}$$
 14. Call niRFSACalAdjustDeviceGain with the value of *PXIe-5698 Minimal Gain Preamplifier Disabled* to the gain input and the current RF frequency to the frequency input.
 15. Repeat steps 7 to 14 for all frequencies in Table 4.
 16. Close the calibration session.
 17. Close the PXIe-5698 session.
 18. Close the PXIe-5668 session.

Adjusting Minimal Gain, Preamplifier Enabled



Note Prior to starting this procedure, ensure that you have completed the [Splitter Assembly Characterization Factor](#) and [Spectrum Analyzer Characterization](#) procedures successfully and that the correction data is available.

1. Create and initialize an external calibration session using the appropriate password. The default password for password-protected operations is **NI**.
2. Connect the characterization splitter assembly fixture to the PXIe-5698 RF IN connector using the 2.92 mm (m)-to-2.92 mm (m) adapter. Refer to Figure 3 for a diagram of the completed equipment setup.
3. Set the RF source power to -15 dBm.
4. Create a new session for the PXIe-5668.
5. Create a new session for the PXIe-5698.
6. Configure the PXIe-5668 according to the following fixed property settings. These settings remain unchanged during the procedure:
 - Acquisition Type: Spectrum
 - Averaging Mode: RMS averaging
 - Reference Level: -5
 - RF Attenuation: 10
 - Mechanical Attenuation: 10
 - Number of Averages: 10
 - Digital IF Equalization Enabled: False
 - Digitizer Dither Enabled: Enabled
 - Channel Coupling: AC coupled
 - Span: 100 kHz
 - Resolution Bandwidth: 1 kHz
 - Preamp Enabled: Enabled
 - Device Instantaneous Bandwidth: 300 kHz
 - Preselector enabled: Disabled
7. Configure the PXIe-5698 Preamp Enabled fixed property settings to **Enabled**.
8. Set the PXIe-5668 and PXIe-5698 center frequency and the RF source frequency according to the first row in Table 4.
9. Commit the PXIe-5668 settings to hardware.
10. Commit the PXIe-5698 settings to hardware.
11. Wait for the power sensor reading to stabilize and take a reading of the splitter assembly fixture output 1 with power sensor A. Record the reading as *Power Sensor A₆*.
12. Read the PXIe-5668 power spectrum. Record the peak value of the spectrum as *PXIe-5668 Power₃*.
13. Calculate the *PXIe-5698 Minimal Gain Preamplifier Enabled* at current RF frequency using the following formula:

$$PXIe-5698 \text{ Minimal Gain Preamplifier Enabled} = PXIe-5668 \text{ Power}_6 + \text{Spectrum Analyzer Characterization Factor} - \text{Power sensor } A_6 - \text{Splitter Characterization Factor}$$

14. Call niRFSA Cal Adjust Device Gain with the value of *PXIe-5698 Minimal Gain Preamplifier Enabled* to the gain input and the current RF frequency to the frequency input.
15. Repeat steps 7 to 14 for all remaining frequencies in Table 4.
16. Close the calibration session.
17. Close the PXIe-5698 session.
18. Close the PXIe-5668 session.

Reverification

You do not need to perform a Reverification after adjustment because the device does not use the stored constants to correct the output in either Preamplifier Enable or Disabled modes when used as a standalone module. The calibration constants of the PXIe-5698 are only used when it is part of the PXIe-5668 system to perform measurements using the preamplifier.

Revision History

Revision	Section	Changes
376166A-01 April 2016	—	This is the initial release version of the NI-XXXX Calibration Procedure.
376166B-01 September 2020		

Appendix A: PXIe-5698 Configuration Table

Table 4. RF Configuration Frequencies

Start Frequency	Stop Frequency	Step Size
10 MHz	100 MHz	10 MHz
100 MHz	3.6 MHz	100 MHz
3.6 GHz	8.0 GHz	200 MHz
8.0 GHz	16.0 GHz	200 MHz
16.0 GHz	20.0 GHz	200 MHz
20.0 GHz	26.5 GHz	200 MHz

Appendix B: Power Sensor Calibration Factor Uncertainty

Table 5. Power Sensor Calibration Factor Uncertainty (2σ)

Frequency	Calibration Factor Uncertainty (%)
10 MHz to ≤ 0.10 GHz	≤ 0.85
> 0.10 GHz to 2.0 GHz	≤ 1.0
> 2.0 GHz to 8.0 GHz	≤ 1.2
> 8.0 GHz to 10.0 GHz	≤ 1.4
> 10 GHz to 12 GHz	≤ 1.5
> 12 GHz to 26.5 GHz	≤ 1.9

NI Services

Visit ni.com/support to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

Visit ni.com/services to learn about NI service offerings such as calibration options, repair, and replacement.

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