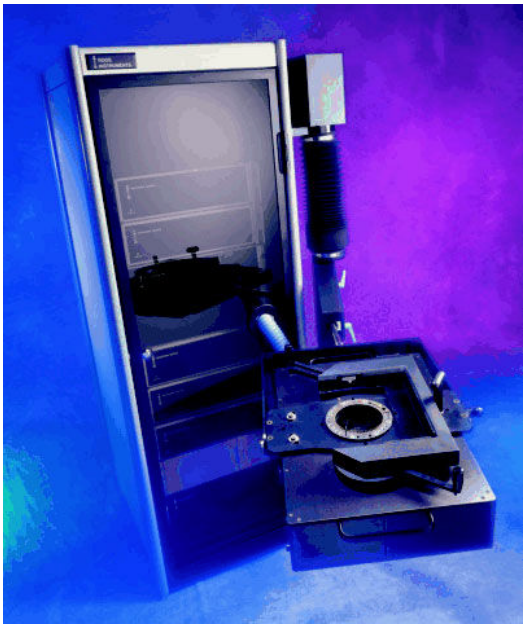

RI7100A RF ATE SYSTEM

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Plan for Calibration

Calibrations should be scheduled every 6 or 12 months following the Preventive Maintenance Schedule. The frequency can be adapted by the end-user's discretion. Calibrations can be safely postponed up to 6 months time if the system is in a thermally stable environment where the ambient temperature does not vary by more than 5° C.

IMPORTANT: At least 4 weeks before a scheduled calibration, check that all the Requirements are met and the instruments are calibrated themselves to the global NIST electromagnetic standard.

Follow the Prepare for Calibration process to assure that calibration is not be performed on a "cold" system that requires at least 2 hours to stabilize enough to calibrate.

Inspect the Cal Kit instrument to assure the item's serial numbers and calibration data are accurate by following the procedure to Inspect and Modify Cal Standards.

Verify that all instruments are functioning properly before starting the Calibration Procedure by following the Diagnose Procedure. Make sure that all calibration standards and instruments in a Cal Kit are in good working order. Look for straight pins, inspect center conductors for wear and clean connectors to remove any debris.

NOTE: Performing a Calibration on a system that is failing may cause the Diagnostics to pass even though a component is not functioning up to specifications. ALWAYS follow the Diagnose Procedure prior to following the Calibration procedure.

The Calibration Procedure can take about 4 to 6 hours, depending on frequency range (6 GHz ,12 GHz, or 20 GHz), for a typical system configuration to complete. Calibrations are interactive so the total time is dependent on the responsiveness of the operator and the model and configuration of Instruments.

Preventive Maintenance Procedure

Roos Instruments recommends that the following Preventive Maintenance Procedure be carried out at least once every six months to maintain the RI7100A System in top performance.

1. Carefully inspect all of the RF connectors and pogo pins around the Testhead Pogo Ring. Look for physical damage, bent pins or fingers, and contamination such as dirt, metal flakes, etc. If the connectors need to be cleaned, then carefully clean the connector with alcohol and blow dry with compressed air. If there is physical damage, replace the bad connector/cable assembly per the Connector Replacement Procedure.

2. Open the back of the system rack, inspect all the cable connections and check all SMA cable connectors for tightness.

CAUTION: On rear panel SMA cables, do not try to put a wrench on the gold trim cap.

3. Clean the air filters on the Testhead and on the back of all the RF Sources per the RF Source Maintenance and Cleaning procedure.

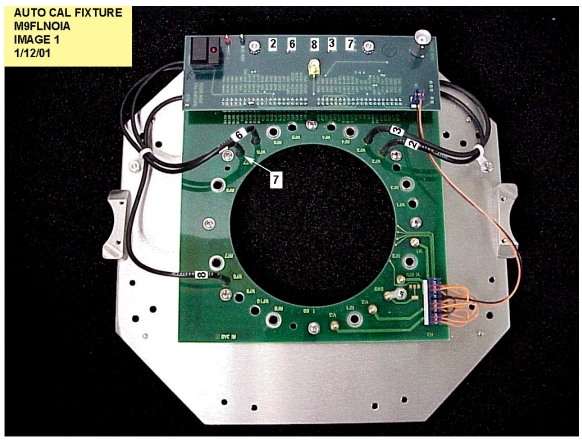
4. Follow the Prepare for Calibration procedure until step 7 and Dock and Activate the Cal Fixture to the Testhead. Read the "% Life Left" for the *Testhead* and for the *Src12* instruments. Consider replacing the relays if the output is less than “25% Live Left".

5. Follow the Diagnose Procedure. If there are any failures, rerun that specific Diagnostic and verify the failure by contacting RI Support (support@roos.com). If you have sufficient resources, replace the most likely defective component and rerun the specific diagnostic.

Calibration Requirements

To calibrate a RI7100A system, the following items are needed:

- RI7100A Diagnostic/Calibration (Diag/Cal) Fixture
- 20 GHz (or 40 GHz) Calibration Kit (Cal Kit)
- Calibration Tools: (facility provided)
  - SMA Torque Wrench
  - 1/4” Open-end Wrench
  - 5/16” Open-end Wrench



RI7100A DIAG/CAL FIXTURE

The RI7100A Diagnostic/Calibration (Diag/Cal) Fixture is included with delivery of a new RI7100A system and includes the “auto cal” Fixture needed to perform the calibration. The Diag/Cal Fixture can be used on all RI7100A system configurations.

The Cal Kit includes a Power Meter and Sensor, Digital Volt meter, S-Parameter Standards, Noise standard, Cables, RF Adapters, and RF Attenuator used for calibrating the system up to 20 GHz.

The instruments and standards in the Cal Kit need to be calibrated regularly to NIST standards for Electromagnetic Measurements. The facility is responsible for setting the duration of the calibration interval and maintaining documentation. The Roos Instruments Calibration Scope outlines the measurement capabilities and an estimation of measurement uncertainties and/or errors for calibration.

The power meter, power sensor, and DMM are typically calibrated annually. The noise standard and OSL standards can be calibrated bi-annually. If available, use a calibration lab (Cal Lab) at your facility or one in your local area. If a Cal Lab is not available or can not calibrate a

specific instrument or standard, it may have to be sent to the manufacturer for calibration. RI offers Cal Kit service as RIK0082A for 20 GHz cal kits. Reference the Cal Kit Instrument Calibration Interval table.

RI provides a NIST traceable calibration certificate when a preventive maintenance and calibration (PMC) is performed. Calibration should be performed when any component is repaired or replaced, but a certificate is not always issued.

The Cal Kit includes a USB drive with a Cal Kit instrument file (.INT) containing the Cal Kit coefficients. Be sure to update the file on the USB stick whenever the Cal standard coefficients change and be sure the Cal Kit file (.INT) is copied to the system's "D:\RiApps\Inst" directory before using the Cal Kit.

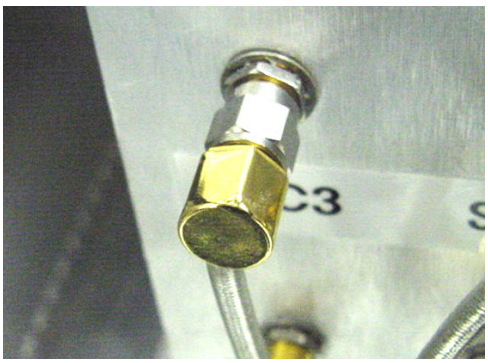
Calibration Tools

A SMA Torque Wrench is required to attach SMA RF cables to various instruments during calibration. The torque wrench should be set to 0.8-1.1 N·m or 7-10 in·lb.

CAUTION: Over tightening a SMA connection could permanently damage the connector. Under tightening a SMA connection could cause measurement repeatability issues.

SMA TORQUE WRENCH

CAUTION: DO NOT use a wrench on the gold trim cap found on the SMA cables accessible from the rack's rear access door.



GOLD CAP ON SMA CABLES INSIDE RACK

Calibration Kit Contents

The Cal Kit contains instruments and accessories required to perform a calibration up to 20 GHz.

CAUTION: Due to the sensitive nature of the standards, all the components of a Cal Kit should remain secured in the provided case and not used for engineering or development tasks.

Power Meter may have a manually set 110/220 Volt switch, set for the correct facility provided voltage or the power supply may become damaged.

NOTES:

Adapters and Attenuator should be stored in the provided vials when not in use.

SMA conformable cable should NOT be straightened for storage after use to avoid damage.

The N-SMA adapter on the Power Meter may be left connected while being stored.

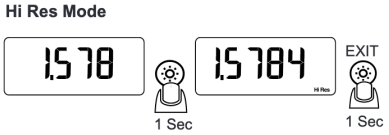
Calibration coefficients for the Open standard are found printed inside the OSL box or stored on a USB drive or floppy disk and the ENR table is labeled on the Noise Source.

Cal Kit Instruments

Description	Part Number
Adapter, N(m)-SMA(f)	G90H7K2A
Cable, Power Sensor-N(m)	MNXEHK4A
Cal Standards 18GHz, SMA O/S/L, Anritsu C5224	M6LPY61A
DC Multimeter (DMM) , Fluke 87v (5 digit accuracy)	MFN6ZK1B
Noise Source .1-18GHz, 20dB ENR	M6LPZJ1A
Power Sensor 20GHz, SMA, Spanawave/Gigatronics	M7CJ2B2A
Power Meter, Spanawave/Gigatronics 8541C	M7CJ222A

ADAPTER, CABLE, POWER METER, & SENSOR SPANAWAVE 8541C 20 GHZ SMA

DC MULTIMETER (DMM), FLUKE 87V SERIES 5 (5 DIGIT ACCURACY)



HOLD HI RES BUTTON FOR 1 SET TO ENABLE 5 DIGIT ACCURACY

CAL STANDARDS 18GHZ, SMA O/S/L, ANRITSU C5224

ADAPTERS, SMA(F)-SSIS(M)

Cal Kit Accessories

Description	Part Number
Adapter, SMA(m)-SMA(f), 20 GHz	GM73Y02A
Adapter, SMA(f)-SMA(f), Bulkhead	M6GVJT1B
Adapters, SMA(f)-SSIS(m) (QTY 5)	M6GVHT1A
Attenuator, 20dB, 2W	M6GSFV1A
Banana mini gripper leads, 24in 1 red 1 black (set)	MMB7GT5A
Cable, BNC(m)-BNC(m), 36in	M5WNBC1A
Cable, SMA(m)-SMA(m) Conformable, 11"	M5PJG21A
Cable, GPIB(m)-GPIB(m), 0.5m	GCBCRS2A
Cable, RIFL2, 84in (2m)	GGFEGW2B
GPIB INSTRUMENT POD	RI8502A
USB drive with CalKit Instrument (.INT)	MNXEHS4A

ADAPTER, SMA(M) SMA(F)

ADAPTER, SMA F-F

CABLE, RIFL 2, 84”

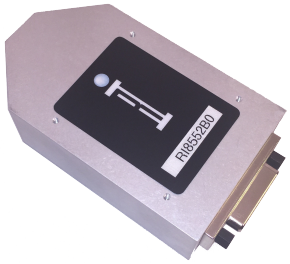
ATTENUATOR, 20DB, 2W

BANANA MINI GRIPPER LEADS

CABLE, BNC M-M 36”

CABLE, SMA M-M 11”

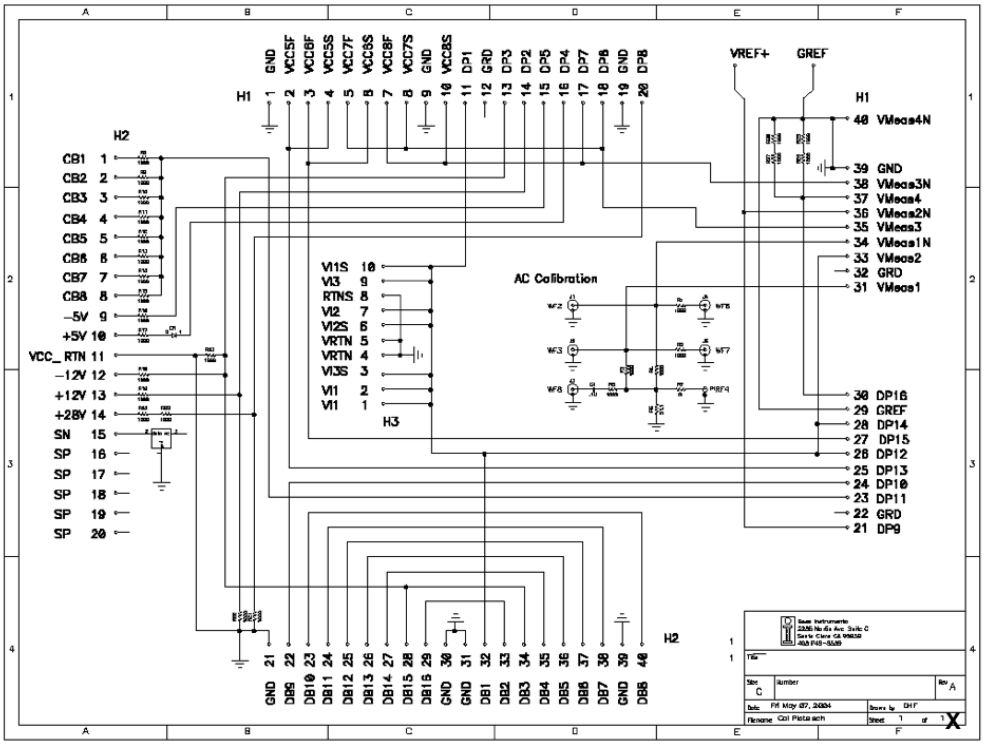
CABLE, GPIB 20”



GPIB INSTRUMENT POD

USB DRIVE

Cal Plate Schematic



Cal Kit Instrument Calibration Interval

The instruments in a Calibration kit should be calibrated at the manufacturer recommended interval, reference Instrument Cal Table below. If an instrument's calibration coefficients change, update the replaced instrument's serial number and calibration coefficients using the Inspect and Modify Cal Standards procedure.

Instrument Cal Table

Standard	Interval	Performed By[1]
Voltmeter/Ammeter (DMM)	1 Year	Any DC Cal Lab
RF Power Sensor	1 Year	Spanawave
RF Power Meter	1 Year	Spanawave
O/S/L Standards[2]	2 Years	Anritsu
Noise Source[2]	2 Years	Noisecom

1 On-site Cal Lab can be used if capabilities exist.
2 Open and Noise Source are the only standards that have unique calibration data.

Prepare for Calibration

Use the following procedure to prepare the system for calibration:

1. Start warming up the Power Meter by attaching the AC power and turning it ON. Start a 20 minute timer to know when to proceed with the Zero/Cal step.

CAUTION: If Power Meter has a manually set 110/220 Volt switch, set for the correct facility provided voltage or it may damage the power supply.

2. If the RI RFIC Test Environment window is not already open, turn on the system's main power and monitor. Double click on the **RI System Software** icon on the desktop to open the RI RFIC Test Environment window.

3. Select **System > Login** from the menu and double click any user with "Admin" or higher privileges and enter the password. The currently active user icon will change to red, indicating it is active.

4. Close the Login window by pressing the X in the upper right corner or **Close** from the folder's key icon in the upper left corner.

5. Choose **System > Messages > Show** to open the Log window to display the messages displayed by the system. Leave this window open for the duration of the Calibration.

6. If a Fixture is attached, unlatch and remove from the test head.

7. Choose **System > Startup** to activate the latest tester configuration. The system will perform an internal self-test and leave all the instruments to their default idle state. The Log window will display "ACTIVE HARDWARE MODE!!!" message after startup has finished.

CAUTION: The system must be running for a minimum of 2 hours after a startup and before running the first testplan on the Cal Exec (See "Run the

Calibration and Validation Plans in Groups”). This warm-up time is required for the instruments’ internal temperature to stabilize and minimize the affects on the Calibration data.

8. If the Log window displays an Error or Warning message, please correct the problem before continuing. Inspect the "% Life Left" for the Testhead and for the Src12 instruments. If the reading is 25% or lower, consider replacing that relay.

9. Set a timer for 2 hours to identify when it is OK to proceed with running the Calibration test plans. It is OK to run Diagnostics before this time is reached.

10. Choose **Test > Tester** from the RI RFIC Test Environment window to open the Testers window.

11. Backup the current Tester and Cal data by selecting the active Tester (red icon) and choosing **Copy** from the right mouse button menu. Enter the Tester’s Name, Today’s Date and “Cal Backup”. Now in the Tester window, you should have a new tester icon named, for example, "Roos1_051020_Cal Backup".

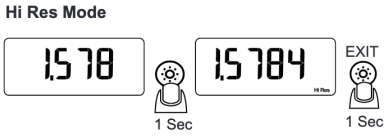
12. From the Tester window, choose **Configure** from the right mouse button menu on the active (red) tester to open the Configuration window. Leave this window open for the duration of the Calibration.

13. If not recently completed, follow the Diagnose Procedure to verify that all Instruments are functioning properly. DO NOT continue with calibration if any Instruments fail diagnostics until getting feedback from Roos Instruments support (support@roos.com).

Activate & Inspect Calibration Components

After completing the steps in the Prepare for Calibration section above, the Digital Multimeter (DMM), Power Meter (*Pmeter*), RI7100A Diagnostic/ Calibration Fixture (*Fixture*), and Calibration Kit (*CalKit*) must be prepared and loaded into the configuration before the Calibration Procedure can be followed.

Enable Hi-Res Mode on the Fluke DMM:



1. Power on the DMM by selecting V.
2. Hold Hi Res button for 1 second to enable 5 -Digit Accuracy. Notice the number of digits change from 4 to 5.
3. Connect the leads to V and press SHIFT to enter DC mode.

Activate and Zero the Power Meter (*Pmeter*):

1. If not already done, attach the AC power cable to the Power Meter and the wall outlet. Turn ON the Power Meter. Set timer for 20 minutes to allow the Power Meter to warm up before Zero/Cal.

CAUTION: If Power Meter has a manually set 110/220 Volt switch, set for the correct facility provided voltage or it may damage the power supply.

2. Attach the RIFL cable to the GPIB Instrument Pod and any available RIFL ports on the back of the Tester.
3. Connect the GPIB cable to the GPIB Instrument Pod and the Power Meter.
4. Attach Power Sensor cable between the Power Meter's Sensor port and to the Power Sensor.

5. If if not already attached, connect the N-SMA Adapter to the Power Meter Cal port.

6. Choose **Test > Instruments** from the RI RFIC Test Environment window. Right click on the **Gigatronics Series 8540B Power Meter** (or similar) and choose **Select** button.

7. Perform a Startup by choosing the **System > Startup** from the RI RFIC Test Environment window. The *Pmeter* instrument should now be visible in the configuration window.

NOTE: Roos Instruments always sets the power meter to use GPIB address 13. The facility may have a power meter used for calibrations set to a different GPIB address.

8. After waiting 20 minutes from when the Power Meter was turned ON, connect the Power Sensor to the Cal port on the Power Meter. press **Zero/Cal** button on the Power Meter and wait for the calibration to finish. (Proceed to Activate and Inspect the Calibration Kit (CalKit) while this time elapses.)

9. After the Power Meter calibration is complete, remove the Power Sensor from the Cal port and the *Pmeter* instrument is ready for use.

10. Continue on to Activate and and Inspect the Calibration Kit steps.

Activate and Inspect the Calibration Kit (CalKit):

1. Choose **Tester > Instruments** from the RI RFIC Test Environment window.

2. Right click on the Cal Kit that matches the Cal Kit Name (OSL and Noise Source) and choose **Activate** button from the Instruments window.

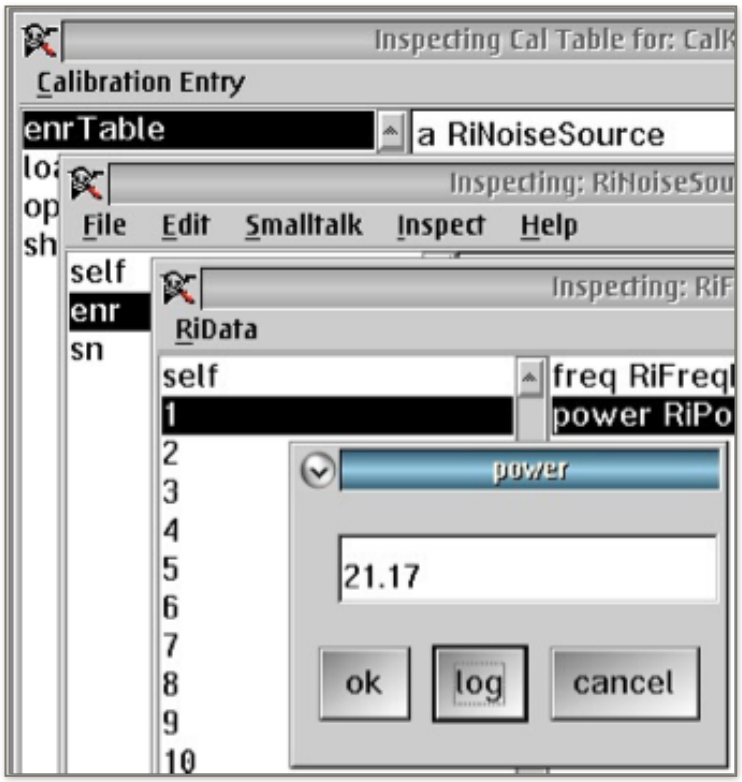
3. The *CalKit* instrument should now be in the Configuration window.

4. Select the **Cal Kit** listed in the Instrument window and select **Inspect Calibration**. Double-click the appropriate element. Entries default to linear values. For logarithmic values, click the **lin** button.

5. To change the coefficients for the Open, double click “open”. You will see coefficient values for '**C0**', '**C1**', '**C2**', and '**C3**' in "e" notation. Verify that these match the corresponding coefficients from Open standard based on the printout or values stored on the provided floppy or USB drive. If not, change them directly in the text entry field on the right. Verify that the serial number in '**sn**' matches the file's serial number and matches the serial number of the actual open. If not, change it.

6. For the Load and Short standards, the only thing to change is the serial number. Double-click on '**load**'. Highlight '**sn**'. Verify that it matches the serial number of the actual load. If not, change it so it matches. Repeat this for the Short. After making any changes, select the CalKit instrument and choose **Instrument > Calibration > Save** menu.

7. Changing the Noise Source coefficients, Double-click on '**enrTable**', then double-click on '**enr**'. There are coefficients corresponding to the values on the noise source's label. Highlight ‘**1**' then perform the next step, repeating through the complete list.



INSPECTING POWER VALUE FROM ENR TABLE

NOISE SOURCE LABEL

*NOTE: The **lin**/**log** button shows the current format, not the desired format. When displaying in linear format, the button shows 'lin'. Clicking on the button changes to log format, and the button changes to 'log.' The values on the Noise Source are logarithmic dB, so the button should say 'log' when comparing to the Noise Source label.*

8. Verify that the frequency is '**10**', corresponding to the 10 MHz coefficient on the noise source's label. Then double click on '**Power**' and since the value displayed is linear (the button says **lin**), change it to log by pressing the **lin** button. With the button now displaying log, confirm that this number exactly matches the coefficient on the noise source's label. If not, change it to match and select the **ok** button.

9. Repeat step 5 for each of coefficients, then close the **Inspecting: RiFrVsPower** window.

10. Choose **View** > **Rectangle** from the right mouse button menu in the left pane (array of values) to view a plot of the ENR table, check for invalid data that does is out of the normal pattern.

11. Finally, verify that the enrTable serial number in **sn** item matches the serial number of the Noise Source. If not, change it.

12. Close all “Inspecting” windows that were opened in this process.

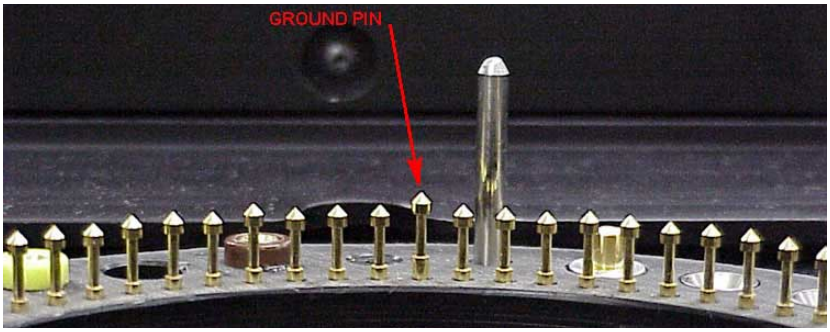
13. After making any changes, select the CalKit instrument and choose **Instrument > Calibration > Save** menu.

14. From the Instrument window, choose the active Cal Kit (in red) and choose **Deactivate** from the right mouse button menu. Now right click on the Cal Kit and choose **Activate.** This guarantees that the latest saved Cal data is loaded.

15. Continue on to Dock and Activate the Cal Fixture steps.

Dock and Activate the Cal Fixture:

1. Before connecting the Cal Fixture to the testhead, visually inspect the fixture and test head connectors. The RF connectors should be clean and the DC pogo pin heights should be aligned. (See Measuring & Setting Pogo Pin Height https://roos.com/docs/JWAD-4W4U47). Inspect the Red/Black Ground, Ground Ref and VI 1, VI 2, and VI 3 connectors. Do not attach if any damaged pins are found.



2. Use the three (3) guide pins and orientation arrow in the testhead to align the RI7100A Cal Fixture with the testhead. Press the Cal Fixture downward onto the test head. Notify RI Support (support@roos.com) if you have any missing guide pins.

3. Rotate the cam (locking) arms to hold the Fixture in place.

4. Choose **Test > Fixture** from the RI RFIC Test Environment window and double click or choose Activate from the right mouse button menu for "**Cal Fixture CF2**" (or similar) to have the system load the Cal Fixture into the system configuration.

5. The Fixture will appear as "*Fixture, <Cal Kit Name> Transient*" in the configuration window. If the configuration window is not already open, from the Tester window, choose **Configure** from the right mouse button menu on the active (red) tester.

6. Once the Fixture, PMeter, and CalKit are visible in the configuration window, continue on to the Diagnose Procedure.

Diagnose Procedure

Before calibrating, always run the diagnostics to identify any possible failures. Contact RI Support (support@roos.com) if any failures appear prior to proceeding with the calibration.

To Open the Diagnostic Executive window:

1. Follow the Prepare for Calibration and only Dock and Activate the Cal Fixture steps. Cal Kit and PMeter instruments are not required.

2. If the Tester window is not still open, choose **Test > Testers** From the RI RFIC Test Environment window to open the Testers window.

3. Open the Diagnose Executive window by choosing **Diagnose** from the right mouse button menu from the Active (red) tester window.

4. Choose **Options > Show All Results** and save the Results as “before Calibration” data.

5. Choose **Run > All** to execute each service plan listed in the Diagnostic executive. Each service test plan is described in the Diagnose Exec Testplans table below.

6. Confirm PASS result. Report any FAIL results to Roos Instrumets Support at support@roos.com.

Diagnose Exec Testplans

Testplans	Explanation
Ri7240-Diagnose Fixt Pwr C Bits CF2 Ri7420-Diagnose Vmeas CF2 Ri7430-Diagnose DB1-16 CF2 Ri7322-Verify Receiver RevE	• Checks the fixture power and the C bits • Checks the voltage measurement (Vmeas) function • Checks that the static digital (DB lines) and the parametric measure are functioning. • Verifies receiver I/Q gain, IF gain, etc. *NOTE: This "verify" will FAIL if out of cal. Any break in the RF path will cause FAIL.*
Ri7322-Diagnose Rec Filters Ri7322-Diagnose LNA IP3 20 Ri7240-Diagnose Noise Reference Ri7240-Diagnose Noise Source Ri7240-Diagnose Noise Floor 20	• Checks the bandwidth and rejection of filters in the receiver • Measures receive path IP3. *NOTE: FAIL on this test are path loss problems, not IP3 problems* • Checks the internal noise reference • Checks the noise source and the noise receive path. *NOTE: FAIL if receive path has too much loss.*

Testplans	Explanation
Ri7240-Diagnose Ports 20 Ri7240-Diagnose Direct Receive Ri7240-Diagnose Receive Attenuation Ri7240-Diagnose Relays	• Checks that signal is getting to the ports and that they are a good match • Checks that the direct receive paths are functional • Checks the receive attenuator's relative attenuation (receive attenuator is in the Testhead.) • Checks source/receive RF relays in Testhead (11, 12, 21, 22)
Ri7240-Diagnose Source1 Ri7240-Diagnose Source2 Ri7240-Diagnose Source3 Ri7240-Diagnose Switch F Ri7240-Diagnose Switch G Ri7240-Diagnose Switch H Ri7240-Diagnose Switch I Ri7240-Diagnose Switch M	• Checks the sources produce RF • Checks the coaxial switches in the Testhead for through loss and match
Ri7269-Diagnose 1&2 Relays Ri7265-Diagnose Src3 Amp Module	• Checks the Source 1/2 combiner module • Checks the Source 3 amp module
Ri7420-VCC 123456 Verify CF2 Ri7430-Verify PowerVi1 CF2 Ri7430-Verify PowerVi2 CF2 Ri7430-Verify PowerVi3 CF2 Ri7710-Verify Lin Src1,2&3 Std 4Port	• Verifies that the VCCs are operating • Verifies that the Power VI's are operating • Checks the sources for output power and linearity

Testplans	Explanation
Ri7240-RF2 Verify IM Internal 20 Ri7240-RF2 Verify IM Amp Internal Ri7240-RF2 Verify Src3 20 Ri7240-RF2 Verify Src3 Amp Ri7240-RF3 Verify IM Internal 20 Ri7240-RF3 Verify IM Amp Internal Ri7240-Rf4 & Rf5 Verify Internal Ri7240-RF6 Verify IM Internal 20	• Verifies the test port paths
Ri7240-EA Verify 20 Ri74103-Verify Digitizer CF2 Ri74103-Verify BER	• Verifies the complex S-parameters are functioning • Verifies the digitizer (oscilloscope) • Verifies the bit error rate function is operating

7. If all test plans report “Pass”, then proceed with the Calibration Procedure. Any “FAIL” results, contact RI Support (support@roos.com) before proceeding.

Calibration Procedure

The Calibration Executive window enables the user to run multiple calibration and verification test plans in the proper order. The Calibration Executive automatically saves the calibration data only after the verification test plan passes.

Calibration and Validation plans should ALWAYS be run as a pair. The calibration data is reset (lost) when a Calibration service plan is compiled and the calibration data is only saved after the Validation plan passes.

After Diagnostics have been run and the Calibration components are activated, open the Calibration Executive window to begin calibrating the tester.

CAUTION: The system must be running for a minimum of 2 hours after a Startup (See step 7 of Prepare for Calibration) and before choosing Run > Selected in step 2 below. This warm-up time is required for the instruments' internal temperature to stabilize and minimize the affects on the Calibration data.

After setting the Calibration Due Date, the Tester must be saved for the calibration data to be stored to the disk.

Open the Calibration Executive window:

1. Open the Calibration Executive window by choosing **Tester > Calibrate** from the configuration window.

2. Choose **Options > Show all results** and **Options > Log Results to Disk** to document the calibration. Leave **Options > Auto Save** to append the logs to the file as it is written.

3. Proceed to Run the Calibration and Validation plans in Groups.

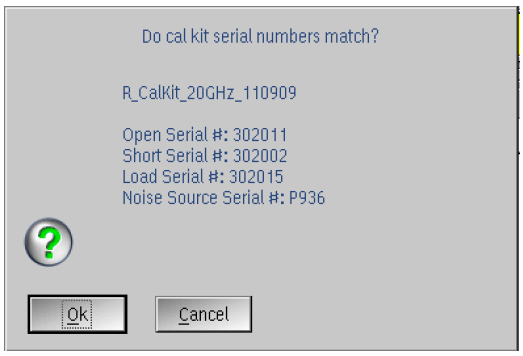
CAUTION: Closing the Calibration Executive window before running all Calibration and Validation plans may leave Invalid Cal data saved and cause measurements to be inaccurate.

Run the Calibration and Validation Plans in Groups:

1. Highlight the test plans in groups identified by their instrument name by clicking on the test plan name to select it. Don't select more than 8 plans and don't select a Calibration plan without its Validation pair. Use "Calibration Exec Testplans" below for suggested groupings, prompts and instrument setup.

2. To run the selected tests, select **Run > Selected** from the menu.

3. Confirm the Serial Numbers on the OSL and Noise Source and choose **OK** at the "Do cal kit serial numbers match?" prompt.



IMPORTANT: Be sure "Inspect and Modify Cal Standards" procedure has been completed to assure values are correct.

4. Follow the operator prompts provided by the test system while it runs the calibration plan. "Validation" plans typically use the same "Calibration" prompts in reverse order.

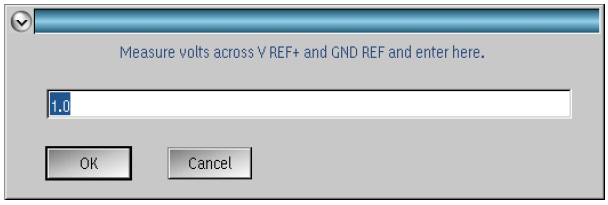
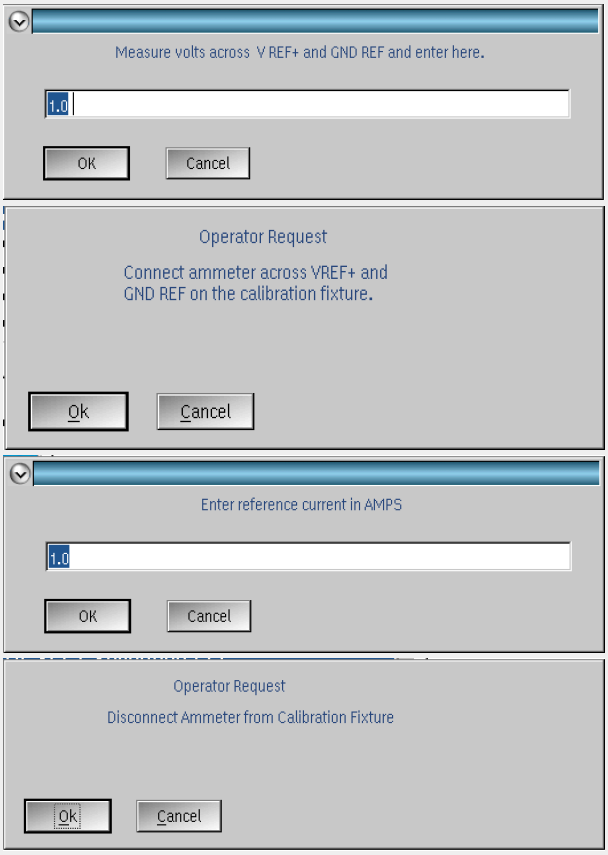
NOTE: The system only saves the Calibration factors AFTER all selected plans have been run and PASS, so run only a few plans at a time. With this method, if an operator error occurs and a validate plan fails, then only the selected Calibration plans will have to be run again.

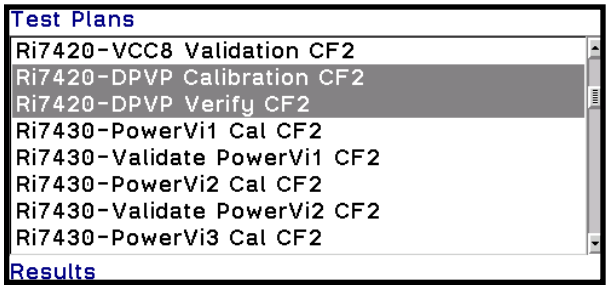
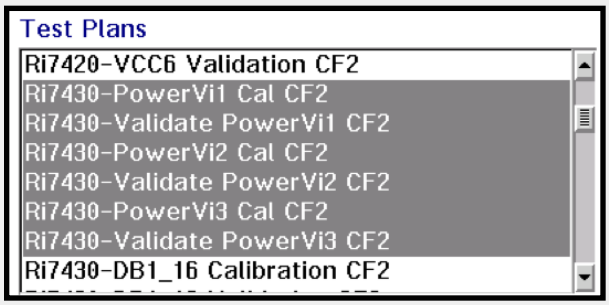
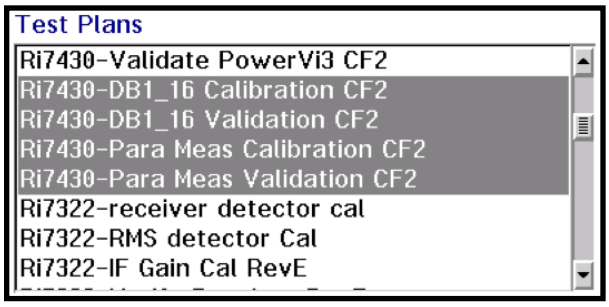
5. Choose **Run > Unselect All Tests** and repeat steps 1 through 3 until all of the test plans have been performed. If the validation test plan fails, run the Diagnostic tests for the Instrument that failed and contact RI support (support@roos.com).

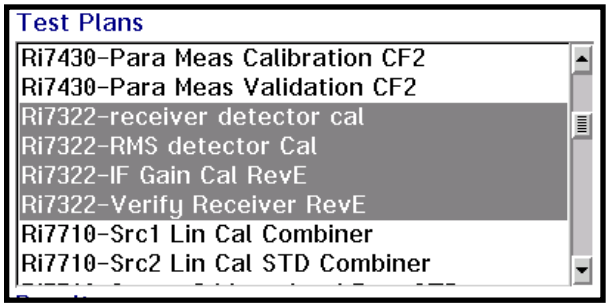
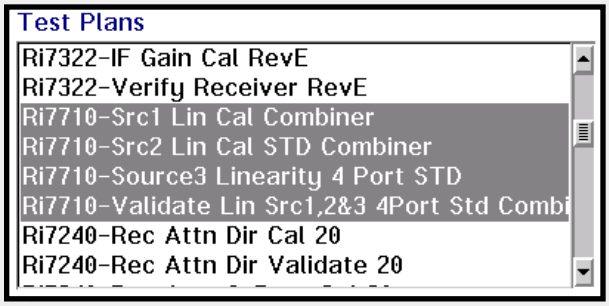
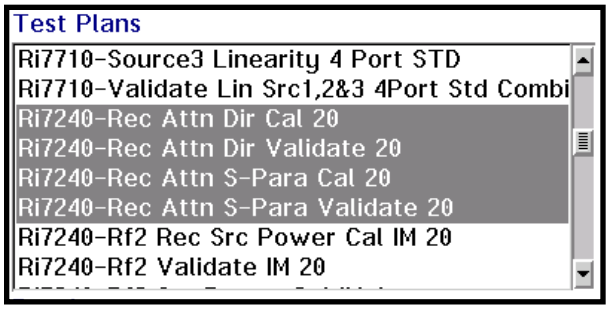
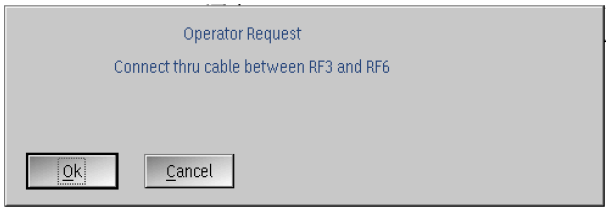
6. IMPORTANT: Remember to connect the BNC cable to the Noise Source before the 'Noise" Calibrations. Instead of selecting Cal/ Validate plans in pairs, run ALL THE 'NOISE' Calibration plans before the Validate plans. If a Validate FAILS, RUN ALL THE CALIBRATION PLANS starting after the last passing Validate. DO NOT "ONLY" RUN the immediate Calibration plan, choose ALL of them.

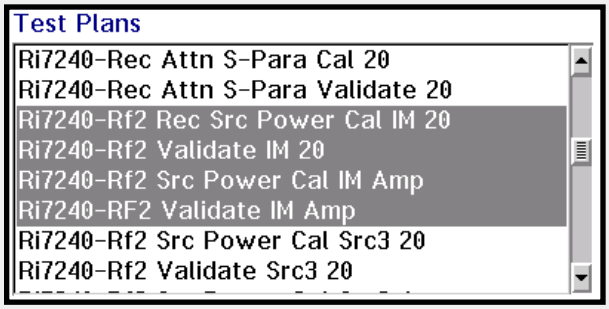
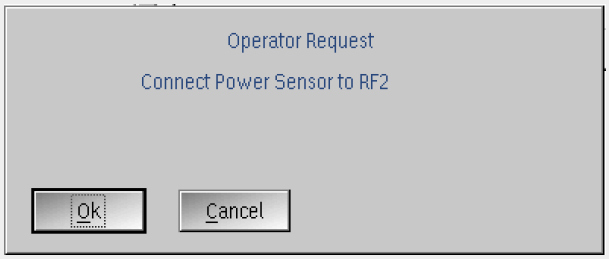
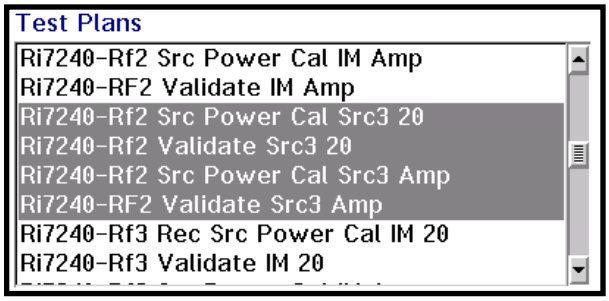
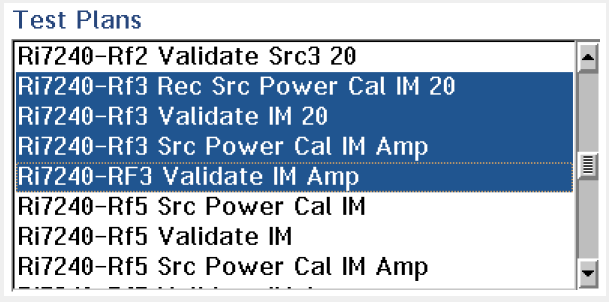
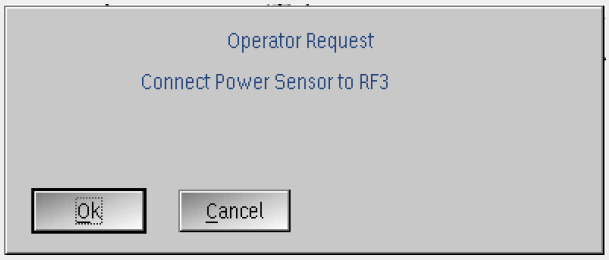
7. After all instruments have been calibrated, the System Calibration is considered complete, continue on to Set Cal Due Date and Save Calibration Data.

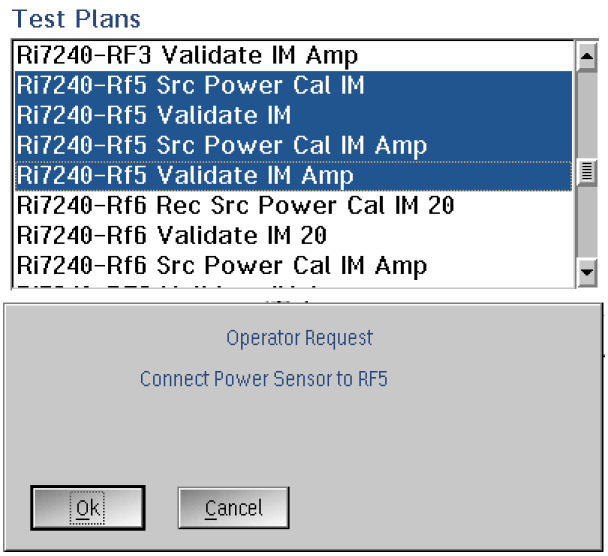
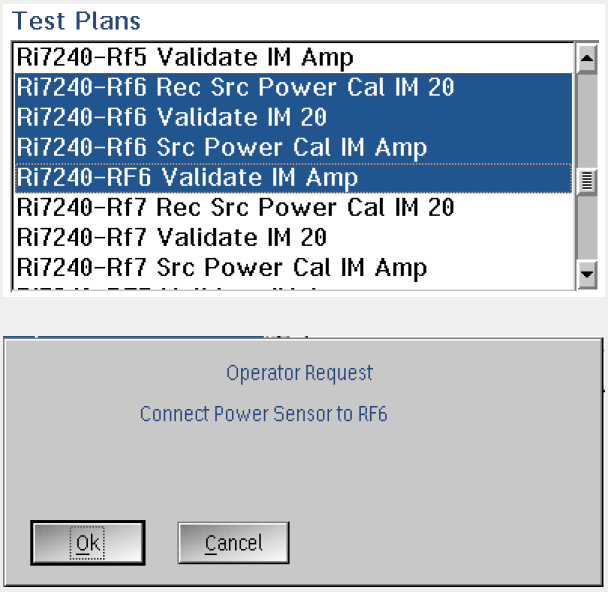
Calibration Exec Testplans

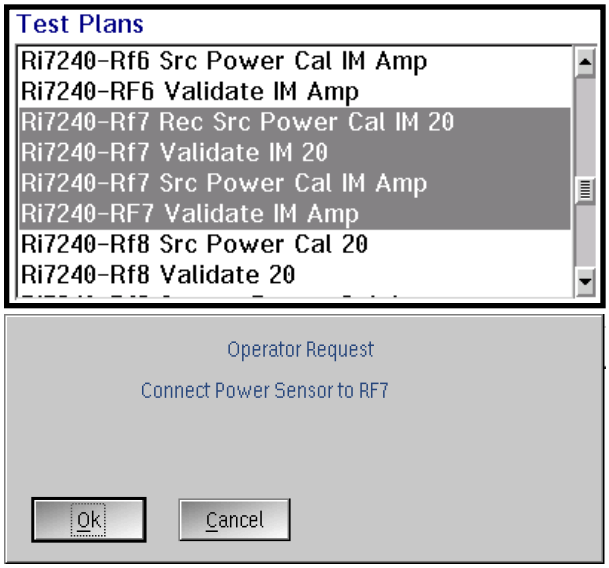
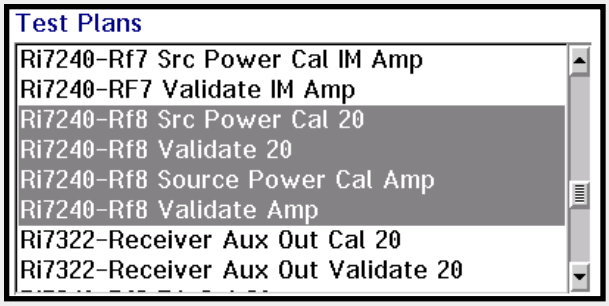
Testplan Groups and Prompts	Setup
Ri7420-ADC Calibration CF2 Ri7420-ADC Validation CF2 	• Calibrates the voltage measurement function • Uses a DMM in DC Voltage ( ) mode *NOTE: The DMM must be in 5-digit "hi-res" mode.*
Ri7420-VCC1 Calibration CF2 Ri7420-VCC1 Validation CF2 Ri7420-VCC2 Calibration CF2 Ri7420-VCC2 Validation CF2 Ri7420-VCC3 Calibration CF2 Ri7420-VCC3 Validation CF2 Ri7420-VCC4 Calibration CF2 Ri7420-VCC4 Validation CF2 	• Calibrate VCC1 voltage and current • Use a DMM in DC Voltage ( ) and milliAmps (mA) modes. • Internal VCC1 and Vmeasure (ADC) for VCC2 - VCC8 • Select VCC1-VCC4, then VCC5-VCC8 (not pictured). *NOTE: The Data is entered in AMPS, not milliamps & connections must be maintained until Disconnect Ammeter from Calibration Figure prompt.*

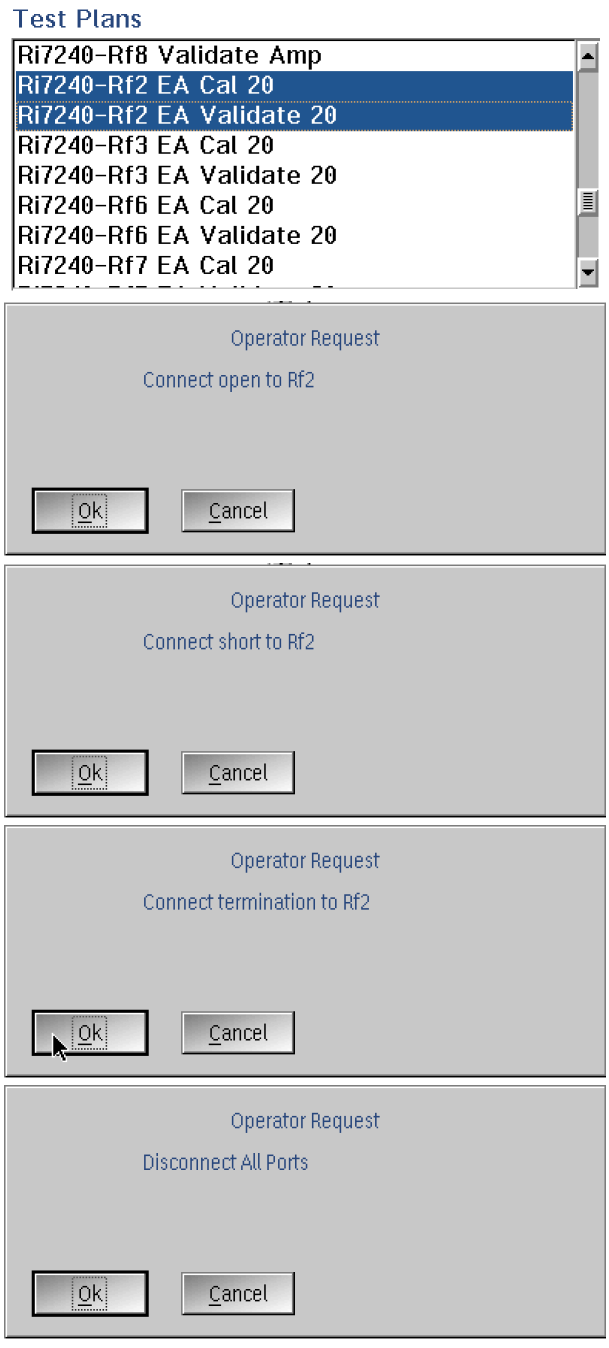
Testplan Groups and Prompts	Setup
	• Calibrate the DP parametric measure function • Use internal Vmeasure and VCC1 to calibrate
	• Calibrate the VI voltage and current limit functions • Use internal Vmeasure and VCC1 to calibrate
	• Calibrate the Static Digital (“DB” lines) & the Parametric Measure • Use internal Vmeasure and VCC1 to calibrate
System DC Calibration is now complete.	

Testplan Groups and Prompts	Setup
	• Calibrate the receiver for gain and for I/Q match (relative) • Use internal Source1 through the Testhead via Cal Fixture (no thought cables required) *NOTE: If Receiver is replaced, these must be done before anything other RF (incl. Diagnostics)*
	• Calibrate all sources for relative power linearity (not for frequency response)
 	• Calibrate the receive attenuator (in the Testhead) relative attenuation vs. frequency relative to the 10 dB step. • Use Thru Cable to connect Direct Receive, RF2, RF3, RF6, and RF7 paths

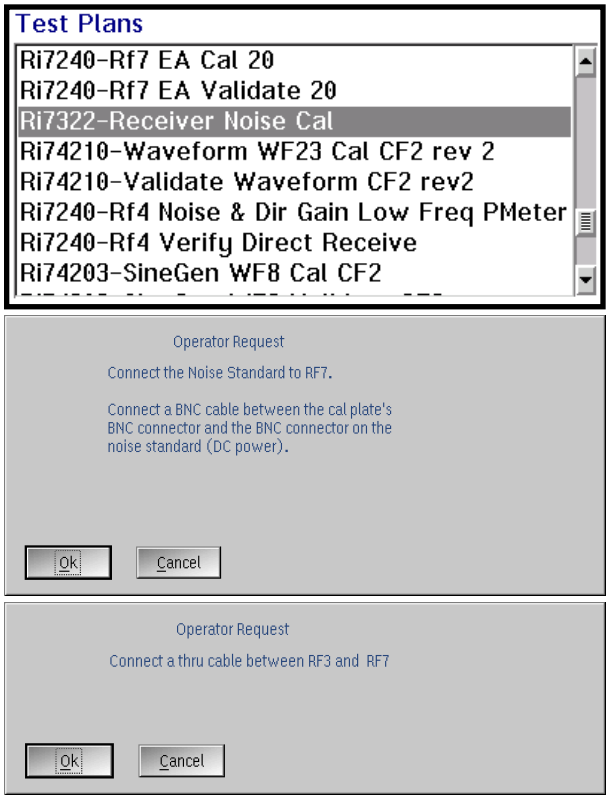
Testplan Groups and Prompts	Setup
 	• Calibrate the RF2 signal path • Use PMeter, Sensor with adapters attached to RF2 *NOTE: Follow the "Activate Calibration Components" steps before using PMeter.* • Source and receive path are calibrated simultaneously • Amp source path is also calibrated
 *Note: No Prompts because Sensor is already connected to RF2*	• Calibrate the Rf2 signal path for Source3 (Optional) • Use PMeter, Sensor with adapter attached to Rf2 • Rf2 is the only RF port with Source 3 routed to it.
 	• Calibrate Rf3 • Use PMeter, Sensor with adapters attached to Rf3 • The same as Rf2 except does not include Source3

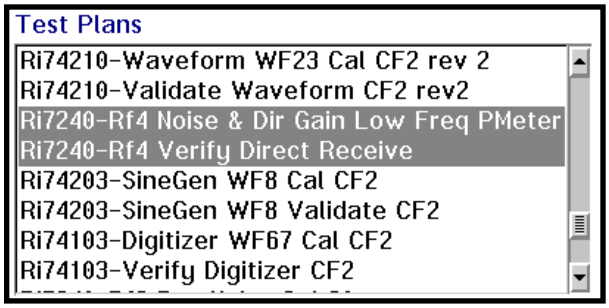
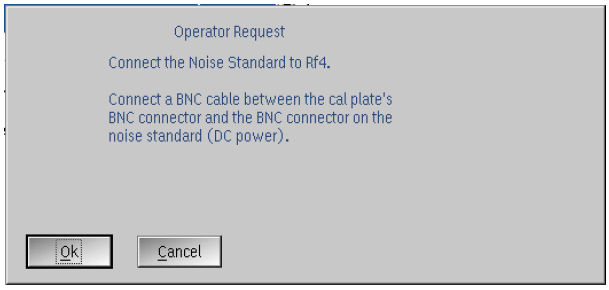
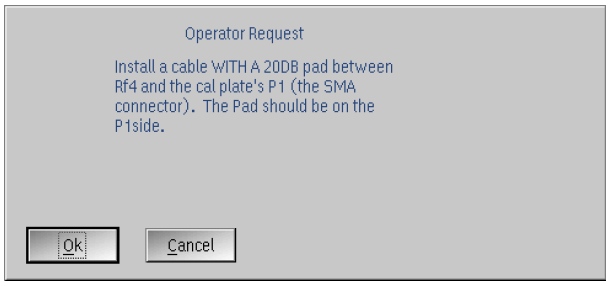
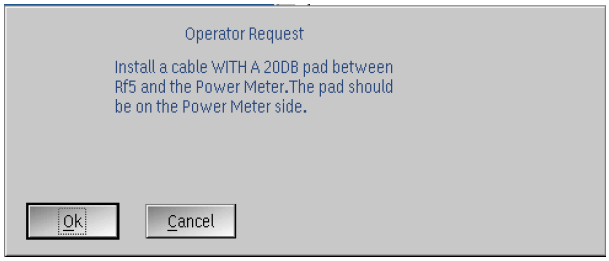
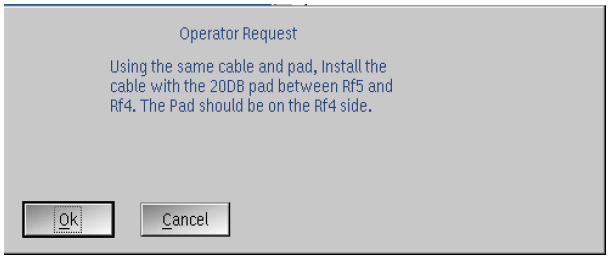
Testplan Groups and Prompts	Setup
	• Calibrate Rf5 • Use PMeter, Sensor with adapter attached to Rf5 *NOTE: RF5 is low frequency source-only path*
	• Calibrate Rf6 • Use PMeter, Sensor with adapter attached to Rf6 • The same as Rf2 except does not include Source3

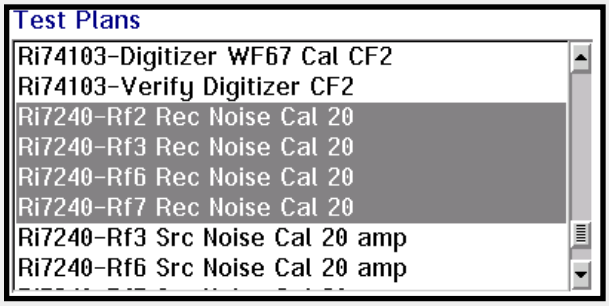
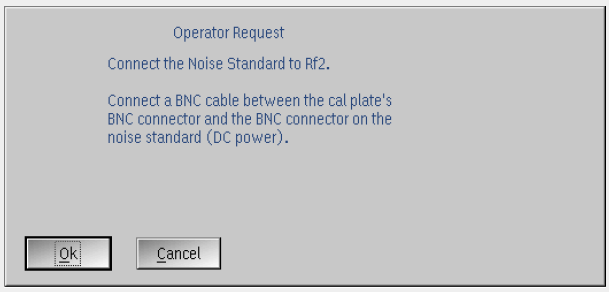
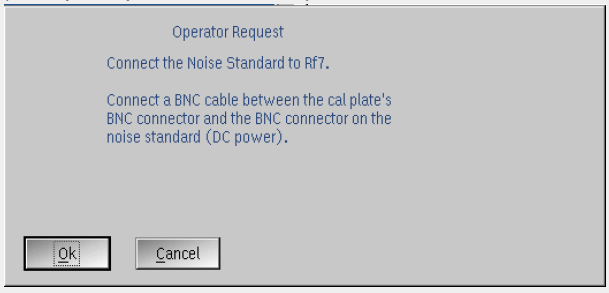
Testplan Groups and Prompts	Setup
	• Calibrate Rf7 signal path • Use PMeter, Sensor with adapters attached to Rf7 • The same as Rf2 except does not include Source3
	• Calibrate the source path for Rf8, Source 2 • If the tester is configured with the Source4 instrument, RF8 will use Source4 instead of Source2. *NOTE that Rf8 is a source-only path for Source2 when the Testhead is in the 'separate' mode.*

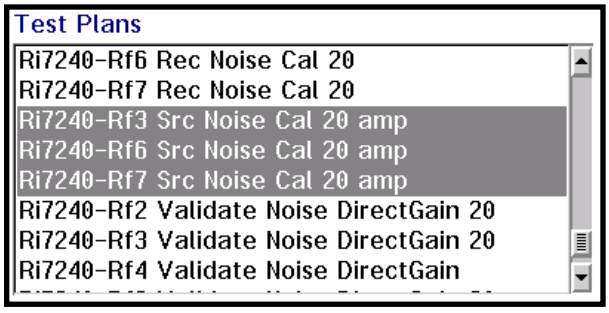
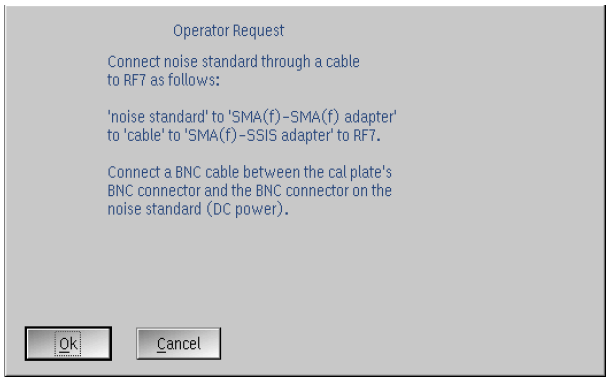
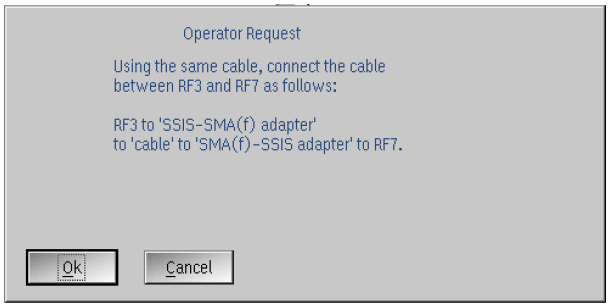
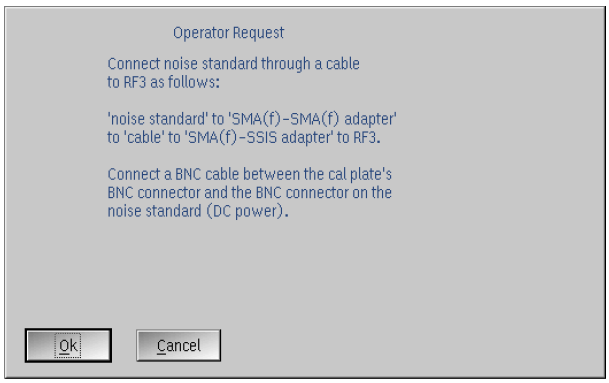
Testplan Groups and Prompts	Setup
	• **Run 1 Port EA Cal & Validate for only 1 Rf port at a time** • Calibrates full vector (phase and amplitude) and generates Error Adapters (EA). • Use the Open, Short, Load (“Termination”) standards with adapters

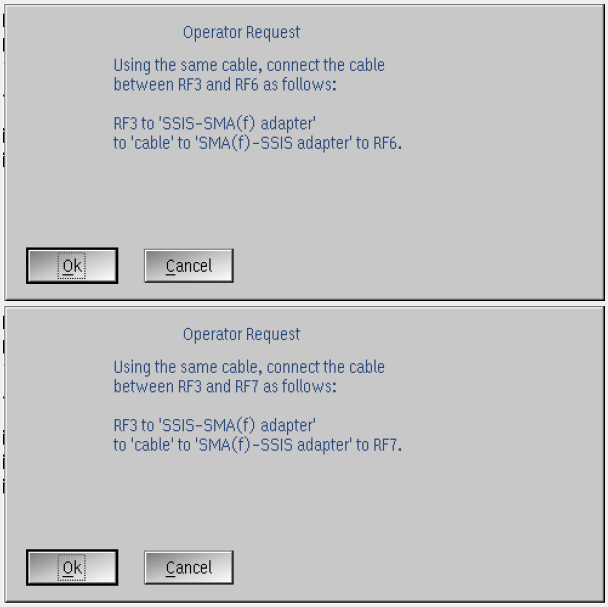
The core RF calibration for Source1, Source2, Src12, and Receiver Instruments is now complete. Proceed to calibrate Testhead Noise and SineWave and Waveform Instruments.

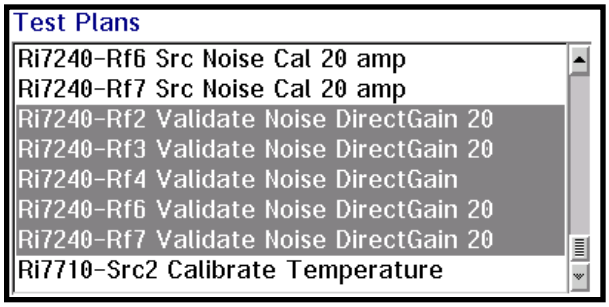
Testplan Groups and Prompts	Setup
	• Simple cal that calibrates the receiver's detector for noise vs. discrete signal • Connect Noise Standard with BNC cable connected to NOISE SRC port on the Fixture for DC power and connected to Cal Fixture Rf7 port. • Use Thru Cable to connect Rf3 and Rf7 *No Validate is available.* *NOTE: Additional "2nd chance" prompts allows the operator to make connection if sufficient power is not measured.*
	• Waveform cal calibrates the waveform generator gain and offset for amplitude accuracy

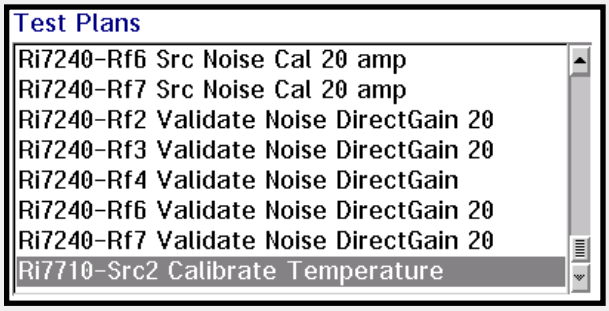
Testplan Groups and Prompts	Setup
    	• Calibrates RF4 for receive path accuracy • Use Noise Standard with BNC cable for DC power and connected to Cal Fixture Rf4 port. • Thru cable with 20dB attenuator • Uses the PMeter as the standard above 10 MHz with 20dB Thru cable • Uses internal Waveform instrument below 10 MHz

Testplan Groups and Prompts	Setup
  *(Prompts repeat Rf3 and Rf6)* 	• Noise gain vs. frequency for Rf2, Rf3, Rf6, Rf7 • Uses the Noise Standard • Validates are run after *NOTE: Additional “2nd chance” prompts allows the operator to make connection if sufficient power is not measured.*

Testplan Groups and Prompts	Setup
    (RF3 connection is repeated a few times between ports)	• Calibrate noise path to the Rf3, Rf6 and Rf7 ports • Uses the Noise Standard with through cable and adapters *NOTE: Additional “2nd chance” prompts allows the operator to make connection if sufficient power is not measured.*

Testplan Groups and Prompts	Setup
 	Continued…

Testplan Groups and Prompts	Setup
     	• Validate that the noise cals were done correctly of all RF ports • Use Through Cable with adapters • Should NOT be performed until all the noise cals are complete. • IMPORTANT: A FAIL result requires ALL Noise Cal plans above to be repeated.

Testplan Groups and Prompts	Setup
	• Records the ambient temperature for documentation purposes. Does not affect measurements. • Uses the thermistor built into source 2.

After Calibrate Temperature testplan is completed, repeat the steps in the *Diagnose Procedure* with **Options > Show All Results**. Save Results to document “After Calibration” data.

Inspect Noise Calibration Data

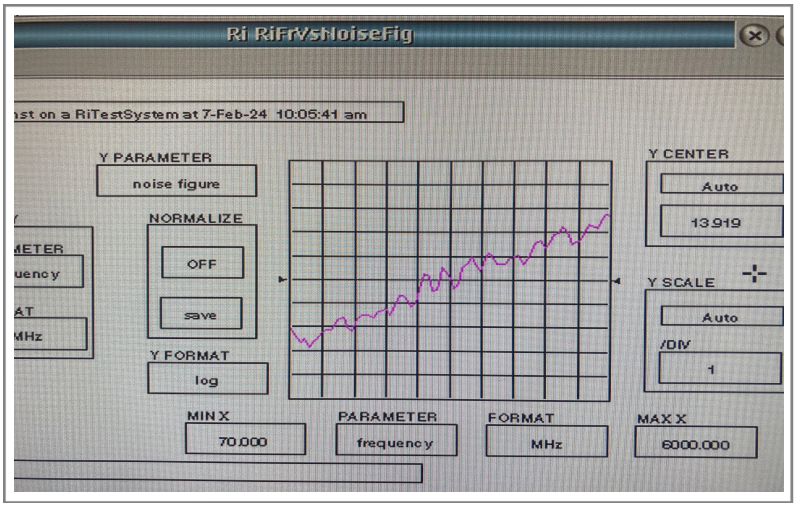
After running Diagnostics, inspect Noise Calibration data to confirm valid data or identify invalid data.

To Inspect Noise Calibration Data:

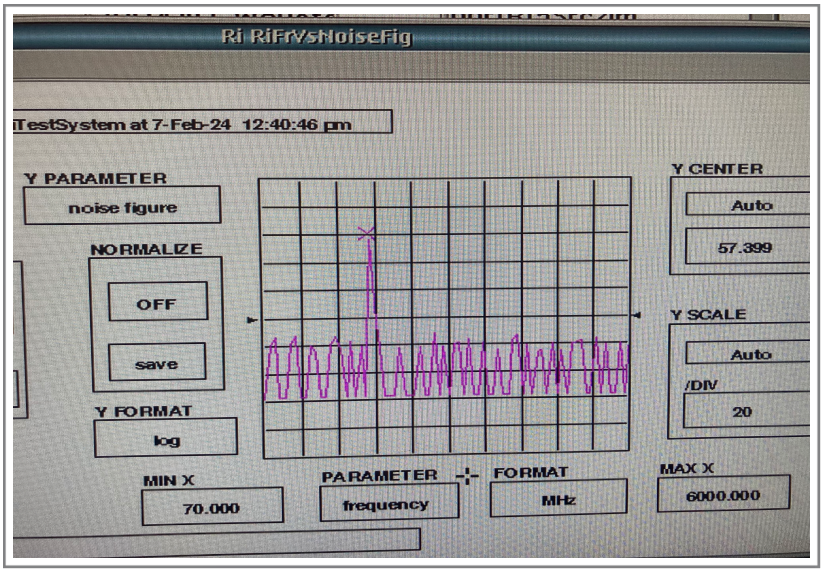
1. From the Testers window, choose Configuration from from the active Tester’s right mouse button menu.
2. From the Configuration window, choose **Calibration > Inspect** from the **Ri7240 Testhead** instrument.
3. Choose **portRf2Nf** calibration data and select **View** from the right mouse button menu and and **Rectangular** then **Select** to open the Data Viewer.
4. Choose Y PARAMETER button and select **noise figure**.
5. Choose Y FORMAT button and select **log** from the menu.

6. Choose **Auto** button below Y CENTER and Y SCALE and compare with the example “Good Data” and “Bad Data” images below.

7. If the data is similar to the “Bad Data” image with dramatic MAX/MIN data and possibly outliers only visible when choosing , repeat ALL the Noise Calibration calibration plans. If the data is similar to “Good Data” with steady “saw” edge appearance, then proceed with *Set Calibration Due Date and Save Calibration Data* steps.



GOOD DATA EXAMPLE



BAD DATA EXAMPLE

Set Calibration Due Date and Save Calibration Data

After setting the Calibration Due Date, the Tester must be saved for the calibration data to be stored to the disk.

To Set Cal Due Date and Save Cal Data:

1. Right mouse button click on the active (red) Tester which was just calibrated and choose **Configure**.

2. In the configuration panel, choose **Testers > Set Cal Due Date** menu. The default value will be 6 months + 1 week. The extra week is in case of system use or other issues that cause the original due date to be missed.

3. Enter a new due date in MM/DD/YY format. The recommended period between calibrations is 6 or 12 months. The new date entered should be 6 or 12 months from the date of the cal plus a week for flexibility. Enter a date, the select **OK**.

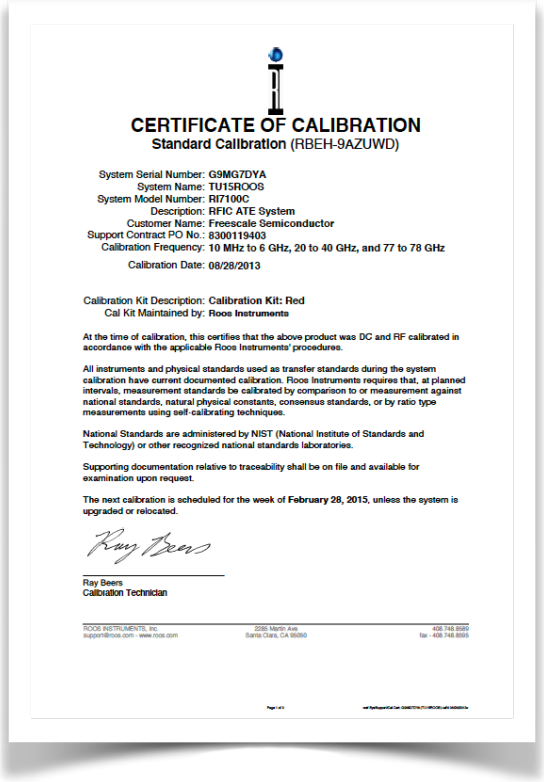
4. From the Tester window, choose **Save** from the right mouse button menu on the active (red) Tester to save all of the new cal data with the updated calibration due date.

5. Now choose **System > Start Up** from the main window. The new calibration due date should be displayed at the end of the start up in the Log window.

Calibration Documentation

If Roos Instruments performs the calibration, a “Certificate of Calibration" document that provides NIST traceable Model and Serial Numbers and "Calibration Sticker" will be sent via standard mail in 2-4 weeks after the calibration is completed. The “Calibration Sticker” should be attached to the system that was calibrated.

Schedule a calibration according to the 6 or 12 month Preventive Maintenance Schedule.



CERTIFICATE OF CALIBRATION
Standard Calibration (RBEH-9AZUWD)

System Serial Number: **G9MG7DYA**
System Name: **TU15ROOS**
System Model Number: **RI7100C**
Description: **RFIC ATE System**
Customer Name: **Freescale Semiconductor**
Support Contract PO No.: **8300119403**
Calibration Frequency: **10 MHz to 6 GHz, 20 to 40 GHz, and 77 to 78 GHz**
Calibration Date: **08/28/2013**

Calibration Kit Description: **Calibration Kit: Red**
Cal Kit Maintained by: **Roos Instruments**

At the time of calibration, this certifies that the above product was DC and RF calibrated in accordance with the applicable Roos Instruments' procedures.

All instruments and physical standards used as transfer standards during the system calibration have current documented calibration. Roos Instruments requires that, at planned intervals, measurement standards be calibrated by comparison to or measurement against national standards, natural physical constants, consensus standards, or by ratio type measurements using self-calibrating techniques.

National Standards are administered by NIST (National Institute of Standards and Technology) or other recognized national standards laboratories.

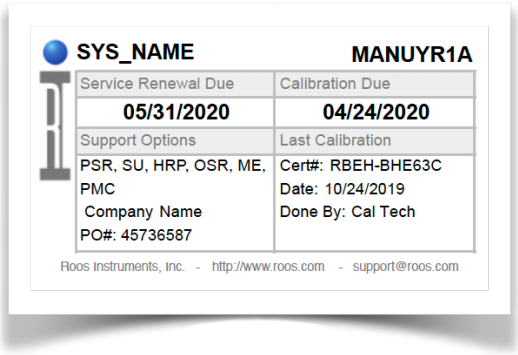
Supporting documentation relative to traceability shall be on file and available for examination upon request.

The next calibration is scheduled for the week of **February 28, 2015**, unless the system is upgraded or relocated.

Ray Beers
Calibration Technician

ROOS INSTRUMENTS, Inc. 2286 Martin Ave 408.748.8589
support@roos.com - www.roos.com Santa Clara, CA 95050 fax - 408.748.8595

CALIBRATION CERTIFICATE



SYS_NAME **MANUYR1A**

Service Renewal Due	Calibration Due
05/31/2020	**04/24/2020**
Support Options	Last Calibration
PSR, SU, HRP, OSR, ME, PMC Company Name PO#: 45736587	Cert#: RBEH-BHE63C Date: 10/24/2019 Done By: Cal Tech

Roos Instruments, Inc. - http://www.roos.com - support@roos.com

CALIBRATION STICKER