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S9100A 5G Multi-Band Vector Transceiver

380 MHz to 6 GHz and 24.25 to 43.5 GHz



The Keysight S9100A 5G Multi-Band Vector Transceiver is a streamlined, non-signaling measurement system that enables automated testing of 5G New Radio (5G NR) infrastructure equipment in both FR1 (380 MHz to 6 GHz) and millimeter wave FR2 (24.25 to 43.5 GHz) frequencies; some configurations also enable automated testing in High IF (6 to 12 GHz) frequencies.

KEYSIGHT

STARTUP GUIDE

Notices

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

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1 Overview

The Keysight S9100A 5G Multi-Band Vector Transceiver
is a streamlined, non-signaling measurement system that enables automated testing of 5G New Radio (5G NR) infrastructure equipment in both the FR1 (380 MHz to 6 GHz) and millimeter wave FR2 (24.25 to 43.5 GHz) frequencies.



In this document...

This document describes the installation process to start up and prepare the Keysight S9100A 5G Multi-Band Vector Transceiver for use.

1. Review this Overview
2. Review Safety Requirements on page 9
3. Review Hardware Components on page 25
4. Install Hardware on page 43
5. Install Software on page 55
6. Verify Operation on page 57
7. Run Power Calibration on page 65
8. Reference of S910xA SCPI Programming Commands on page 95

2 Review Safety Requirements

Review all safety information in this section before operating any of the equipment:

- Warning Statements and Symbols on page 9
- Safety on page 10
- Weight and Dimensions on page 12
- Handling and Lifting on page 12
- Cleaning on page 13
- Environmental Conditions (Operating) on page 14
- EMC (Electromagnetic Compatibility) on page 15
  - South Korean Class A EMC Declaration on page 15
  - Declaration of Conformity on page 15
- Ventilation on page 16
- Location and Mounting on page 17
- Power Requirements on page 18
- AC Power Cord on page 20
- Protecting Against Electrostatic Discharge (ESD) on page 21
- Front and Rear Panel Symbols on page 22
- Returning for Service on page 24

2. 1 Warning Statements and Symbols

The following notices are used throughout this document. Familiarize yourself with each of the notices and their meaning before operating these products.

CAUTION A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

2. 2 Safety

The safety information in this section applies to the following products.

Keysight S9100A 5G Multi-Band Vector Transceiver consists of:

- Keysight S9100A Base System (a PXIe chassis with modules, rugged panel, and cables)
- Keysight E7770A Common Interface Unit (CIU)
- Keysight M1740A mmWave Transceiver

These products have been designed and tested in accordance with accepted industry standards and have been supplied in a safe condition. This documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain products in a safe condition.

2. 2. 1 Safety Compliance

These products comply with the essential requirements of the European LVD (Low Voltage Directive) as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

- IEC/EN 61010-1
- Canada: CSA C22.2 No. 61010-1
- USA: UL std no. 61010-1

2. 2. 2 Acoustic Statement (European Machinery Directive)

Acoustic noise emission
LpA <70 dB
Operator position
Normal operation mode per ISO 7779

2. 2. 3 General Safety Notices

WARNING If these products are not used as specified, the protection provided by the equipment could be impaired.
These products must be used in a normal condition (in which all means for protection are intact) only.

WARNING No operator serviceable parts inside.
Refer servicing to qualified personnel.
To prevent electrical shock, do not remove covers.

WARNING This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The Mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

CAUTION The Keysight S9100A 5G Multi-Band Vector Transceiver is designed for use in Installation Category II and Pollution Degree 2, per IEC 61010 Second Edition and 664 respectively.

CAUTION **The Keysight S9100A Base System is designed for indoor use only and does not support hot-swapping of modules;** for example, inserting and removing modules with the chassis powered up. Before installing modules in or removing modules from the chassis, power down the chassis, but leave the power cord connected to the AC Mains because it serves as a ground and helps protect the chassis and modules from electrostatic damage.

CAUTION **The E7770A CIU is designed for indoor use only and does not support hot-swapping of the LO Card, LO Distribution Card, or Channel Card;** for example, inserting or removing cards with the CIU powered up. Before inserting into or removing cards from the CIU, power down the CIU, but leave the power cord connected to the AC Mains because it serves as a ground and helps protect the CIU and cards from electrostatic damage.

2. 3 Weight and Dimensions

Keysight S9100A Base System:

- Height: 192.4 mm (7.6 in); with feet removed
- Height: 197.8 mm (7.8 in); with feet installed
- Width: 449.5 mm (17.7 in); with rugged panel
- Depth: 568.9 mm (22.4 in); with rugged panel
- Weight: 20.4 kg (45 lbs)

E7770A Common Interface Unit (CIU):

- Height: 145.6 mm (5.7 in); with feet installed
- Width: 449 mm (17.7 in); across handles
- Depth: 424 mm (16.7 in); across front connectors and rear feet
- Weight: 18.1 kg (40 lbs)

Keysight M1740A mmWave Transceiver:

- Height: 66 mm (2.6 in)
- Width: 139 mm (5.5 in)
- Depth: 183 mm (7.2 in)
- Weight: 2.2 kg (4.85 lbs)

2. 4 Handling and Lifting

For best practice and proper ergonomics, the weight of the components may require the assistance of two persons to lift and carry.

WARNING **Use both side handles when lifting the Keysight S9100A Base System or E7770A CIU.**

Use a rolling cart when transporting the Keysight S9100A Base System or E7770A CIU.

2. 5 Cleaning

Clean the outside of Keysight products with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

WARNING To prevent electrical shock, disconnect the Keysight S9100A Base System and E7770A CIU from Mains before cleaning.

In regards to the M1740A mmWave Transceiver, disconnect from all cables before cleaning (power, in the form of a DC voltage, is delivered through the cables from the E7770A CIU).

Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

WARNING Cleaning connectors with isopropyl alcohol shall only be done with the instruments power cord removed and in a well-ventilated area. Allow all residual alcohol moisture to evaporate and the fumes to dissipate prior to energizing the instrument.

WARNING Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. The isopropyl alcohol shall not be stored, or left open, in the area of the equipment. Use isopropyl alcohol with adequate ventilation to prevent the combustion of fumes or vapors.

Avoid contact with eyes, skin, and clothing, as isopropyl alcohol causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling. In case of spill, soak up with sand or earth. Flush spill area with water. Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

2. 6 Environmental Conditions (Operating)

CAUTION **The Keysight S9100A Base System and the E7770A CIU are designed for use in Installation Category II and Pollution Degree 2, per IEC 61010 Second Edition and 664 respectively.**

CAUTION **The M1740A mmWave Transceiver is designed for use in Installation Category II and Pollution Degree 2, per IEC 61010-1 Third Edition and 664 respectively.**

The Keysight S9100A 5G Multi-Band Vector Transceiver is designed for use in the following conditions:

- For indoor use only
- Altitude up to 6,561.68 ft (2,000 m)
- Operating Temperature 10 to 40° C,
  Maximum Relative Humidity (non-condensing): 85% RH

Samples of these products have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of Storage, Transportation and end-use. Those stresses include, but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions.

Test Methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

2. 7 EMC (Electromagnetic Compatibility)

These products comply with the essential requirements of the European LVD (Low Voltage Directive) as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity):

- IEC/EN 61326-1
- CISPR Pub 11 group 1, class A
- AS/NZS CISPR 11
- ICES/NMB-001

  This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB-001 du Canada.

2. 7. 1 South Korean Class A EMC Declaration

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. This EMC statement applies to the equipment only for use in business environment.

사 용 자 안 내 문
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2. 7. 2 Declaration of Conformity

Declarations of Conformity for these products and for other Keysight products may be downloaded from the Web. Go to http://www.keysight.com/go/conformity and click on "Declarations of Conformity." You can then search by product number to find the latest Declaration of Conformity.

2. 8 Ventilation

CAUTION VENTILATION REQUIREMENTS: When installing the product into a cabinet, the convection into and out of the product must not be restricted. Consideration shall also be given to the individual instruments to avoid having the heated discharge of one instrument, now becoming the cooling intake air for another instrument.

Another area of concern is verification that the maximum ambient operating temperature of the instrument(s) is not exceeded by cabinet installation.

Keysight recommends forced air convection whenever instrument(s) are installed in a cabinet and further recommends that the maximum operating temperature of the cabinet be reduced 10°C from the lowest, of the maximum operating temperature of a single instrument.

If there are any concerns or special requirements, a Keysight Field Engineer should be consulted to assure instrument(s) temperature compliance and performance.

CAUTION **Do NOT block vents and fan exhaust:** To ensure adequate cooling and ventilation, leave a gap of at least 50 mm (2") around vent holes on both sides of the chassis.

2. 9 Location and Mounting

Consider ergonomics when locating any keyboard or mouse which will be used in connection with an instrument.

Install the Keysight S9100A Base System and E7770A CIU so that the detachable power cords are readily identifiable and is easily reached by the operator. The detachable power cord is the disconnecting device. It disconnects the Mains circuits from the Mains supply before other parts of the Keysight S9100A Base System or E7770A CIU. (The front panel switches are only standby switches and are not LINE switches.) Alternatively, externally installed switches or circuit breakers (which are readily identifiable and is easily reached by the operator) may be used as disconnecting devices.

CAUTION **The Keysight S9100A Base System requires a 1U space below when rack mounting.**

The M1740A mmWave Transceiver does not have an AC power connection. It is powered by a DC voltage from the E7770A CIU; this voltage is supplied over the RF Cable Assembly to the **LO/Pwr/Ctrl/IF In** connector. The DC supply does not represent a risk of personal injury.

CAUTION **The RF Cable Assembly should not be connected to, or disconnected from, the M1740A mmWave Transceiver while it is suppling DC power from the E7770A CIU. This connection should be made only when the E7770A is powered off, or the cable is not connected to the E7770A.**

If the LED status indicator on the front of the M1740A is lit, this indicates that it is powered up and the cable should not be disconnected.

2. 10 Power Requirements

100/120 VAC, 220/240 VAC
50/60 Hz
1200 W Max (Lower range), 1300 W Max (Upper range)

WARNING "WARNING: Safety of any system incorporating the equipment is the responsibility of the assembler of the system."

NOTE "NOTE: The input terminals for this product are classified as Measurement Category None."

The Keysight S9100A Base System does **not** contain customer serviceable fuses, but the E7770A CIU fuse can be replaced. See fuse replacement in the E7770A Common Interface Unit (CIU), User's Guide E7770-90001.

WARNING Failure to ground the test set properly can result in personal injury. Before turning on the test set, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power cable plug into a socket outlet that has a protective earth contact only. DO NOT defeat the earth-grounding protection by using an extension cable, power cable, or auto-transformer without a protective ground conductor.

CAUTION This instrument has auto-ranging line voltage input. Before switching on the instrument, be sure the supply voltage is within the specified range and voltage fluctuations do not exceed 10 percent of the nominal supply voltage.

2. 10. 1 Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the external markings described under Front and Rear Panel Symbols on page 22.

WARNING The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure to ensure adequate earth grounding by not using the correct components may cause product damage and serious injury.

2. 10. 2 Ground the Instrument

WARNING These products must be used in a normal condition (all means for protection are intact).

WARNING This is a Safety Protection Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

The M1740A mmWave Transceiver does not have an AC power connection. It is powered by a DC voltage from the E7770A CIU; this voltage is supplied over the RF Cable Assembly to the **LO/Pwr/Ctrl/IF In** connector. The DC supply does not represent a risk of personal injury.

CAUTION The RF Cable Assembly should not be connected to, or disconnected from, the M1740A mmWave Transceiver while it is suppling DC power from the E7770A CIU. This connection should be made only when the E7770A CIU is powered off, or the cable is not connected to the E7770A CIU. If the LED status indicator on the front of the M1740A is lit, this indicates that it is powered up and the cable should not be disconnected.

When the M1740A mmWave Transceiver is used in connection with the E7770A CIU, use only the RF Cable Assembly that was supplied with the M1740A to connect it with the other instrument and connect it only to the mmW ports on that instrument.

2. 11 AC Power Cord

The Keysight S9100A Base System and E7770A CIU are equipped with three-wire power cords, in accordance with international safety standards. These power cords ground the Keysight S9100A Base System and E7770A CIU cabinet when connected to an appropriate power line outlet.

Use the Keysight supplied power cord or one with the same or better electrical rating. The cable appropriate to the original shipping location is included with the Keysight S9100A Base System and E7770A CIU. See: http://www.keysight.com/find/powercords4

CAUTION Always use the three-prong AC power cord supplied with these products. Failure to ensure adequate earth grounding by not using these cords can cause product damage.

WARNING If these products are not used as specified, the protection provided by the equipment could be impaired. These products must be used in a normal condition (in which all means for protection are intact) only. Install the Keysight S9100A Base System and E7770A CIU so that their detachable power cords are readily identifiable and easily reached by the operator. The detachable power cord is the instrument's disconnecting device. It disconnects the Mains circuits from the Mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch.
Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

WARNING For continued protection against fire hazard, when using the E7770A CIU, replace the line fuse only with the same type and rating (115 V and 230 V operation: T 10 AH 250 V). The use of other fuses or material is prohibited.

See fuse replacement in the E7770A Common Interface Unit (CIU), User's Guide E7770-90001.

The M1740A mmWave Transceiver does not have an AC power cord connection. It is powered by a DC voltage from the E7770A CIU; this voltage is supplied over the RF Cable Assembly to the LO/Pwr/Ctrl/IF In connector. The DC supply does not represent a risk of personal injury.

2. 12 Protecting Against Electrostatic Discharge (ESD)

CAUTION **Electrostatic discharge (ESD) can damage or destroy electronic components (the possibility of unseen damage caused by ESD is present whenever components are transported, stored, or used).**

Shipping Materials and ESD

Keysight's chassis and instrument modules are shipped in materials which prevent static electricity damage. These instruments should only be removed from the packaging in an anti-static area, ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not installed.

Test Equipment and ESD

To help reduce ESD damage that can occur while using test equipment:

WARNING **Do not use these first three techniques when working on circuitry with a voltage potential greater than 500 volts.**

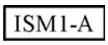
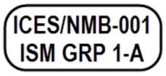
- Before connecting any coaxial cable to a test set connector for the first time each day, momentarily short the center and outer conductors of the cable together.
- Personnel should be grounded with a 1 MΩ resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the test set.
- Be sure that all instruments are properly earth-grounded to prevent build-up of static charge.
- Perform work on all components or assemblies at a static-safe workstation.
- Keep static-generating materials at least one meter away from all components.
- Store or transport components in static-shielding containers.
- Always handle printed circuit board assemblies by the edges. This reduces the possibility of ESD damage to components and prevent contamination of exposed plating.

Additional Information About ESD

For more information about ESD and how to prevent ESD damage, contact the Electrostatic Discharge Association (http://www.esda.org). The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

2. 13 Front and Rear Panel Symbols

Symbols that may be on the exterior of S9100A hardware components are:

Symbol	Description
	This symbol is used to indicate power ON and to mark the position of the instrument power line switch.
	This symbol is used to indicate power STANDBY mode (yellow in standby, green when instrument is ON) and to mark the position of the instrument power line switch.
	The AC symbol is used to indicate the required nature of the line module input power.
	This symbol indicates instruction documentation. The product is marked with this symbol when it is necessary for the user to refer to the instruction in the documentation.
	UK conformity mark is a UK government owned mark. Products showing this mark comply with all applicable UK regulations.
	The CE marking is a registered trademark of the European Community (if accompanied by a year, it is the year when the design was proven). It indicates that the product complies with all relevant directives.
	The RCM mark is a registered trademark of the Australian Communications and Media Authority.
	The Keysight email address is required by EU directives applicable to our products. ccr.keysight@keysight.com
	This is a symbol of an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 5).
	ICES / NMB-001 This is a marking to indicate product compliance with the Industry Canada Interference-Causing Equipment Standard (ICES-001). The following statements must be in the user documentation. "This ISM device complies with Canadian ICES-001." "Cet appareil ISM est conforme a la norme NMB du Canada."
	South Korean Certification (KC) mark. It includes the marking's identifier code which follows this format: R-R-Kst-ZZZZZZZ.
	The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation. Please refer to www.keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.

Symbol	Description
	China Restricted Substance Product Label. The EPUP (environmental protection use period) number in the center indicates the time period during which no hazardous or toxic substances or elements are expected to leak or deteriorate during normal use and generally reflects the expected useful life of the product.
	Universal recycling symbol. This symbol indicates compliance with the China standard GB 18455-2001 as required by the China RoHS regulations for paper/fiberboard packaging.
	The CSA mark is a registered trademark of the CSA International.
	This symbol indicates that anti-static precautions should be taken.
	This symbol indicates earth ground.
	This mark designates Direct Current.

2. 14 Returning for Service

Should it become necessary to return the system for repair or service, follow these steps:

1. Review the warranty information shipped with the product.
2. Contact Keysight to obtain a Return Material Authorization (RMA) and a return address. For assistance finding Keysight contact information, go to: www.keysight.com/find/assist
3. Write the following information on a tag and attach it to the equipment:
   - Name and address of owner.
     P.O. boxes are not acceptable as return addresses.
   - System or module serial numbers. The serial number label is located on the side panel of the module. The serial number can also be read from the Soft Front Panel interface – after the hardware is installed.
   - Description of failure or service required.
4. Use original packaging or comparable.
   - Pack the system in its original ESD bag and packing carton.
   - If the original carton is not available, use bubble wrap or packing peanuts, place the system in a sealed container, and mark the container “FRAGILE”.
   - Include all original cables and modules when sending in the system for repair or service.
5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

NOTE **In your correspondence, refer to the system by serial number.**

3 Review Hardware Components



Before installing hardware or software, review the following hardware components:

- Hardware Components on page 26
- Connector Descriptions on page 27
  - Connectors, 10 MHz Ref In/Out on the Rugged Front Panel on page 27
  - Connectors, RF Transceiver on the Rugged Front Panel on page 28
  - Connectors, Head 1 on the Rugged Front Panel on page 28
  - Connectors, S9100A Rear Panel (M9019A PXIe Chassis) on page 31
  - Connectors, E7770A Common Interface Unit (CIU) on page 34
  - Connectors, M1740A mmWave Transceiver on page 39

3. 1 Hardware Components

NOTE The S9100A is available in three standard configurations.



Keysight S9100A Option RH1 5G Multi-Band Vector Transceiver on page 45 includes:

- one S9100AX (S9100A Base System with
  one M9410A PXIe VXT Vector Transceiver)
- one E7770A Common Interface Unit (CIU) with
  one Channel Card – No DUT IF
  one LO Distribution Card
  one LO Card
- one M1740A mmWave Transceiver with
  one set of cables



Keysight S9100A Option 007 mmWave Transceiver with High IF (Dual-Use Configuration: High IF and mmWave) on page 48 includes:

- one S9100AX-007 (S9100A Base System with
  one M9410A PXIe VXT Vector Transceiver)
- one E7770A Common Interface Unit (CIU) with
  one Channel Card – High IF (Slot 1)
  one Channel Card – No DUT IF (Slot 2)
  one LO Distribution Card
  one LO Card
- one M1740A mmWave Transceiver with
  one set of cables



Keysight S9100A Option 022 mmWave Transceiver with High IF and Blocker (Dual-Use Configuration: High IF and mmWave) on page 51 includes:

- one S9100AX-022 (S9100A Base System with
  two M9410A PXIe VXT Vector Transceivers;
  one creates a wanted signal, one creates a blocker signal)
- one E7770A Common Interface Unit (CIU) with
  one Channel Card – High IF (Slot 1)
  one Channel Card – No DUT IF (Slot 2)
  one LO Distribution Card
  one LO Card
- one M1740A mmWave Transceiver with
  one set of cables

3. 2 Connector Descriptions

3. 2. 1 Connectors, 10 MHz Ref In/Out on the Rugged Front Panel



10 MHz Ref Out (Connects from M9300A PXIe Reference **10 MHz Out**.)	
Connector	BNC (f)
Amplitude	9.5 dBm, *nominal*
10 MHz Ref In (Connects behind rugged panel, to M9300A PXIe Reference **Ref In**, and locks to another reference with a value of 10 MHz or 100 MHz.)	
Connector	BNC (f)
Frequency[1]	10 MHz or 100 MHz, sine wave
Lock range	± 1 ppm, *nominal*
Amplitude	0 to 10 dBm, *nominal*

[1]The 10 MHz Ref In connector frequency range, on S910xA systems, is different from the M9300A PXIe Frequency Reference Data Sheet. The S910xA systems only support 10 MHz or 100 MHz inputs.

3. 2. 2 Connectors, RF Transceiver on the Rugged Front Panel



RF Transceiver, RF Out	
Connector	Type-N (f), 50 Ω, *nominal*
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +30 dBm Maximum Reverse Input Power
RF Transceiver, RF In	
Connector	Type-N (f), 50 Ω, *nominal*
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +27 dBm Maximum Safe Input Power
RF Transceiver, Trig 1 and Trig 2 (Input or Output, Selectable)	
Connectors	SMA (f)
Input Impedance	1 kΩ or 50 Ω, *nominal*
Input Level Range	–3.3 V to +3.3 V
Output Impedance	50 Ω, *nominal*
Output Level Range	3.3 V LVTTL
RF Transceiver, Half Duplex	
Connector	Type-N (f)
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +30 dBm Maximum Safe Input Power

3. 2. 3 Connectors, Head 1 on the Rugged Front Panel



Head 1 IF In	
Connector	Type-N (f), 50 Ω, *nominal*
Frequency Range	380 MHz to 6 GHz
Amplitude	± 10 VDC, +33 dBm Maximum
Head 1 IF Out	
Connector	Type-N (f), 50 Ω, *nominal*
Frequency Range	380 MHz to 6 GHz
Amplitude	± 10 VDC, +33 dBm Maximum
Head 1 LO/Pwr/Ctrl Out	
Connector	TNC (f)
Head 1 Ch 1A In or Ch 1B In	
Connector	SMA (f)

3. 2. 4 Connectors, M9037A PXIe Embedded Controller



Status LEDs	
PWR (Green)	On, indicates power supply to embedded controller is good.
SSD (Amber)	Flashes when Solid State Drive is active.
Link (Green)	Indicates PCIe Link status: Off = No link; Blinking @ 1 Hz = Gen1 speed Blinking @ 2 Hz = Gen2 speed On steady = Gen3 speed
LAN (White), USR (Grey)	Both LEDs are reserved for Keysight use only.
Video/Dual Display Ports	
Connectors	Two, Dual Mode DisplayPort++ connectors can support either a DisplayPort or DVI-D monitor
USB 2.0 and 3.0	
Connectors	Four, USB 2.0 (Type A)
Connectors	Two, USB 3.0
LAN 1 and LAN 2	
Connectors	Two, 10/100/1000BASE-T (RJ-45) Gigabit Ethernet ports
LAN Connector Top LED (Amber)	Active, blinks if accessing IO
LAN Connector Bottom LED (Off) Bottom LED (Green) Bottom LED (Amber)	 LAN Speed: 10 Mbps LAN Speed: 100 Mbps LAN Speed: 1000 Mbps
LAN Connectors, Top and Bottom LEDs (Off)	Network link not established or system is powered off.
LAN RST (Reset) Button	Reserved for Keysight use only.
Trig (PXI Trigger In/Out)	
Connector	SMB (m) snap-on, bi-directional trigger connector for routing an external trigger signal to/from PXI backplane
GPIB	
Connector	GPIB (Micro-D 25-pin)
PCIe	
Connector	x8 Gen 3 PCIe IPASS connector for controlling a second PXIe or AXIe chassis or RAID storage

CMOS Backup Battery

WARNING
Danger of explosion if battery is incorrectly replaced.

Replace only with the same or equivalent type recommended.

Discard used batteries according to manufacturer's instructions.

Follow proper disposal process. Only dispose of old battery according to local codes.



All electric and electronic equipment are required to be separated from normal waste for disposal.

NOTE
Typical battery life varies considerably and depends on operating temperature and standby (shutdown) time of the system. Typical life expectancy of a 190 mAh battery is 4 to 5 years with an average on-time of 8 hours per working day at an operating temperature of 30°C. To ensure that the lifetime of the battery has not been exceeded, you should change the battery after 3 to 4 years of service.

Keysight's M9037A is equipped with a 3.0 V "coin cell" lithium battery. This battery powers the clock circuit and retains configuration memory in CMOS RAM while the system is turned off.



To replace the CMOS Backup Battery

1. Turn off power to the PXIe chassis.
2. Remove the M9037A embedded controller from the chassis. Observe all anti-static precautions.
3. Locate and remove the battery. Press the battery release latch (1). The battery should pop out (2).



4. Place the new battery in the socket. Make sure that you correctly orient the battery for installation. The positive pole (+) must be on the top. You may find it helpful to angle the battery in and pull back on the battery release latch. Replace the lithium battery with an identical battery (BR2032 or equivalent).
5. Install the embedded controller back in the PXIe chassis and apply power. The battery's operational temperature range is less than that of the M9037A's storage temperature range. For exact range information, refer to the battery manufacturer's specifications.

NOTE See the Data Sheet for the Keysight M9037A, 5991-3661EN.

3. 2. 5 Connectors, S9100A Rear Panel (M9019A PXIe Chassis)

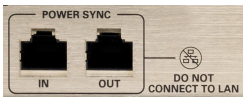


AC Line Input

(Use the AC line cord supplied with the S9100A.)

Connector, Three-Prong	100/120 V, 50/60 Hz, 1200 W MAX (Lower range) 220/240 V, 50/60 Hz, 1300 W MAX (Upper range)

NOTE See also AC Power Cord on page 20.



POWER SYNC

(DO NOT CONNECT TO LAN!)

Connector, IN and OUT	RJ-45 cables (CAT5 or better not exceeding two meters in length) can be used to connect multiple PXI chassis; up to four chassis may be connected together for power-up synchronization. **DO NOT connect to the LAN!** When connected with RJ-45 cables, the power button on any chassis may be used to power up or power down the entire system.



FAN and INHIBIT Switches

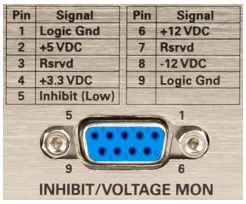
(Used for remote inhibit and power rail monitoring.)

AC Line Input
(Use the AC line cord supplied with the S9100A.)
POWER SYNC
(DO NOT CONNECT TO LAN!)
FAN and INHIBIT Switches
(Used for remote inhibit and power rail monitoring.)

FAN Switch	The **FAN** switch controls the fan speed: **HIGH** - the fan voltage duty cycle is set to 100%, which generates the highest fan speeds and best chassis cooling (as well as the most fan noise). **AUTO** - the speed of the three fans are controlled based on the temperature of the chassis and the setting on the Soft Front Panel (SFP) Temperature parameter. See the Keysight PXIe Chassis User Guide (M9019-90003).
INHIBIT Switch	The **INHIBIT** switch controls the method of powering up the chassis: **DEF (default)** - recommended position when connecting AC power cord. Front panel power button is used to switch between ON and Standby and requires that an M9024A or M9037A is installed in system controller slot 1. **MAN (manual)** - Inhibit signal on the rear panel DB-9 connector controls chassis power. When set to MAN, POWER SYNC feature is disabled.
Connector, Three-Prong	100/120 V, 50/60 Hz, 1200 W MAX (Lower range) 220/240 V, 50/60 Hz, 1300 W MAX (Upper range)

NOTE See also AC Power Cord on page 20.

Connector, IN and OUT	RJ-45 cables (CAT5 or better not exceeding two meters in length) can be used to connect multiple PXI chassis; up to four chassis may be connected together for power-up synchronization. **DO NOT connect to the LAN!** When connected with RJ-45 cables, the power button on any chassis may be used to power up or power down the entire system.



INHIBIT/VOLTAGE MON

(Use for remote inhibit and power rail monitoring.)

Connector	DB-9

For details on use, see the Keysight PXIe Chassis User Guide (M9019-90003).



10 MHz REF IN and OUT

Connectors, Rear Panel	BNC (f), 50 Ω, *nominal*
Frequency Input	10 MHz ±100 PPM
Input Signal	100 mVPP to 5 VPP (square-wave or sine-wave)
Input signal (PXI timing slot PXI_CLK10_IN)	5 V or 3.3 V TTL signal

NOTE These 10 MHz REF IN and OUT connectors are for supplying the PXI_CLK10_IN and OUT signals from the System Timing Module.

To provide a 10 MHz Clock to the S9100A, see Connectors, 10 MHz Ref In/Out on the Rugged Front Panel on page 27.

NOTE For additional information, see the Data Sheet for the Keysight M9019A, 5992-1481EN.

3. 2. 6 Connectors, E7770A Common Interface Unit (CIU)



3. 2. 6. 1 Connectors, E7770A CIU, Local Oscillator Card (LO Card)

The LO Card provides the conversion frequency used when up-converting Sub – 6 GHz signals from the M9410A PXIe VXT and provides the **LO/CTRL/PWR** to M1740A mmWave Transceiver. The E7770A CIU supports up to two LO Cards.



Status LED	
Locked (Green)	On, indicates LO Card is locked to the 10 MHz In. If LED is Red, LO Card is not locked to the 10 MHz In.
10 MHz In	
Connector	BNC (f), 50 Ω, *nominal*
Frequency	10 MHz reference signal input
LO Aux Out	
Connector	SMA (f), 50 Ω, *nominal* LO Card **LO Aux Out** to LO Distribution Card **LO In**. This connection supplies the local oscillator signal to Channel Cards, through the LO Distribution Card.
Ref Out	
Connector	SMA (f), 50 Ω, *nominal* (Intended for future use.)
CLK In	
Connector	SMA (f), 50 Ω, *nominal* (Intended for future use.)
LO Out	
Connector	SMA (f), 50 Ω, *nominal* This connector supplies the local oscillator output for use with a second (independent) LO source.

3. 2. 6. 2 Connectors, E7770A CIU, LO Distribution Card

The LO Distribution Card distributes the LO signal, from the LO Card, to Channel Cards. It can also be used to send LO signals to multiple E7770A CIUs or to configure two different local oscillators on the same E7770A CIU.



LO In	
Connector	SMA (f), 50 Ω, *nominal* LO Card **LO Aux Out** to LO Distribution Card **LO In.** See Install Hardware on page 43.
LO Out 1	
Connector	SMA (f), 50 Ω, *nominal* LO Distribution Card **LO Out 1** to Channel Card 1 **LO In.**
LO Out 2	
Connector	SMA (f), 50 Ω, *nominal* LO Distribution Card **LO Out 2** to Channel Card 2 **LO In**.
LO Out 3	
Connector	SMA (f), 50 Ω, *nominal* LO Distribution Card **LO Out 3** to Channel Card 3 **LO In**.
LO Out 4	
Connector	SMA (f), 50 Ω, *nominal* LO Distribution Card **LO Out 4** to Channel Card 4 **LO In.**
LO Aux In	
Connector	SMA (f), 50 Ω, *nominal* Auxiliary input source from the LO Card **LO Out** used for configuring two different local oscillator sources.
LO Aux 1	
Connector	SMA (f), 50 Ω, *nominal* Auxiliary local oscillator output 1.
LO Aux 2	
Connector	SMA (f), 50 Ω, *nominal* Auxiliary local oscillator output 2.
LO Aux 3	
Connector	SMA (f), 50 Ω, *nominal* Auxiliary local oscillator output 3.
LO Aux 4	
Connector	SMA (f), 50 Ω, *nominal* Auxiliary local oscillator output 4.
LO In 2	
Connector	SMA (f), 50 Ω, *nominal* Input source used in configurations with multiple E7770A CIUs; this connection would be from the LO Card **LO Out** of a second E7770A CIU.

3. 2. 6. 3 Connectors, E7770A CIU, Channel Card

The Channel Card provides connectivity between the test system hardware and (depending on the configuration) the IF interface on the device under test (DUT).

See Install Hardware on page 43 for configurations using Channel Card - No DUT IF and Channel Card equipped with IF circuitry.

Configurations using a Channel Card - No DUT IF;
IF connectors do not function and only **LO In** is used:



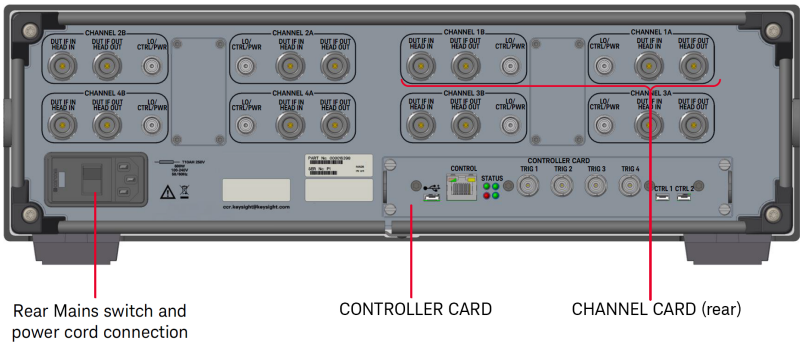
Configurations using a Channel Card equipped with IF circuitry;
IF connectors do function and also use **LO In**:



IF In A	
Connector	Type-N (f), 50 Ω, *nominal* DL IF input Channel A.
DUT IF In/Out A	
Connector	SMA (f), 50 Ω, *nominal* In/Out connection for Channel A.
IF Out A	
Connector	Type-N (f), 50 Ω, *nominal* UL IF output for Channel A.
LO In	
Connector	SMA (f), 50 Ω, *nominal* Local oscillator input for the Channel Card.
IF In B	
Connector	Type-N (f), 50 Ω, *nominal* DL IF input for Channel B.
DUT IF In/Out B	
Connector	SMA (f), 50 Ω, *nominal* In/Out connection for Channel B.
IF Out B	
Connector	Type-N (f), 50 Ω, *nominal* UL IF output for Channel B.

3. 2. 6. 4 Connectors, E7770A CIU Rear Panel

The rear panel of the E7770A CIU contains rear connections for the CONTROLLER CARD and all installed Channel Cards; if there is only one installed Channel Card, only rear panel connectors for CHANNEL 1A and CHANNEL 1B are usable. The rear panel of the E7770A CIU is also labeled with all required safety and compliance indicators and contains the Mains switch where the AC power cable is connected. Since the LO Card and the LO Distribution Card do not extend through to the rear panel, there are no rear connections for the LO Card or LO Distribution Card.



3. 2. 6. 5 Connectors, E7770A CIU Rear Panel, Channel Cards

The E7770A CIU rear panel contains the connectors for up to four Channel Cards; each rear panel Channel Card (labeled: 1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B) corresponds to a Channel Card available from the front of the E7770A CIU.

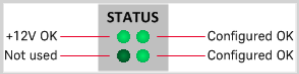


LO/CTRL/PWR	
Connector	TNC (f), 50 Ω, *nominal* Local oscillator, control, and power from **LO/CTRL/PWR**
Frequency, LO Power DC Power	6 to 12 GHz, 10 dBm, minimum +36 VDC, 1A
DUT IF IN HEAD IN	
Connector	Type-N (f), 50 Ω, *nominal* Output for connecting to DUT for High IF testing.
DUT IF OUT HEAD OUT	
Connector	Type-N (f), 50 Ω, *nominal* Input for connecting to DUT for High IF testing.

3. 2. 6. 6 Connectors, E7770A CIU Rear Panel, Controller Card

Each E7770A CIU contains a single CONTROLLER CARD. The status of the E7770A CIU is identified using the status lights on the CONTROLLER CARD.





Status LEDs	
Top Left LED, Green	On, indicates +12 V supply if okay.
Top Right LED, Green	On, indicates configured okay.
Bottom Left LED, Red	Not used.
Bottom Right LED, Green	On, indicates configured okay.
USB	
Connector	Micro-USB B Reserved for Keysight internal use only.
CONTROL (LAN)	
Connector	10/100/1000BASE-T (RJ-45) Gigabit Ethernet Port
TRIG 1	
Connector	BNC (f), 50 Ω, *nominal*
Input Level Range	5 V TTL (Trigger signal below 0.8 volts is a "zero" (low) and anything above +2.4 volts is a "one" (high).
TRIG 2	
Connector	BNC (f), 50 Ω, *nominal*
Input Level Range	5 V TTL (See description for TRIG 1.)
TRIG 3	
Connector	BNC (f), 50 Ω, *nominal*
Input Level Range	5 V TTL (See description for TRIG 1.)
TRIG 4	
Connector	BNC (f), 50 Ω, *nominal*
Input Level Range	5 V TTL (See description for TRIG 1.)
Ctrl 1	
Connector	Micro-HDMI Reserved for Keysight internal use only.
Ctrl 2	
Connector	Micro-HDMI Reserved for Keysight internal use only.

3. 2. 7 Connectors, M1740A mmWave Transceiver

3. 2. 7. 1 Ext Trig, LEDs, & Interfaces on M1740A mmWave Transceiver



Ext Trig	
Connector	SMP (m), 50 Ω, *nominal*, DC to 40 GHz
Input Level Range	5 V TTL (Trigger signal below 0.8 volts is a "zero" (low) and anything above +2.4 volts is a "one" (high). See the descriptions for TRIG 1, 2, 3, and 4 under Connectors, E7770A CIU Rear Panel, Controller Card on page 38. This trigger input (is used by Keysight in testing and is usually not needed for customer use). In normal usage, the trigger input is included in the combined input signal to the LO/Pwr/Ctrl/IF In port.
LEDs	
Trig (LED)	A trigger indicator (used by Keysight in testing; not needed for customer use). In normal usage (as described for Ext Trig) the LED does not light.
RF1 (LED)	Indicates the current status of the **RF Tx/Rx 1** port, according to the color scheme: – Blue = Tx (port is in transmit mode) – Green = Rx (port is in receive mode) – White = Idle (port is not in use) During switching between modes, intermediate shades of color occur temporarily.
RF2 (LED)	Indicates the current status of the **RF Tx/Rx 2** port, according to the color scheme described for RF1 above.
Status (LED)	Lights to indicate that the M1740A is currently under the control of the E7770A, E7760B, or other instrument, according to the color scheme: – Orange = connected, but no active communication currently – Green = connected, with active communication currently



USB	
Connector	Micro-USB B Reserved for Keysight internal use only.
Aux	
Connector	Micro-D 15-pin A power input (used by Keysight in testing; not needed for customer use).

3. 2. 7. 2 Connectors, mmWave Side of M1740A mmWave Transceiver

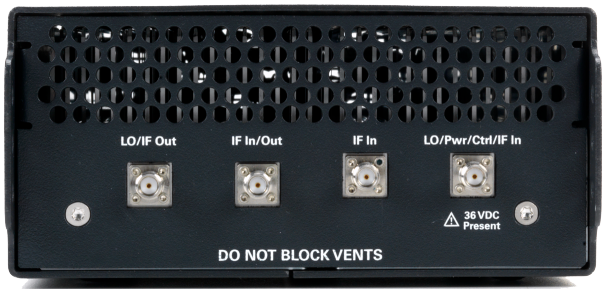


RF Tx/Rx 1	
Connector	2.4 mm (f), 50 Ω, *nominal* This port can be configured either to supply a mmWave signal to a Device Under Test (DUT), or to receive a mmWave signal from a DUT.
Frequency, M1740A Frequency, S9100A Amplitude	24 to 44 GHz, 24.25 to 29.5 GHz and 37 to 40 GHz, 15 VDC, +20 dBm Maximum Input
RF Tx/Rx 2	
Connector	2.4 mm (f), 50 Ω, *nominal* This port can be configured either to supply a mmWave signal to a Device Under Test (DUT), or to receive a mmWave signal from a DUT.
Frequency, M1740A Frequency, S9100A Amplitude	24 to 44 GHz, 24.25 to 29.5 GHz and 37 to 40 GHz, 15 VDC, +20 dBm Maximum Input

NOTE Although the M1740A mmWave Transceiver is operational from 24 to 44 GHz, the performance information for the S9100A is only provided for the frequency bands called out in its Data Sheet.

See the Data Sheet for the Keysight S9100A, 5992-3561EN.

3. 2. 7. 3 Connectors, IF Side of M1740A mmWave Transceiver



LO/IF Out		
	Connector	SMA (f), 50 Ω, *nominal* This port provides the IF output of the down-converter in the M1740A. This port also accepts an LO input to be used by the downconverter.
IF In/Out		
	Connector	SMA (f), 50 Ω, *nominal* This port can be used either to accept an IF input to the upconverter in the M1740A or to provide the IF output of the downconverter in the M1740A.
	IF frequency range IF input power range IF output power range	2.5 to 4 GHz –20 to –30 dBm minimum, CW –24 to –8 dBm, CW
IF In		
	Connector	SMA (f), 50 Ω, *nominal* This port accepts an IF input to the upconverter in the M1740A.
	IF frequency range IF input power range	2.5 to 4 GHz –20 to –30 dBm minimum, CW
LO/Pwr/Ctrl/IF In		
	Connector	SMA (f), 50 Ω, *nominal* This port accepts an IF input to the upconverter in the M1740A. This port also accepts the following inputs, which are combined with the IF input signal: – An LO input to be used by the upconverter and/or downconverter in the M1740A. – A +36 VDC voltage input to power the M1740A. – A control signal to operate the M1740A.
	Frequency range, LO, DC power	6 to 12 GHz, –20 dBm, minimum +36 VDC, 1A

CAUTION Do not connect or disconnect the RF cable, at either end, while the connected instrument is powered on.

4 Install Hardware

WARNING Before installing hardware, Review Safety Requirements on page 9.

4. 1 Standard Configurations

The S9100A is available in three standard configurations:

- Keysight S9100A Option RH1 5G Multi-Band Vector Transceiver on page 45, one-channel configuration, consists of one RF transceiver and one mmWave transceiver providing one Tx channel and one Rx channel, operating in one frequency range at a time:
  - FR1 frequencies ranging from 380 MHz to 6 GHz
  - or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz

- Keysight S9100A Option 007 mmWave Transceiver with High IF (Dual-Use Configuration: High IF and mmWave) on page 48, one-channel configuration, consists of one RF transceiver, one mmWave transceiver, as well as one High IF Channel Card in the E7770A Common Interface Unit (CIU) providing one Tx channel and one Rx channel, operating in one frequency range at a time:
  - FR1 frequencies ranging from 380 MHz to 6 GHz
  - or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz
  - or High IF frequencies ranging from 6 to 12 GHz

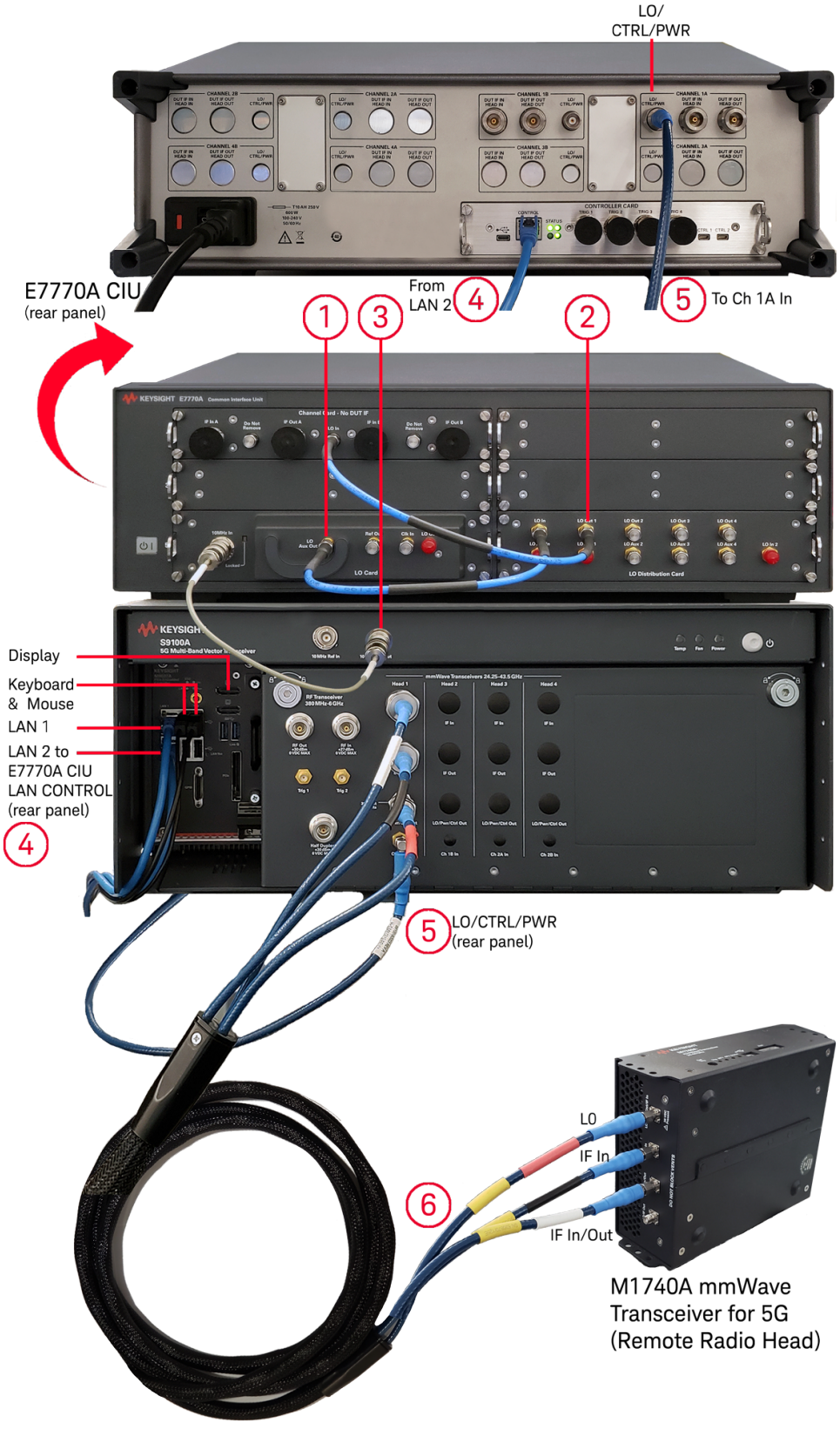
  High IF frequencies are provided by using additional High IF input & output connectors that route the signal path through up and down converters, located on a Channel Card, in the Keysight E7770A Common Interface Unit (CIU).

- Keysight S9100A Option 022 mmWave Transceiver with High IF and Blocker (Dual-Use Configuration: High IF and mmWave) on page 51, one-channel configuration, consists of two RF transceivers, one mmWave transceiver, as well as one High IF Channel Card (in the E7770A Common Interface Unit) providing one Tx channel and one Rx channel, operating in one frequency range at a time:
  - FR1 frequencies ranging from 380 MHz to 6 GHz
  - or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz
  - or High IF frequencies ranging from 6 to 12 GHz

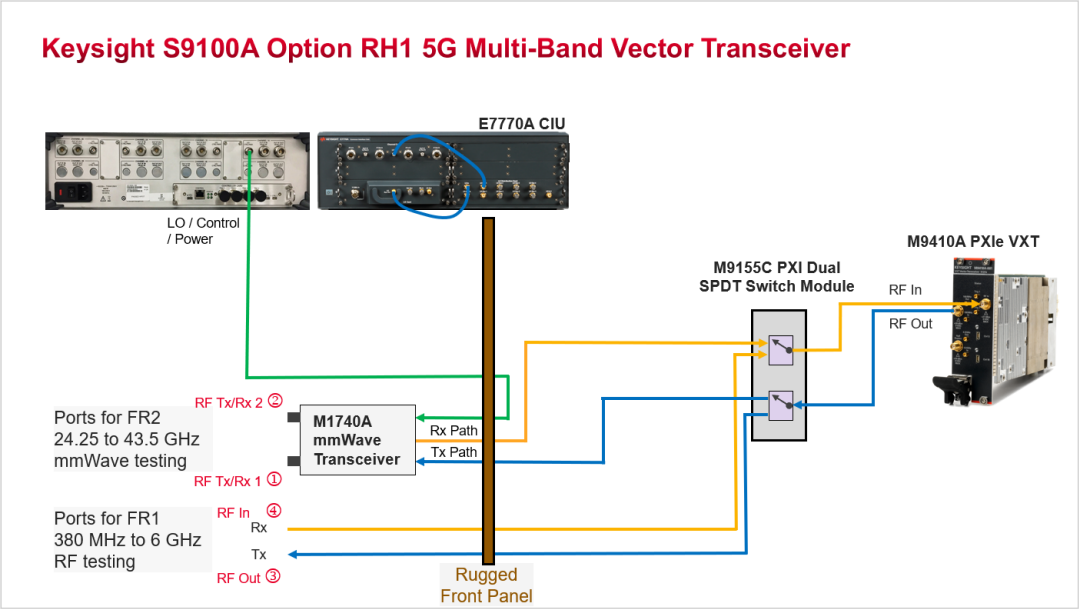
High IF frequencies are provided by using additional High IF input & output connectors that route the signal path through up and down converters, located on a Channel Card, in the Keysight E7770A Common Interface Unit (CIU).

This configuration also provides the capability to perform Rx tests with a blocking signal (interfering signal). This configuration can generate a *Wanted* signal and at the same time generate a *Blocking* signal; a *Wanted* signal (produced from the RF Out of a Primary M9410A VXT) is combined with a blocking signal (produced from the RF Out of a 2nd M9410A VXT). The combined wanted and blocking signals are available in all three frequency ranges: FR1, FR2, or High IF.

4. 2 Keysight S9100A Option RH1 5G Multi-Band Vector Transceiver



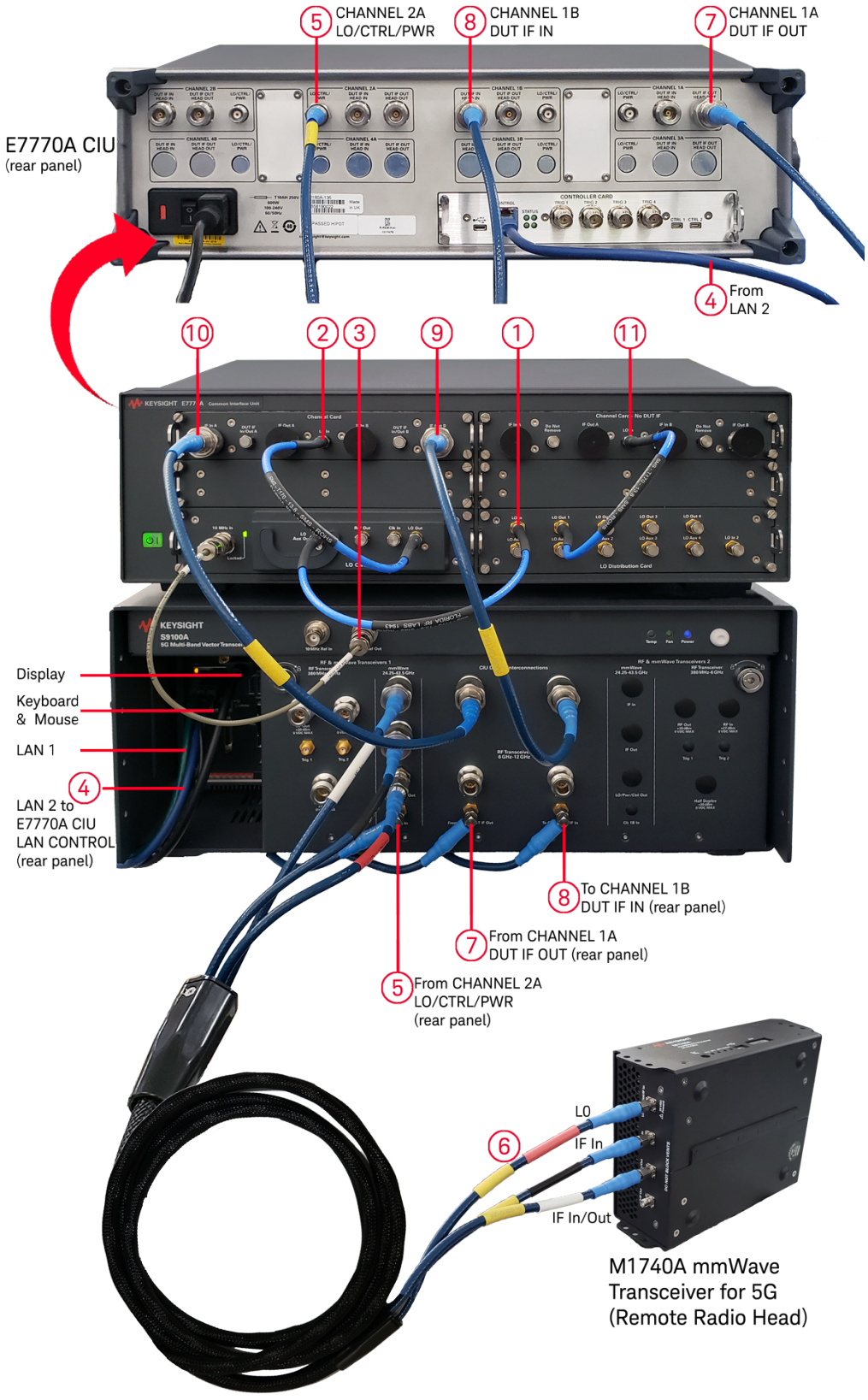
Item	Qty	Connection To... From...
1, 2 	2	– **8121-3044 RF Cable**, SMA (m) to SMA (m), 350 mm (13.8 in) – Connect LO Card **LO Aux Out** to LO Distribution Card **LO In**. – Connect LO Distribution Card **LO Out 1** to Channel Card 1 **LO In**.
3 	1	– **8121-3199 BNC Cable,** BNC (m) to BNC (m), 300 mm (11.8 in) – Connect S9100A **10 MHz Out** to E7770A CIU **10 MHz In**.
4 	1	– **8121-1351, LAN Cable**, Patch-5E RJ-45 (m) to RJ-45 (m) 24-AWG 8-Conductor PVC, 2133.6 mm (84 in), Blue or equivalent – Connect M9037A PXIe Embedded Controller **LAN 2** to E7770A CIU **LAN CONTROL** (rear panel).
5 	1	– **S9100-60003 RF Cable**, SMA (m) to TNC (m), 1100 mm (43.3 in) – Connect E7770A CIU CHANNEL 1A **LO/CTRL/PWR** (rear panel) to S9100A Head 1 **Ch 1A In**.
6 	1*	– **S9100-60005 Three-Cable Bundle (Color-Coded)** – **Red**, SMA (m) to TNC (m), 4000 mm (157.5 in) Connect M1740A **LO/Pwr/Ctrl IF In** to S9100A **LO/Pwr/Ctrl Out**. – **Black**, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In** to S9100A **IF Out**. – White, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In/Out** to S9100A **IF In**. *One of these three-cable bundles is included with each Option RH1.
	1	– **8121-3222 loop-back cable**, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) – Connect this loop-back cable from **RF Tx/Rx 1** to **RF Tx/Rx 2** on the M1740A mmWave Transceiver.



Keysight S9100A Option RH1 5G Multi-Band Vector Transceiver on page 45, one-channel configuration, consists of one RF transceiver and one mmWave transceiver providing one Tx channel and one Rx channel, operating in one frequency range at a time:

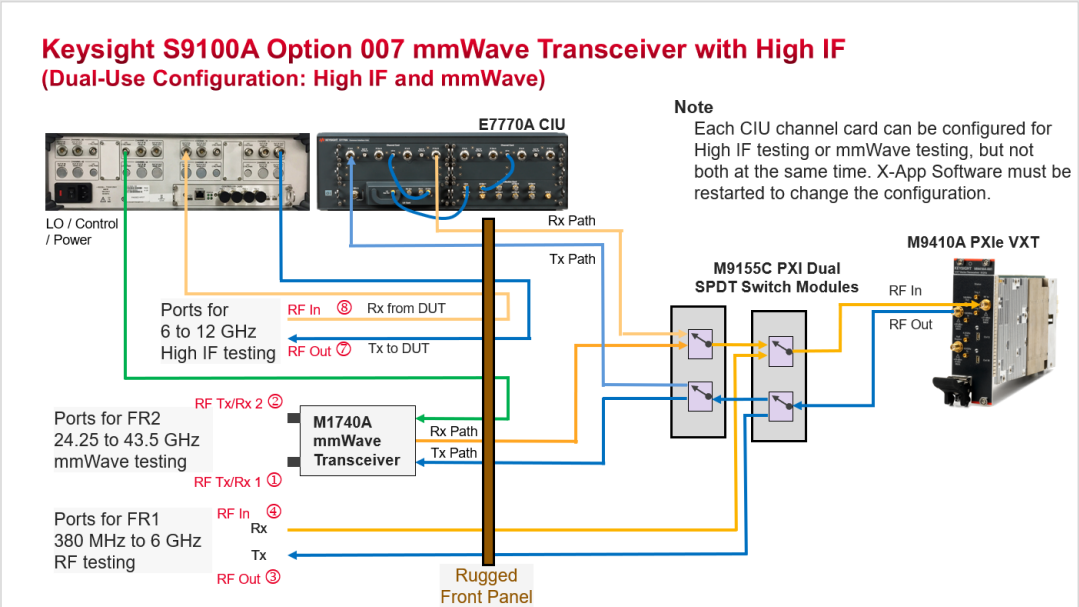
- FR1 frequencies ranging from 380 MHz to 6 GHz
- or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz

4. 3 Keysight S9100A Option 007 mmWave Transceiver with High IF (Dual-Use Configuration: High IF and mmWave)



Connect the hardware as described in the following table.

Item	Qty	Connection To... From...
1, 2, 11 	3	– **8121-3044 RF Cable**, SMA (m) to SMA (m), 350 mm (13.8 in) – Connect LO Card **LO Aux Out** to LO Distribution Card **LO In**. – Connect LO Distribution Card **LO Out 1** to Channel Card 1 **LO In**. – Connect LO Card **LO Out** to Channel Card 2 **LO In** (right-side).
3 	1	– **8121-3199 BNC Cable,** BNC (m) to BNC (m), 300 mm (11.8 in) – Connect S9100A **10 MHz Out** to E7770A CIU **10 MHz In**.
4 	1	– **8121-1351, LAN Cable**, Patch-5E RJ-45 (m) to RJ-45 (m) 24-AWG 8-Conductor PVC, 2133.6 mm (84 in), Blue or equivalent – Connect M9037A PXIe Embedded Controller **LAN 2** to E7770A CIU **LAN CONTROL** (rear panel).
5 	1	– **S9100-60003 RF Cable**, SMA (m) to TNC (m), 1100 mm (43.3 in) – Connect E7770A CIU CHANNEL 2A, **LO/CTRL/PWR** (rear panel) to S9100A labeled: **"Ch 1A In"** (front panel).
6 	1	– **S9100-60005 Three-Cable Bundle (Color-Coded)** – White, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In/Out** to S9100A **IF In**. – **Black**, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In** to S9100A **IF Out**. – Red, SMA (m) to TNC (m), 4000 mm (157.5 in) Connect M1740A **LO/Pwr/Ctrl IF In** to S9100A **LO/Pwr/Ctrl Out**.
7, 8 	2	– **S9100-60011 RF Cable**, SMA (m) to Type-N (m), 1100 mm (43.3 in) – Connect from E7770A CIU CHANNEL 1A, **DUT IF OUT** (rear panel) to S9100A labeled: **"From Ch 1A DUT IF Out"** (front panel). – Connect from E7770A CIU CHANNEL 1B, **DUT IF IN** (rear panel) to S9100A labeled: **"To Ch 1B DUT IF In"** (front panel).
9, 10 	2	– **S9100-60012 RF Cable**, Type-N (m) to Type-N (m), 457 mm (18 in) – Connect Channel Card **IF Out B** to CIU DUT IF Interconnection, **IF In**. – Connect Channel Card **IF In A** to CIU DUT IF Interconnection, **IF Out**.
	1	– **8121-3222 loop-back cable**, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) – Connect this loop-back cable from **RF Tx/Rx 1** to **RF Tx/Rx 2** on the M1740A mmWave Transceiver.

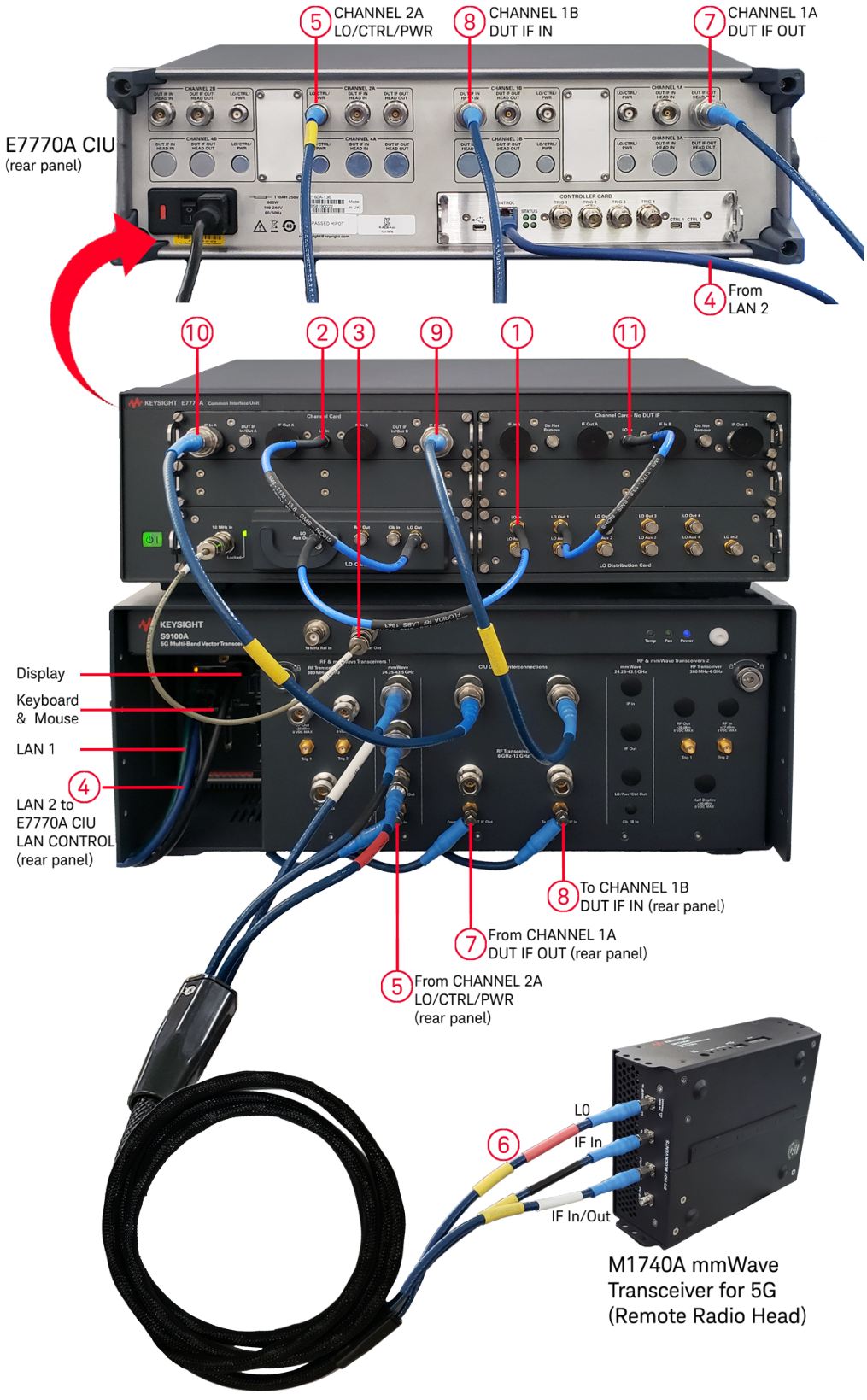


Keysight S9100A Option 007 mmWave Transceiver with High IF (Dual-Use Configuration: High IF and mmWave) on page 48, one-channel configuration, consists of one RF transceiver, one mmWave transceiver, as well as one High IF Channel Card in the E7770A Common Interface Unit (CIU) providing one Tx channel and one Rx channel, operating in one frequency range at a time:

- FR1 frequencies ranging from 380 MHz to 6 GHz
- or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz
- or High IF frequencies ranging from 6 to 12 GHz

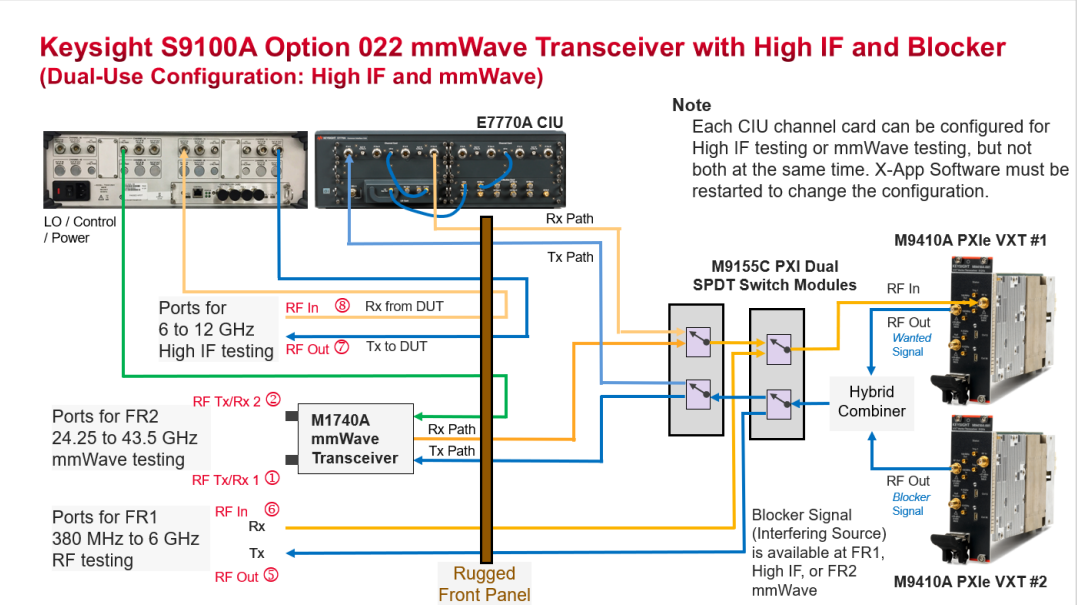
High IF frequencies are provided by using additional High IF input & output connectors that route the signal path through up and down converters, located on a Channel Card, in the Keysight E7770A Common Interface Unit (CIU).

4. 4 Keysight S9100A Option 022 mmWave Transceiver with High IF and Blocker (Dual-Use Configuration: High IF and mmWave)



Connect the hardware as described in the following table.

Item	Qty	Connection To... From...
1, 2, 11 	3	– **8121-3044 RF Cable**, SMA (m) to SMA (m), 350 mm (13.8 in) – Connect LO Card **LO Aux Out** to LO Distribution Card **LO In**. – Connect LO Card **LO Out** to Channel Card **LO In** (left-side card). – Connect LO Distribution Card **LO Out 1** to Channel Card - No DUT IF **LO In** (right-side card).
3 	1	– **8121-3199 BNC Cable,** BNC (m) to BNC (m), 300 mm (11.8 in) – Connect S9100A **10 MHz Out** to E7770A CIU **10 MHz In**.
4 	1	– **8121-1351, LAN Cable**, Patch-5E RJ-45 (m) to RJ-45 (m) 24-AWG 8-Conductor PVC, 2133.6 mm (84 in), Blue or equivalent – Connect M9037A PXIe Embedded Controller **LAN 2** to E7770A CIU **LAN CONTROL** (rear panel).
5 	1	– **S9100-60003 RF Cable**, SMA (m) to TNC (m), 1100 mm (43.3 in) – Connect E7770A CIU CHANNEL 2A, **LO/CTRL/PWR** (rear panel) to S9100A labeled: **"Ch 1A In"** (front panel).
6 	1	– **S9100-60005 Three-Cable Bundle (Color-Coded)** – White, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In/Out** to S9100A **IF In**. – **Black**, SMA (m) to Type-N (m), 4000 mm (157.5 in) Connect M1740A **IF In** to S9100A **IF Out**. – Red, SMA (m) to TNC (m), 4000 mm (157.5 in) Connect M1740A **LO/Pwr/Ctrl IF In** to S9100A **LO/Pwr/Ctrl Out**.
7, 8 	2	– **S9100-60011 RF Cable**, SMA (m) to Type-N (m), 1100 mm (43.3 in) – Connect from E7770A CIU CHANNEL 1A, **DUT IF OUT** (rear panel) to S9100A labeled: **"From Ch 1A DUT IF Out"** (front panel). – Connect from E7770A CIU CHANNEL 1B, **DUT IF IN** (rear panel) to S9100A labeled: **"To Ch 1B DUT IF In"** (front panel).
9, 10 	2	– **S9100-60012 RF Cable**, Type-N (m) to Type-N (m), 457 mm (18 in) – Connect Channel Card **IF Out B** to CIU DUT IF Interconnection, **IF In**. – Connect Channel Card **IF In A** to CIU DUT IF Interconnection, **IF Out**.
	1	– **8121-3222 loop-back cable**, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) – Connect this loop-back cable from **RF Tx/Rx 1** to **RF Tx/Rx 2** on the M1740A mmWave Transceiver.



Keysight S9100A Option 022 mmWave Transceiver with High IF and Blocker (Dual-Use Configuration: High IF and mmWave) on page 51, one-channel configuration, consists of two RF transceivers, one mmWave transceiver, as well as one High IF Channel Card (in the E7770A Common Interface Unit) providing one Tx channel and one Rx channel, operating in one frequency range at a time:

- FR1 frequencies ranging from 380 MHz to 6 GHz
- or FR2 banded mmWave frequencies from 24.25 to 43.5 GHz
- or High IF frequencies ranging from 6 to 12 GHz

High IF frequencies are provided by using additional High IF input & output connectors that route the signal path through up and down converters, located on a Channel Card, in the Keysight E7770A Common Interface Unit (CIU).

This configuration also provides the capability to perform Rx tests with a *Blocking* signal (interfering signal). This configuration can generate a *Wanted* signal and at the same time generate a *Blocking* signal; a *Wanted* signal (produced from the RF Out of a Primary M9410A VXT) is combined with a *Blocking* signal (produced from the RF Out of a 2nd M9410A VXT). The combined *Wanted* and *Blocking* signals are available in all three frequency ranges: FR1, FR2, or High IF.

5 Install Software

NOTE If a standard configuration that includes the M9037A PXIe Embedded Controller was ordered, all needed software should have come pre-installed; proceed to Verify Operation on page 57.

6 Verify Operation

NOTE **All of the previous sections must be completed before verifying operation of the Keysight S9100A 5G Multi-Band Vector Transceiver.**

In this section...

Verify Operation by performing the following:

1. Powering on the Keysight S9100A Base System
   - The M9037A PXIe Embedded Controller and the M9300A PXIe Reference are part of the Keysight S9100A Base System; they both power on and initialize automatically when the Keysight S9100A Base System is powered on.

2. Verifying X-Apps Software Controls the S9100A on page 58
   - Verify the X-Apps Software Controls the S9100A at 3 GHz on page 58
   - Verify the X-Apps Software Controls the S9100A at 28 GHz on page 62

6. 1 Verifying X-Apps Software Controls the S9100A

NOTE This process must be repeated for each M9410A and its selected X-Apps software pair in a system.

6. 1. 1 Verify the X-Apps Software Controls the S9100A at 3 GHz

1. Connect an RF loop-back cable from RF In to RF Out connectors on the RF Transceiver, located on the Rugged Front Panel.
   (This loop-back cable is NOT included with the S9100A.)
   - This connection can be made using a cable with two adapters.

     For example, a cable with adapters (or equivalent) can be used:
     one 5063-1530 RF Cable, SMA (m) to SMA (m), 152.4 mm (6.0 in) and
     two 1250-1250 Adapters, SMA (f) to Type-N (m)



RF Transceiver

(Zoomed-Out from the Rugged Front Panel)

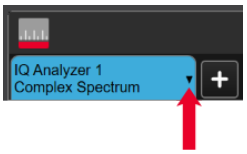
2. If it is not already running, start the Modular TRX software and review the interface; this interface is referred to as a **Mode:**

NOTE The Modular TRX interface can be started as follows:
Select the **Start** menu (lower-left corner icon)
> Scroll down to "**K**" applications
> Select the **Keysight Modular Transceiver** drop-down arrow
> Scroll down the list and select **LaunchModularTRX**

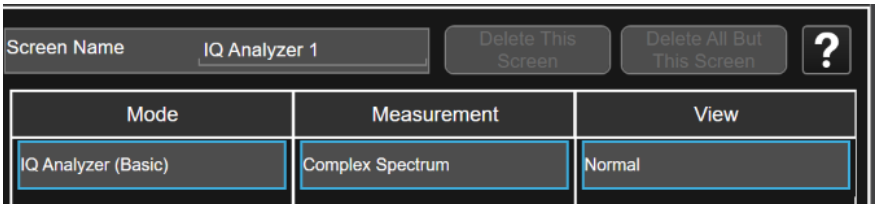
   - Each Mode looks different and has its own collection of measurement capabilities, controls, windows, and SCPI commands.
   - Each Mode runs within a screen (there can be multiple screens).
   - Screens are shown as tabs across the top of the interface.
     IQ Analyzer Mode is included with the S9100A and appears as a tab with the label **IQ Analyzer 1**.



3. Select the **IQ Analyzer 1** drop-down selector.

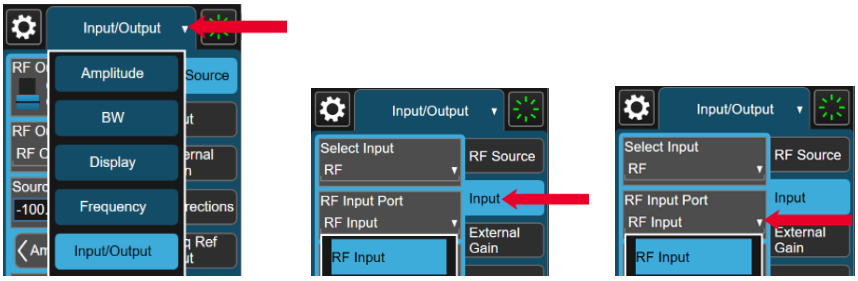


4. Set the **Mode / Measurement / View** for IQ Analyzer 1:

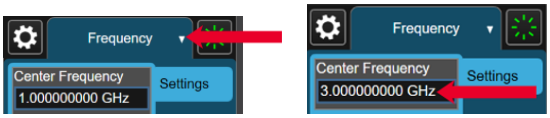


   a. Select **Mode** as **IQ Analyzer (Basic)**.
   b. Select **Measurement** as **Complex Spectrum**.
   c. Select **View** as **Normal**.
   d. Select **OK**.

5. Set the **RF Input** to 3 GHz; this is the RF In port on the Rugged Front Panel.
   a. Select the drop-down menu panel (top-right corner) select **Input/Output**, select the **Input** tab, select the **RF Input Port** drop-down menu, and select **RF Input**.

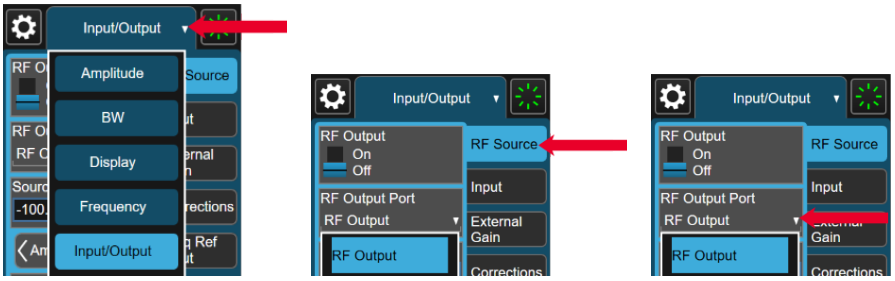


   b. Select the drop-down menu panel (top-right corner) and select **Frequency**, select the **Center Frequency** entry box, and set it to **3 GHz**.

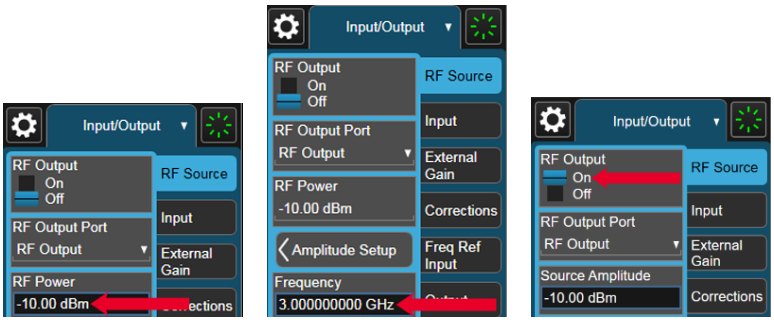


   c. Leave all of the other RF Input Port settings in their preset state.

6. Set the **RF Output** to 3 GHz; this is the RF Out port on the Rugged Front Panel.
   a. Select the drop-down menu panel (top-right corner)
   select **Input/Output**, select the **RF Source** tab,
   select the **RF Output Port** drop-down menu, and select **RF Output**.



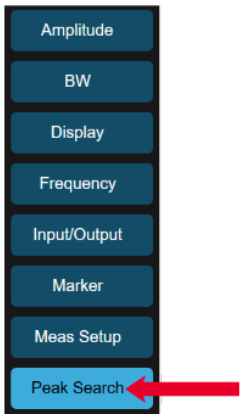
   b. Set **RF Power** to **–10 dBm**, **Frequency** to **3 GHz**, and **RF Output** to **On**.



7. Verify **IQ Analyzer** Mode displays a signal at 3 GHz and –10 dBm.



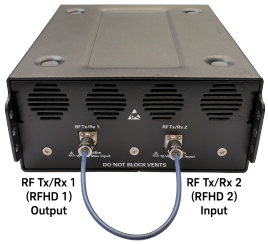
   a. Select the drop-down menu panel (top-right corner) and select **Peak Search**.



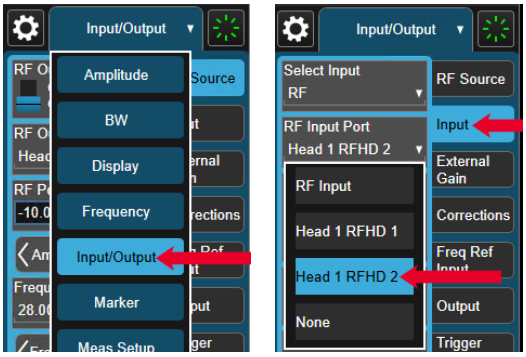
      - If there is a signal at 3 GHz and approximately –10 dBm, the RF Transceiver RF Input and RF Output ports of the S9100A are working properly. (The power level is only approximate because there is loss in the cable being used and this loss is not being corrected during the measurement.)

6. 1. 2 Verify the X-Apps Software Controls the S9100A at 28 GHz

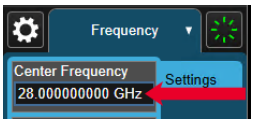
1. Connect a loop-back cable from RF Tx/Rx 1 to RF Tx/Rx 2 connectors on the M1740A mmWave Transceiver. One **8121-3222 loop-back cable**, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in), is included with each S9100A.



2. Set the **RF Tx/Rx 2** (Head 1 RFHD 2) to 28 GHz; this port can be thought of as the RF Input (Receiver or Analyzer port) on the M1740A mmWave Transceiver.
   a. Select the drop-down menu panel (top-right corner) and select **Input/Output**, select the **Input** tab, select the **RF Input Port** drop-down menu, and set it to **Head 1 RFHD 2**.

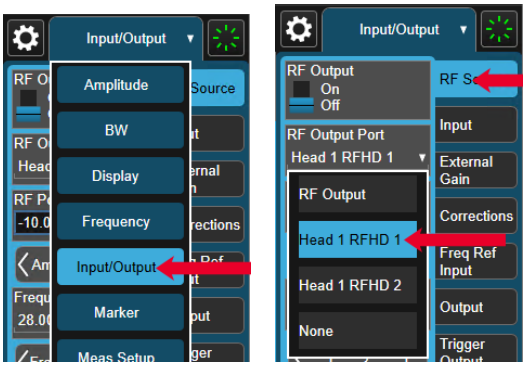


   b. Select the drop-down menu panel (top-right corner) select **Frequency**, select the **Center Frequency** entry box, and set it to **28 GHz**.

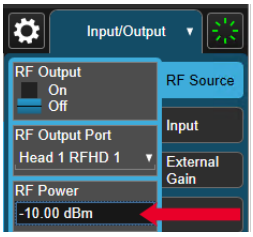


   c. Leave all of the other Input port settings in their preset state.

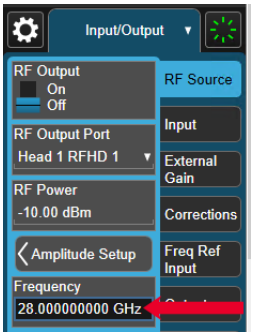
3. Set the **RF Tx/Rx 1** (Head 1 RFHD 1) to 28 GHz; this port can be thought of as the RF Output (RF Source port) on the M1740A mmWave Transceiver.
    a. Select the drop-down menu panel (top-right corner) and select **Input/Output**, select the **RF Source** tab, select the **RF Output Port** drop-down menu, and select **Head 1 RFHD 1**.



    b. Select the **RF Power** entry box and set it to **–10 dBm**.

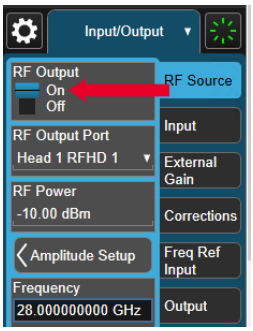


    c. Select the **Frequency** entry box and set it to **28 GHz**.



    d. Leave all of the other RF Output port settings in their preset state.

e. Select the **RF Output On/Off** switch and set it to **On**.



4. Verify **IQ Analyzer** Mode displays a signal at 28 GHz and –10 dBm.



a. Select the drop-down menu panel (top-right corner) and select **Peak Search**.



– If there is a signal at 28 GHz and approximately –10 dBm, the RF Tx/Rx 1 and RF Tx/Rx 2 ports of the S9100A are working properly. (The power level is only approximate because there is loss in the cable being used and this loss is not being corrected during the measurement.)

7 Run Power Calibration

Before running Power Calibration on mmWave ports, review the following:

1. Review Calibration Conditions on page 66
2. Review Calibration Equipment Required on page 67
3. Review Calibration Connectors (Ports 1 to 8) on page 68

How to proceed...

4. Run S910xA System Calibration Software on page 70
5. Connect Equipment
   See Using the Equipment Tab on page 71
6. Perform Alignments
   See Using X-Apps to Perform Alignments on page 80
7. Perform Calibration
   See Using the Power Calibration Tab on page 81

7.1 Calibration Conditions

CAUTION All needed alignments and calibrations were performed at the factory before this S9100A system was shipped.

- Power Calibration on mmWave ports should be performed at least once a week to correct for drift caused by temperature or humidity changes.
- If additional calibrations are required, contact Keysight Support; see Returning for Service on page 24.

NOTE Before running Power Calibration on mmWave ports, confirm that all of the following conditions are met; these same conditions are also described in the Keysight S9100A Data Sheet, 5992-3561EN.

- S9100A system performance is valid for an ambient temperature of 25°C unless otherwise noted
- S9100A system is within its recommended calibration cycle of one year (described in the Data Sheet under "General Performance")
- S9100A system has been stored at an ambient temperature within the allowed operating range for at least two hours before being powered on
- S9100A system has been powered on continuously for at least two hours warm-up time, with IQ Analyzer or X-Series application (e.g. 5G NR) running and the M1740A mmWave Transceiver powered on (verify that LEDs are on)

  Depending on environmental conditions, longer warm-up time (up to 24 hours) may lead to more stable results. If the system met these warm-up time requirements and there is a brief power shutdown, such as a system reboot, allow 45 minutes of warm-up time after the system is powered back on.
- "Align Now All" alignments have been run in the M9410A PXIe VXT module, and performed at least once within the previous seven days, after warm-up period; see Using X-Apps to Perform Alignments on page 80
- A "Fast Alignment" has been run within the previous eight hours and again if the temperature has changed more than 5°C from when the previous "Fast Alignment" was performed
- Amplitude accuracy characteristics apply after calibration has been performed in the current environment and humidity has not changed by more than ±10%.

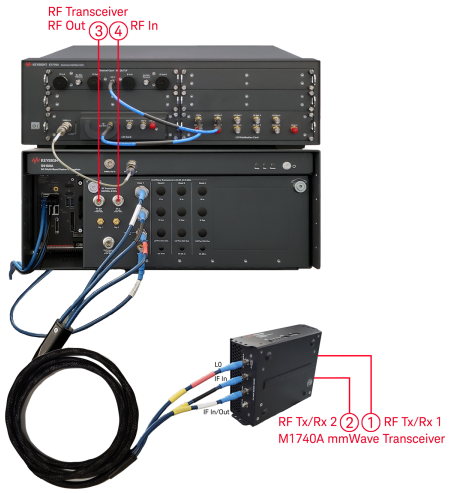
7. 2 Calibration Equipment Required

Keysight Equipment	Purpose
U8487A 10 MHz to 50 GHz USB Thermocouple Power Sensor or equivalent (Alternates) N8487A 50 MHz to 50 GHz Thermocouple Power Sensor with: N1913A or N1914A.	Power Sensor with built-in calibration.
8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent One of these loop-back cables are included with each S9100A standard configuration.	This loop-back cable can be connected from RF Tx/Rx 1 to RF Tx/Rx 2 (source to receiver) on the M1740A mmWave Transceiver only when testing for operation; during normal use, this loop-back cable is removed.
11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent	This adapter is used to connect the U8487A Power Sensor or equivalent to the end of the loop-back cable (described above) that is used during Cable signal path calibration. It can also be used to connect two 2.4 mm (m) to (m) cables during Receiver (Rx) signal path calibration.
11903B adapter, 2.4 mm (f) to Type-N (f) or equivalent (Alternate) 1250-1472 adapter, Type-N (f) to Type-N (f) can also be used, but with lower accuracy. If an EPM or P-Series power meter is used, this adapter can be used on the power meter for sensor calibration.	This adapter is used to connect two Type-N (m) to (m) cables during Receiver calibration.
11903D adapter, 2.4 mm (f) to Type-N (m) or equivalent	This adapter is used to connect a 2.4 mm (m) to Type-N (f) ports, such as DUT IF and RF ports.
8121-3144 cable, Type-N (m) to Type-N (m), 500 mm (19.7 in) or equivalent	This cable is used to connect source to receiver during Receiver calibration.
1250-1472 adapter, Type-N (f) to Type-N (f) or equivalent	This adapter is used to connect two Type-N (m) to (m) cables during Cable calibration.

7. 2. 1 Calibration Connectors (Ports 1 to 8)

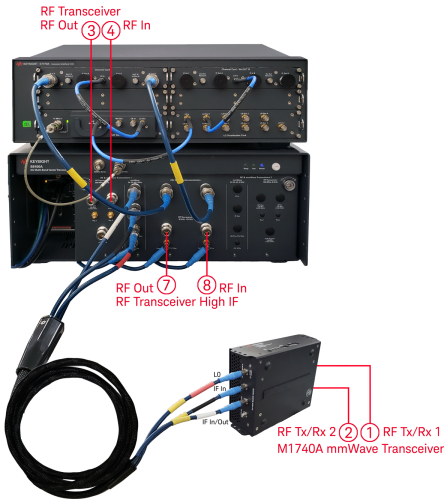
The S9100A system is available in three standard configurations with multiple ports:

S9100A Option RH1 5G Multi-Band Vector Transceiver



Port Selection	Hardware Calibration Paths...	Ports
RRH 1 RFHD 1 -> RRH 1 RFHD 2	M1740A Port 1 -> 2	1, 2
RRH 1 RFHD 2 -> RRH 1 RFHD 1	M1740A Port 2 -> 1	2, 1
RF Output -> RF Input	RF Transceiver ...without a Blocker	3, 4

S9100A Option 007 mmWave Transceiver with High IF

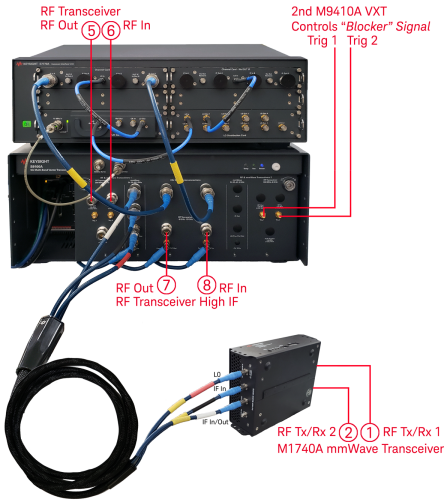


Port Selection	Hardware Calibration Paths...	Ports
RRH 1 RFHD 1 -> RRH 1 RFHD 2	M1740A Port 1 -> 2	1, 2
RRH 1 RFHD 2 -> RRH 1 RFHD 1	M1740A Port 2 -> 1	2, 1
RF Output -> RF Input	RF Transceiver ...without a Blocker	3, 4
IFIO 1 -> IFIO 1	High IF (E7770A w/ DUT IF Channel Card)	7, 8

NOTE

If calibration is required for ports RF Output -> RF Input or IFIO 1 -> IFIO 1, contact Keysight Support; see Returning for Service on page 24.

S9100A Option 022 mmWave Transceiver w/ High IF and Blocker



Port Selection	Hardware Calibration Paths...	Ports
RRH 1 RFHD 1 -> RRH 1 RFHD 2	M1740A Port 1 -> 2	1, 2
RRH 1 RFHD 2 -> RRH 1 RFHD 1	M1740A Port 2 -> 1	2, 1
RF Output -> RF Input	RF Transceiver ...combined with a Blocker	5, 6
IFIO 1 -> IFIO 1	High IF (E7770A w/ DUT IF Channel Card)	7, 8

CAUTION All needed alignments and calibrations were performed at the factory before this S9100A system was shipped.

- Power Calibration on mmWave ports should be performed at least once a week to correct for drift caused by temperature or humidity changes.
- If additional calibrations are required, contact Keysight Support; see Returning for Service on page 24.

- **All** S9100A standard configurations have mmWave ports RF Tx/Rx 1 ① & RF Tx/Rx 1 ②

  M1740A mmWave Transceiver have ports RF Tx/Rx 1 ① & RF Tx/Rx 1 ② that can be calibrated when Port Selection is set to one of the following:

  ```
  RRH 1 RFHD 1 -> RRH 1 RFHD 2
  RRH 1 RFHD 2 -> RRH 1 RFHD 1
  ```

- **All** S9100A standard configurations have RF ports that are either RF Out ③ and RF In ④ or RF Out ⑤ and RF In ⑥.

  S9100A Option RH1 and 007 have **RF Transceiver** ports RF Out ③ and RF In ④ and
  S9100A Option 022 have **RF Transceiver** ports RF Out ⑤ and RF In ⑥
  Although output and input ports RF Out ⑤ and RF In ⑥ with a Blocker have the same name on the external labeling as ports RF Out ③ and RF In ④ without a Blocker, they have different system performance.

  Differences are because **S9100A Option 022** have different source system performance than an S9100A Option RH1. On an **S9100A Option 022**, the Transmit (Tx) RF Out ⑤, 380 MHz to 6 GHz, signal path is routed through a hybrid combiner with additional cabling and switching that combines the RF Out of a Primary Transceiver (M9410A PXIe VXT), “Wanted” signal, with the RF Out of a Secondary Transceiver (M9410A PXIe VXT), “Blocker” signal. The RF In ⑥ path is not affected by the Blocker on an S9100A Option 022.
  RF Out ③ and RF In ④ or RF Out ⑤ and RF In ⑥
  can be calibrated when Port Selection is set to:

  ```
  RF Output -> RF Input
  ```

- **Some** S9100A standard configurations have High IF ports RF Out ⑦ and RF In ⑧.

  S9100A Option 007 and 022 have **RF Transceiver High IF** ports RF Out ⑦ and RF In ⑧ that route the signal path through up and down converters, located in the Keysight E7770A Common Interface Unit (CIU), along with additional cabling and switching which results in signals ranging from 6 to 12 GHz.
  RF Out ⑦ and RF In ⑧ can be calibrated when Port Selection is set to:

  ```
  IFIO 1 -> IFIO 1
  ```

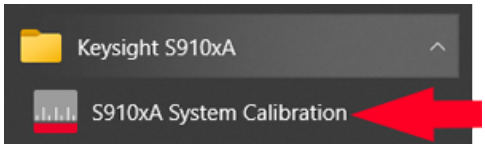
7. 3 Run S910xA System Calibration Software

Once S910xA System Calibration has been installed, a shortcut can be found in the Windows Start menu. S910xA System Calibration can also be started by navigating to the installation folder: `C:\Program Files\Keysight\S9100A\System Calibration` and running `S9100A System Calibration.exe`

If it is not already running, start S910xA System Calibration:

NOTE

S910xA System Calibration can be started as follows:
Select the Start menu (lower-left corner icon)
> Scroll down to "K" applications
> Select the Keysight S910xA drop-down arrow
> Scroll down the list and select S910xA System Calibration



The following tabs are available in S910xA System Calibration software:

Equipment

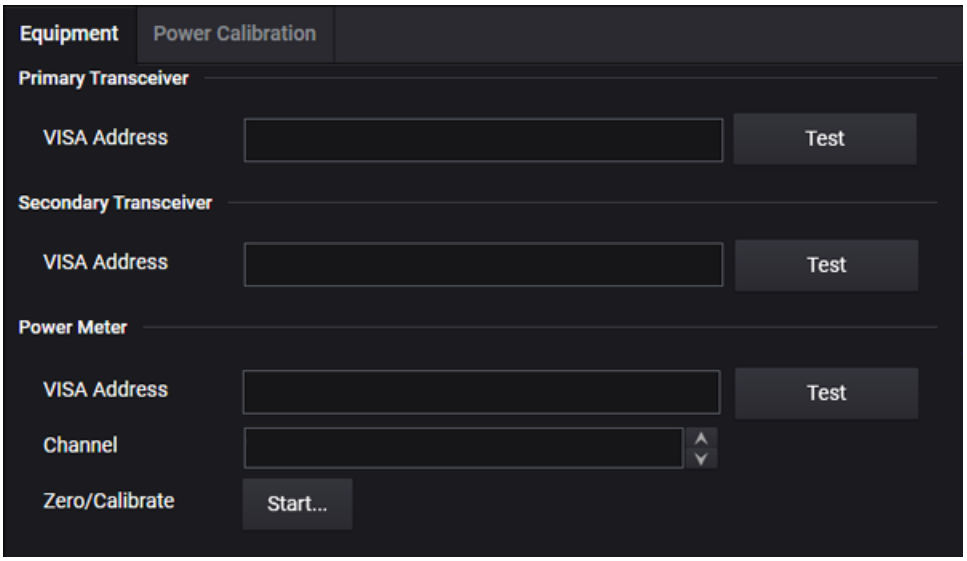
Using the Equipment Tab on page 71
to enter VISA Address and hislip socket number "Connection Strings" for all equipment used during Calibration.

Power Calibration

Using the Power Calibration Tab on page 81
to provide an accurate power level at each mmWave Transceiver input and output port.

7. 3. 1 Using the Equipment Tab

This section describes how the Equipment tab is used to set VISA Address and hislip socket number "Connection Strings" for a Primary Transceiver, Secondary Transceiver, and a Power Meter (Power Sensor).



`Primary Transceiver` and `Secondary Transceiver`

`VISA Address`

These `VISA Address` entry boxes accept "Connection Strings" for a `Primary Transceiver` (1st M9410A PXIe VXT) and a `Secondary Transceiver` (2nd M9410A PXIe VXT); only used in an S9100A-022 mmWave Transceiver with High IF and Blocker.

"Connection Strings" differ depending on whether the Calibration is run on an embedded controller (local host) or an external controller (remote host); when run on an:

embedded controller (local host),

the "Connection String" should include a local host `hislip` socket; for example, `TCPIP0::localhost::hislip0::INSTR`
The default embedded controller (local host), is an M9037A PXIe Embedded Controller which is located in Slot-1 of the chassis containing the PXIe modules.

external controller (remote host),

the "Connection String" should include the name of the external controller (remote host);
for example, `TCPIP0::K-M9037A-12345::hislip0::INSTR`
or include the IP address of the external controller (remote host);
for example, `TCPIP0::141.121.XXX.YYY::inst0::INSTR`

`Power Meter (Power Sensor)`

`VISA Address`

This `VISA Address` entry box accepts a "Connection String" for a one or two channel power meter controlled over LAN or a "Connection String" for a USB power sensor controlled over USB; the "Connection String" should contain the IP address;
for example, `TCPIP0::141.121.XXX.YYY::inst0::INSTR`

`Channel`

The `Channel` entry box designates which channel the power sensor is connected to on the power meter.

- On a power meter with two channels, select `1` to use Channel 1 and select `2` to use Channel 2.
- On a power meter with one channel or a USB power sensor, select `1` to use Channel 1.

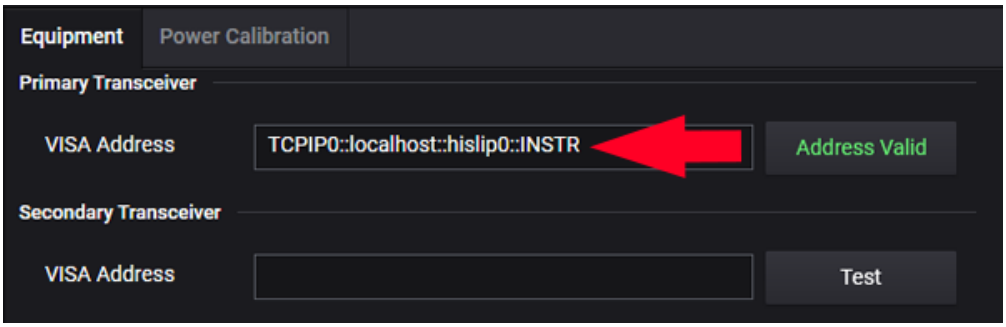
`Zero/Calibrate`

`Start...` is used to calibrate the power meter before use.

7. 3. 1. 1 Connection String Examples for S9100A-RH1

S9100A Option RH1 5G Multi-Band Vector Transceiver

using an **embedded controller (local host)**
with one M9410A PXIe VXT as the `Primary Transceiver`,
the "Connection String" should include the name of the
embedded controller (local host):
`Primary Transceiver` `TCPIP0::localhost::hislip0::INSTR`
`Secondary Transceiver` `VISA Address` entry box should remain blank



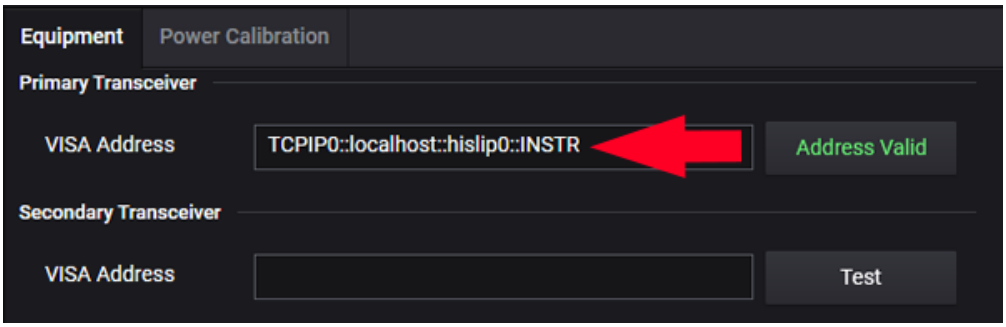
using an **external controller (remote host)**
with one M9410A PXIe VXT as the `Primary Transceiver`,
the "Connection String" should include the name of the
external controller (remote host):
`Primary Transceiver` `TCPIP0::K-M9037A-12345::hislip0::INSTR` or
`Primary Transceiver` `TCPIP0::141.121.XXX.YYY::inst0::INSTR`
`Secondary Transceiver`: `VISA Address` entry box should remain blank



7. 3. 1. 2 Connection String Examples for S9100A-007

S9100A Option 007 mmWave Transceiver with High IF

using an **embedded controller (local host)**
with one M9410A PXIe VXT as the `Primary Transceiver`,
the "Connection String" should include the name of the
embedded controller (local host):
`Primary Transceiver` `TCPIP0::localhost::hislip0::INSTR`
`Secondary Transceiver` `VISA Address` entry box should remain blank



using an **external controller (remote host)**
with one M9410A PXIe VXT as the `Primary Transceiver`,
the "Connection String" should include the name of the
external controller (remote host):
`Primary Transceiver` `TCPIP0::K-M9037A-12345::hislip0::INSTR` or
`Primary Transceiver` `TCPIP0::141.121.XXX.YYY::inst0::INSTR`
`Secondary Transceiver`: `VISA Address` entry box should remain blank

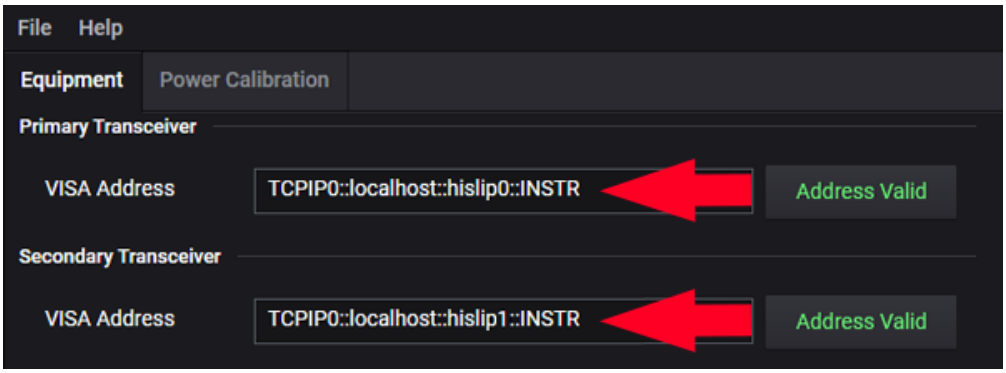


7. 3. 1. 3 Connection String Examples for S9100A-022

S9100A Option 022 mmWave Transceiver with High IF and Blocker

using an **embedded controller (local host)**
with one M9410A PXIe VXT as the `Primary Transceiver`
and one M9410A PXIe VXT as the `Secondary Transceiver`,
the "Connection String" should include the name of the
embedded controller (local host):

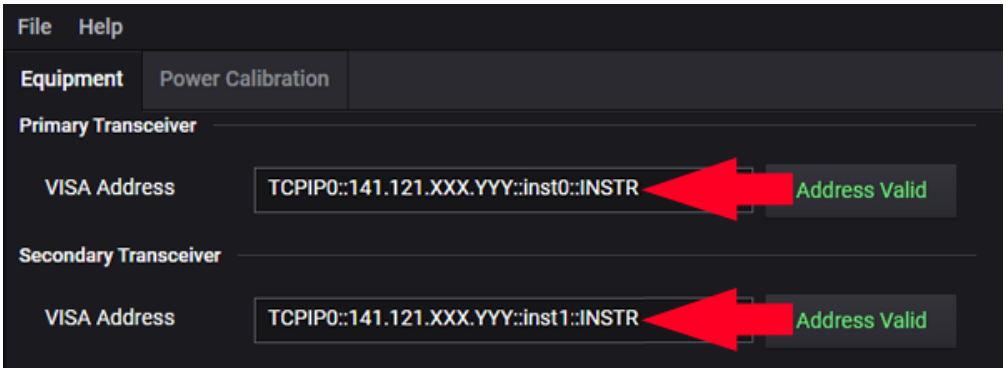
```
Primary Transceiver    TCPIP0::localhost::hislip0::INSTR
Secondary Transceiver  TCPIP0::localhost::hislip1::INSTR
```



using an **external controller (remote host)**
with one M9410A PXIe VXT as the `Primary Transceiver`
and one M9410A PXIe VXT as the `Secondary Transceiver`,
the "Connection String" should include the name of the
external controller (remote host):

```
Primary Transceiver    TCPIP0::K-M9037A-12345::hislip0::INSTR  or
Primary Transceiver    TCPIP0::141.121.XXX.YYY::inst0::INSTR

Secondary Transceiver  TCPIP0::K-M9037A-12345::hislip1::INSTR  or
Secondary Transceiver  TCPIP0::141.121.XXX.YYY::inst1::INSTR
```



7. 3. 1. 4 Using Keysight Connection Expert to Retrieve VISA Addresses

Keysight Connection Expert[1] can be used to retrieve the "Connection Strings" for the Primary Transceiver, Secondary Transceiver, and the Power Meter (Power Sensor).

- To open Keysight Connection Expert on page 76
- To retrieve and set the VISA Address of the Primary or Secondary Transceiver on page 77
- To retrieve and set the VISA Address of the Power Meter (Power Sensor) on page 78

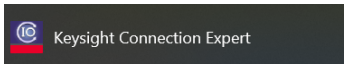
To open Keysight Connection Expert

On Windows desktop:

1. Select the **Start** menu (lower-left corner icon) and a list of applications appear in alphabetical order.
2. Select any letter, such as "A", from this list of applications and a selection menu should appear.
3. Select the letter "K" from this selection menu.
4. Scroll down the list of "K" applications that appear and select **Keysight Connection Expert**.



This runs the `ConnectionExpert.exe` located at: `C:\Program Files\Keysight\IO Libraries Suite`

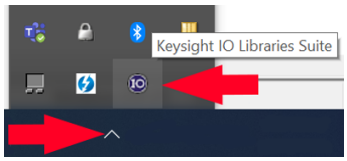


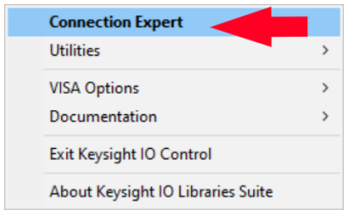
NOTE Keysight Connection Expert can also be started from the tray icon.

a. Select the tray icon.

b. Select the IO icon (Keysight IO Libraries Suite).

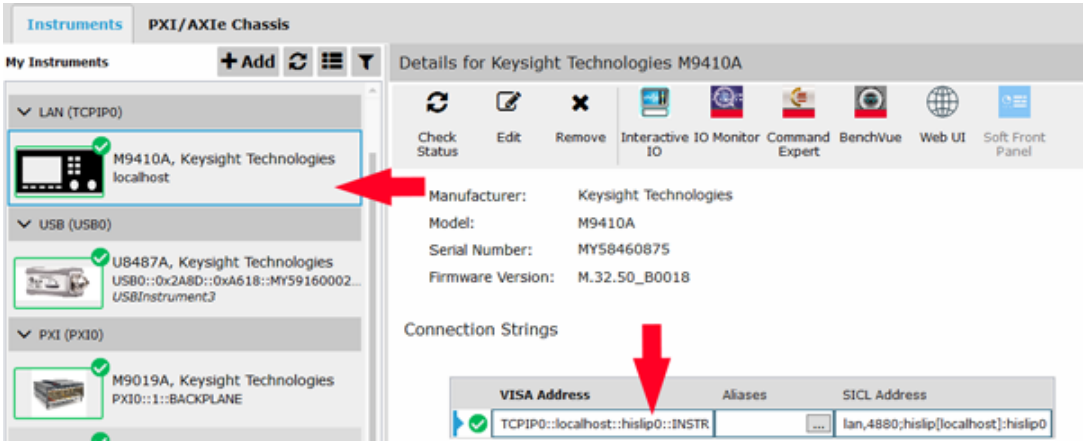
c. Select **Connection Expert**.





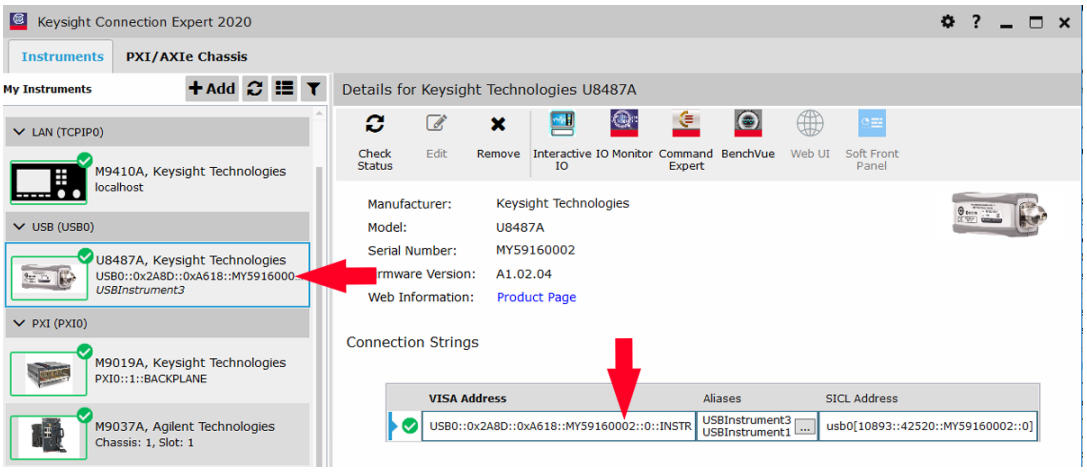
[1] Keysight Connection Expert is a utility of Keysight IO Libraries that helps connect instruments and display their status as determined by the Keysight Instrument Discovery Service.

To retrieve and set the VISA Address of the Primary or Secondary Transceiver



1. Open **Keysight Connection Expert**.
2. Select the **Instruments** tab.
    a. On the left side of the dialog box, from the list of LAN instruments, select the **M9410A, Keysight Technologies** `localhost`.
    b. On the right side of the dialog box, under "Connection Strings", highlight the VISA Address to be used on the S910xA System Calibration dialog **Equipment** tab.
    c. On the S910xA System Calibration dialog, select the **Equipment** tab.
    d. Once the VISA Address has been entered, verify connectivity by clicking **Test** located next to the VISA Address **entry box**; Address Valid is displayed on a button if the address connects properly.

To retrieve and set the VISA Address of the Power Meter (Power Sensor)



1. Open **Keysight Connection Expert**.
2. Select the **Instruments** tab.
    a. On the left side of the dialog box, from the list of USB instruments, select the **U8487A Power Sensor or equivalent**.
    b. On the right side of the dialog box, under "Connection Strings", highlight the VISA Address of the Power Sensor and select Ctrl-C (to copy the VISA Address to the Clipboard); this should be of the form: `USB0::0x2A8D::0xA618::MY59160002::0::INSTR`

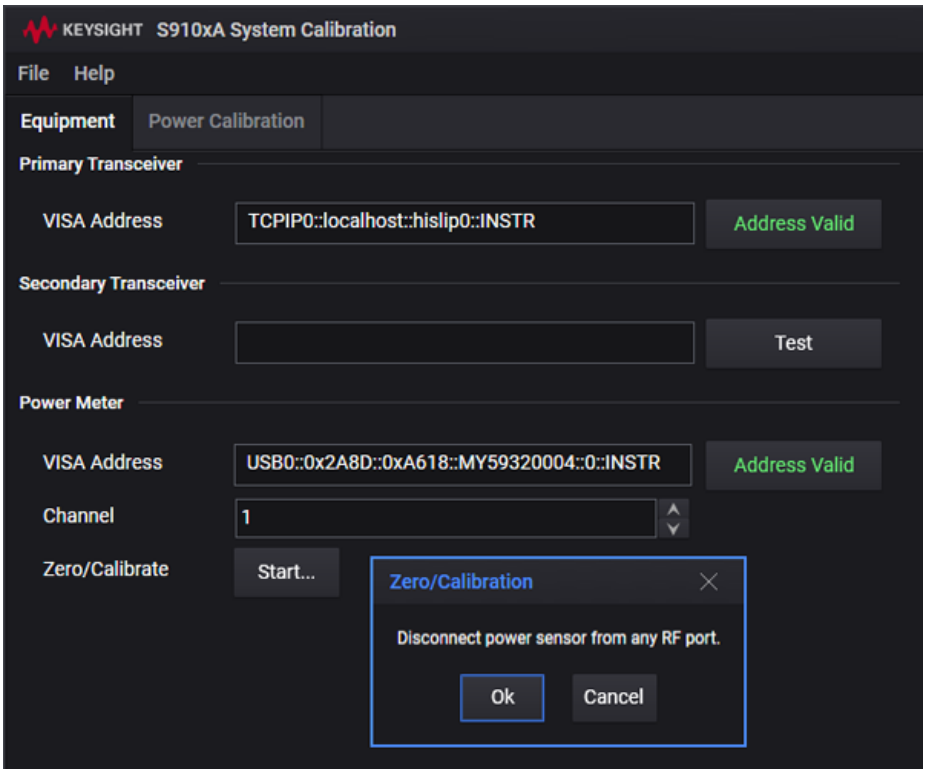


    c. Open the S910xA System Calibration dialog, select the **Equipment** tab, click the VISA Address entry box, and type Ctrl-V (to paste the VISA Address from the Clipboard).



    d. Once the VISA Address has been entered, verify connectivity by clicking the **Test** button located next to the entry box; Address Valid is displayed on a button if the address connects properly.

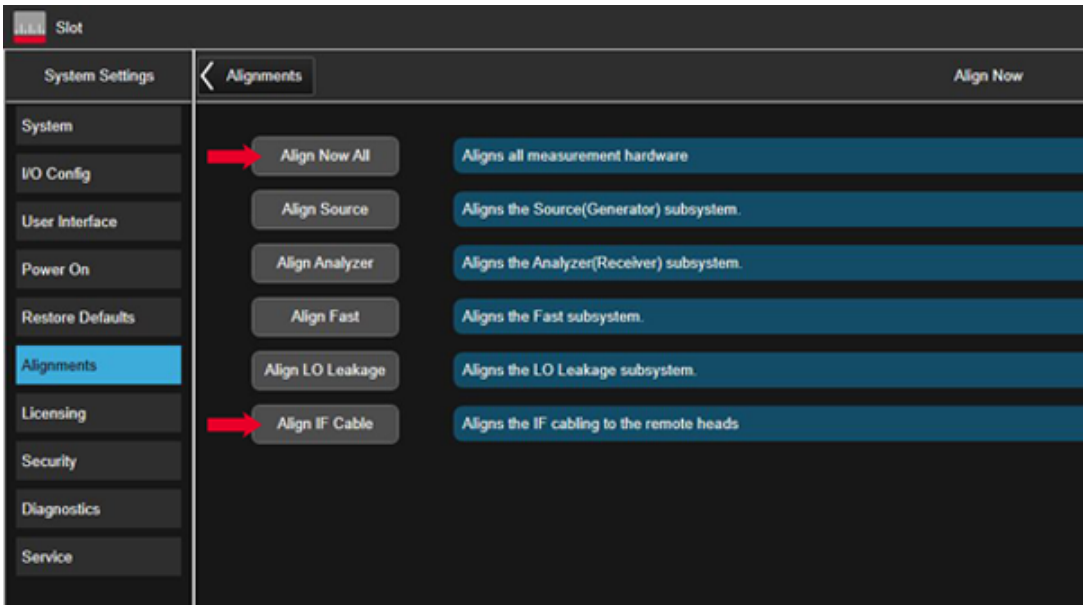
e. (Optional) Before use, Zero/Calibrate the Power Sensor by clicking **Start**.



NOTE Disconnect the power sensor from any RF ports; the zero/calibration will not be valid if any power is connected during the zero/calibration process.

7. 3. 2 Using X-Apps to Perform Alignments

NOTE All alignments must be performed before Power Calibration.



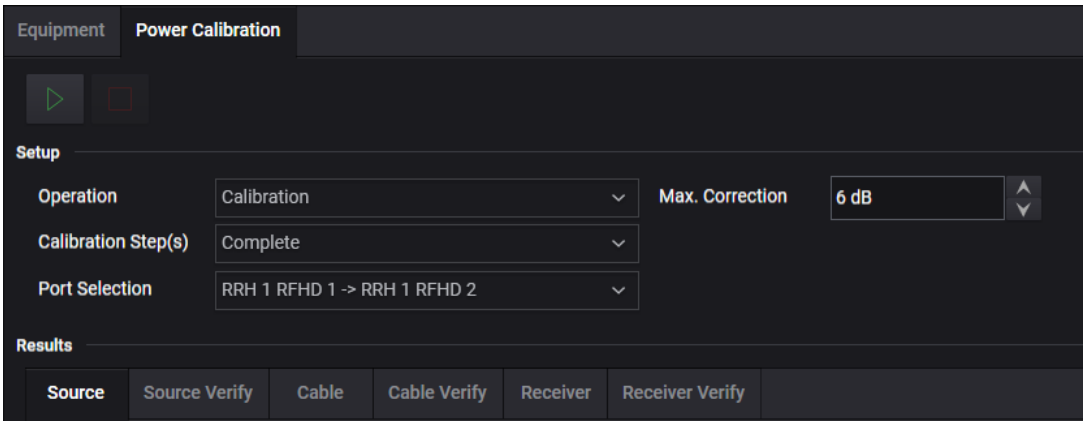
1. If it is not already running, start the Modular TRX interface:

   NOTE The Modular TRX interface can be started as follows:
   Select the **Start** menu (lower-left corner icon)
   > Scroll down to "**K**" applications
   > Select the **Keysight Modular Transceiver** drop-down arrow
   > Scroll down the list and select **LaunchModularTRX**

2. Select the **settings** icon (top right corner of the display).
3. Select **Alignments** (all alignments must be performed before calibrations).
   a. Select **Align Now All**.
   b. Select **Align IF Cable**.

7. 3. 3 Using the Power Calibration Tab

This section describes how the Power Calibration tab is used to provide an accurate power level at each mmWave Transceiver input and output port.



NOTE

- The calibrations to be run depend on the standard configuration being calibrated: S9100A-RH1, S9100A-007, or S9100A-022
- All alignments must be run before Power Calibrations. (See Using X-Apps to Perform Alignments on page 80.)

Power Calibrations

- If the standard configuration is:
  S9100A Option RH1 5G Multi-Band Vector Transceiver
  a. Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2 on page 82
  b. Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1 on page 84
- If the standard configuration is:
  S9100A Option 007 mmWave Transceiver with High IF
  a. Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2 on page 86
  b. Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1 on page 88
- If the standard configuration is:
  S9100A Option 022 mmWave Transceiver with High IF and Blocker
  a. Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2 on page 90
  b. Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1 on page 93

7. 3. 4 Calibrating S9100A Option RH1

7. 3. 4. 1 Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2

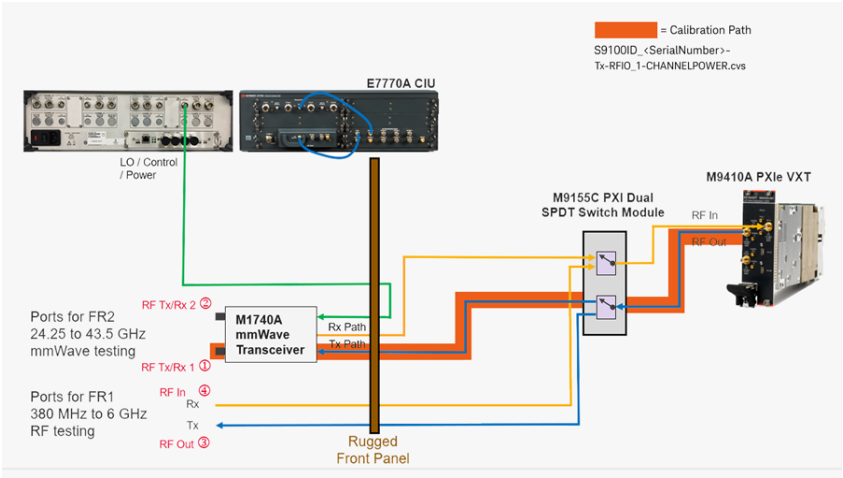
NOTE This calibration is used to calibrate FR2 ports (with RF Tx/Rx 1 ① used as the RF Output) on an S9100A Option RH1 5G Multi-Band Vector Transceiver.

When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default.

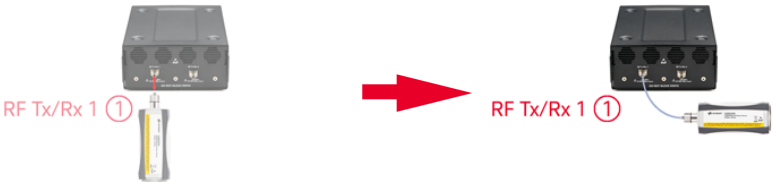
1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 1 -> RRH 1 RFHD 2`.
   e. Select ▷ `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.



   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.
      - Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_1-CHANNELPOWER.csv`

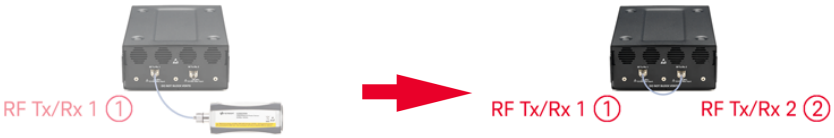


2. Calibrate the Cable signal path
    a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
    b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
    c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.

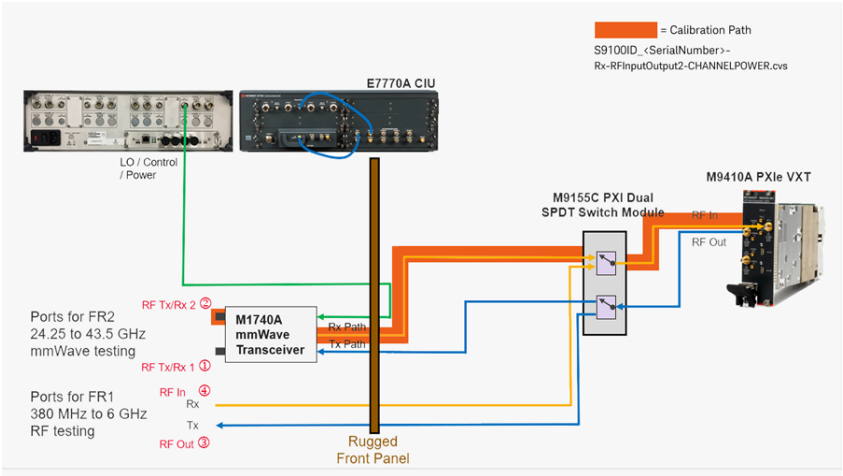


    d. Select `Ok` to continue the calibration.
        - View the `Results Cable` tab when the calibration is complete.

3. Calibrate the Receiver (Rx) signal path
    a. Disconnect the power sensor and adapter from the cable.
    b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



    c. Select `Ok` to complete the calibration.
        - View the `Results Receiver` tab when the calibration is complete.
        - Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput2-CHANNELPOWER.csv`



7. 3. 4. 2 Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1

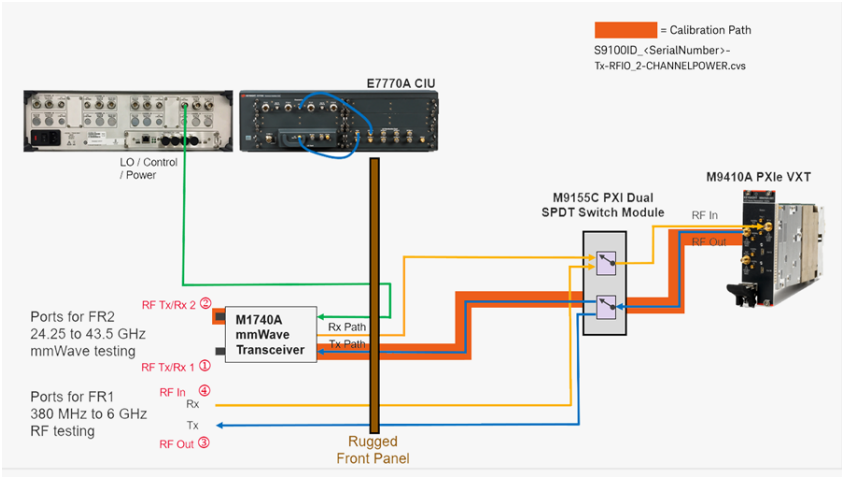
NOTE This calibration is used to calibrate FR2 ports (with RF Tx/Rx 2 ② used as the RF Output) on an S9100A Option RH1 5G Multi-Band Vector Transceiver.

When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default.

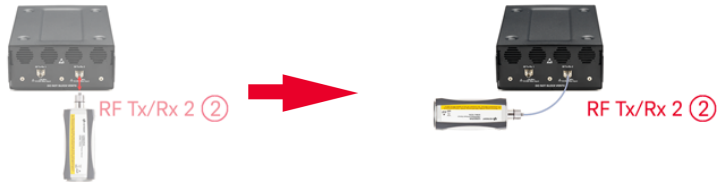
1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 2 -> RRH 1 RFHD 1`.
   e. Select `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.
      - Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_2-CHANNELPOWER.csv`



2. Calibrate the Cable signal path
    a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.

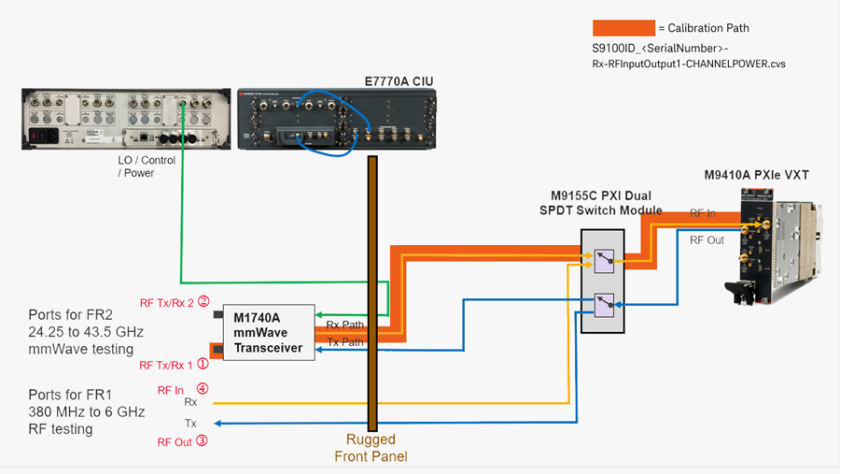


    d. Select `Ok` to continue the calibration.
        - View the `Results Cable` tab when the calibration is complete.

3. Calibrate the Receiver (Rx) signal path
    a. Disconnect the power sensor and adapter from the cable.
    b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.



    c. Select `Ok` to complete the calibration.
        - View the `Results Receiver` tab when the calibration is complete.
        - Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput1-CHANNELPOWER.csv`



7. 3. 5 Calibrating S9100A Option 007

7. 3. 5. 1 Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2

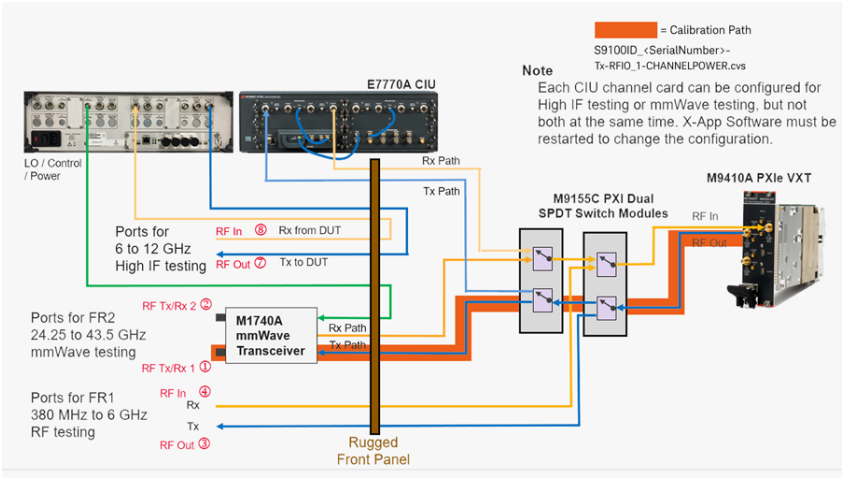
NOTE This calibration is used to calibrate FR2 ports (with RF Tx/Rx 1 ① used as the RF Output) on an S9100A Option 007 mmWave Transceiver with High IF.

When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default.

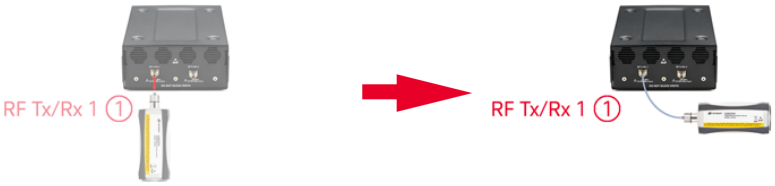
1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 1 -> RRH 1 RFHD 2`.
   e. Select ▷ `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.



   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.
      - Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_1-CHANNELPOWER.csv`

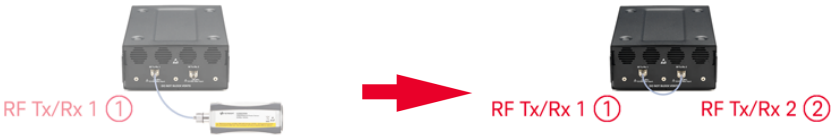


2. Calibrate the Cable signal path
    a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
    b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
    c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.

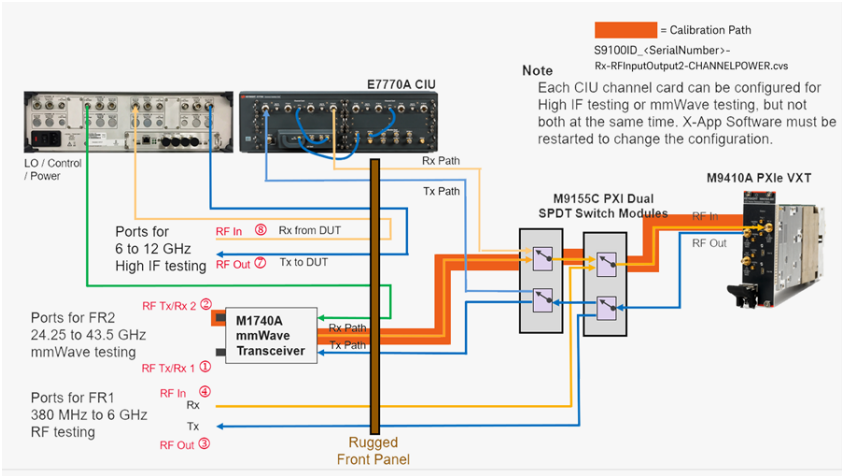


    d. Select `Ok` to continue the calibration.
        - View the `Results Cable` tab when the calibration is complete.

3. Calibrate the Receiver (Rx) signal path
    a. Disconnect the power sensor and adapter from the cable.
    b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



    c. Select `Ok` to complete the calibration.
        - View the `Results Receiver` tab when the calibration is complete.
        - Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput2-CHANNELPOWER.csv`



7. 3. 5. 2 Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1

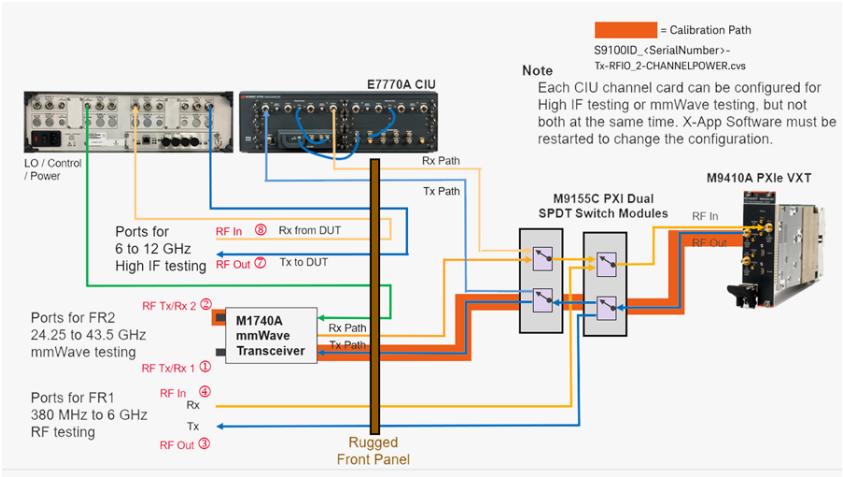
NOTE This calibration is used to calibrate FR2 ports (with RF Tx/Rx 2 ②) used as the RF Output) on an S9100A Option 007 mmWave Transceiver with High IF.

When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default.

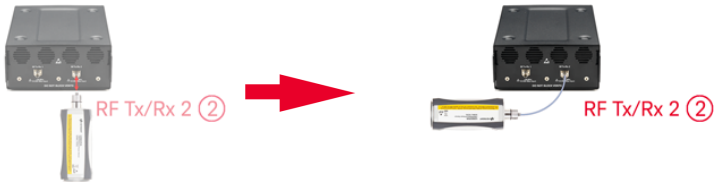
1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 2 -> RRH 1 RFHD 1`.
   e. Select `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.
      - Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_2-CHANNELPOWER.csv`



2. Calibrate the Cable signal path
    a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.

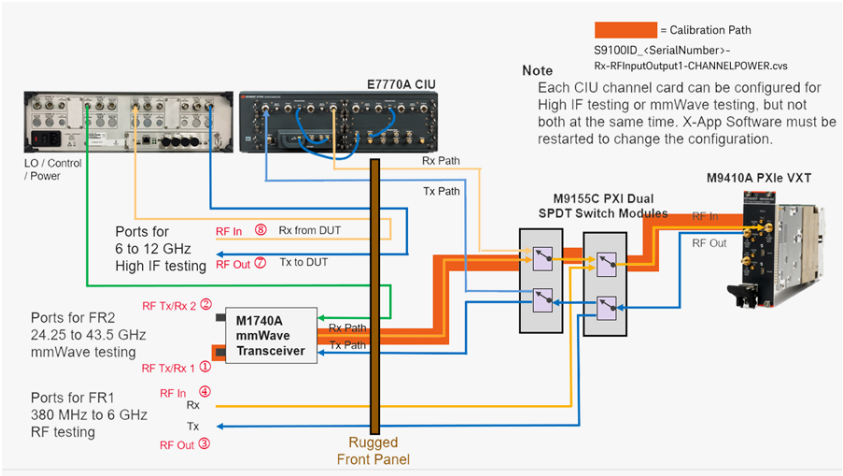


    d. Select `Ok` to continue the calibration.
        - View the `Results Cable` tab when the calibration is complete.

3. Calibrate the Receiver (Rx) signal path
    a. Disconnect the power sensor and adapter from the cable.
    b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.



    c. Select `Ok` to continue the calibration.
        - View the `Results Receiver` tab when the calibration is complete.
        - Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput1-CHANNELPOWER.csv`



7. 3. 6 Calibrating S9100A Option 022

7. 3. 6. 1 Calibration 1 of 2: Power from RRH 1 RFHD 1 -> RRH 1 RFHD 2

NOTE

This calibration is used to calibrate the FR2 ports (with RF Tx/Rx 1 ① used as the RF Output) on an S9100A Option 022 mmWave Transceiver with High IF and Blocker.

When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default. The power level from M9410A PXIe VXT #1 is calibrated while the RF Output for M9410A PXIe VXT #2 is set to Off.

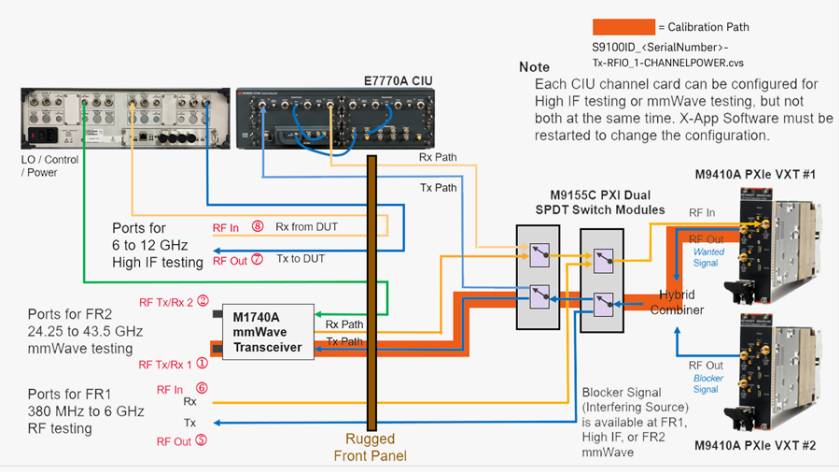
---

1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 1 -> RRH 1 RFHD 2`.
   e. Select `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.

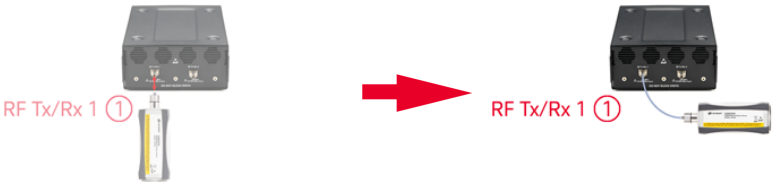


   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.

- Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_1-CHANNELPOWER.csv`

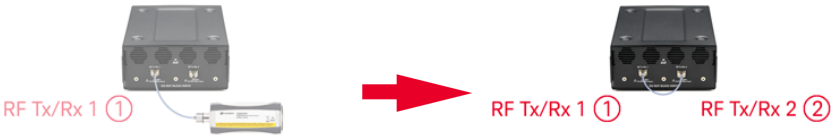


2. Calibrate the Cable signal path
   a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
   b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.
   c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.



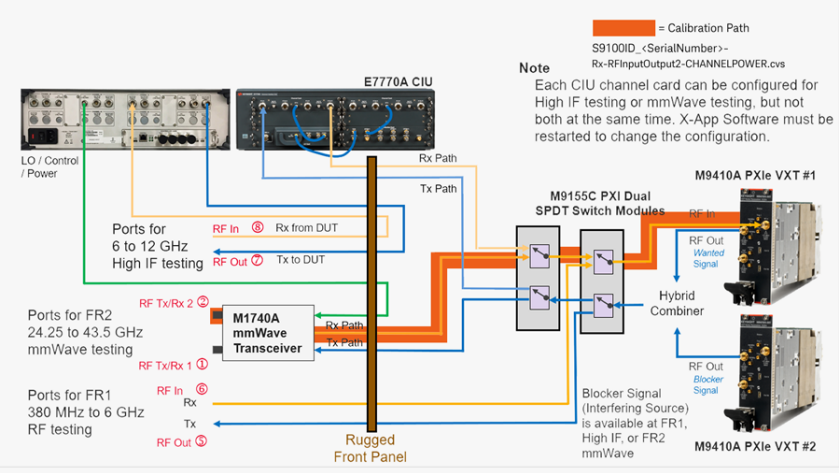
   d. Select `Ok` to continue the calibration.
      - View the `Results Cable` tab when the calibration is complete.

3. Calibrate the Receiver (Rx) signal path
   a. Disconnect the power sensor and adapter from the cable.
   b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



   c. Select `Ok` to complete the calibration.

- View the `Results Receiver` tab when the calibration is complete.
- Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput2-CHANNELPOWER.csv`



7. 3. 6. 2 Calibration 2 of 2: Power from RRH 1 RFHD 2 -> RRH 1 RFHD 1

NOTE

This calibration is used to calibrate FR2 ports (with RF Tx/Rx 2 ② used as the RF Output) on an S9100A Option 022 mmWave Transceiver with High IF and Blocker.

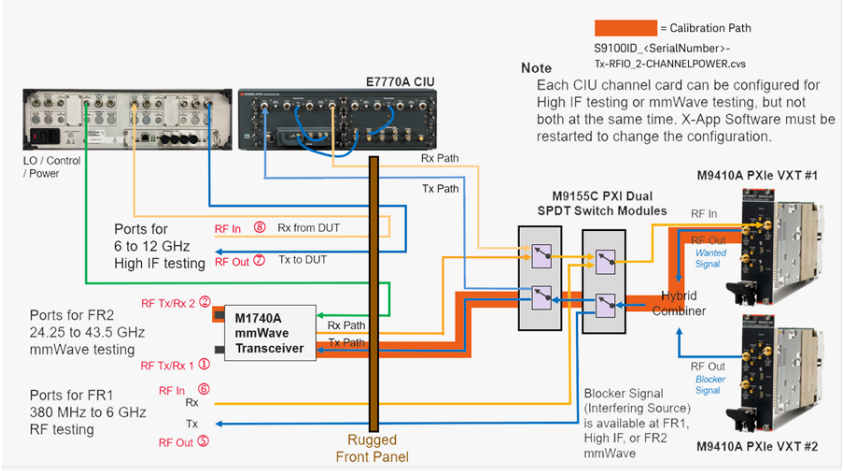
When performing this Power Calibration, the Source (Tx) output power level is set to -5 dBm by default. The power level from M9410A PXIe VXT #1 is calibrated while the RF Output for M9410A PXIe VXT #2 is set to Off.

---

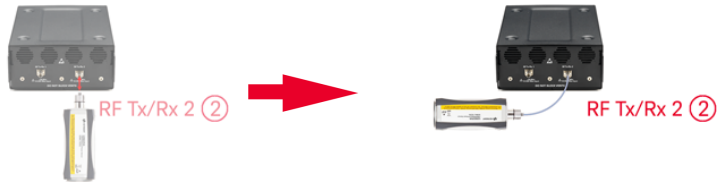
1. Calibrate the Source (Tx) signal path
   a. Select the **Power Calibration** tab.
   b. Select the **Operation** drop-down arrow and select `Calibration`.
   c. Select the **Calibration Step(s)** drop-down arrow and select `Complete`.
   d. Select the **Port Selection** drop-down arrow and select `RRH 1 RFHD 2 -> RRH 1 RFHD 1`.
   e. Select `Start the calibration` and follow the prompts.
   f. Connect the U8487A Power Sensor or equivalent to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.



   g. Select `Ok` to continue the calibration.
      - View the `Results Source` tab when the calibration is complete.
      - Corrections are stored in: `S9100ID_<SerialNumber>-Tx-RFIO_2-CHANNELPOWER.csv`



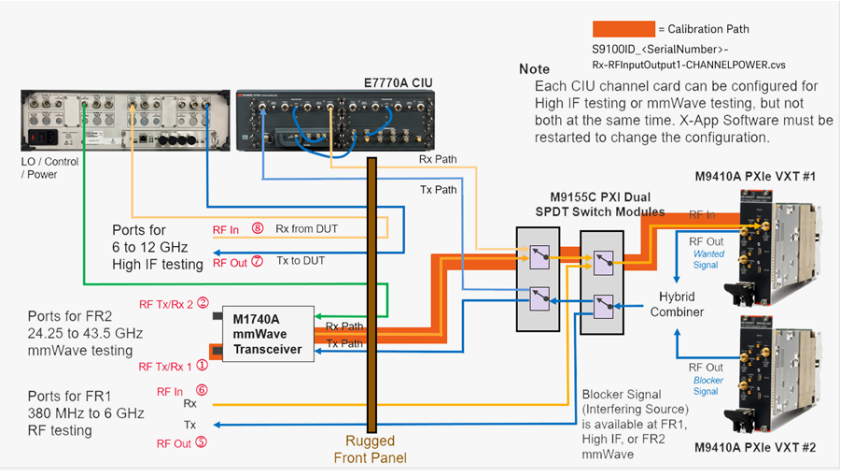
2. Calibrate the Cable signal path
    a. Disconnect the power sensor from M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    b. Using an 8121-3222 cable, 2.4 mm (m) to 2.4 mm (m), 152.4 mm (6.0 in) or equivalent, connect one end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 2 ②.
    c. Using an 11900B adapter, 2.4 mm (f) to 2.4 mm (f) or equivalent, connect the U8487A Power Sensor or equivalent to the end of the cable.



    d. Select `Ok` to continue the calibration.
        - View the `Results Cable` tab when the calibration is complete.
3. Calibrate the Receiver (Rx) signal path
    a. Disconnect the power sensor and adapter from the cable.
    b. Connect the free end of the cable to M1740A mmWave Transceiver connector RF Tx/Rx 1 ①.



    c. Select `Ok` to complete the calibration.
        - View the `Results Receiver` tab when the calibration is complete.
        - Corrections are stored in: `S9100ID_<SerialNumber>-Rx-RFInputOutput1-CHANNELPOWER.csv`



8 S910xA SCPI Programming Commands

Keysight S910xA configurations support a SCPI service beginning with version 2.13.0 that provides programming features for the following:

- Control the Frequency Reference for 10 MHz internal or 10/100 MHz external reference signal
- Query the "locked" state of the Frequency Reference
- Route the M9019A PXI Chassis Front Panel triggers to PXI Backplane Triggers
- Set up Conformance Test configurations on appropriately configured solutions with S91XXBLK-1FP licensees

By default, the SCPI service can be reached via `hislip` address `314`, for example: `"tcpip0::localhost::hislip314::instr"`

IEEE 488.2 Common Commands on page 97
- *IDN? on page 97
- *RST on page 97

System Subsystem on page 98
- :SYSTem:ERRor[:NEXT]? on page 98
- :SYSTem:OPTion? on page 98

Status Subsystem on page 98
- :STATus:OPERation:ROSCillator? on page 98

Display Subsystem on page 98
- :DISPlay:ENABle 0|1|OFF|ON on page 98
- :DISPlay:ENABle? on page 98

Service Subsystem on page 99
- :SERVice:PATH:IFLoopback[:STATe] 0|1|OFF|ON on page 99
- :SERVice:PATH:IFLoopback[:STATe]? on page 99

Reference Oscillator Subsystem on page 99
- :ROSCillator:SOURce INTernal | EXTernal on page 99
- :ROSCillator:SOURce? on page 99
- :ROSCillator:FREQuency:EXTernal <value> on page 99
- :ROSCillator:FREQuency:EXTernal? on page 99
- :ROSCillator:LOCKed[:STATe]? on page 99

Chassis Subsystem on page 100
- :CHASsis:TRIGger:ROUTe TRIG1|TRIG2,NONE,PXI0...PXI7 on page 100
- :CHASsis:TRIGger:ROUTe? TRIG1|TRIG2 on page 100

Source Subsystem on page 101
- [:SOURce]:CONFigure:ADDRress PRIMary|SECondary,{hislip number} on page 101

- [:SOURce]:CONFigure:ADDRress? PRIMary|SECondary on page 101
- [:SOURce]:CONFigure[:STATe] 0|1|ON|OFF on page 101
- [:SOURce]:CONFigure[:STATe]? on page 101
- [:SOURce]:CONFigure:PORT[:OUTPut] RRH1RFHD1|RRH1RFHD2|IFIO1|IFIO2|RFOut on page 101
- [:SOURce]:CONFigure:PORT[:OUTPut]? on page 101
- [:SOURce]:CONFigure:PRIMary:FREQuency <num>[<freq_suffix>] on page 102
- [:SOURce]:CONFigure:PRIMary:FREQuency? on page 102
- [:SOURce]:CONFigure:PRIMary[:POWer]:AMPLitude <num>[<dbm_suffix>] on page 102
- [:SOURce]:CONFigure:PRIMary[:POWer]:AMPLitude? on page 102
- [:SOURce]:CONFigure:SECondary:FREQuency <num>[<freq_suffix>] on page 102
- [:SOURce]:CONFigure:SECondary:FREQuency? on page 102
- [:SOURce]:CONFigure:SECondary[:POWer]:AMPLitude <num>[<dbm_suffix>] on page 102
- [:SOURce]:CONFigure:SECondary[:POWer]:AMPLitude? on page 102
- [:SOURce]:CONFigure:SECondary:BANDwidth <num>[<freq_suffix>] on page 102
- [:SOURce]:CONFigure:SECondary:BANDwidth? on page 102
- [:SOURce]:CONF[:POWer]:OFFSet <num> on page 103
- [:SOURce]:CONF[:POWer]:OFFSet? on page 103

- To control the `Secondary Transceiver` ("Blocker" signal) with SCPI Commands, see Example of Controlling the Secondary Transceiver Source on page 104.

8. 0. 1 IEEE 488.2 Common Commands

*IDN?

The identification query returns an identifying string as a comma separated list:

```
Keysight,S9101A,,CIU Server,3.0.184.0,Installer,2.13.5
```

Fields:

- Manufacturer: `Keysight`
- Model Number: `S9100A` (w/ E7770A CIU) or `S9101A` (PXI CIU)
- Empty string
- `“CIU Sever”`
  - `Version string`
- `“Installer”`
  - `Version string`

*RST

The reset command resets conformance test properties back to their default values.

Also, the connections to M941x X-Apps instances, used for conformance test, are closed and reopened.

This command will not change the Frequency Reference or PXI trigger routings.

8. 0. 2 System Subsystem

:SYSTem:ERRor[:NEXT]?

The system error query returns the next error from the SCPI error queue.

- If there are no error messages in the SCPI error queue, the system error query returns the following:

  `+0,"No Error"`

- If there are more than one error message in the SCPI error queue, the system error query must be sent for each message.

:SYSTem:OPTion?

The system option query returns a comma separated list of options for the S910xA system.

8. 0. 3 Status Subsystem

:STATus:OPERation:ROSCillator?

The status operation query returns the status bit for the register of the reference.

- If the reference module is unlocked, this query returns a 1.
- If the reference module is locked, this query returns a 0.

8. 0. 4 Display Subsystem

:DISPlay:ENABle 0|1|OFF|ON

:DISPlay:ENABle?

The display enable command enables or disables the display of conformance property values for debugging purposes that are set through SCPI commands. The property information is displayed in the S910x Service Manager window.

Leaving this enabled has a performance penalty due to the overhead of writing the information to the user interface as the properties are set on hardware.

`Default OFF (0)`

8. 0. 5 Service Subsystem

:SERVice:PATH:IFLoopback[:STATe] 0|1|OFF|ON

:SERVice:PATH:IFLoopback[:STATe]?

The service path IF loopback command is useful for debugging purposes only.

This command allows the source to loopback the signal, from the M941x Transceiver, through the IF section of the Remote Radio Head (RRH) and back into the M941x.

```
Default OFF (0)
```

8. 0. 6 Reference Oscillator Subsystem

:ROSCillator:SOURce INTernal | EXTernal

:ROSCillator:SOURce?

The reference oscillator source command changes the reference frequency source to either:

- use the internal clock
- or use the front panel external reference

```
Default INTernal
```

:ROSCillator:FREQuency:EXTernal <value>

:ROSCillator:FREQuency:EXTernal?

The reference oscillator frequency external command allows changing the frequency[1] to match the external clock signal.

<value> can range from: 10e+6 (10 MHz) or 100e+6 (100 MHz)

```
Default 10e+6 (10 MHz)
```

:ROSCillator:LOCKed[:STATe]?

The reference oscillator locked query returns a 0 (not locked) or 1 (locked) to indicate the state of the frequency reference module. This query works the same whether the internal or external reference oscillator source is being used.

[1]The 10 MHz Ref In connector frequency range, on S910xA systems, is different from the M9300A PXIe Frequency Reference Data Sheet. The S910xA systems only support 10 MHz or 100 MHz inputs.

8. 0. 7 Chassis Subsystem

:CHASsis:TRIGger:ROUTe TRIG1|TRIG2,NONE,PXI0...PXI7

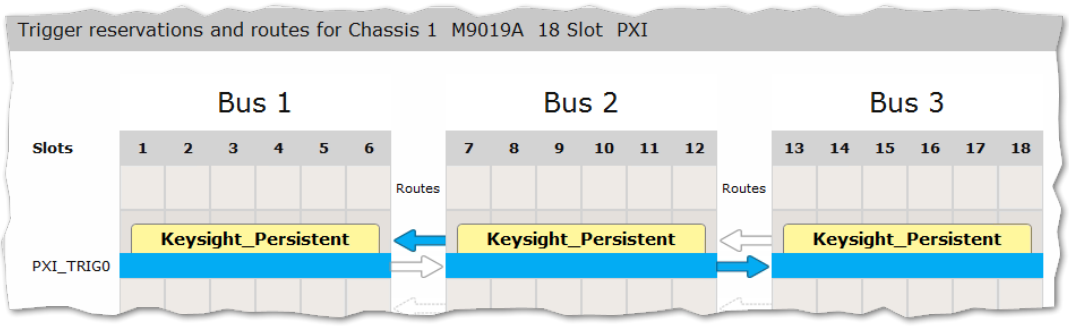
:CHASsis:TRIGger:ROUTe? TRIG1|TRIG2

The chassis trigger route command routes front panel trigger 1 or front panel trigger 2 to none or any one of the eight PXI trigger lines (numbered PXI0 to PXI7).

The chassis trigger route query returns the current routing from front panel trigger 1 or front panel trigger 2.

NOTE

Important!
By convention, the front panel triggers are set on bus segment 2. To forward the triggers between bus segments within the PXI chassis, Keysight Connection Expert should be used to make persistent bus segment routes on a per trigger line basis. These routings can be saved to the firmware in the chassis and will be restored on power cycles.



8. 0. 8 Source Subsystem

Source Subsystem commands are only available when the S91XXBLK-1FP license is present on the system and all the required hardware is present.

In conformance test systems, there are two sources:

primary source
: is the "intended" signal of interest (wanted signal)

secondary source
: is the "blocking" signal that could possibly interfere, jam, or block the signal of interest

[:SOURce]:CONFigure:ADDRress PRIMary|SECondary,{hislip number}

[:SOURce]:CONFigure:ADDRress? PRIMary|SECondary

The source configure address command exists for maintenance or custom configurations.

The `hislip` number of the primary and secondary M941x sources should not need to be changed as they are inferred from the hardware configuration.

[:SOURce]:CONFigure[:STATe] 0|1|ON|OFF

[:SOURce]:CONFigure[:STATe]?

The source configure state command allows for enabling or disabling a conformance test.

As the configuration is enabled, the conformance properties are set on the primary and secondary M941x sources.

```
Default 0 (Off)
```

[:SOURce]:CONFigure:PORT[:OUTPut] RRH1RFHD1|RRH1RFHD2|IFIO1|IFIO2|RFOut

[:SOURce]:CONFigure:PORT[:OUTPut]?

The source configure port output command sets the port to be used when outputting the combined signal (of primary and secondary M941x sources) for conformance testing. Ports are restricted by available hardware in the system.

```
Default RRH1RFHD1
```

[:SOURce]:CONFigure:PRIMary:FREQuency <num>[<freq_suffix>]

[:SOURce]:CONFigure:PRIMary:FREQuency?

The source configure primary frequency command sets the output frequency of the intended signal. The frequency is restricted by the port that was set by [:SOURce]:CONFigure:PORT[:OUTPut] RRH1RFHD1|RRH1RFHD2|IFIO1|IFIO2|RFOut on page 101.

```
Default 28.0e+9)
```

[:SOURce]:CONFigure:PRIMary[:POWer]:AMPLitude <num>[<dbm_suffix>]

[:SOURce]:CONFigure:PRIMary[:POWer]:AMPLitude?

The source configure primary power amplitude command sets the intended signal output power.

```
Default -100 dBm
```

[:SOURce]:CONFigure:SECondary:FREQuency <num>[<freq_suffix>]

[:SOURce]:CONFigure:SECondary:FREQuency?

The source configure secondary frequency command sets the output frequency of the blocking signal.

The output frequency range is restricted by the port that was set by [:SOURce]:CONFigure:PORT[:OUTPut] RRH1RFHD1|RRH1RFHD2|IFIO1|IFIO2|RFOut on page 101.

```
Default 28.0e+9
```

[:SOURce]:CONFigure:SECondary[:POWer]:AMPLitude <num>[<dbm_suffix>]

[:SOURce]:CONFigure:SECondary[:POWer]:AMPLitude?

The source configure secondary power amplitude command sets the output power of the blocking signal.

```
Default -100 dBm
```

[:SOURce]:CONFigure:SECondary:BANDwidth <num>[<freq_suffix>]

[:SOURce]:CONFigure:SECondary:BANDwidth?

The source configure secondary bandwidth command sets the bandwidth of the blocking signal.

Note that this property isn't actually set on the hardware, but is used as error checking when setting up the conformance test configuration.

```
Default 50e+6
```

[:SOURce]:CONF[:POWer]:OFFSet <num>

[:SOURce]:CONF[:POWer]:OFFSet?

The source configure power offset command sets the loss between the source output port and the DUT input port.

This value ends up being set as the power offset on the primary source for the intended signal. A loss between the source output port and the DUT input port would be entered as a negative number. For example, with an over the air loss of 50 dB, a value of -50.0 should be entered with this command.

```
Default 0 dB
```

8. 0. 8. 1 Example of Controlling the Secondary Transceiver Source

In this example, SCPI commands are used to turn on a system configuration with a Secondary Transceiver Source ("Blocker" signal also referred to as an "interfering" signal), after both signals have been loaded and are playing on individual M9410A PXIe VXTs.

NOTE

- Because `:SOUR:CONF:STAT 1;` changes the behavior of the system to support an interfering signal, it should be followed with `:SOUR:CONF:STAT 0;` when the use of the secondary source is complete.
- The wanted signal can be on either the primary or secondary M9410A PXIe VXT.

```
// Configure settings common to both sources
ScpiCommand(":SOUR:CONF:PORT " + SignalPort + ";");
ScpiCommand(":SOUR:CONF:POW:OFFS " + OtaLoss.ToString("G6"));

// Configure the Primary signal
ScpiCommand(":SOUR:CONF:PRIM:FREQ " +
PrimarySourceFrequency.ToString("F2") + ";");
ScpiCommand(":SOUR:CONF:PRIM:POW:AMPL " +
PrimarySourcePower.ToString("G6") + ";");

// Configure the interfering signal
ScpiCommand(":SOUR:CONF:SEC:FREQ " +
SecondarySourceFrequency.ToString("F2") + ";");
ScpiCommand(":SOUR:CONF:SEC:POW:AMPL " +
SecondarySourcePower.ToString("G6") + ";");
ScpiCommand(":SOUR:CONF:SEC:BAND  " +
SecondarySourceBandwith.ToString("G6") + ";");

// Enable the dual source function, which is very sticky
// - need to disable for VXTIIs to work correctly.
// Need the *OPC? to make sure errors have time to
// make it into the queue before continuing
ScpiQuery(":SOUR:CONF:STAT 1;*OPC?");
```

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

Keysight S9100A 5G Multi-Band Vector Transceiver
www.keysight.com/find/s9100a

Keysight M9019A PXIe Chassis: 18-slot, 3U, 24 GB/s, Gen 3
Keysight M9037A PXIe High Performance Embedded Controller
Keysight M9410A PXIe VXT Vector Transceiver
Keysight M9155C PXI Hybrid Dual SPDT Coaxial Switch
Keysight M9300A PXIe Frequency Reference
Keysight E7770A Common Interface Unit (CIU)
Keysight M1740A mmWave Transceiver

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