Agilent V2891A Upconverter

Installation and Quick Start Guide

Agilent Technologies

Notices

Manual Part Number

V2891-90001

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Sales and Technical Support

To contact Agilent for sales and technical support, refer to the "support" links on the following Agilent web resources:

- www.agilent.com/find/V2891A
  (product-specific information and support)

- www.agilent.com/find/assist
  (worldwide contact information for repair and service)

Information on preventing damage to your Agilent equipment can be found at www.agilent.com/find/tips.

Warranty

Technology Licenses

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Restricted Rights Legend

Regulatory Compliance

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

EMC COMPLIANCE:

- Complies with European EMC Directive 2004/108/EC
- IEC/EN 61326-1 or IEC/EN 61326-2-1
- 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 du Canada.)

SAFETY COMPLIANCE:

- Complies with European Low Voltage Directive 2006/95/EC
- IEC/EN 61010-1, 2nd Edition
- Canada: CSA C22.2 No. 61010-1
- USA: UL std no. 61010-1, 2nd Edition

- This instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung -3.GSGV Deutschland).

Acoustic noise emission	Geraeuschemission
LpA < 70 dB	LpA < 70 dB
Operator position	Am Arbeitsplatz
Normal position	Normaler Betrieb
Per ISO 7779	Nach DIN 45635 t.19

Safety Notices

The following safety precautions should be observed before using this product and any associated instrumentation.

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

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

The types of product users are:

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

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

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

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

Agilent products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

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

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

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

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

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

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

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

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

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

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

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

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

Instrumentation and accessories shall not be connected to humans.

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

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

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.**

FRONT AND REAR PANEL SYMBOLS:

$C \in$ The CE mark is a registered trademark of the European Community.

N10149 The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

ICES/NMB-001 ISM GRP.1 CLASS A This symbol indicates product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).

This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).

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

This symbol indicates the instrument requires AC input power.

This symbol on the rear panel power switch indicates that power is turned OFF when the rocker switch is push in that direction.

This symbol on the rear panel power switch indicates that power is turned ON when the rocker switch is push in that direction. The rear panel power (LINE) switch disconnects the mains circuits from the mains supply.

This symbol on the front panel power button is illuminated amber if the instrument is in STANDBY power mode, green if the power button is turned on, or OFF (not illuminated) if the rear panel power switch is turned OFF or the mains power is removed to the instrument.

This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

IP20 As defined by IEC 60529, IP20 indicates that the enclosure protects a finger or similar object (12 mm in diameter and 80 mm long) from entering any opening and touching dangerous internal parts, and there is no protection against water intrusion.

The CSA mark is a registered trademark of the CSA International.

CLEANING PRECAUTIONS:

WARNING **To prevent electrical shock, disconnect the Agilent Technologies instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally. To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.**

Table of Contents

Installing the System

In this section

Introduction

The Agilent V2891A Upconverter allows for testing differential input and output wireless devices. The V2891A block diagram is composed of two main sections. On the baseband side the V2891A takes the baseband IQ single-ended outputs from a Vector Signal Generator like the Agilent V2920A and generates fully differential IQ signals for driving the customer's wireless device.

On the modulator side the V2891A receives single-ended or fully differential baseband IQ signals from the customer's wireless device and modulates this data using a high-fidelity IQ modulator to an RF carrier frequency of 622.10 MHz. This modulated RF signal can then be demodulated and analyzed with an Agilent Series V2800 Vector Signal Analyzer.
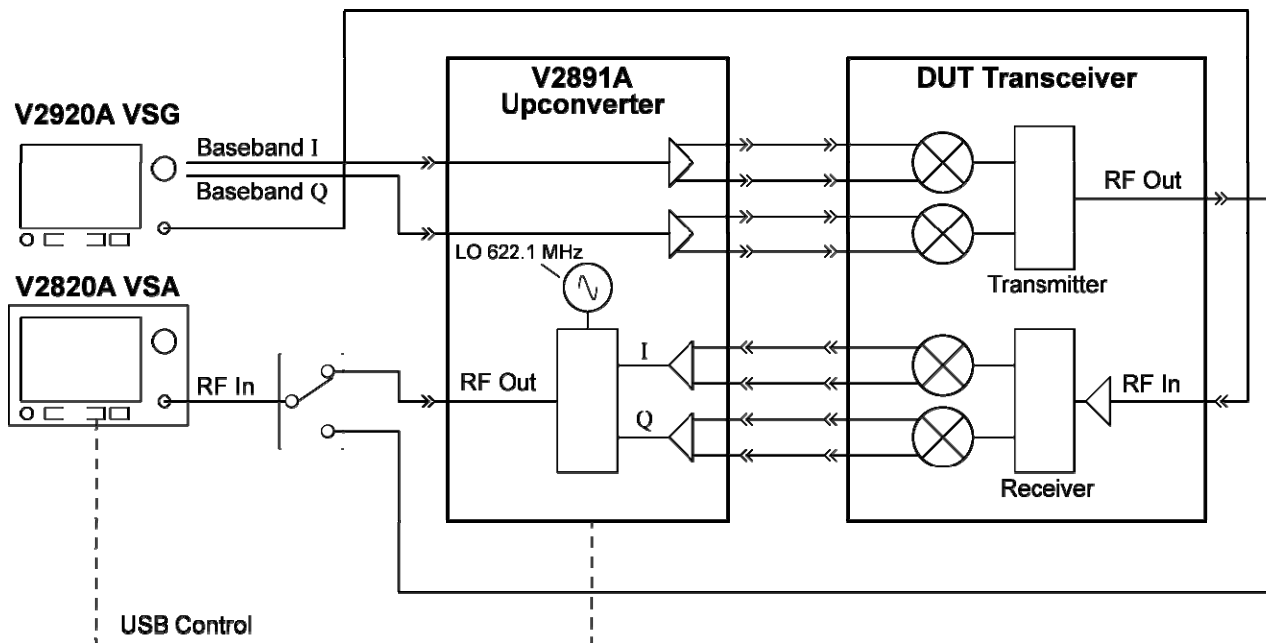
Figure 1: V2891A Connections to a Wireless Device in a Typical Application

The small size of the V2891A is ideal for getting close to the wireless device under test. This allows for low loading even on high impedance devices, thereby maximizing signal bandwidth. Similarly the selectable 50 Ω / 100 kΩ impedance of the V2891A inputs allows for connecting to high impedance devices.

The high-performance IQ modulator provides excellent signal fidelity, allowing the customers device to be truly measured without noise floor interference from the V2891A Upconverter itself.

Control of the V2891A is accomplished via a USB connection and a simplified *SCPI command set* (page 3-1). Signal differential offsets may be set and adjusted, modulator gain set and in addition ten user instrument states may be saved and recalled in non volatile EEPROM.

The key features are:

▪ Small size for easy placement next to the device under test
▪ Selectable input impedances
▪ Modulator gain adjustments for interface to a wide variety of devices
▪ Very high performance, low error vector magnitude (EVM) modulator upconverter
▪ Simplified control via USB and *SCPI command set*
▪ Direct baseband interface to a variety of Agilent Vector Signal Generators
▪ Allows baseband devices to be modulated to RF, and then the RF can be analyzed by the Agilent Vector Signal Analyzers

V2891A Physical Description
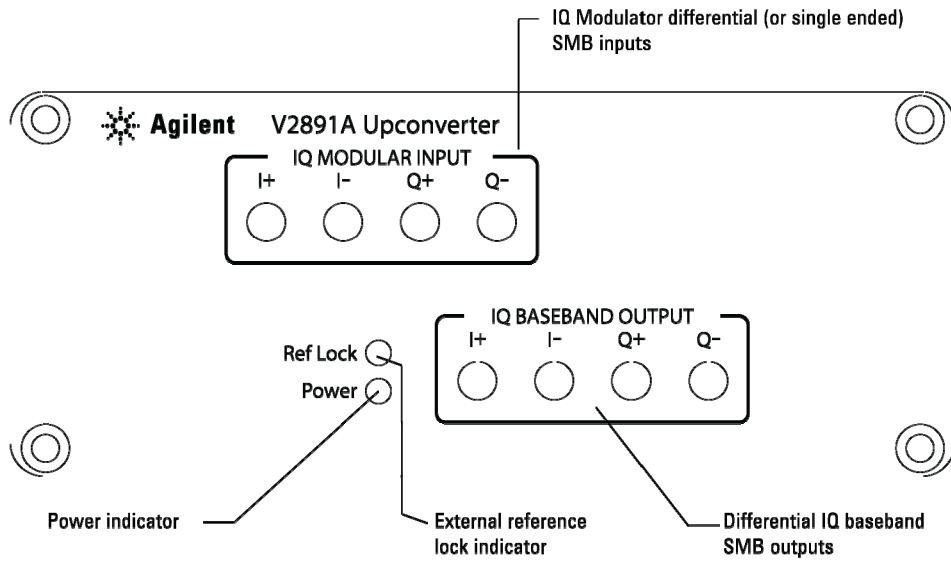
Figure 2: V2891A Front Panel
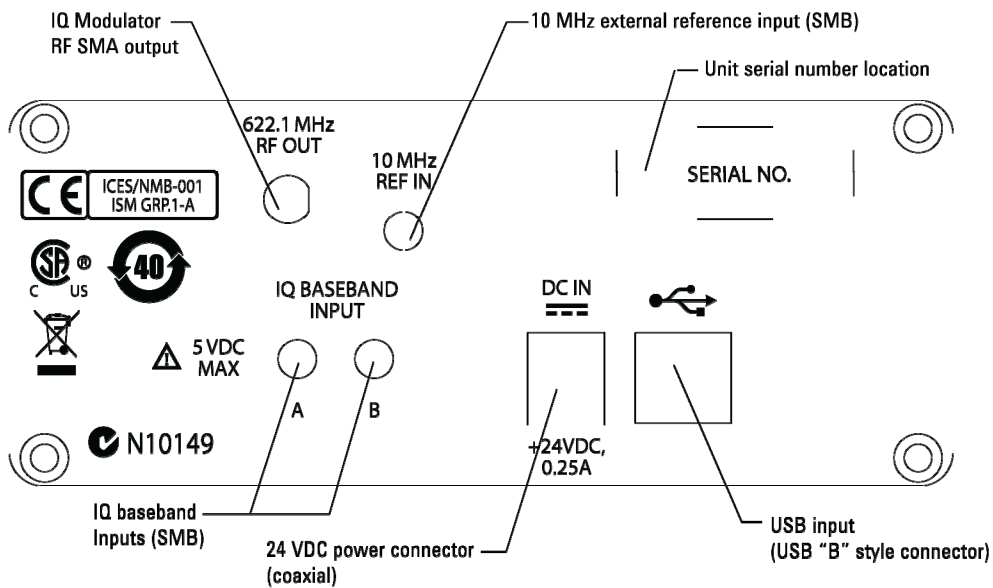
Figure 3: V2891A Rear Panel

Mechanical Dimensions

Top View

167.64
(6.60)

185.42
(7.30)

Front View

58.42
(2.30)

129.54
(5.10)

millimeters (inches)
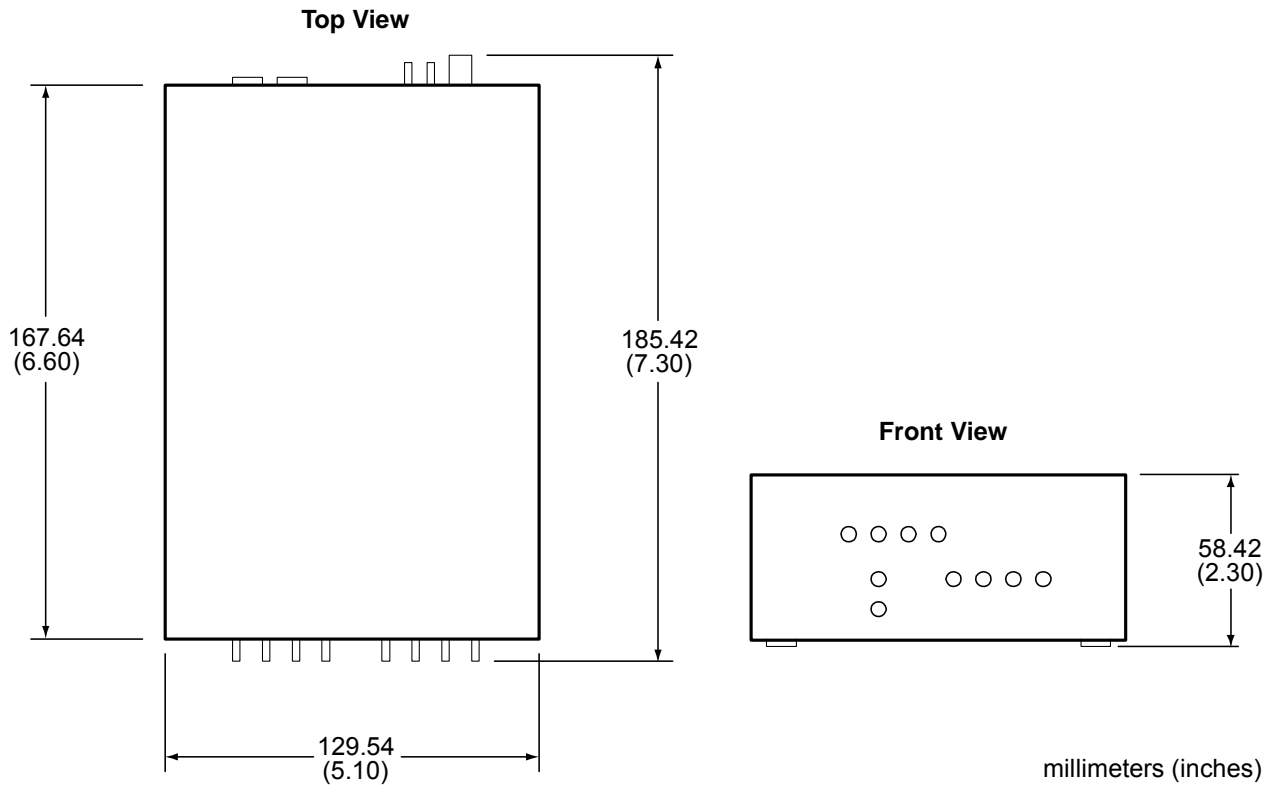
Figure 4: V2891A Dimensions

Environment Requirements

Locate the V2891A such that it will operate within an ambient temperature of 0°C to +50°C (+23°C is optimal).

NOTE: Accuracy specifications are based on operation at 23°C ±5°C and between 5% and 70% RH. Refer to the product specifications for derating factors outside these ranges. Air-conditioned environments are highly recommended.

Powering On and Using the V2891A Upconverter

Before applying power to this instrument, observe the following precautions:

CAUTIONS:	• This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Second Edition.
	• Use only the supplied Agilent V2891A external power supply. The V2891A power supply operates with these input voltages: 100-240 VAC, 50-60 Hz, 10 VA max. Be sure the supply voltage is within the specified range.
	• Operate the V2891A from a dedicated power source to avoid possible problems caused by electrical transients or line voltage fluctuations.
	• Install the instrument so that the operator can readily identify and easily reach a switch that disconnects mains power from the instrument. The detachable power cord can be removed from the electrical supply. Alternately, 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.
	• 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. Operating the instrument on an incorrect line voltage may cause damage, possibly voiding the warranty.

NOTE:	There are no fuses or user-serviceable parts in the V2891A.

Setting Up the Equipment

1   Plug in the external power supply (provided) into the V2891A DC connector on the rear panel.

2   Plug the other end of the external power supply into a *grounded* AC power outlet.

    The green **POWER** LED on the front panel should now be illuminated.

3   Install the USB driver. The USB driver and installation instructions are provided on the V2891A CD-ROM. Insert the V2891A CD-ROM into your PC. When the CD navigation interface launches, navigate to the Applications Info page and install the USB driver:
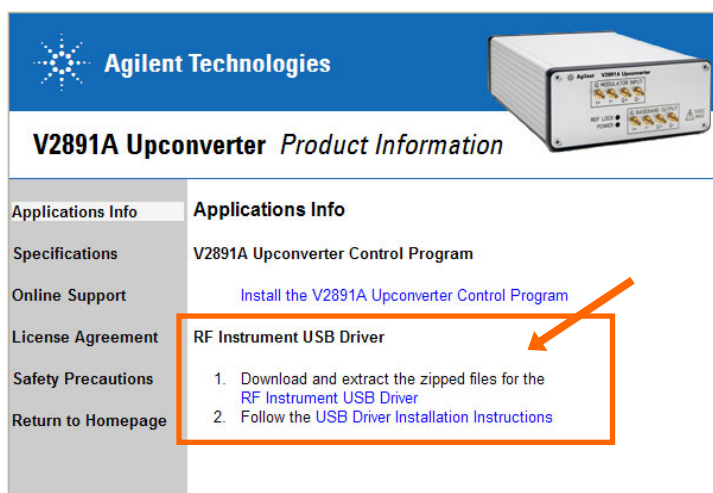

4   Connect the rear panel **10 MHz REF IN** to your system 10 MHz reference. Verify that the front panel REF LOCK LED is now illuminated.

5   Connect the rear panel **622.1 MHz RF OUT** to your Vector Signal Analyzer.

6   Tune your Vector Signal Analyzer to 622.10 MHz.

7   Connect the V2891A to your device under test via the front panel connections.

8 Install the V2891A Control Program on your PC.

   a. Insert the V2891A CD-ROM into your PC. When the CD navigation interface launches, navigate to the Applications Info page and click the "Install the V2891A Upconverter Control Program" link to run the installer. Follow the prompts to install the control program on your computer.
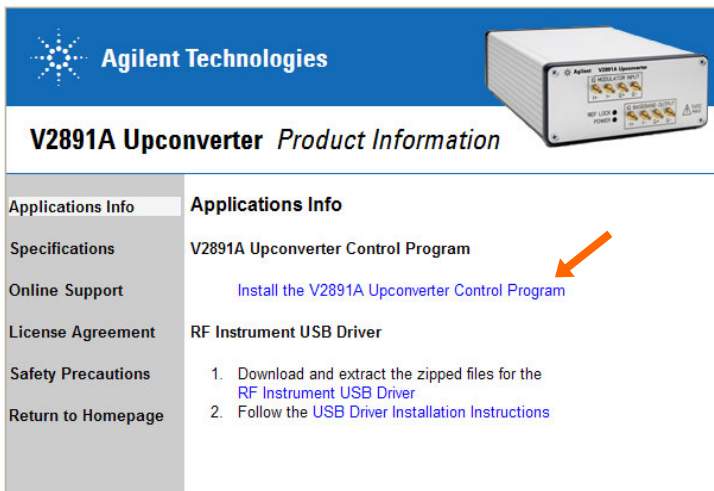
NOTE: The control program installer is also located on the Agilent web site at www.agilent.com/find/V2891A.

   b. Connect the V2891A Upconverter to your computer, using the provided USB cable.

   c. Launch the Agilent V2891A Control Program. Navigate to **Start > Programs** > **Agilent Technologies > Agilent V2891A.exe**.

   Alternative: Use Windows Explorer to navigate to C:\Program Files\Agilent Technologies\Agilent V2891A (default installation location) and double-click the Agilent V2891A.exe file.

   d. The program will look for V2891A hardware attached to your PC via the USB cable. If there is V2891A hardware found it will prompt you with a selection table showing each piece of hardware that it found, asking you to pick one. The devices are listed by serial number. Pick the proper device (the serial number is located on the V2891A back panel) and then press **Select and Continue**.
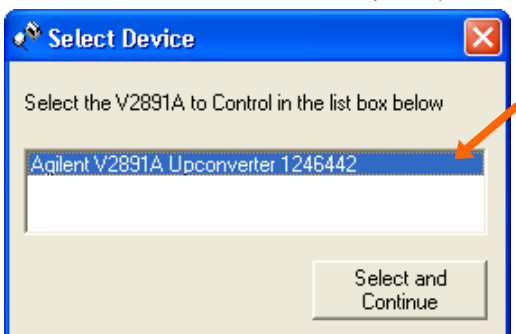
9 You are now ready to start making measurements with the V2891A Upconverter. Refer to the following for further information on using the V2891A Upconverter:

   ▪ Using the V2891A Control Program: see *Using the V2891A Control Program* on page 1-7

   ▪ Connections to the V2891A: see *Connection Diagrams* on page 2-1

   ▪ Remote control via SCPI commands: see *SCPI Commands* on page 3-1

Using the V2891A Control Program

The V2891A Control Program allows you to control the V2891A hardware from any PC running the Microsoft® Windows® operating system (2000 or XP and later). In addition, all instrument settings may be graphically changed and saved into any of 10 potential user-defined states for later recall.

If you have not already installed the V2891A Control Program, refer to the instructions on page .

Interface Tour

The main panel features are detailed below. Most of the commands are labeled with their *SCPI command equivalent*.
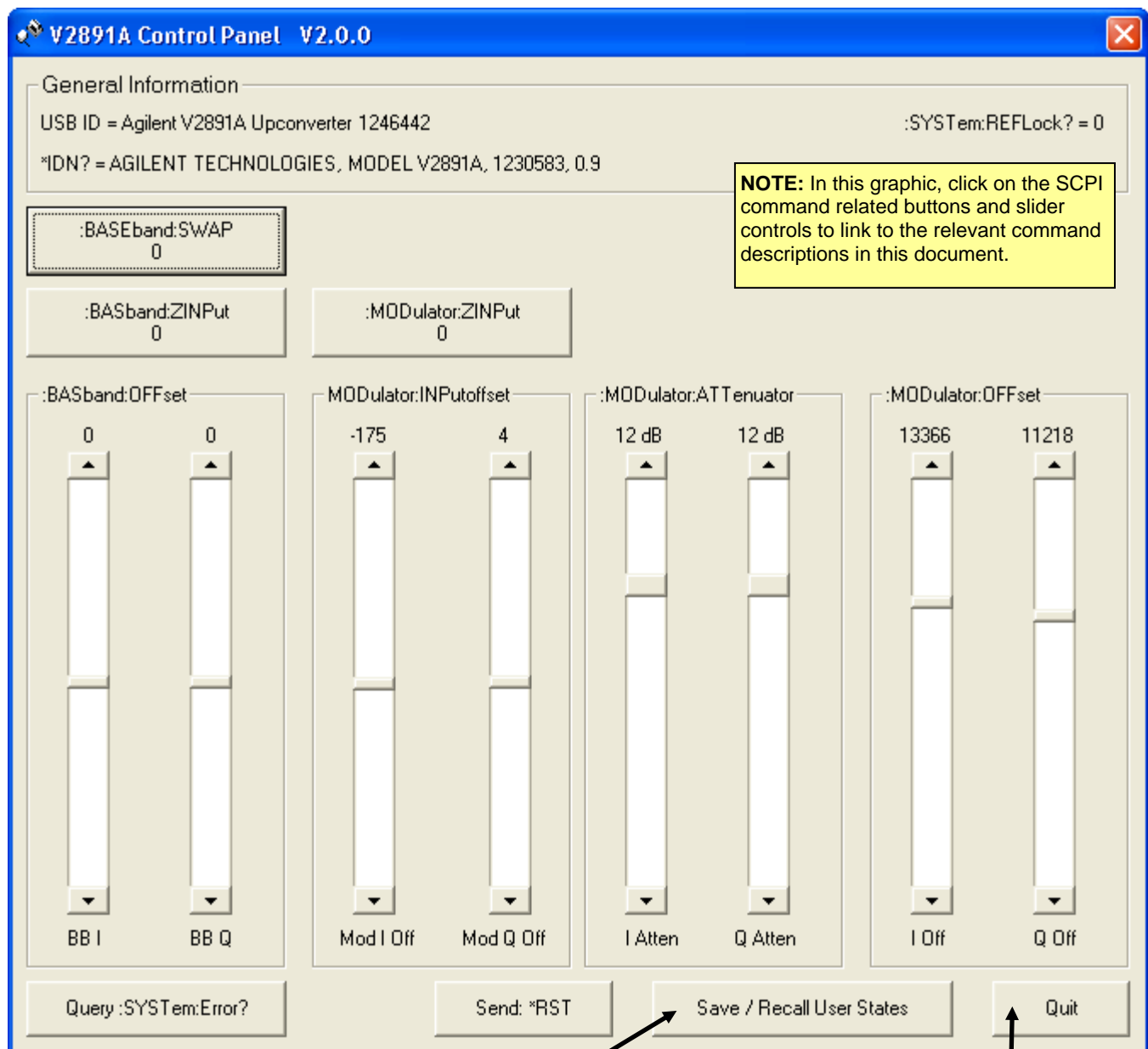
To *Save or Recall a user state* press here ⟶   To quit the program press here ⟶

Saving and Recalling User-Defined States

To save and recall user-defined states, click the **Store/Recall User States** button on the main screen.

A smaller screen will open that allows you to select 0-9 user states and then either store or recall previously saved states. Click the **Return** button when you are finished to return to the main screen.

NOTE: In this graphic, click on the SCPI command related buttons to link to the relevant command descriptions in this document.

Select the desired state

Select the desired action (Save or Recall)

Press **Return** to go back to the main screen
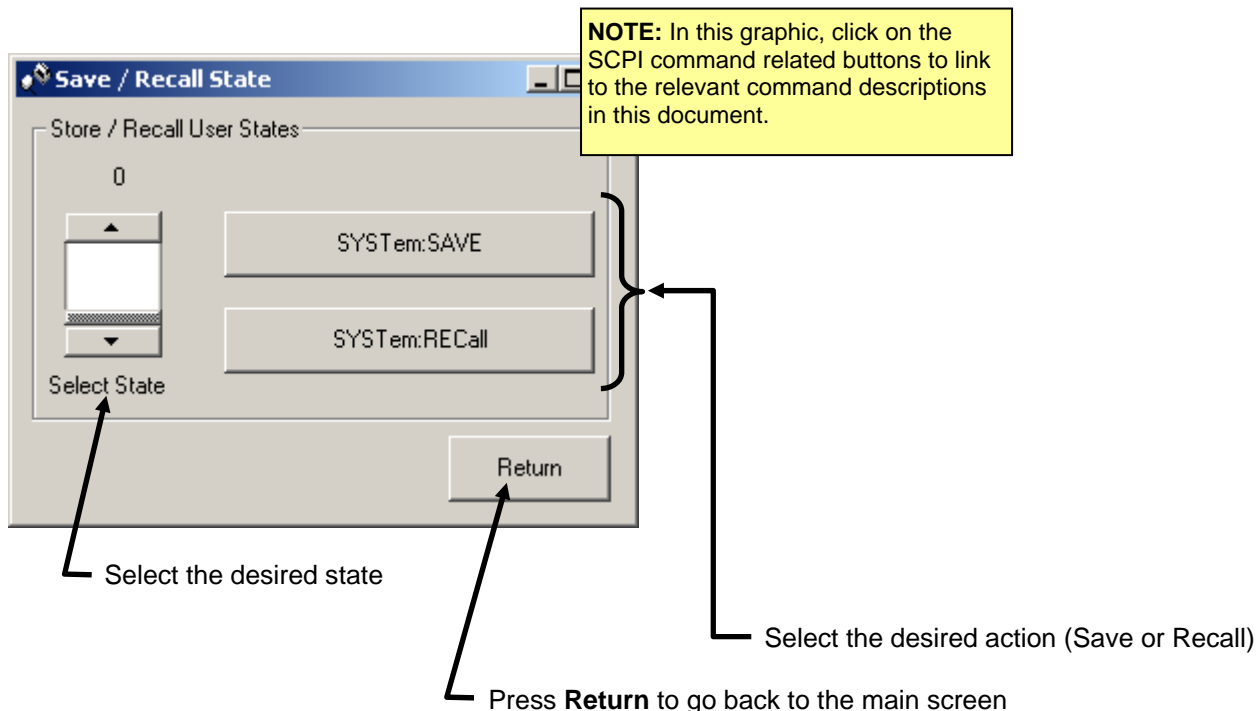
Returning the instrument for service

Should it become necessary to return the Agilent V2891A for repair or service, follow the steps below:

1 Review the warranty information shipped with your product.

2 Contact Agilent to obtain a Return Material Authorization (RMA) and return address. If you need assistance finding Agilent contact information go to www.agilent.com/find/assist (worldwide contact information for repair and service) or refer to the "Support" information on the product web page at www.agilent.com/find/V2891A.

3 Write the following information on a tag and attach it to the malfunctioning equipment.

- Name and address of owner
- Product model number (for example, V2891A)
- Product serial number (for example, MYXXXXXXXX). The serial number label is located on the rear panel of the instrument.
- Description of failure or service required

4 Carefully pack the entire unit in its original packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container "FRAGILE".

5 On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

NOTE: If any correspondence is required, refer to the product by serial number and model number.

Connection Diagrams

In this section

Baseband Section

Figure 5: Baseband Section

This section takes a single-ended baseband input from a waveform generator like an Agilent V2920A VSG and converts it to a differential/balanced output. The overall signal gain is 1 v/v when the differential outputs are loaded into their respective matched impedance as shown in *Figure 6*. Each differential amplifier may be adjusted for common mode offset by its corresponding DAC.

The single-ended inputs may be swapped by using a `:BAS:SWAP` SCPI command (see page 3-3). The input impedance is selectable between 50 Ω and 100 kΩ by using a `:BAS:ZINP` SCPI command (see page 3-4).

For highest bandwidth performance, Agilent recommends using a 50 Ω matched impedance system throughout. This includes the use of equal-length, high-quality coaxial cables from the vector signal source to the V2891A Upconverter.

In normal operation, with the inputs not swapped (`:BAS:SWAP 0`), the A input corresponds to the I signal and the B input corresponds to the Q signal.
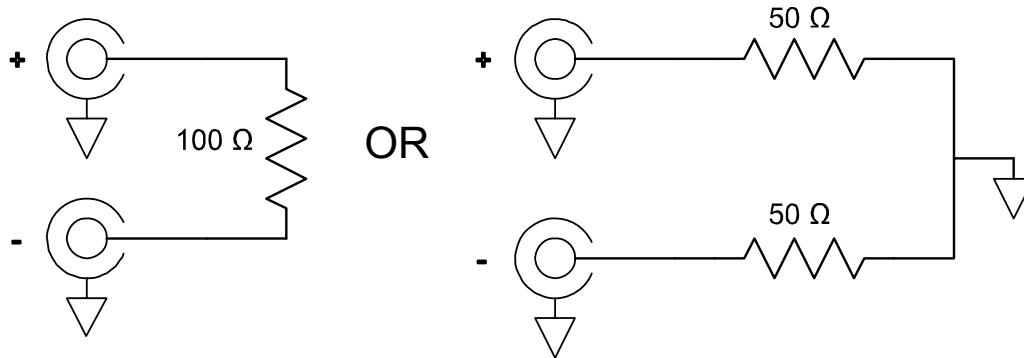
Figure 6: Baseband Output Match Loading

Long cable runs from the baseband differential outputs are possible by matching the impedance of the differential outputs of the DUT even if the DUT does not have the proper input impedance itself. Differential baseband output matching may be accomplished as shown above.

Modulator Input Section
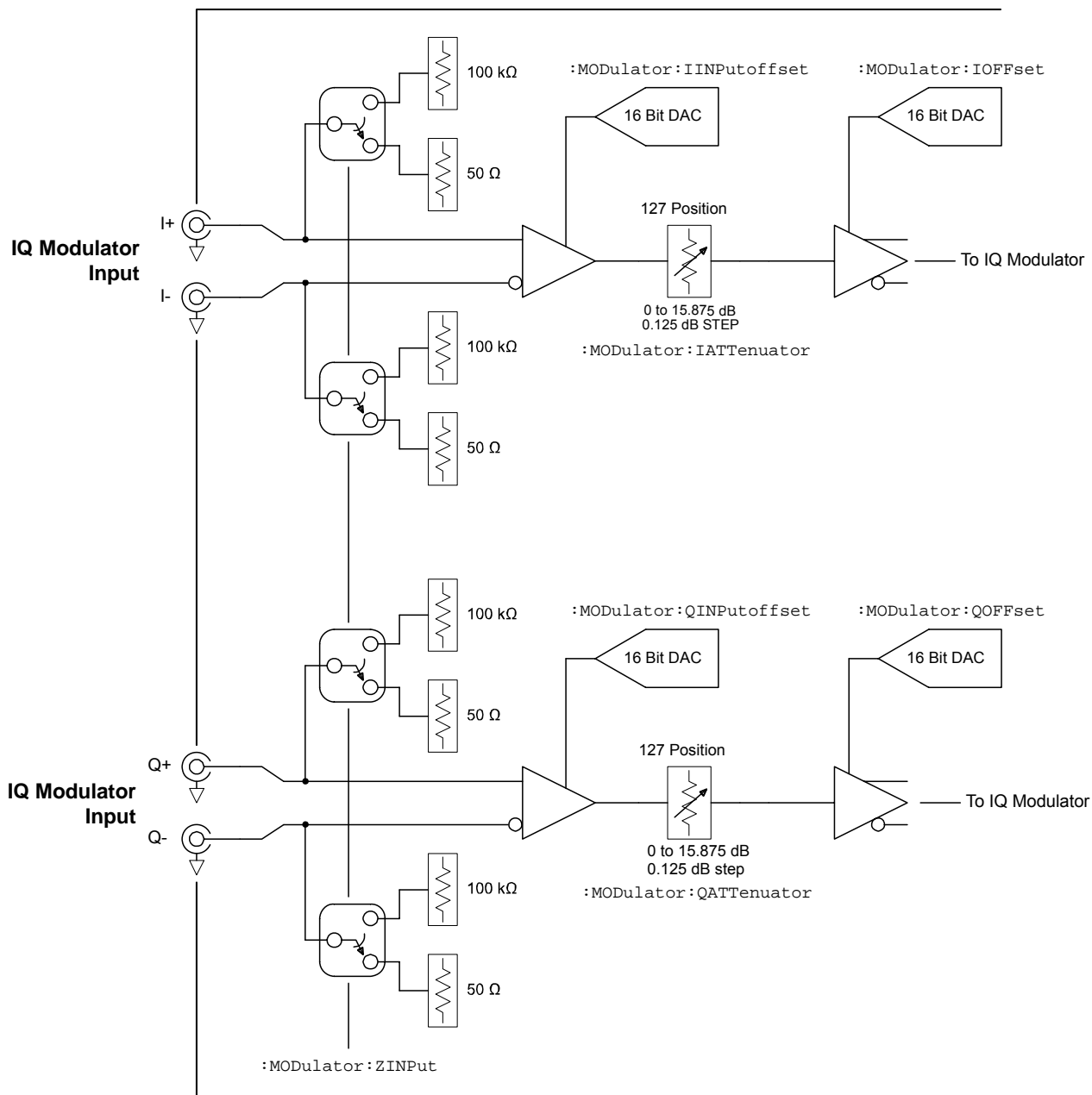
Figure 7: Modulator Differential Inputs

The modulator differential inputs have a selectable input impedance of 50 Ω or 100 kΩ. Differential offsets may be compensated for by adjusting the DAC on the differential input driver. After the amplifier a 127-step (0.125 dB resolution), 0 to 15.875 dB total range attenuator is provided to fine tune the level input to the IQ modulator. The IQ modulator driver also has an offset adjustment DAC that allows for trimming the IQ modulator for maximum EVM performance.

Modulator Input Levels

The I and Q modulator attenuator allows for a range of DUT voltage levels to be accommodated. At the maximum attenuation of 15.875 dB a DUT voltage of approximately 3.0 volts peak (differential) will provide maximum modulation. At the minimum attenuation of 0 dB a DUT voltage of approximately 0.48 volts peak (differential) will provide maximum modulation.

The differential inputs may also be used as single-ended inputs. Be sure to terminate the unused input in a low impedance (either 50 Ω or a short) directly at the SMB input connector.

Modulator RF Section

The IQ modulator provides a vector modulated output at 622.1 MHz. The 622.1 MHz LO is generated by a precision, low-noise surface acoustic wave voltage controlled oscillator (SAW VCO) that is phase locked to the customer's external 10 MHz system reference. A low-noise, precision external reference must be used for proper operating the V2891A Upconverter.

The V2891A front panel REF LOCK LED illuminates when the internal VCO is phase locked to the external reference. The PLL lock state can also be queried with the `:SYSTEM:REFLock?` SCPI command.

A 50-ohm, low-loss, high-quality RF rated coax cable must be used from the IQ modulator RF output to the vector signal analyzer.
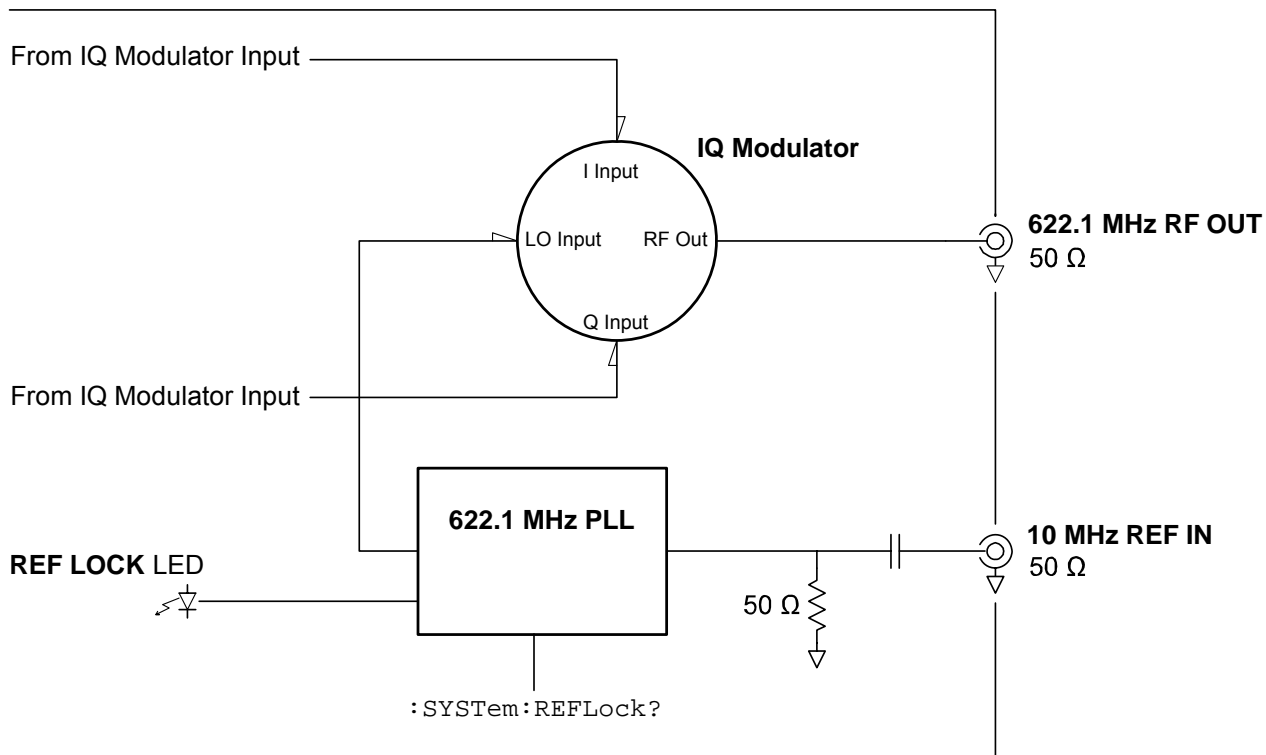
Figure 8: IQ Modulator

Loop Back Test Mode
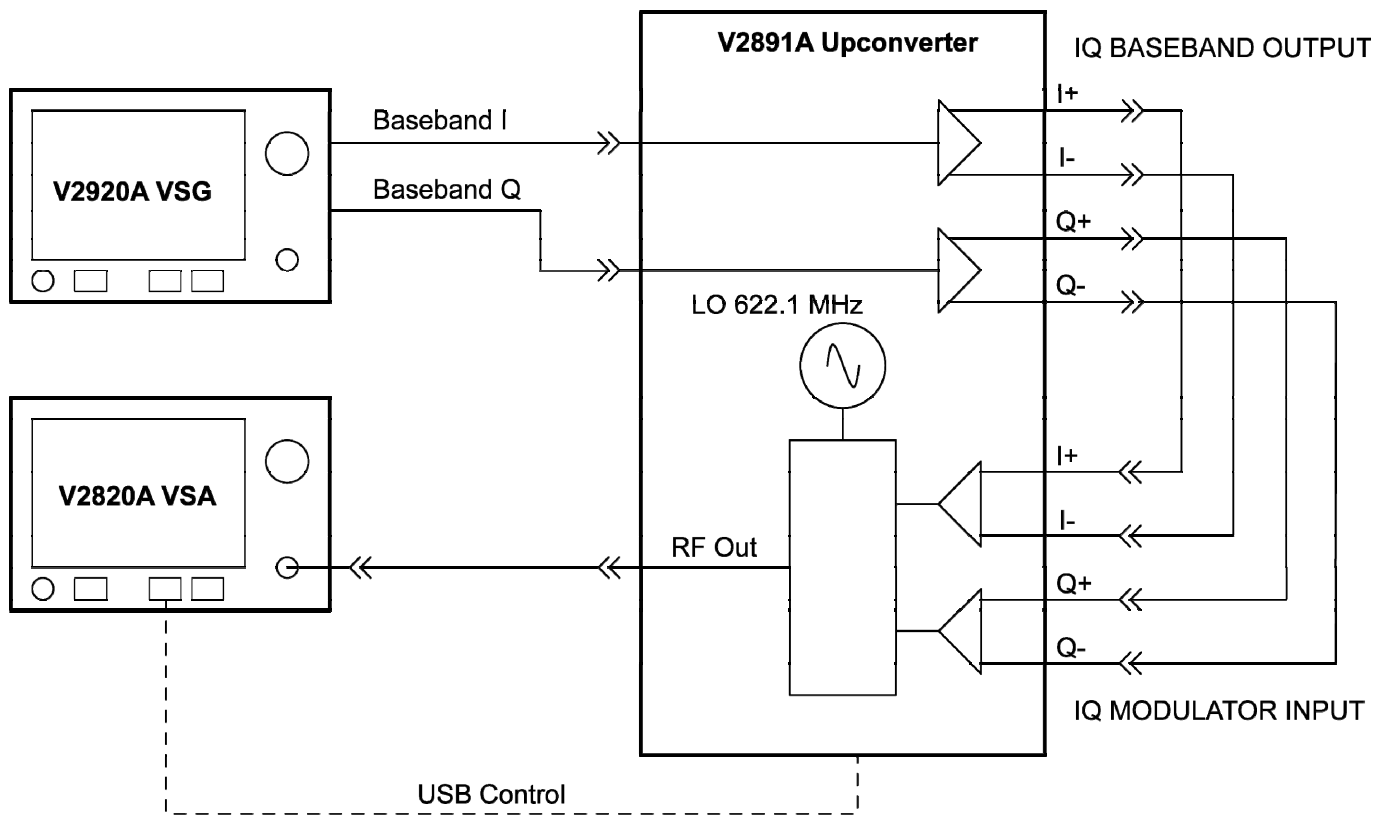
Figure 9: Loop Back Test Mode

Using the four short SMB cables supplied. The V2891A can be configured in a loop back test mode. In this mode the V2891A can be tested without the use of an external device under test. For a 1-volt peak baseband waveform, the factory calibration of the V2891A should provide close to optimal performance. You can also use the *V2891A Control Program* to test the various adjustments of the V2891A Upconverter on modulation performance.

SCPI Commands

In this section

General SCPI Command Information

▪ The SCPI Parser in the V2891A takes commands in the form,

```
:header:command {parameter} (LF)
```

Where:
{parameter} may be a required numeric parameter for the specific command.
(LF) is a line-feed character terminator (ASCII 10 decimal).

▪ A space must be used between the command and any required parameters.

▪ Multiple commands may be present on a single line. Multiple commands are separated by a semi-colon ("`;`"). For example,

```
:BAS:ZINP 1;:BAS:ZINP?
```

In this example, the first command sets the baseband input impedance to high and the second command reads back the current baseband input impedance (in this case a "`1`" is returned).

▪ The maximum length of the command line is 200 characters.

Common Commands

*IDN?

Queries the instrument identifier and returns a string in the form:

```
AGILENT TECHNOLOGIES INC.,{Model Number}, {Serial Number},{FW Version}
```

Example:

```
AGILENT TECHNOLOGIES INC.,MODEL V2891A, 0000101,1.0
```

*RST

Resets the instrument to the default state (loads the saved factory calibration data). The following table lists the factory default values for the instrument settings.

Instrument-Setting SCPI Commands		Factory Default State
Baseband Commands	BASeband:SWAP	0
	BASeband:IOFFset	0
	BASeband:QOFFset	0
	BASeband:ZINPut	0
IQ Modulator Commands	MODulator:IATTenuator	120
	MODulator:IINPutoffset	0
	MODulator:IOFFset	11400
	MODulator:QATTenuator	120
	MODulator:QINPutoffset	0
	MODulator:QOFFset	11400
	MODulator:ZINPut	0

NOTE: The defaults listed in the above table are for a non-calibrated unit and provide a good starting point. The actual factory calibration values may differ from these.

*OPC?

Returns a "1" when the last sequential command completes. For example,

```
:*RST;*OPC?
```

A "1" is returned when the *RST command is complete.

Baseband Commands

:BASeband:SWAP

Swaps the A and B Baseband inputs. The variable `<val>` can be 0 or 1 with 0 being not swapped and 1 being swapped. A setting of 0 will make the A input correspond to the I input and B will correspond to the Q input.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Boolean data	Yes	0 or 1	none	0	0	1	none

Examples
```
:BASeband:SWAP 1
:BAS:SWAP 0
:baseband:swap 0
:BASeband:SWAP?
```

:BASeband:IOFFset

Sets or queries the offset of the I Baseband Differential output. The value is converted to an approximate output offset using the following formula.

Approximate output offset = <val> * 125e-6 (volts)

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	0	-32768	32767	none

Examples
```
:BASeband:IOFFset 300
:BAS:IOFF 300
:baseband:ioffset 300
:BASeband:IOFFset?
```

:BASeband:QOFFset

Sets or queries the offset of the Q Baseband Differential output. The value is converted to an approximate output offset via the following formula.

Approximate output offset = <val> * 125e-6 (volts)

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	0	-32768	32767	none

Examples

```
:BASeband:QOFFset 300
:BAS:QOFF 300
:baseband qoffset 300
:BASeband:QOFFset?
```

:BASeband:ZINPut

Sets the input impedance of the A and B baseband inputs. The variable `<val>` can be 0 or 1, with 0 being 50 Ω input impedance and 1 being 100 kΩ impedance.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Boolean data	Yes	0 or 1	none	0	0	1	none

Examples

```
:BASeband:ZINPut 1
:BAS:ZIN 0
:baseband:zinput 1
:BASeband:ZINPut?
```

IQ Modulator Commands

:MODulator:IATTenuator

Sets or queries the attenuator in the I modulator path. The value is converted to an attenuation value using the following formula.

Approximate attenuation = <val> * 0.125 dB

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	120	0	127	none

Examples

```
MODulator:IATTenuator 0
MOD:IATT 127
modulator:iattenuator 127
MOD:IATT?
```

:MODulator:IINPutoffset

Sets or queries the offset of the I Modulator Differential input. The value is converted to an approximate output offset via the following formula.

Approximate attenuation = <val> * 125e-6 (volts)

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	0	-32768	32767	none

Examples

```
:MODulator:IINPutoffset 300
:MOD:IINP 300
:modulator:iinputoffset 300
:MODulator:IINPutoffset?
```

:MODulator:IOFFset

Sets or queries the offset of the I Modulator driver.

NOTE:	This control has a highly nonlinear effect on the modulator performance and should be changed only slightly from its factory default setting to optimize a specific waveform parameter as required.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	11400	-32768	32767	none

Examples

```
:MODulator:IOFFset 300
:MOD:IOFF 300
:modulator:ioffset 300
:MODulator:IOFFset?
```

:MODulator:QATTenuator

Sets or queries the attenuator in the Q modulator path. The value is converted to an attenuation value using the following formula.

Approximate attenuation = <val> * 0.125 dB

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	120	0	127	none

Examples

```
:MODulator:QATTenuator 0
:MOD:QATT 127
:modulator:qattenuator 0
:MOD:QATT?
```

:MODulator:QINPutoffset

Sets or queries the offset of the Q Modulator Differential input. The value is converted to an approximate output offset using the following formula.

Approximate output offset = <val> * 125e-6 (volts)

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	0	-32768	32767	none

Examples

```
:MODulator:QINPutoffset 300
:MOD:QINP 300
:modulator:qinputoffset 300
:MODulator:QINPutoffset?
```

:MODulator:QOFFset

Sets or queries the offset of the Q Modulator driver.

NOTE: This control has a highly nonlinear effect on the modulator performance and should be changed only slightly from its factory default setting to optimize a specific waveform parameter as required.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Digits	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer.	none	11400	-32768	32767	none

Examples

```
:MODulator:QOFFset 300
:MOD:QOFF 300
:modulator:qoffset 300
:MODulator:QOFFset?
```

:MODulator:ZINPut

Sets or queries the input impedance of the A and B Baseband inputs. The variable <val> can be 0 or 1, with 0 being 50 Ω input impedance and 1 being 100 kΩ input impedance.

Query	Return Parameter	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Boolean data	Yes	0 or 1	none	0	0	1	none

Examples

```
:MODulator:ZINPut 1
:MOD:ZINP 0
:modulator:zinput 1
:MOD:ZINP?
```

System Commands

:SYSTem:CLEar

Clears the last error message.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
No	n/a	Yes	none	none	n/a	n/a	n/a	none

Examples

```
:SYSTem:CLEar
:SYST:CLE
:system:clear
```

:SYSTem:ERRor?

Returns the last error that occurred. If no error has occurred, `+000, "No error"` is returned. A `:SYSTem:CLEar` command is executed after reporting the last error.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	string	No	n/a	n/a	n/a	n/a	n/a	none

Examples

```
:SYSTem:ERRor?
:SYST:ERR?
:system:error?
```

:SYSTem:RECall

Recalls a previously saved instrument state and sets the hardware accordingly. At instrument power up or the issuance of a *RST command the factory defaults will be loaded.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
No	n/a	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer (e.g., 8)	none	none	0	9	none

Examples

```
:SYSTem:RECall 0
:SYST:REC 4
:system:recall 9
```

:SYSTem:REFLock?

Queries whether the reference phase lock loop (PLL) is locked. A "1" is returned if the reference PLL is locked. A "0" is returned if the reference PLL is unlocked.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Boolean data	No	n/a	n/a	n/a	n/a	n/a	none

Examples

```
:SYSTem:REFLock?
:SYST:REFL?
:system:reflock?
```

:SYSTem:SAVE

Saves the current instrument state to the EEPROM in one of ten specified user state locations (0-9). These saved settings are stored in the non-volatile EEPROM and survive subsequent power on and off cycles. All of the user configurable settings are saved.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
No	n/a	Yes	Numeric representation format. This parameter is a number than can be expressed as an integer (e.g., 8)	none	none	0	9	none

Examples

```
:SYSTem:SAVE 0
:SYST:SAVE 1
:system:save 9
```

:SYSTem:VERSion?

Returns the SCPI version. For example, `1992.0`.

Query	Return Parameters	Set	Set Parameters	Special Parameters	Def	Min	Max	Units
Yes	Boolean data	No	n/a	n/a	n/a	n/a	n/a	none

Examples

```
:SYSTem:VERSion?
:SYST:VERS?
:system:version?
```

SCPI Errors

The last system error may be found by using the query, `:SYSTem:ERRor?`

Error	Description
+000, "No error"	No error was found.
-109, "Missing parameter"	A required parameter was missing.
-113, "Undefined header"	The command was not recognized.
-120, "Numeric data error"	The parameter value was out of range.