

V2895A MIMO Synchronization Unit

Installation and Quick Start Guide



Agilent Technologies

Notices

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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/V2895A (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.

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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. 61010-1-04
- 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	Geräuschemission
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.

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.

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:



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.



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.

Agilent V2895A Description

The Agilent V2895A MIMO Synchronization Unit provides synchronized signals to MIMO system instruments. This gives the MIMO system a highly precise and stable alignment between up to eight signal analyzers and eight signal generators. The V2895A is designed to be used with Agilent V2820A Vector Signal Analyzers (VSA) and Agilent V2920A Vector Signal Generators (VSG).

Companion literature

For additional detail on V2895A product use and specifications, refer to and the *V2895A MIMO Application Guide* and *V2895A Specifications*. These documents are provided at www.agilent.com/find/V2895A, and on the CR-ROM that ships with the V2895A instrument.

Key features and benefits

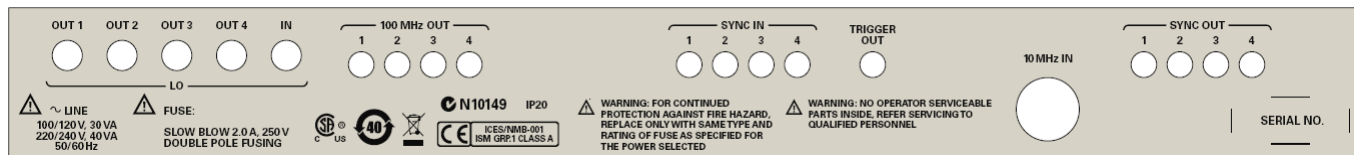
- Synchronization unit creates a MIMO system using standard MIMO-ready Agilent VSAs or VSGs
- Two, three, or four channel configurations
- Very wide bandwidth
- Does not degrade instrument EVM measurements
- Ideal for 802.11n WLAN and 802.16e WiMAX Wave 2
- Same synchronization unit works with both sources (VSGs) and receivers (VSAs)
- Powerful MIMO signal-analysis software package option

Supplied accessories

Part number	Description	Quantity for 4x4 or less	Quantity for greater than 4x4
(varies, depending on country)	AC power cable	1	3
V2895-90001	V2895A MIMO Synchronization Unit Installation and Quick Start Guide	1	1
V2895-90004	MIMO Application Guide	1	1
2895-308A	Rack-mount hardware (2 ears plus 4 dress screws)	1	3
CA-469-30A	MIMO sync/clock, 30-inch, triple shielded, SMB (male) right angle both ends	12	36
CA-473-20A	LO distribution cable, 20-inch, SMA (male) to SMA (male) right angle, both ends.	5	15

Rear view and connectors

Figure 1:
V2895A rear view



V2895A rear panel connectors:

Connector	Characteristic
LO OUT 1 through 4	Provides distributed LO power to the slave V2820As or V2920As and back to the master V2820A or V2920A, SMA
LO IN	Connects to the master V2820A or V2920A LO OUT, SMA
100 MHz OUT 1 through 4	Provides 100 MHz clock outputs to the master and slave V2820A or V2920A, SMB (male)
SYNC IN 1 through 4	Inputs from V2820A or V2920A sync outputs. Input level: 3.3V CMOS, SMB (male)
SYNC OUT 1 through 4	Provides SYNC signals to V2820As or V2920As. Output level: 3.3V CMOS, SMB (male)
TRIGGER OUT	SMB
10 MHz IN	Inputs external 10 MHz reference, BNC, 50 Ω impedance

Returning the instrument for service

Should it become necessary to return the Agilent V2895A 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/V2895A.
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, V2895A)
 - 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.

Guidelines for installing the V2895 MIMO Synchronization Unit

- When installing in a rack, use the provided [rack-mount hardware \(p/n 2895-308A\)](#).
- Input AC supply requirements: 100 VAC to 240 VAC, 50 Hz to 60 Hz (auto-detected), 30 VA maximum at 100-120VAC, 40 VA maximum at 220-240 VAC.
- **Before applying power to this instrument, observe the following precautions:**

-
- CAUTIONS:**
- If you power up the instruments individually, power them up in the following order:
 1. V2895A(s); these units supply clocks for the other instruments
 2. All master instruments
 3. All slave instruments
 - This product is designed for use in INSTALLATION CATEGORY II and POLLUTION DEGREE 2, per IEC 61010-1 Second Edition.
 - This instrument has auto-ranging line voltage input of 100 VAC to 240 VAC, be sure the supply voltage is within the specified range.
 - Install the instrument so that the operator can readily identify and easily reach a switch that disconnects mains power from the instrument. The rear panel power (LINE) switch disconnects the mains circuits from the mains supply; it disconnects the mains circuits from the mains supply before other parts of the instrument. The detachable power cord can also 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.
 - Operate the V2895A from a dedicated power source to avoid possible problems caused by electrical transients or line voltage fluctuations.

- WARNINGS:**
- Use only the supplied, grounded line cord to assure proper safety grounding.
 - This is a Safety Class 1 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. Failure to use a grounded outlet may result in serious personal injury due to electric shock.

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- **Replacing the fuse:**

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- WARNINGS:**
- Verify the instrument is disconnected from the AC line and other equipment before changing line fuse.
 - This instrument is supplied with “Double Pole Fusing” at the Line Entry Module.
 - For continued protection against fire hazard, replace fuses, and or circuit breakers only with same type and ratings. The use of other fuses, circuit breakers or materials is prohibited. If the instrument repeatedly blows fuses, return the unit to Agilent.

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- Replace the fuse with Agilent part number 2110-0587. Fuse specifications: 2.0 Amp, 250 VAC, 5x20 mm slow-blow fuse (Schurter 0034.3120 UL and VDE approved fuse).

- **Ventilation requirements:**

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- CAUTION:**
- When installing the V2895A in a cabinet, the convection into and out of the V2895A must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4°C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.
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For details on MIMO system interconnections and power-up guidelines, refer to the next section, [Setting up the V2895A](#).

Setting up the V2895A

To set up the MIMO system

1. Connect the system equipment, using the cable configurations shown in Figure 2 or Figure 3.

Figure 2:
V2895A cable connections for 4x4 or less MIMO testing

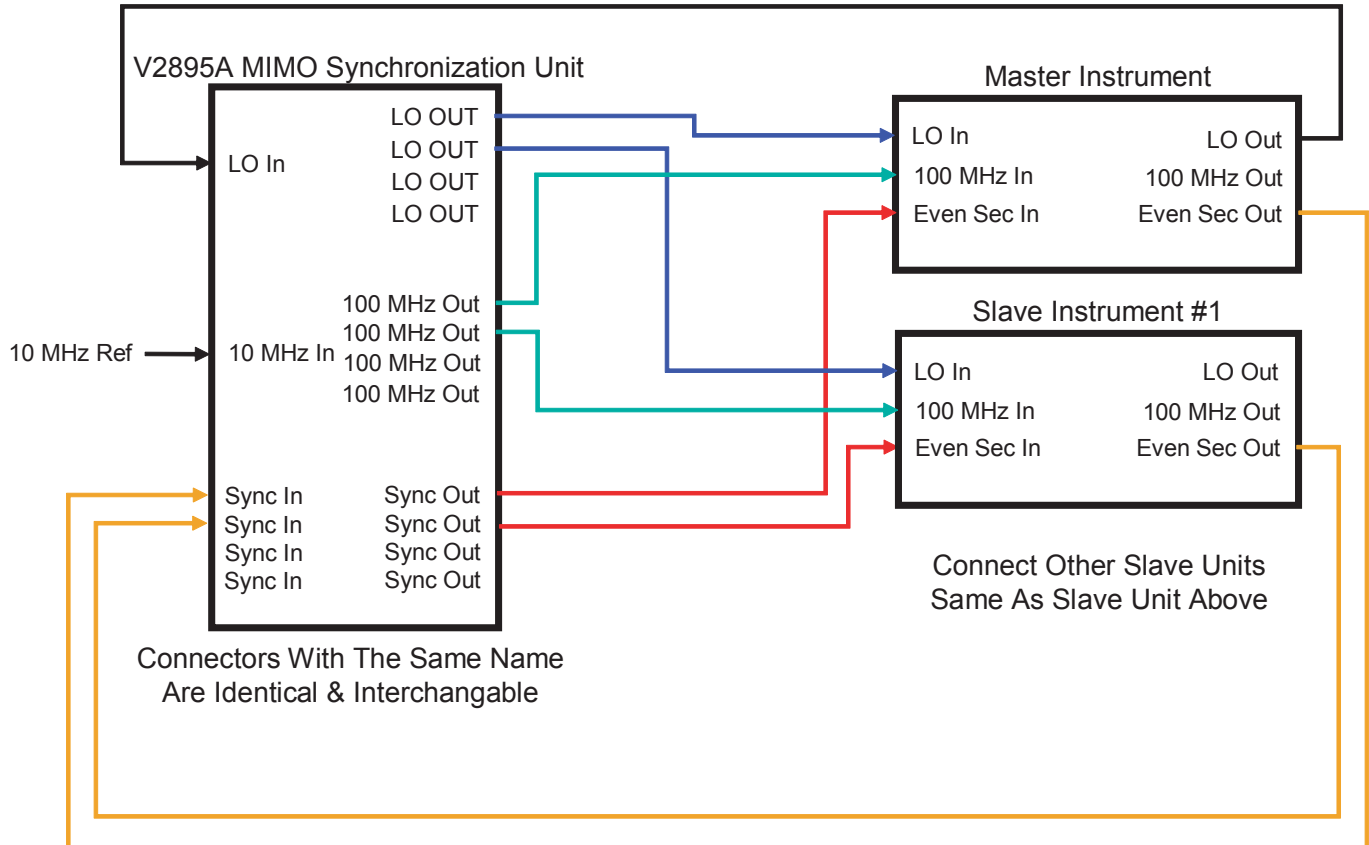
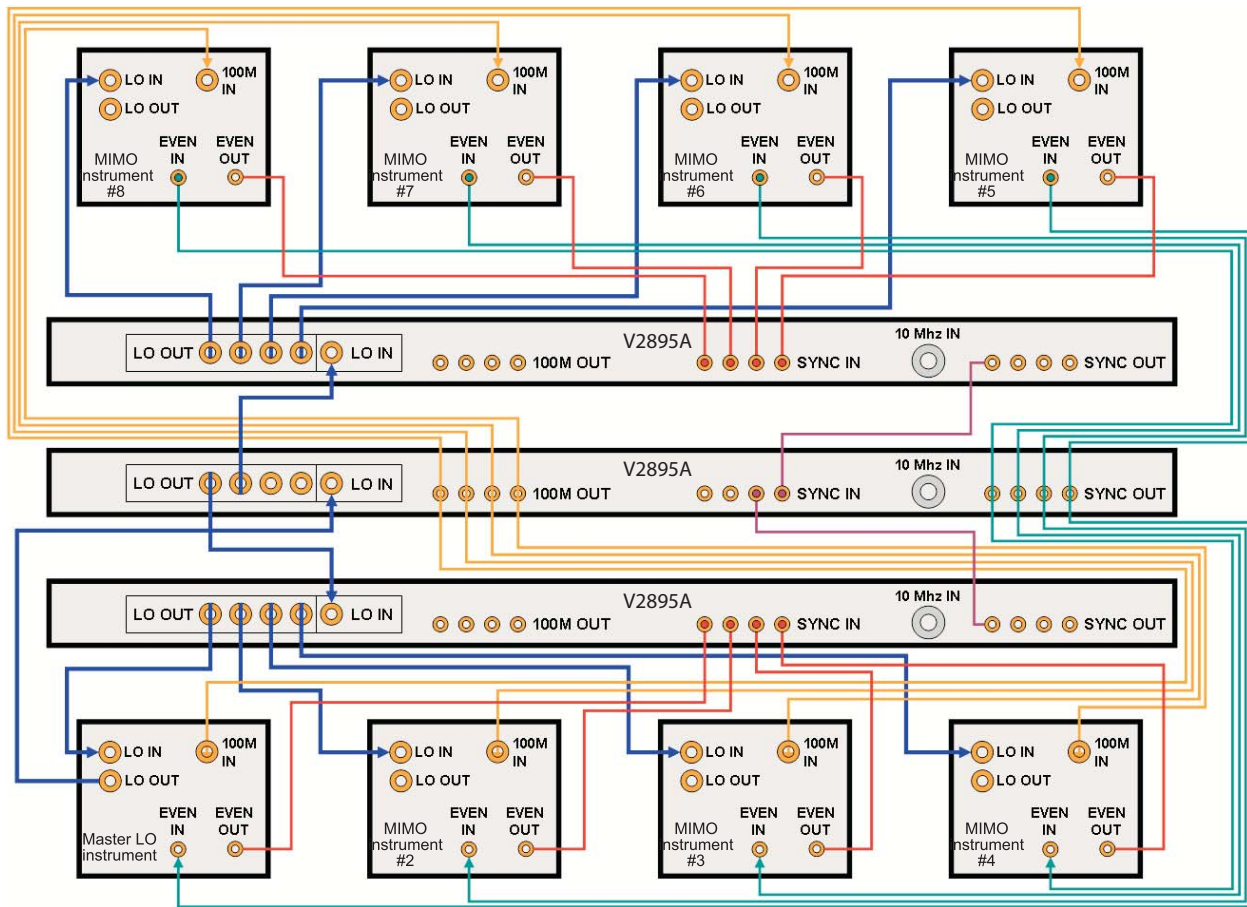


Figure 3:
V2895A cable connections for greater than 4x4 MIMO testing



- Blue lines LO distribution
- Orange Lines 100 MHz clock distribution
- Green Lines sync and trigger signal distribution
- Red Lines trigger signal distribution
- Purple Lines sync and trigger signal distribution

2. **Power Up:** You may power up all of the MIMO system instruments at the same time if desired, or individually.

NOTE: If you power up the instruments individually, power them up in the following order:

1. V2895A(s); these units supply clocks for the other instruments
2. All master instruments
3. All slave instruments

3. On each signal generator, select the following parameters:

- a) Select **RF: On**.
- b) For the master instrument, select **Menu > Global Settings > MIMO > Master > Close**.
- c) For each of the slave instruments, select **Menu > Global Settings > MIMO > Slave > Close**.
- d) For master and slave instruments, select **Menu > Global Settings > Trigger > Trigger Mode > Trigger start of Arb waveform > Close**.

4. On each signal analyzer, select the following parameters:
 - a) Select **Spectrum > General Purpose > Zero Span**.
 - b) Select **Sweep Single**.
 - c) For the master instrument, select **Menu > Global Settings > MIMO > Master > Close**.
 - d) For each of the slave instruments, select **Menu > Global Settings > MIMO > Slave > Close**.

To load arbitrary waveforms and synchronize the signal generators:

1. Starting with the master signal generator, load the same arbitrary waveform file into each instrument's waveform playback table:
 - a) Choose **Select Modulation > Arb > Add Arb > Add Arb File**.
 - b) Locate and load the *.arb file:
 - If the file is in the User directory, select the filename and then select **Open**.
 - If you do not see the file that you want in the User directory, open the **Look in:** drop-down menu and select the directory where the file is located. Select the filename and then select **Open**.
2. On each signal generator, deselect the **Modulation: On** button to switch off the modulation.
3. Select the **Modulation On** button to switch on the modulation for each of the slave signal generators.
4. Select the **Modulation On** button to switch on the modulation for the master signal generator.
5. Select **Menu > Global Settings > Trigger > Trigger Now** on each slave signal generator to create a trigger event.
6. Select **Menu > Global Settings > Trigger > Trigger Now** on the master signal generator.

To center the burst across the signal analyzer screen:

1. On the master signal analyzer, select the following parameters:
 - a) Select **Menu > Global Settings > Trigger > Trigger Source > Video > Close**.
 - b) Double-click **Bandwidth > Set to Max**.
2. Adjust the master signal analyzer to view a complete burst on the analyzer screen.
 - a) Select **Sweep Time** and adjust the value to see a burst on the analyzer screen.
 - b) Visually measure the width of the burst on the screen by counting the number of vertical divisions across the displayed burst.
 - c) Multiply the number of divisions you counted by the scale per division. Then, set the master analyzer sweep time to the value calculated in the previous step.
 - d) Select **Menu > Global Settings > Trigger > Trigger Delay** and adjust the delay value to view the entire burst on the screen.
 - e) Select **Sweep Single** to take a measurement sweep and see if the entire burst is centered on the analyzer screen. If necessary, adjust the sweep time and trigger delay values.
3. Set the slave signal analyzers' trigger source, sweep time and trigger delay settings to the same values that you used for the master in the previous step.

Troubleshooting

Source MIMO problems

Problem	Possible causes
Instrument reports “Could not init RF Hardware” at power-up	<ul style="list-style-type: none"> The instrument rear panel 100 MHz clock input might not be properly connected to the V2895A. The V2895A is not turned on. The instrument 100 MHz input/outputs are swapped or mislabeled.
No signal appears at source output when MIMO operation is not enabled	<ul style="list-style-type: none"> The front panel RF button must be “On.” The instrument LO IN signal might not be properly connected. Check for proper LO power by selecting Menu > Global Settings > MIMO. Verify that the LO Power display shows “Present.” If the LO Power displays as “Lo,” make sure that the instrument rear panel LO IN connector is properly connected to one of the V2895A LO OUT connectors. The master instrument LO OUT signal might not be properly connected. Check for proper LO power by selecting Menu > Global Settings > MIMO. Verify that the LO Power display shows “Present.” If the LO Power displays as “Lo,” make sure that the master instrument rear panel LO OUT signal is properly connected to the V2895A LO IN connector. The V2895A is not turned on. The instrument LO input/outputs are improperly connected or mislabeled.
Source RF output or modulation does not start up as expected when MIMO is enabled	<ul style="list-style-type: none"> The front panel RF button must be “On.” For modulation, the Modulation button must be “On.” The instruments are waiting for one of the VSAs or VSGs to be triggered. Trigger all instruments. If Trigger Source is set to SCPI or Front Panel Trigger, press the Trigger Now button on each instrument. One of the VSAs or VSGs does not have MIMO sync turned on. To turn it on, select Menu > Global Settings > MIMO. Set the instrument to either Master or Slave, then turn RF/modulation on and trigger all units. One of the V2895A sync unit’s SYNC OUT lines might not be properly connected. Make sure that all of the VSAs or VSGs have one of the V2895A SYNC OUT connectors properly connected to that instrument’s EVEN SEC IN connector. One of the V2895A’s SYNC IN lines might not be properly connected. Make sure that each of the VSAs or VSGs have their EVEN SEC OUT connector properly connected to one of the V2895A’s SYNC IN connectors.
Source outputs not synchronized	<ul style="list-style-type: none"> Instruments may have different firmware revisions. Load identical firmware into all instruments. MIMO sync might not be turned on. To turn it on, select Menu > Global Settings > MIMO. Set each instrument to either Master or Slave. Triggering might not be turned on. To turn it on, select Menu > Global Settings > Trigger. Set Trigger Mode to Trigger start of arb waveform. Trigger each instrument to start outputs in synchronization.

Receiver MIMO problems

Problem	Possible causes
Instrument reports “Could not init RF Hardware” at power-up	<ul style="list-style-type: none"> • The instrument rear panel 100 MHz clock input might not be properly connected to the V2895A. • The V2895A is not turned on. • The instrument 100 MHz input/outputs are swapped or mislabeled.
No signal appears on receiver display	<ul style="list-style-type: none"> • The instrument LO IN signal might not be properly connected. Check for proper LO power by selecting Menu > Global Settings > MIMO. Verify that the LO Power display shows “Present.” If the LO Power displays as “Lo,” make sure that the VSA or VSG rear panel LO IN connector is properly connected to one of the V2895A’s LO OUT connectors. • The master Instrument LO OUT might not be properly connected. Check for proper LO power by selecting Menu > Global Settings > MIMO. Verify that the LO Power display shows “Present.” If the LO Power displays as “Lo,” make sure the Master instrument rear panel LO OUT signal is properly connected to the V2895A’s LO IN connector. • The V2895A is not turned on. • The instrument LO input/outputs are improperly connected or mislabeled.
Receivers freeze and do not sweep	<ul style="list-style-type: none"> • One of the V2895A’s MIMO SYNC OUT lines might not be properly connected. Make sure that each of the VSAs or VSGs have one of the V2895A’s SYNC OUT connectors properly connected to that instrument’s EVEN SEC IN connector. • One of the V2895A’s MIMO SYNC IN lines might not be properly connected. Make sure that each of the VSAs or VSGs have their EVEN SEC OUT connector properly connected to one of the V2895A’s SYNC IN connectors. • Instruments might be waiting for the master to trigger (either a video or external trigger). Check if external or video trigger is set on the master. If external trigger is set, see if an external trigger is being provided. If a video trigger is set, see if the video trigger level is set properly, or if an input signal that would provide a trigger is being input. • One of the instruments might not have MIMO sync enabled. Select Menu > Global Settings > MIMO. Set instrument to either “Master” or “Slave.” • Instrument setup might not be correct. Try switching the master instrument out of MIMO mode to troubleshoot and see if the master instrument will operate and trigger on its own. When the setup is corrected, switch back into MIMO mode.
Instruments not synchronized	<ul style="list-style-type: none"> • Instruments might have different firmware revisions. Load identical firmware into all instruments. • MIMO sync is not enabled. To turn it on, select Menu > Global Settings > MIMO. While all instruments are in “hold” (not sweeping), set to either Master or Slave. • Triggering is not set to the exact same mode on all instruments. Set all instruments to the same triggering mode by selecting Menu > Global Settings > Trigger (note that instruments configured as slaves will ignore this setting and obtain their triggering from the master, but this trigger setting must be set to the same selection on all units). • One of the V2895A’s MIMO SYNC OUT lines might not be properly connected. Make sure that each of the VSAs or VSGs has one of the V2895A SYNC OUT connectors properly connected to that instrument’s EVEN SEC IN connector. • One of the V2895A’s MIMO SYNC IN lines might not be properly connected. Make sure that each of the VSAs or VSGs have their EVEN SEC OUT connector properly connected to one of the V2895A’s SYNC IN connectors. • MIMO mode might have been enabled when the units were in different states. Switching instruments into MIMO mode while some instruments are sweeping or in non-identical instrument states might put the instruments out of sync with each other. To correct, place all of the instruments in hold (press Sweep Single) and then into the same instrument state before switching all of them into MIMO mode.