

**Agilent Technologies  
E8241A, E8244A, E8251A,  
and E8254A Option H30**

User's and Service Guide Supplement



**Agilent Technologies  
E8241A, E8244A, E8251A, and E8254A  
Option H30**

**RF Frequency Upconverter  
User's and Service Guide Supplement**

**Use this manual with this document:**

**PSG Family User's Guide  
Part Number E8251-90023**

**Agilent Technologies Part Number: E8251-90047  
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**Agilent Technologies  
E8241/44/51/54A Option H30**

## Description

The Agilent E8244A and E8254A (E8244/54A) Option H30 adds a mixer and coax switch to enable the E8244A/54A Option H30 to upconvert a RF carrier signal of 100 kHz to 6 GHz (input is provided on the rear panel) to a frequency range of 6 GHz to 46 GHz, depending on E8244A/54A Option H30 frequency setting.

The Agilent E8241A and E8251A (E8241/51A) Option H30 adds a mixer and coax switch to enable the E8241A/51A Option H30 to upconvert a RF carrier signal of 100 kHz to 5 GHz (input is provided on the rear panel) to a frequency range of 0.125 GHz to 25 GHz, depending on E8241A/51A Option H30 frequency setting.

A coax switch allows the E8241/24/51/54A Option H30 to be switched from standard synthesizer mode to upconverter mode. This allows the it to be used as a standard source instrument as well as an upconverter. The synthesizer/upconverter modes can be selected from the front panel or by remote command. The upconverter signal output is the same front panel RF output, 2.4 mm male conductor. The input conductor is a SMA on the rear panel.

The E8241/24/51/54A Option H30 can be used with an E4432B - E4438B or another source to upconvert a digitally modulated carrier to a desired microwave frequency. If the input carrier is at 2 GHz and the E8241/51A Option H30 is at 30 GHz, the RF output of the E8241/51A Option H30 will be 2 GHz, 18 GHz, 20 GHz, and 22 GHz. If the input carrier is at 2 GHz and the E8244/54A Option H30 is at 30 GHz, the RF output of the E8244/54A Option H30 will be 2 GHz, 28 GHz, 30 GHz, and 32 GHz. Filtering is not supplied in the Option H30. The upconverted signal power can be attenuated by the Option 1E1 RF attenuator to reduce power level to the operator's requirements.



## Characteristics

The following specifications are characteristic.

**Table 1-1 E8241/51A Option H30 Performance Characteristics**

Description	Frequency
Rear Panel Frequency Range	100 kHz to 5 GHz
Conversion Loss for Upconverted Signal to the Front Panel	15 dB
Front Panel RF Upconverted frequency Range	125 GHz to 25 GHz
Usable IF Bandwidth (depends on the IF freq. used on rear panel)	5 GHz, flatness typically < 2 dB over any 1 GHz span

**Table 1-2 E8244/54A Option H30 Performance Characteristics**

Description	Frequency
Rear Panel Frequency Range	100 kHz to 6 GHz
Conversion Loss for Upconverted Signal to the Front Panel	-8 dB (6 GHz) to -20 dB (46 GHz)
Front Panel RF Upconverted frequency Range	6 GHz to 46 GHz
Usable IF Bandwidth (depends on the IF freq. used on rear panel)	6 GHz, flatness typically < 2 dB over any 1 GHz span

**NOTE**

When in upconverter mode, the displayed RF output power level is LO drive. The displayed RF power in upconverter mode does not represent the power of the upconverted signal at the RF output.

The maximum RF power output of the E8241/44/51/54A Option H30 is reduced by 2 dBm due to the added insertion loss of the coax transfer switch required for the design. For units with Option H30, subtract 2 dBm from the power output specifications listed in Table 1 of the standard user's guide (E8251-90023).





## Conventions

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**NOTE**

The following key conventions are used throughout this document.

- **[HARDKEYS]** are labeled front panel keys
  - **SOFTKEYS** are unlabeled keys whose function is indicated on the instrument display
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## Operation

### E8241A and E8251A

To use the E8241/51A Option H30 as a standard instrument, refer to the User's Guide.

To use the E8241/51A Option H30 as an RF upconverter, use the following steps:

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**CAUTION** Maximum power into the rear panel RF upconverter input must not exceed +20 dBm!

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**CAUTION** Damage to upconverter mixer can result if the reverse power into the RF output port on the front panel occurs while in upconverter mode.

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**NOTE** Performance will vary depending on RF upconverter input power level and the power level set on the E8241/51A Option H30 instrument.

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- Step 1.** On the rear panel, remove the protective connector from the RF up converter Input.
- Step 2.** Connect the RF source (customer supplied) preset to within recommended power and frequency ranges, to the H30 rear panel RF upconverter input using a suitable RF cable and adapters as necessary. For best performance, it is recommended the user set power level < +10 dBm.
- Step 3.** To activate upconverter mode from the front panel, press:

**[FREQUENCY]**  
**MORE 1/2,** (1 of 2)  
**UPC ON/OFF,** (to activate mode)

Use the same front panel key to return the instrument to normal synthesizer mode.

The command "UPC ON" can be used to remotely select the upconverter mode. Use the command "UPC OFF" to return the instrument to normal synthesizer mode.

## **E8244A and E8254A**

To use the E8244A/54A Option H30 as a standard instrument, refer to the User's Guide.

To use the E8244A/54A Option H30 as an RF upconverter, use the following steps:

---

**CAUTION** Maximum power into the rear panel RF upconverter input must not exceed +20 dBm!

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---

**CAUTION** Damage to upconverter mixer can result if the reverse power into the RF output port on the front panel occurs while in upconverter mode.

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**NOTE** Performance will vary depending on RF upconverter input power level and the power level set on the E8244A/54A Option H30 instrument.

---

- Step 1.** On the rear panel, remove the protective connector from the RF up converter Input.
- Step 2.** Connect the RF source (customer supplied) preset to within recommended power and frequency ranges, to the H30 rear panel RF upconverter input using a suitable RF cable and adapters as necessary. For best performance, it is recommended the user set power level < +10 dBm.
- Step 3.** To activate upconverter mode from the front panel, press:

**[FREQUENCY]**  
**MORE 1/2,** (1 of 2)  
**UPC ON/OFF,** (to activate mode)

Use the same front panel key to return the instrument to normal synthesizer mode.

The command "UPC ON" can be used to remotely select the upconverter mode. Use the command "UPC OFF" to return the instrument to normal synthesizer mode.

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## Specifications

### E8241A and E8251A

With upconverter mode OFF:

The power level specification for the E8244A/54A Option H30 is +8 dBm, reduced by 2 dBm from the standard unit with Option 1E1. Characteristically, output power is the same as standard unit at room temperature (22 °C).

There are no other specification changes with the upconverter OFF.

With upconverter mode ON:

RF Upconverter Input, 100 kHz to 5 GHz  
Input Power Level Range, -40 dBm to 20 dBm.

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#### CAUTION

Because damage may result in levels greater than 20 dBm, it is not recommended to use power levels above 20 dBm. Power levels < 10 dB are recommended for best performance.

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Upconverted RF Output Frequency Range; 0.125 GHz to 256 GHz.

Upconverter conversion loss:  
15 dB over 0.125 to 25 GHz.

IF BW:  
5 GHz, flatness typically < 2 dB over any 1 GHz span.

## **E8244A and E8254A**

With upconverter mode OFF:

The power level specification for the E8244A/54A Option H30 is +8 dBm, reduced by 2 dBm from the standard unit with Option 1E1. Characteristically, output power is the same as standard unit at room temperature (22 °C).

There are no other specification changes with the upconverter OFF.

With upconverter mode ON:

RF Upconverter Input, 100 kHz to 6 GHz  
Input Power Level Range, -40 dBm to 20 dBm.

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**CAUTION**

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Because damage may result in levels greater than 20 dBm, it is not recommended to use power levels above 20 dBm. Power levels < 10 dB are recommended for best performance.

Upconverted RF Output Frequency Range, 6 GHz to 46 GHz.

Upconverter conversion loss:  
-8 dB for frequencies from 6 GHz,  
-20 dB for frequencies up to 46 GHz.

IF BW:

6 GHz, flatness typically < 2 dB over any 1 GHz span.



## Performance Check

The E8241/44/51/54A Option H30 can be verified to be functional using the following equipment and methods:

The E8241/44/51/54A Option H30 must first meet standard product specifications with the exception that the power output may be degraded by up to 2.0 dBm. (Subtract 2.0 dBm from the Option 1E1 output power specification.)

Refer to the [Table 2-1 on page 7](#) for a list of equipment needed in addition to the E8241/44/51/54A Option H30 being tested:

**Table 2-1**

Instrument	Recommended
50 GHz Spectrum Analyzer	Agilent 8565EC
4 GHz RF Signal Source	Agilent ESG1000-4000D
RF Cable SMA male 3 ft.	Agilent 5061-6669
RF Cable 2.4 mm 3 ft.	Agilent 5063-9820
SMA Female to Type-N Adapter	Agilent 1250-1250
2.4 mm to 2.4 mm Female Adapter	Agilent 11900B (or comparable)

To set up the E8241/44/51/54A Option H30 for verification follow the following procedure:

- Step 1.** Connect the RF source (preset power level to -10 dBm and frequency to 4 GHz) using an RF cable and adapters to the E8244A/54A Option H30 rear panel RF Upconverter Input.
- Step 2.** Set the E8244A/54A Option H30 to the upconverter mode, set power level to +8 dBm, and CW frequency to 40 GHz, then press:  
**[Frequency],**  
**More 1/2,**  
**UPC Mode ON/OFF.**
- Step 3.** Set the E8241A/51A Option H30 to the upconverter mode, set power level to +8 dBm, and CW frequency to 20 GHz, then press:  
**[Frequency],**  
**More 1/2,**  
**UPC Mode ON/OFF.**

An audible click should be heard from the E8241/44/51/54A Option H30 as the transfer switch switches from the upconverter mixer LO to the coupler output and mixer RF out to the 1E1 step attenuator's input.

Verify on the E8244/54A spectrum analyzer that a 44 GHz signal appears when in upconverter mode and is not present when in standard synthesizer mode. The level of the upconverter IF signal (4 GHz + 40 GHz = 44GHz) is characteristically -28 dBm. Verify on the E8241/51A spectrum analyzer that a 24 GHz signal appears when in upconverter mode and is not present when in standard synthesizer mode. The level of the upconverter IF signal (4 GHz + 20 GHz = 24GHz) is characteristically -28 dBm. Since this is a functional test only, measurement uncertainty is not taken into account. This verifies the switch path and mixer are functioning. Should no signal be present, a problem has occurred. First check the setup of equipment, verifying output on the sources and connections.

Verify the E8241/44/51/54A Option H30 Upconverter switch is working:

The following procedure will aid in determining whether the MID board (E8251-60089) or the coax switch (87222E) is functional.

- Step 1.** Select upconverter mode on/off, then listen for the coax switch to click. If it doesn't click, check the ribbon cable connection to the switch (under switch/mixer assembly). Remove the switch end of the cable from the switch and check:

pin 1 for +32 Vdc,  
pin 7 for +5 Vdc or 0 Vdc,  
pin 8 for +5.2 Vdc and  
pin 9 for Ground.

If voltages are incorrect, check the ribbon cable connection to the MID board assembly. The ribbon cable should be connected to J14. Cycle the upconverter mode on/off repeatedly while looking at pin 7 voltage. Pin 7 should toggle from +5 Vdc (upconverter mode on) to 0 Vdc (upconverter mode off). If pin 7 voltage does not toggle, either the MID board (E8251-60089) or a configuration error is at fault. Consult with Agilent Service for repair. Refer to [“Contacting Agilent” on page 11](#).

- Step 2.** If the voltages and control signal are present at the ribbon cable as verified in step 1, reconnect the ribbon cable to the coax switch and select upconverter mode and toggle it ON/OFF. To verify the switch is not ultra quiet, measure the ports on the coax switch while toggling the upconverter mode.

(Coupler out) PORT 1 PORT 2 (mixer LO input)  
(Atten. input) PORT 4 PORT 3 (mixer RF output)

Port 4 should connect to port 3 in upconverter on mode and port 1 in upconverter off mode. If it doesn't, replace the 87222E coax switch.

The following procedure will aid in determining whether or not the upconverter mixer is functional:

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**CAUTION** Possible damage may occur if RF upconverter input levels exceed 20 dBm or if reverse power is applied at the RF output connector. First verify all cable configurations are correct before applying a signal to the instrument.

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The RF step attenuator cable to the coax switch is functional if the instrument operates as a standard synthesizer.

The RF cable from the coupler output is also functional if the instrument operates as a standard synthesizer.

- Step 1.** Check the RF cable from the rear panel of the connector labeled RF upconverter to the mixer's IF input port. Check power at the connection to the mixer with RF source applied.
- Step 2.** Check power through cables to LO input of the mixer (bottom connector). Power should be close to power level coming from the coupler output. Replace the cables if power insertion loss is excessive and damage is suspected. These cables have a K-type connector and a 2.92 mm adapter should be used for mating to connectors.
- Step 3.** If all cables are verified to be functional, verify mixer orientation with the markings on the outside of the mixer LO down, RF connector up and IF connector facing rear of instrument. Replace the mixer and verify its functionality by using the verification procedure.

## Replaceable Parts

Table 2-2

Ref. Des	Description	Agilent Part Number	Qty
A100	Mixer 6–46 GHz (E8244/54A)	0955-1447	1
A100	Mixer 6–46 GHz (E8241/51A)	0955-0488	1
SW1	Coax transfer switch, 4 port, 50 Ω, 50 GHz, 87222E	87222-60015	1
W101	RF Cable Coupler- SW	E8251-20082	1
W102	RF Cable Attenuator - SW	E8251-20083	1
W103	RF Cable Mixer IF - Rear Panel	E8251-20084	1
W104	RF Cable Mixer LO - SW	E8251-20085	1
W105	RF Cable Mixer R - SW	E8251-20086	1
W106	Ribbon Cable conn. to Coax Switch	8121-6187	1
A9	MID board (J14 mixer-switch output)	E8251-60089	1
MP101	Mixer switch bracket (mounts to RF attenuator)	E8251-00092	2
MP102	Torx 3.0 mm with self lock for mounting switch to bracket	0515-0376	2
MP103	Torx 3.0 mm to mount bracket to RF step attenuator (1E1)	0515-1035	2
MP104	00-90 inch screw to mount mixer	3030-0436	2
MP105	Hex nut for 00-90 inch screw	0608-0004	2
MP106	Rear Panel Label Printed, “RF Upconverter Input”	9320-1232	1
MP107	Rear Pnl connector mounting plate	E8251-00093	1
MP108	SMA Panel Connector, RF Upconverter Input	1250-1753	1
MP109	Torx 3.0 mm x 6 mm screw to mount conn/bracket	0515-0372	2
	User’s and Service Supplement	E8251-90047	1
	DUST CAP F SMA	1250-2759	1

## Contacting Agilent

<b>Online assistance:</b> <a href="http://www.agilent.com/find/assist">www.agilent.com/find/assist</a>			
<b>United States</b> <i>(tel)</i> 1 800 452 4844	<b>Latin America</b> <i>(tel)</i> (305) 269 7500 <i>(fax)</i> (305) 269 7599	<b>Canada</b> <i>(tel)</i> 1 877 894 4414 <i>(fax)</i> (905) 282-6495	<b>Europe</b> <i>(tel)</i> (+31) 20 547 2323 <i>(fax)</i> (+31) 20 547 2390
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Operation and Service  
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