Evaluation Board for the ADF5904 4-Channel, 24 GHz Receiver Downconverter

FEATURES
Contains ADF5904 4-channel, 24 GHz receiver downconverter
Accompanying software allows control of ADF5904 functions from a PC

EVALUATION KIT CONTENTS
EV-ADF5904SD2Z evaluation board

ADDITIONAL EQUIPMENT
PC running Windows XP or more recent version
Analog Devices, Inc., EVAL-SDP-CS1Z system demonstration platform-serial (SDP-S) board
Spectrum analyzer (optional)
Oscilloscope
5 V power supplies
USB cable

DOCUMENTS NEEDED
ADF5904 data sheet

REQUIRED SOFTWARE
Analog Devices ADF5904 Software

GENERAL DESCRIPTION
The EV-ADF5904SD2Z evaluation board allows the user to evaluate the performance of the ADF5904 24 GHz receiver downconverter. Figure 1 shows the board, which contains the ADF5904, five high frequency SMA connectors for the local oscillator (LO) input, four receiver (Rx) inputs, eight SMA connectors for the baseband outputs, banana connectors for power supply, and a connector for serial interface.

The evaluation kit also contains software that is compatible with Windows® XP and later versions to allow easy programming of the device.

This evaluation board requires an EVAL-SDP-CS1Z SDP-S board (not supplied with the kit). The SDP-S board allows software programming of the ADF5904 device.

Full specifications on the ADF5904 are available in the product data sheet, which should be consulted in conjunction with this user guide when working with the evaluation board.

EVALUATION BOARD PHOTOGRAPH

Figure 1.
TABLE OF CONTENTS
Features ........................................................................................................ 1
Evaluation Kit Contents ........................................................................ 1
Additional Equipment ........................................................................... 1
Documents Needed ................................................................................ 1
Required Software ................................................................................ 1
General Description ............................................................................. 1
Evaluation Board Photograph ............................................................. 1
Revision History .................................................................................. 2
Quick Start Guide ................................................................................ 3
Evaluation Board Hardware ................................................................. 4
Power Supplies ..................................................................................... 4
Input Signals .......................................................................................... 4
Output Signals ....................................................................................... 4
Default Operation ................................................................................ 4
Evaluation Board Software ................................................................. 5
Evaluation and Test ............................................................................... 7
Evaluation Board Schematics and Artwork ......................................... 8
Ordering Information ............................................................................ 13
Bill of Materials ................................................................................... 13
Related Links ....................................................................................... 13

REVISION HISTORY
3/15—Revision 0: Initial Version
QUICK START GUIDE

Follow these steps to quickly evaluate the ADF5904.

1. Connect the power supply to the EV-ADF5904SD2Z:
   a. 5 V to Banana Connector P2
   b. GND to Banana Connector P1
2. Install the ADF5904 software.
3. Connect the SDP-S motherboard to the PC and to the EV-ADF5904SD2Z evaluation board.
4. Follow the hardware driver installation procedure.
5. Run the ADF5904 software.
6. Select the ADF5904 device and the USB board in the Select Device and Connection tab of the software front panel window (see Figure 2).
7. Check that the message SDP board connected appears at the bottom left of the software window (see Figure 2).
8. Connect an ac-coupled RF source to LOIN SMA and connect an ac-coupled RF source to one of the RXxIN input SMAs.
9. In the Main Controls tab, click Initialize.
10. Connect the corresponding Rx baseband channel output to an oscilloscope.
11. Measure the results.
EVALUATION BOARD HARDWARE
The evaluation board requires an SDP-S motherboard to program the device. The SDP-S board is not included and must be purchased separately. The EV-ADF5904SD2Z schematics are shown in Figure 5 to Figure 9. The top layer and assembly layout are shown in Figure 10.

POWER SUPPLIES
The evaluation board is powered via one external supply, 5 V connected as described in the Quick Start Guide section.

INPUT SIGNALS
The LO input pin and the Rx input pins on the ADF5904 contain a dc bias voltage; the inputs must be ac-coupled to the evaluation board.

OUTPUT SIGNALS
The baseband outputs from the ADF5904 contain dc bias voltages and are available on the J3 to J11 output SMAs.

<table>
<thead>
<tr>
<th>Rx Input</th>
<th>Baseband Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF1IN</td>
<td>J3, J4</td>
</tr>
<tr>
<td>RF2IN</td>
<td>J6, J7</td>
</tr>
<tr>
<td>RF3IN</td>
<td>J8, J9</td>
</tr>
<tr>
<td>RF4IN</td>
<td>J10, J11</td>
</tr>
</tbody>
</table>

DEFAULT OPERATION
All components necessary for ADF5904 operation are inserted on the board.
EVALUATION BOARD SOFTWARE

The control software for the EV-ADF5904SD2Z is included in the evaluation kit on a CD. To install the software, follow the on-screen instructions.

To run the software, click the ADF5904 file on the desktop or from the Start menu.

In the Select Device and Connection tab, select the device and the connection method, and click Connect.

Confirm that Analog Devices Eval Board connected is displayed at the bottom left of the window (see Figure 2). Otherwise, the software has no connection to the evaluation board.

Note that, when connecting the board, it takes approximately 5 sec to 10 sec for the status label to change.

Figure 2. Software Front Panel Display—Select Device and Connection
The **Main Controls** tab controls the ADF5904 device settings (see Figure 3). This tab allows the user to select general options available for the ADF5904, including power up/down control and register readback.

On initial power-up of the device, click the **Initialize** button to perform the initialization sequence as described in the ADF5904 data sheet.

![Figure 3. Software Front Panel Display—Main Controls](image-url)
EVALUATION AND TEST

To evaluate and test the performance of the ADF5904, take the following steps:

1. Install the SDP-S software drivers. Connect the evaluation board to a PC using the supplied USB cable. Follow the hardware driver installation procedure that appears.
2. Connect the SDP-S connector to the EV-ADF5904SD2Z.
3. Install the ADF5904 software.
4. Connect an ac-coupled RF signal to LOIN SMA.
5. Connect an ac-coupled RF signal to the RX1IN input SMA.
6. Connect a 1 MΩ, ac-coupled oscilloscope to the J3 and J4 output SMAs.
7. Run the ADF5904 software.
8. Select the SDP-S board and the ADF5904 device in the Select Device and Connection tab of the software window.
9. In the Main Controls tab, click Initialize to power up the ADF5904 (see Figure 3). See Figure 4 for the suggested setup.
10. Measure the baseband output signals.

Figure 4. Typical Evaluation Setup
Figure 5. Evaluation Board Schematic (Page 1)
Figure 6. Evaluation Board Schematic (Page 2)
Figure 7. Evaluation Board Schematic (Page 3)
### ORDERING INFORMATION

#### BILL OF MATERIALS

Table 2.

<table>
<thead>
<tr>
<th>Qty</th>
<th>Reference Designator</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Part Number</th>
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<tbody>
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<td>C1, C2, C6</td>
<td>0.1 μF capacitor</td>
<td>AVX</td>
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<td>Murata</td>
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<td>10 pF capacitor</td>
<td>AVX</td>
<td>0402SU100GAT2A</td>
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<td>Diode</td>
<td>Multicomp</td>
<td>1N4001</td>
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<td>D2</td>
<td>Diode</td>
<td>On Semiconductor</td>
<td>MBR0520LT1G</td>
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<td>10</td>
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<td>Emerson</td>
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<td>1</td>
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<td>4.7 μH inductor</td>
<td>Coilcraft</td>
<td>EPL2014-472ML</td>
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<td>2.92 mm Rosenberger connectors</td>
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<td>Deltron</td>
<td>571-0100</td>
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<td>10 kΩ resistor</td>
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<td>100 kΩ resistor</td>
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<td>Not applicable</td>
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<td>9</td>
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<td>5000</td>
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<td>1</td>
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<td>Allthread</td>
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<tr>
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<td>Nut/washer, nylon</td>
<td>Duratool</td>
<td>1140030</td>
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<tr>
<td>1</td>
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<td>ADF5904 Rx MMIC</td>
<td>Analog Devices</td>
<td>ADF5904BCPZ</td>
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<tr>
<td>4</td>
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<td>0 Ω resistor</td>
<td>Multicomp</td>
<td>MC 0.0625W 0402 1% 0R</td>
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<tr>
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<td>0.33 Ω resistor</td>
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<td>Kemet</td>
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<tr>
<td>1</td>
<td>C11</td>
<td>10 μF capacitor</td>
<td>Murata</td>
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<td>1 μF capacitor</td>
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<td>Not applicable</td>
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<td>5</td>
<td>R1, R2, R3, R13, R18</td>
<td>0 Ω resistor</td>
<td>Multicomp</td>
<td>MC 0.063W 0603 0R</td>
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</tbody>
</table>

### RELATED LINKS

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADF5904</td>
<td>Product Page, 4-Channel, 24 GHz, Receiver Downconverter</td>
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<tr>
<td>ADP7104</td>
<td>Product Page, 20 V, 500 mA, Low Noise, CMOS LDO</td>
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</tbody>
</table>
NOTES

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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