



# MAX7044 Evaluation Kit

## General Description

The MAX7044 evaluation kit (EV kit) allows for a detailed evaluation of the MAX7044 ASK transmitter. It enables testing of the device's RF performance and requires no additional support circuitry. The RF output uses a 50 $\Omega$  matching network and an SMA connector for convenient connection to test equipment. A reverse polarity SMA is also included to connect to a 1/4-wave whip antenna. The EV kit can also directly interface to the user's embedded design for easy data encoding.

The MAX7044EV kit comes in two versions: a 315MHz version and a 433.92MHz version. The passive components are optimized for these frequencies. These components can easily be changed to work at RF frequencies from 300MHz to 450MHz.

For easy implementation into the customer's design, the MAX7044 EV kit also features a proven PCB layout, which can be easily duplicated for quicker time-to-market. The EV kit Gerber files are available for download at [www.maxim-ic.com](http://www.maxim-ic.com).

## Features

- ◆ Proven Components Parts List
- ◆ Multiple Test Points Provided on Board
- ◆ Available in 315MHz or 433.92MHz Optimized Versions
- ◆ Adjustable Frequency Range from 300MHz to 450MHz\*
- ◆ Can Operate as a Stand-Alone Transmitter with Included Battery
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

\*Requires component changes

## Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX7044EVKIT-315	-40°C to +85°C	8 SOT23-8
MAX7044EVKIT-433	-40°C to +85°C	8 SOT23-8

## Component List

DESIGNATION	QTY	DESCRIPTION
C1 (315MHz)	1	12pF $\pm 5\%$ , 50V ceramic capacitor (0603) Murata GRM1885C1H120J
C1 (433MHz)	1	15pF $\pm 5\%$ , 50V ceramic capacitor (0603) Murata GRM 1885C1H150J
C2 (315MHz)	1	18pF $\pm 5\%$ , 50V ceramic capacitor (0603) Murata GRM1885C1H180J
C2, C6 (433MHz)	2	12pF $\pm 5\%$ , 50V ceramic capacitors (0603) Murata GRM 1885C1H120J
C4, C10	2	0.01 $\mu$ F $\pm 10\%$ , 50V ceramic capacitors (0603) Murata GRM188R71H103KA01
C5, C7, C16, C18, C19	0	Not installed, capacitors
C6 (315MHz)	1	15pF $\pm 5\%$ , 50V ceramic capacitor (0603) Murata GRM1885C1H150J

DESIGNATION	QTY	DESCRIPTION
C11, C12	2	220pF $\pm 5\%$ , 50V ceramic capacitors (0603) Murata GRM1885C1H221J
C14, C15	2	12pF $\pm 5\%$ , 50V ceramic capacitors (0603) Murata GRM1885C1H120J
JU1	1	2-pin header Digi-Key S1012-36-ND or equivalent
JU2, JU3	2	3-pin headers Digi-Key S1012-36-ND or equivalent
L1 (315MHz)	1	27nH $\pm 5\%$ inductor (0603) Coilcraft 0603CS-27NXJB
L1 (433MHz)	1	27nH $\pm 2\%$ inductor (0603) Murata LQW18AN27NG00
L3 (315MHz)	1	18nH $\pm 5\%$ inductor (0603) Coilcraft 0603CS-18NXJB
L3 (433MHz)	1	16nH $\pm 2\%$ inductor (0603) Murata LQW18AN16NG00
R1	1	5k $\Omega$ potentiometer BC Components SM4W502

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R2	0	Not installed, 0 $\Omega$ resistor (0603), any
R3	1	0 $\Omega$ resistor (0603), any
R5	1	47k $\Omega$ $\pm$ 5% resistor (0603), any
R6	1	15k $\Omega$ $\pm$ 5% resistor (0603), any
R7	1	33k $\Omega$ $\pm$ 5% resistor (0603), any
RFOUT	1	SMA connector, top-mount Digi-Key J500-ND Johnson 142-0701-201
ANTENNA_OUT	1	RP-SMA connector LINX CONREVSMA001
REF_IN	1	SMA connector, top-mount, Digi-Key J500-ND Johnson 142-0701-201
Antenna (315MHz)	0	315MHz 1/4-wave whip antenna, not provided Linx ANT-315-CW-RH

DESIGNATION	QTY	DESCRIPTION
Antenna (433MHz)	0	433MHz 1/4-wave whip antenna, not provided Lynx ANT-433-CW-RH
CLKOUT, VDD, VSS, DATA_IN	4	Test points Mouser 151-203 or equivalent
Y1 (315MHz)	1	Crystal, 9.84375MHz Hong Kong X'tals SSL9843750E03FAFZ800 or Crystek 017000
Y1 (433MHz)	1	Crystal, 13.56MHz Hong Kong X'tals SSM1356000E03FAFZ800 or Crystek 017001
BAT1	1	Battery holder MPD BA2032
Battery	1	Coin-cell battery Panasonic BR2032
U1	1	MAX7044AKA-T (8-pin SOT23)
—	3	Shunts (JU1) Digi-Key S9000-ND or equivalent
—	1	PCB: MAX7044 EVALUATION KIT

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Coilcraft, Inc.	847-639-6400	www.coilcraft.com
Crystek Corporation	800-237-3061	www.crystek.com
Digi-Key Corp.	800-344-4539	www.digikey.com
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Panasonic Corp	800-344-2112	www.panasonic.com

**Note:** Indicate that you are using the MAX7044 when contacting these component suppliers.

## Quick Start

The following procedure allows for proper device evaluation.

### Required Test Equipment

- One regulated power supply capable of providing +3.0V
- One spectrum analyzer such as the Agilent 8562E
- One optional ammeter for measuring supply current
- One power meter such as the Agilent EPM-441A

## Connections and Setup

This section provides a step-by-step guide to operating the EV kit and testing the device's functionality. **Do not turn on the DC power until all connections are made:**

- 1) Connect a DC supply set to +3.0V, through an ammeter, to the VDD and VSS terminals on the EV kit. Do not turn on the supply.
- 2) Connect the RF OUT SMA connector to the spectrum analyzer. Set the analyzer to a center frequency of 315MHz (or 433.92MHz) and a span of 1MHz.
- 3) Turn on the DC supply. The spectrum analyzer should display a peak of about +13dBm at 315MHz (or 433.92MHz).

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- 4) Disconnect the spectrum analyzer and connect the power meter instead. Measure the output power and also the current draw. Calculate the efficiency. This is done using the following equation: Efficiency =  $10^{(P_{OUT} / 10)} / (V \times I)$ .
- 5) For example, for an output of +13dBm, and a current of 14.5mA (at 3.0V), the efficiency is 46%.
- 6) In order to transmit ASK data, remove the shunts at JU1 and JU2, and connect DATA\_IN to an external data source.

## Layout Issues

A properly designed PCB is an essential part of any RF/microwave circuit. On high-frequency inputs and outputs, use controlled-impedance lines and keep them as short as possible to minimize losses and radiation. At high frequencies, trace lengths that are on the order of  $\lambda/10$  or longer can act as antennas.

Keeping the traces short also reduces parasitic inductance. Generally, 1in of a PCB trace adds about 20nH of parasitic inductance. The parasitic inductance can have a dramatic effect on the effective inductance. For example, a 0.5in trace connecting a 100nH inductor adds an extra 10nH of inductance or 10%.

To reduce the parasitic inductance, use wider traces and a solid ground or power plane below the signal traces. Also, use low-inductance connections to ground on all GND pins, and place decoupling capacitors close to all VDD connections.

The EV kit PCB can serve as a reference design for laying out a board using the MAX7044.

## Detailed Description

### Power-Down Control

The MAX7044 has an automatic shutdown mode that places the device in low-power mode if the DATA input has not toggled for a specific amount of time. The IC

draws approximately 40nA (at room temperature) in shutdown mode. In order to transmit continuously, the device has to be placed in test mode by biasing the DATA pin to  $V_{DD}/2 + 100mV$ . Jumpers JU1 and JU2 are used to control this mode. Connect the shunt between pins 1 and 2 of JU1 and pins 1 and 2 of JU2. See Table 1 for the jumper function descriptions.

### Data Input

The MAX7044EV kit transmits ASK data with data rates of up to 100kbps. JU1 and JU2 control whether the MAX7044 transmits CW (JU1 shorted, JU2 pins 1 and 2 connected), or an external data stream (no jumper).

### REF\_IN External Frequency Input

For applications where the correct frequency crystal is not available, it is possible to directly inject an external frequency through the REF\_IN SMA (not provided). Connect the SMA to a low-phase noise generator. The addition of C18 and C19 is necessary (use 0.01 $\mu$ F capacitors).

### Battery Operation

The MAX7044 EV kit can be powered by an external power supply or by the supplied 3V coin-cell battery. Set jumper JU3 to connect pins 2 and 3 for battery operation.

### RF Output

The MAX7044 EV kit includes two SMA connectors for RF output. RFOUT is a standard SMA and is used to connect the PA output to test equipment. Output is matched to 50 $\Omega$ . ANTENNA\_OUT is a reverse-polarity SMA and is used to connect to the 1/4-wave whip antenna (not supplied). Note that resistor R2 (0 $\Omega$ ) will need to be added.

### I/O Connections

Table 2 lists all I/O connections. See Table 2 for a description.

For additional information and a list of application notes, consult the [www.maxim-ic.com](http://www.maxim-ic.com) website.

**Table 1. Jumper Function Table**

JUMPER	STATE	FUNCTION
JU1	1-2	RF carrier transmit mode
JU1	NC	Normal OOK operation
JU2	1-2	RF carrier transmit mode
JU2	2-3	PA off, PLL ON
JU2	NC	External OOK data transmit
JU3	1-2	External supply operation
JU3	2-3	Battery operation

**Table 2. I/O Connectors**

SIGNAL	DESCRIPTION
RFOUT	RF output
REF_IN	External reference frequency input
ANTENNA_OUT	Reverse polarity SMA for 1/4-wave antenna
VSS	Ground
VDD	3.0V power input
DATA_IN	Data input
CLKOUT	Crystal frequency divided by 16

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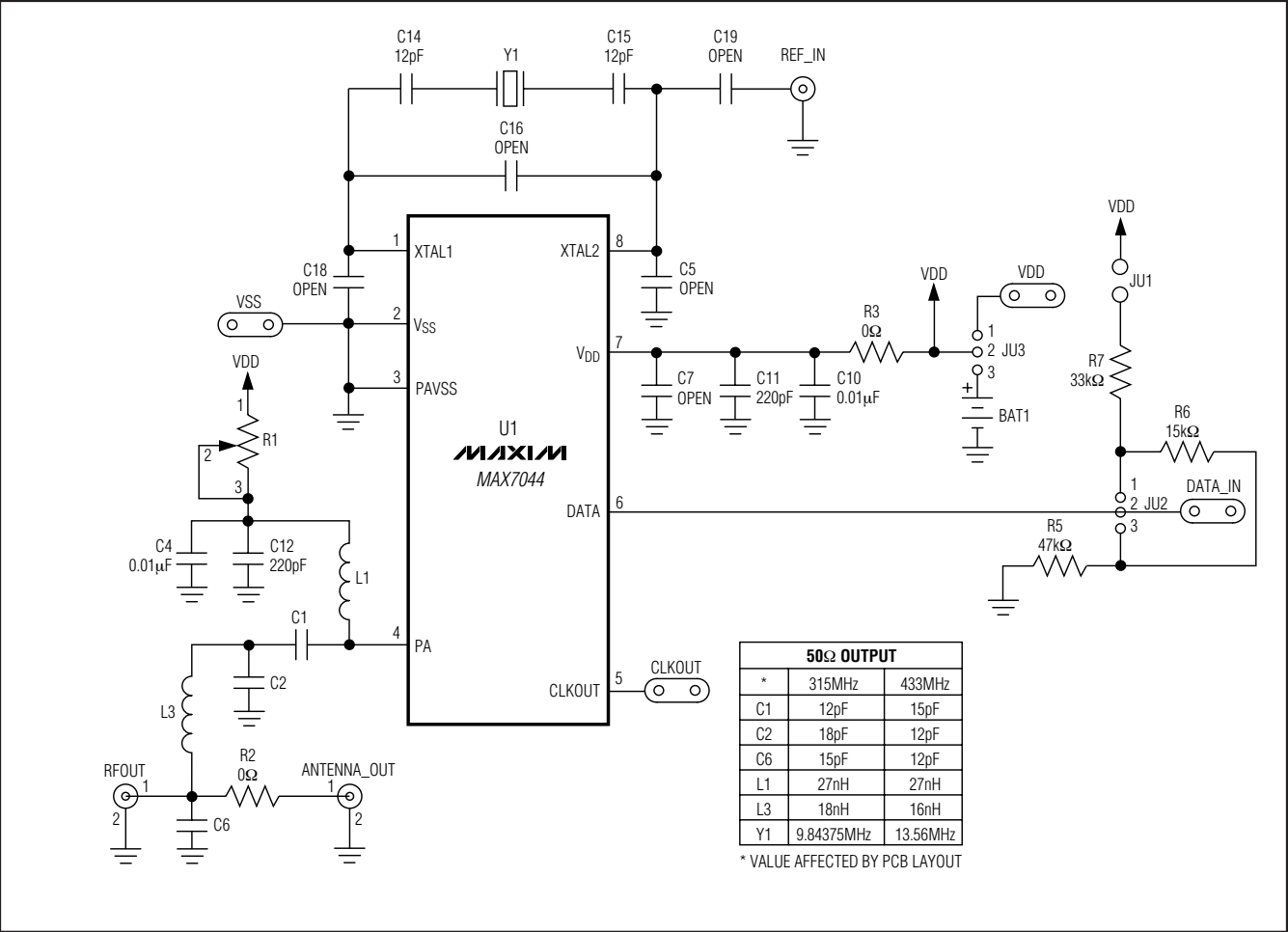


Figure 1. MAX7044 EV Kit Schematic

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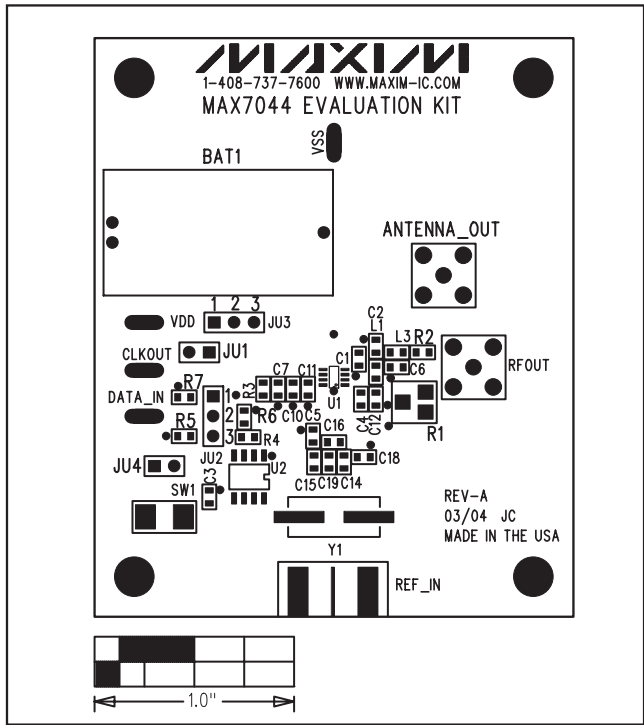


Figure 2. MAX7044 EV Kit Component Placement Guide—Component Side

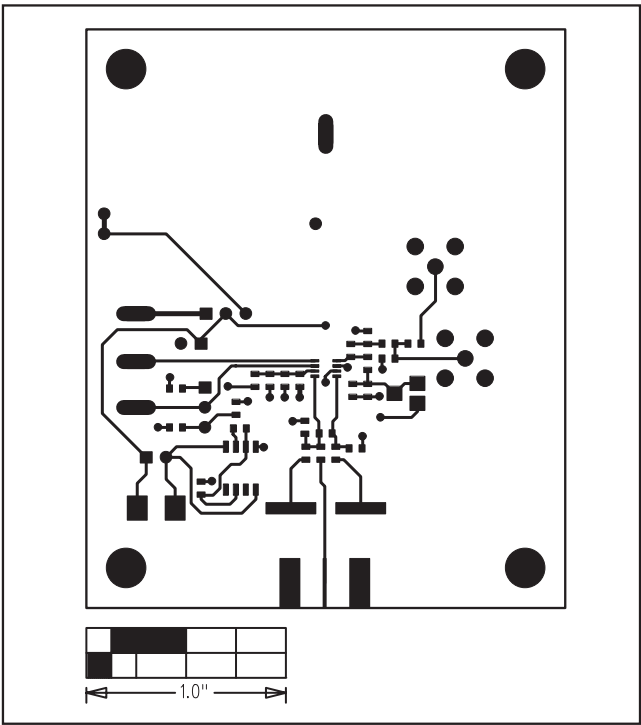


Figure 3. MAX7044 EV Kit PCB Layout—Component Side

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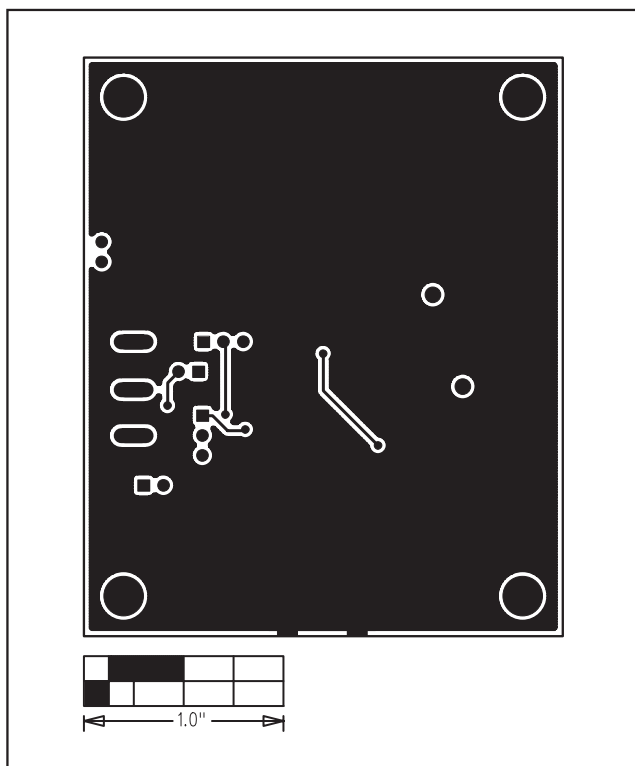


Figure 4. MAX7044 EV Kit PCB Layout—Solder Side

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## Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	3/05	Initial release	—
1	2/12	Updated <i>Component List</i> and Figure 1	1, 4

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