19-2907; Rev 1; 11/03

MAXIM

MAX1472 Evaluation Kit

Evaluates: MAX1472

General Description

The MAX1472 evaluation kit (EV kit) allows for a detailed evaluation of the MAX1472 ASK transmitter. It enables testing of the device's RF performance and requires no additional support circuitry. The RF output uses a 50Ω 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 MAX1472 EV 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 MAX1472 EV kit also features a proven PC board 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.

Features

- ♦ **Proven PC Board Layout**
- ♦ **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***
- ♦ **Fully Assembled and Tested**
- ♦ **Can Operate as a Stand-Alone Transmitter with Included Battery**

**Requires component changes*

Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX1472EVKIT-315	-40°C to +85°C	8 SOT23-8
MAX1472EVKIT-433	-40°C to +85°C	8 SOT23-8

Component List

DESIGNATION	QTY	DESCRIPTION
Antenna (315MHz)	0	315MHz 1/4 wave whip antenna Lynx ANT-315-CW-RH, not installed
Antenna (433MHz)	0	433MHz 1/4 wave whip antenna Lynx ANT-433-CW-RH, not installed
ANTENNA_OUT	1	SMA connector top mount, not installed Digi-Key J500-ND Johnson 142-0701-201
BAT1	1	Battery holder MPD BA2032
Battery	1	Coin-cell battery Panasonic BR2032
C1 (315MHz)	1	15pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H150J
C1 (433MHz)	1	7pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H7R0J
C2 (315MHz)	1	22pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H220J
C2 (433MHz)	1	12pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H120J
C3, C10	2	0.01µF ±10%, 50V ceramic capacitors (0603) Murata GRM188R71H103KA01
C4	1	680pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H681J
C5, C16, C18, C19	0	Not installed
C6 (315MHz)	1	15pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H150J
C6 (433MHz)	1	10pF ±5%, 50V ceramic capacitor (0603) Murata GRM1885C1H100J
C7	1	0.47µF +80% - 20%, 16V ceramic capacitor (0603) Murata GRM188F51C474Z

For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
C11, C12	2	220pF ±5%, 50V ceramic capacitors (0603) Murata GRM1885C1H221J
C14, C15	2	12pF ±5%, 50V ceramic capacitors (0603) Murata GRM1885C1H120J
JU1, JU4	2	2-pin headers Digi-Key S1012-36-ND or equivalent
JU1	3	Shunts Digi-Key S9000-ND or equivalent
JU2, JU3	2	3-pin headers Digi-Key S1012-36-ND or equivalent
L1 (315MHz)	1	27nH ±5% inductor (0603) Coilcraft 0603CS-27NXJB
L1 (433MHz)	1	22nH ±5% inductor (0603) Coilcraft 0603CS-22NXJB
L3 (315MHz)	1	22nH ±5% inductor (0603) Coilcraft 0603CS-22NXJB
L3 (433MHz)	1	15nH ±5% inductor (0603) Coilcraft 0603CS-15NXJB
R1	1	5kΩ potentiometer BC Components SM4W502
R2	0	0Ω resistor (0603), any, not installed
R3	1	5.1Ω resistor (0603), any
R4	1	36kΩ ±5% resistor (0603), any
REF_IN	1	RP-SMA connector Lynx CONREVSMA001
RFOUT	1	SMA connector top mount Digi-Key J500-ND Johnson 142-0701-201
SW1	1	Switch Panasonic EVQ-PJS04K
VDD, VSS, ENABLE, DATA-IN	4	Test points Mouser 151-203 or equivalent
U1	1	MAX1472EKA
U2	1	ICM7555ISA
Y1 (315MHz)	1	Crystal 9.84375 MHz Hong Kong Crystal SSL9843750E03FAFZ800 or Crystek 017000
Y1 (433MHz)	1	Crystal 13.56MHz Hong Kong Crystal SSM1356000E03FAFZ800 or Crystek 017001
—	1	MAX1472 EV kit PC board

Component Suppliers

SUPPLIER	PHONE	FAX
Coilcraft	800-322-2645	847-639-1469
Crystek	800-237-3061	941-561-1025
Hong Kong Crystal	852-2412 0121	852-2498 5908
Murata	800-831-9172	814-238-0490

Quick Start

The following procedure allows for proper device evaluation.

Required Test Equipment

- Regulated power supply capable of providing +3.0V
- Spectrum analyzer such as the Agilent 8562E
- Optional ammeter for measuring supply current
- 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 +10dBm at 315MHz (or 433.92MHz).
4) Disconnect the spectrum analyzer and connect the power meter instead. Measure the output power and also the current draw.

5) Calculate the efficiency. This is done using the following equation:

Efficiency = 10 ^ (Pout / 10) / (V x I)

where I is in mA.

For example, the efficiency is 46.6% for an output of +11dBm, and a current of 9mA (at 3.0V).

Layout Issues

A properly designed PC board 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 λ/10 or longer can act as antennas.

Keeping the traces short also reduces parasitic inductance. Generally, 1in of a PC board 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 PC board can serve as a reference design for laying out a board using the MAX1472.

Detailed Description

Enable Control

The MAX1472 can be controlled externally using the ENABLE connector. The IC draws approximately 1nA (at room temperature) in shutdown mode. Jumper JU1 is used to control this mode. The shunt can be placed between pins 1 and 2 for continuous operation. Remove the JU1 shunt for external control. See Table 1 for jumper function descriptions.

Table 1. Jumper Functions

JUMPER	STATE	FUNCTION
JU1	1-2	Normal operation
JU1	NC	External power-down control
JU2	1-2	RF carrier-transmit mode
JU2	2-3	Transmit pulse-train mode
JU2	NC	External data transmit
JU3	1-2	External supply operation
JU3	2-3	Battery operation
JU4	1-2	Continuous data generation
JU4	NC	Data controlled by SW1

Data Input

The MAX1472 EV kit transmits ASK data with data rates up to 100kbps. JU2 controls whether the MAX1472 transmits CW (jumper pins 1 and 2 connected), an external data stream (no jumper), or train pulses generated by the ICM7555 timer (jumper pins 2 and 3 connected). JU4 controls whether the ICM7555 data is being generated continuously or at the push of SW1.

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 0.01µF capacitors).

Battery Operation

The MAX1472 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 MAX1472 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 50Ω. ANTENNA_OUT is a reverse polarity SMA and is used to connect to a 1/4 wave whip antenna . Note that resistor R2 (0Ω) needs to be added.

I/O Connections

Table 2 lists all I/O connections.

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
ENABLE	External power-down control

For additional information and a list of application notes, consult the Maxim website, www/maxim-ic.com.

MAX1472 Evaluation Kit

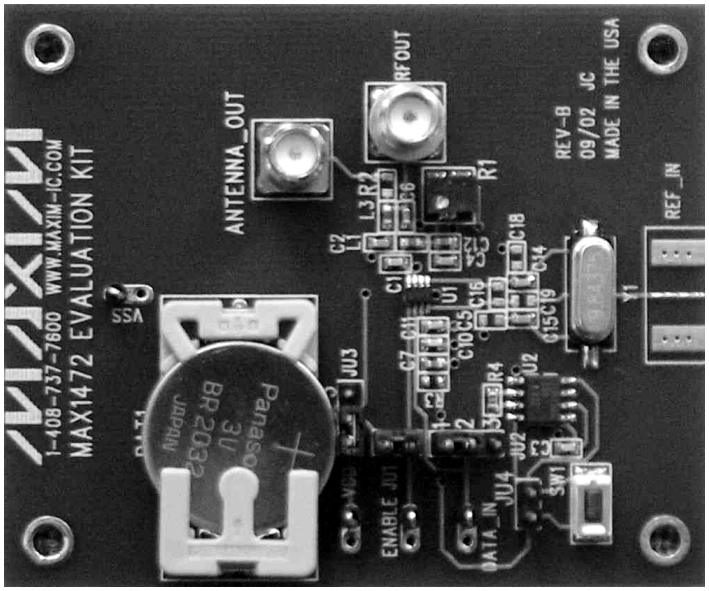


Figure 1. MAX1472 EV Kit

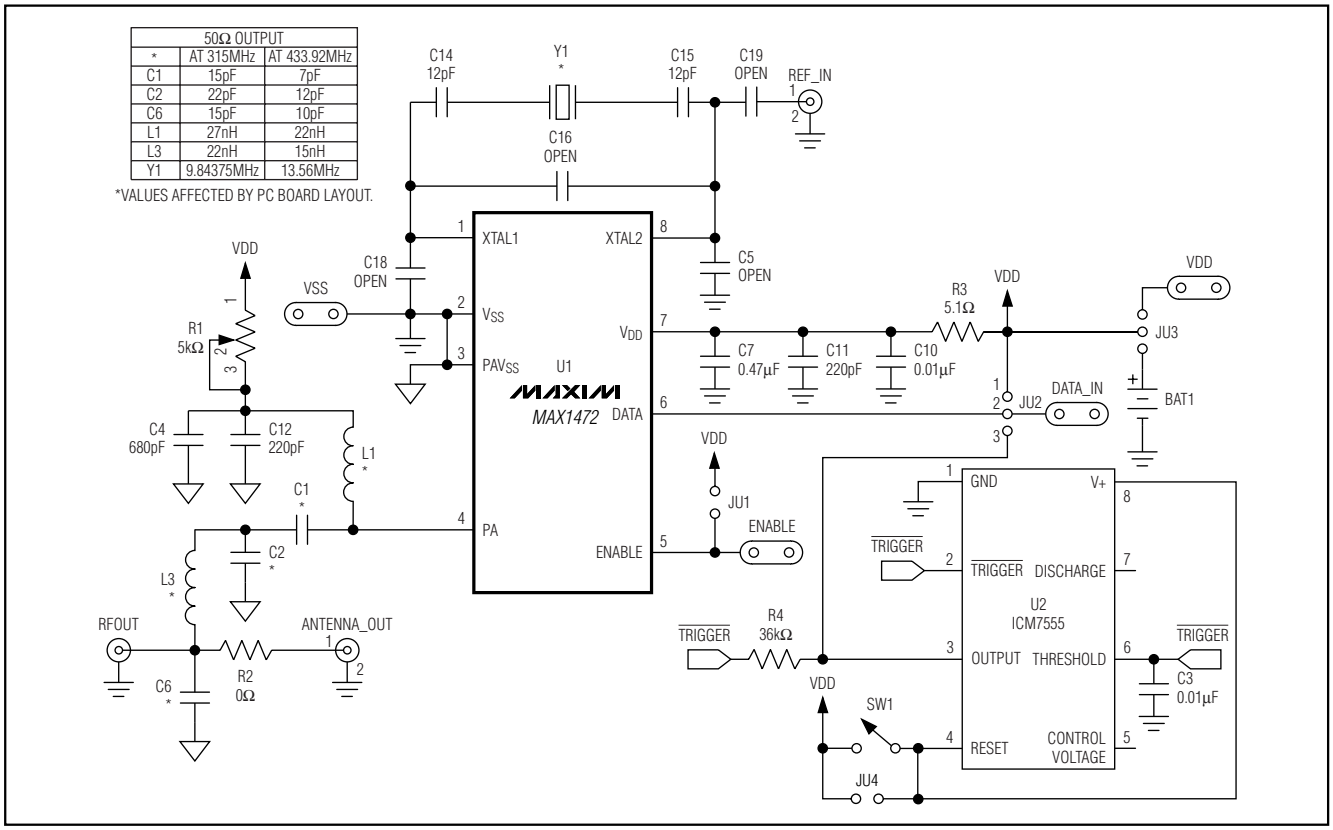


Figure 2. MAX1472 EV Kit Circuit Diagram

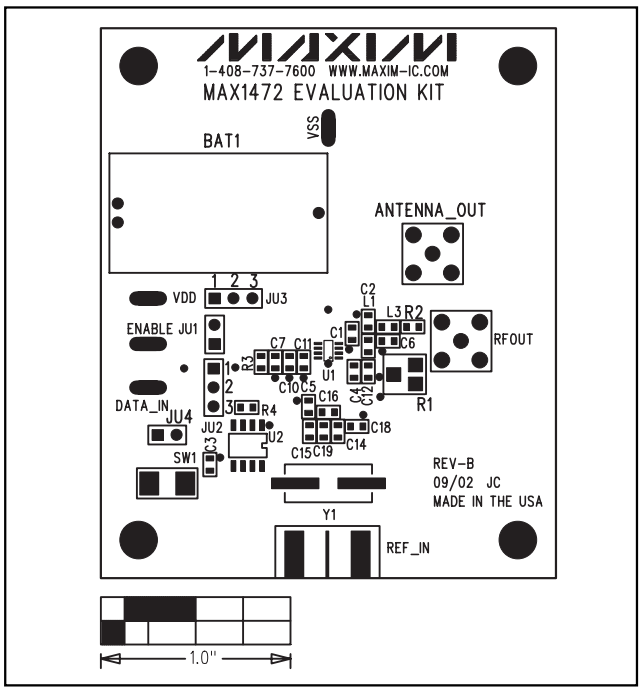


Figure 3. MAX1472 EV Kit Component Placement Guide—Top Silkscreen

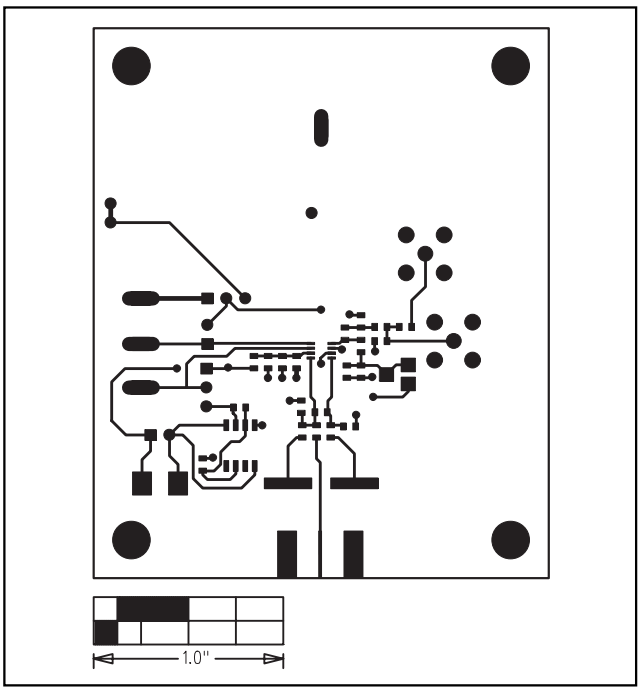


Figure 4. MAX1472 EV Kit PC Board Layout—Top Copper

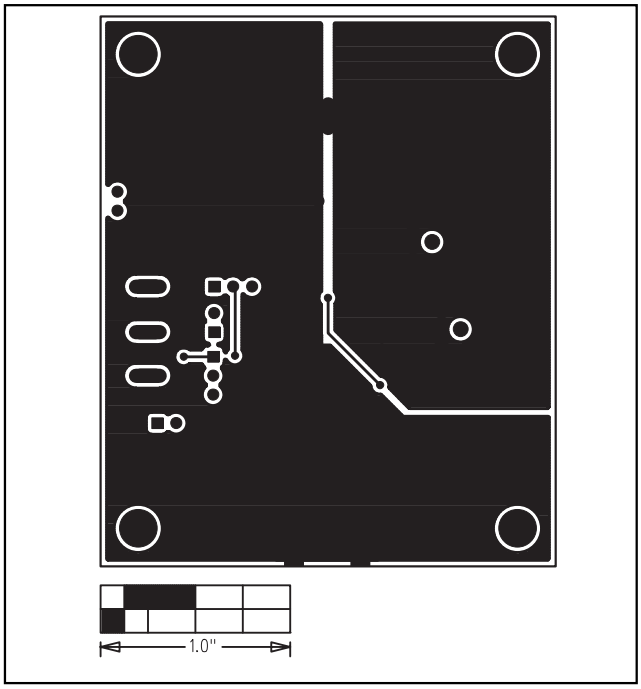


Figure 5. MAX1472 EV Kit PC Board Layout—Bottom Copper

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