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MAX2420 Evaluation Kit

_____General Description

The MAX2420 evaluation kit (EV kit) simplifies evaluation of the MAX2420 900MHz image-reject transceiver.

The EV kit provides 50Ω SMA connectors for all RF inputs and outputs. A varactor-based tank circuit is provided for the MAX2420 VCO and can be tuned by a potentiometer or external voltage. The VCO can be overdriven by an external source, if desired.

Switches are provided to control power-management features.

_____Ordering Information

PART	TEMP. RANGE	BOARD TYPE
MAX2420EVKIT-SO	-40°C to +85°C	Surface Mount

_____Features

♦ **50Ω SMA Ports for Testing Transmit and Receive Paths**

♦ **SMA Port for Prescaler Output**

♦ **Switches Included to Control Power-Management Features**

♦ **VCO Frequency, Receiver Gain, and Transmitter Gain Adjustable via On-Board Potentiometers or External Inputs**

♦ **Fully Assembled and Tested**

_____Component List

DESIGNATION	QTY	DESCRIPTION
C1, C4, C5, C7, C9, C10, C12, C15, C19, C21–C24, C28, C32	15	47pF ceramic capacitors
C2, C3	2	10pF ceramic capacitors
C6, C14	2	0.1µF ceramic capacitors
C8, C11, C13, C20, C25, C29, C30, C31	8	0.01µF ceramic capacitors
C16	1	1000pF ceramic capacitor
C17, C18	2	10µF, ±10%, 10V tantalum capacitors AVX TAJB106K010 or Sprague 2930106X90010B
C27	0	Not installed
D1	1	Dual-varactor diode Alpha SMV1204-199
JU2, JU3, JU4, JU7, JU8	5	Shunts
JU2, JU3, JU4, JU7, JU8, GND, VEXT, DGND	8	2-pin headers
L1	1	22nH inductor Coilcraft 0805CS-220XMBC
L2	1	8.2nH inductor Coilcraft 0805CS-080XMBC
L3	1	8.2nH inductor Toko LL2012-F8N2K

DESIGNATION	QTY	DESCRIPTION
L4	1	100nH inductor Coilcraft 0805CS-101XKBC
L5, L7	0	Not installed
L6	1	12nH inductor Coilcraft 0805CS-120XMBC
L8	1	18nH inductor Coilcraft 0805CS-180XMBC
L9	1	82nH inductor Coilcraft 0805CS-820XKBC
LNAGAIN, TXGAIN, VCOADJ	3	1-pin headers
R1, R2, R3	3	10kΩ potentiometers
R4, R5	2	1kΩ, 5% resistors
R6, R7	2	10Ω, 5% resistors
R8	1	47kΩ, 5% resistor
R9, R14–R17	5	10kΩ, 1% resistors
R10, R13	2	Not installed
R12, R19	2	301Ω, 1% resistors
R18, R20	2	49.9Ω, 1% resistors
RXIN, RXOUT, TXOUT, TXIN, PREOUT, EXT LO INPUT	6	SMA connectors (PC edge mount)
SW1	1	5-position dip switch
U1	1	MAX2420EAI 28SSOP

For free samples & the latest literature: http://www.maxim-ic.com, or phone 1-800-998-8800.
For small orders, phone 408-737-7600 ext. 3468.

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_____Component Suppliers

SUPPLIER*	PHONE	FAX
Alpha Industries	(617) 935-5150	(617) 933-2359
AVX	(803) 946-0690	(803) 626-3123
Coilcraft	(847) 639-6400	(847) 639-1469
Sprague	(603) 224-1961	(603) 224-1430

Please indicate that you are using the MAX2420 when contacting these component suppliers.

_____Quick Start

The MAX2420 EV kit is fully assembled and factory tested. **Do not turn on the DC power and signal sources until all connections are made.**

Test Equipment Required

- RF-signal generator capable of generating frequencies up to 1GHz
- Spectrum analyzer with frequency range at least to 3GHz, such as the HP8561
- Power supply capable of +2.7V to +5.5V output at 100mA

Connections and Signal Conditions

1) Verify that all shunts are installed across jumpers JU2, JU3, JU4, JU7, and JU8.

2) Verify that switch positions 1 through 5 on SW1 are set at the "logic 0" position.

3) Set the power supply to 3.3V, and set the current limit to 100mA.

4) Connect the power supply to the VEXT and GND terminals on the EV kit.

5) For testing the receive path, set the signal-source frequency to 915MHz and the power level to -35dBm. For testing the transmit path, set the signal-source frequency to 10.7MHz and the power level to -0.8dBm.

Analysis

1) Turn on the on-chip oscillator by setting switch VCOON to "logic 1." To observe the VCO frequency, set switch DIV 1 to "logic 1" (disabling the prescaler and enabling the buffer amplifier) and connect an SMA cable from the spectrum analyzer to the PREOUT port. Set the VCO frequency to 925.7MHz by adjusting VCOADJ (R3). The VCO tuning range is typically 180MHz and may vary slightly due to tolerances in the varactor diodes.

2) The receive conversion gain can be evaluated by setting switch RXON to "logic 1," applying a 915MHz signal to the RXIN port, and observing the RXOUT port at 10.7MHz with the spectrum analyzer. The gain of the LNA in the receiver path can be adjusted by varying R2.

Note: R12 and R18 are used as a resistive matching network to present an optimum 330Ω impedance to the RXOUT pin. This network results in a 14.2dB loss in the receiver path. Therefore, 14.2dB must be added to the power level observed on the spectrum analyzer to obtain the true receive output power. For example, with LNAGAIN set at V_{CC} and the receive input level set at -35dBm, the receive output observed on the spectrum analyzer is approximately -27.2dBm. The true receive conversion gain is -27.2 - (-35) + 14.2 = 22dB.

If desired, pads for C8, R18, C30, R12, L5, and C20 can be used to build a custom reactive-matching network.

3) Receive image rejection can be evaluated by changing the receive input frequency to 936.4MHz (while keeping the LO at 925.7MHz) and comparing the output signal level against the one measured in step 2.

4) Before evaluating the transmitter, ensure that the receiver is disabled by setting switch RXON to "logic 0." The transmit conversion gain can be evaluated by setting switch TXON to "logic 1", applying a 10.7MHz signal at -0.8dBm to the TXIN port, and observing the TXOUT port at 915MHz with a spectrum analyzer. The gain of the input buffer amp in the transmit path can be adjusted by varying R1.

Note: R19 and R20 are used as a resistive matching network to present an optimum 330Ω impedance to the TXIN pin. This network results in a 14.2dB loss in the transmit path. Therefore, 14.2dB must be subtracted from the signal source's power to obtain the input power applied to the MAX2420 (-15dBm). With TXGAIN set at 2V and the transmit input level set at -0.8dBm, the transmit output observed on the spectrum analyzer is approximately -4dBm. The transmit conversion gain is -4 - (-15) = 11dB.

If desired, pads for R19, R20, C11, L7, and C25 can be used to build a custom reactive-matching network.

5) Tx image rejection can be evaluated by comparing the desired lower sideband at 915MHz against the unwanted upper sideband at 936.4MHz.

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Adjustments and Control

VCOADJ

The VCO frequency can be tuned by adjusting on-board potentiometer R3. It can also be tuned by first removing the shunt from jumper JU7 and then applying an external voltage via the VCO ADJ terminal. The supply providing the external voltage must be properly bypassed to minimize noise added to the LO.

LNAGAIN

The LNA gain can be adjusted using on-board potentiometer R2. LNA gain control can also be accomplished by first removing the shunt from jumper JU2 and then applying an external voltage via the LNA GAIN terminal.

TXGAIN

The transmit buffer amp gain can be adjusted using on-board potentiometer R1. Transmit gain control can also be accomplished by first removing the shunt from jumper JU3 and then applying an external voltage via the TXGAIN terminal.

RXON and TXON

The receive and transmit sections are enabled by setting switches RXON and TXON to "logic 1," respectively. Since the transmit and receive sections share an LO and an IF frequency, interference will result if both sections are active at the same time. When testing either the receive or transmit section, always disable the other section.

To disable all chip functions, set all switches to "logic 0." To obtain an accurate reading of the device shutdown current, remove the shunt from JU4 and move the V_{CC} connection from the VEXT terminal to the left side of JU4.

Prescaler Control

The function of PREOUT is controlled by the switches labeled "DIV1" and "64" (Table 1).

Table 1. PREOUT Function Control Switches

PREOUT FUNCTION	SWITCH POSITIONS	
	DIV1	64
LO buffered output	Logic 1	Don't care
Prescaler, ÷64	Logic 0	Logic 1
Prescaler, ÷65	Logic 0	Logic 0

Layout Considerations

The MAX2420 EV board can serve as a guide for your board layout. Take care in laying out the oscillator tank circuit. Oscillation frequency is sensitive to parasitic PC board capacitance, trace inductance, and package inductance. Keep the tank layout as symmetrical, tightly packed, and close to the device as possible to minimize LO feedthrough. When using a PC board with a ground plane, a cutout in the ground plane below the oscillator tank reduces parasitic capacitance. Also, keep traces carrying the receive and transmit signals as short as possible to minimize radiation and insertion loss due to the PC board.

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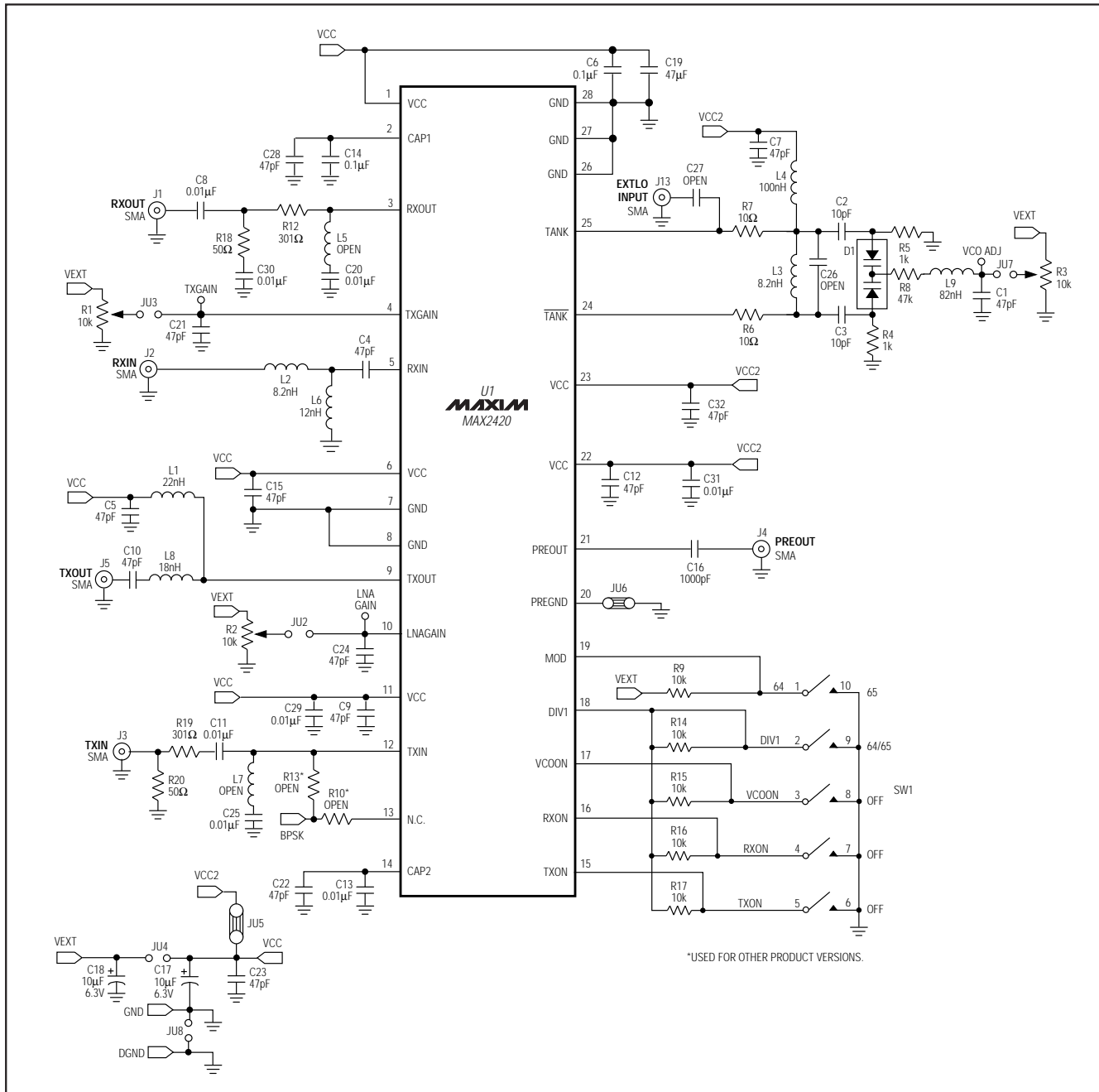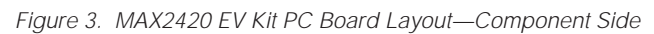Figure 1. MAX2420 EV Kit Schematic

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Figure 2. MAX2420 EV Kit Component Placement Guide—
Component Side

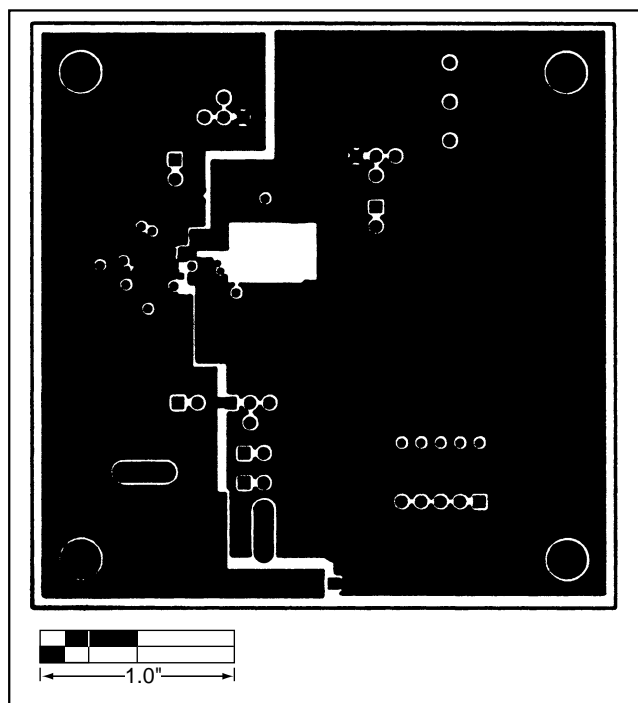Figure 3. MAX2420 EV Kit PC Board Layout—Component Side

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Figure 4. MAX2420 EV Kit PC Board Layout—Ground Plane
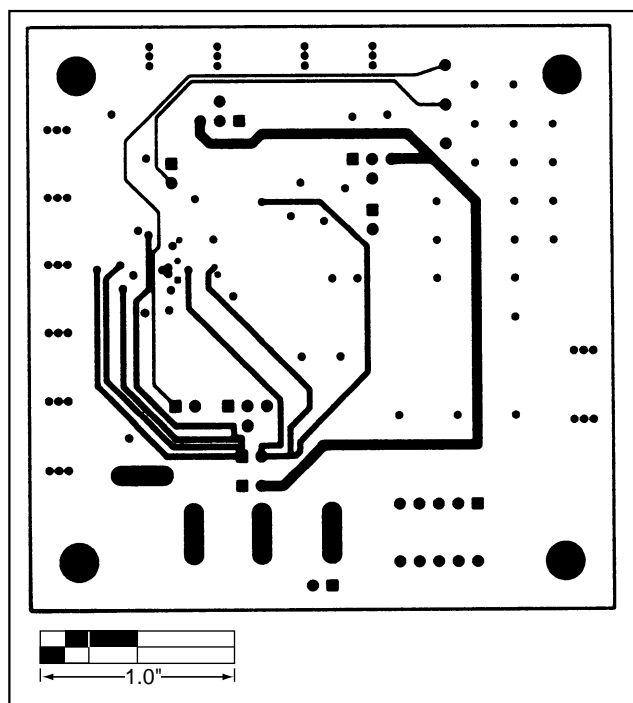
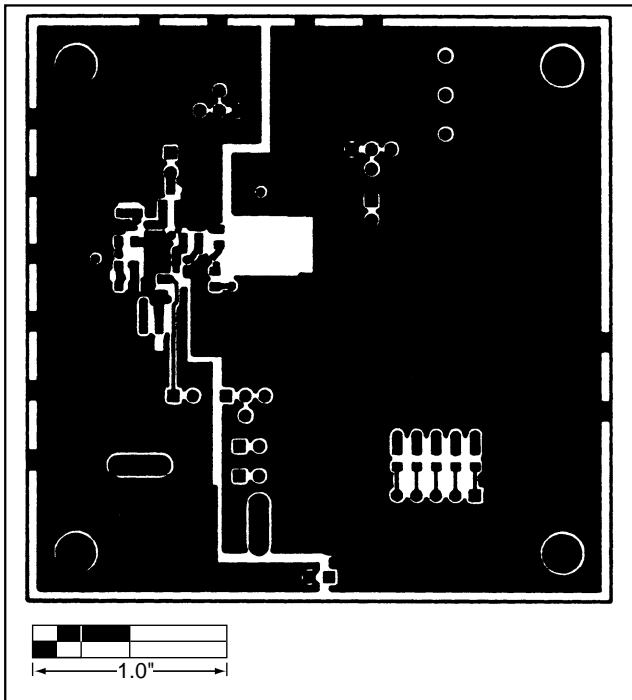Figure 5. MAX2420 EV Kit PC Board Layout—Power Plane

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Figure 6. MAX2420 EV Kit PC Board Layout—Solder Side

Evaluates: MAX2420

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