



# Quadruple-Mode LNA/Mixer Evaluation Kits

## General Description

The MAX2530/MAX2531/MAX2538 evaluation kits (EV kits) simplify evaluation of the MAX2351/MAX2354/MAX2358/MAX2359/MAX2530/MAX2531/MAX2537/MAX2538 high-performance, silicon germanium (SiGe) BiCMOS, quad-mode LNA/mixer ICs. They enable testing of the devices' RF performance and require no additional support circuitry. The signal inputs and outputs use SMA connectors to simplify the connection of RF test equipment.

The MAX2530/MAX2531/MAX2538 EV kits are assembled with an associated IC and incorporate input- and output-matching components optimized for the 869MHz to 894MHz cellular frequency band, 1930MHz to 1990MHz PCS frequency band, 1575.42MHz GPS frequency band, and 183.6MHz IF output frequency. All matching components can be changed to work at other frequencies.

Use the *Evaluation Kit Selector Guide* to determine which EV kit to order based on the application. For example, to evaluate the MAX2354, use the MAX2530EVKIT.

## Features

- ◆ 50Ω SMA Ports for Easy Testing
- ◆ 2.7V to 3.3V Single-Supply Operation
- ◆ Matched to Cellular, PCS, and GPS Bands
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX2530EVKIT	-40°C to +85°C	28 QFN-EP*
MAX2531EVKIT	-40°C to +85°C	28 QFN-EP*
MAX2538EVKIT	-40°C to +85°C	28 QFN-EP*

\*EP = Exposed pad.

## Component List

DESIGNATION	QTY	DESCRIPTION
BAND, BUF_EN, G1, G2, IF_SEL, MODE, PLL_EN, SHDN	8	3-pin headers
C1, C2, C5, C9, C10, C14	6	2.7pF ±0.1pF capacitors Murata GRP1555C1H2R7B
C3	1	8.2pF ±0.1pF capacitor Murata GRP1555C1H8R2B
C4	1	10μF, 16V capacitor Panasonic ECS-T1CX106R
C6	1	1.8pF ±0.1pF capacitor Murata GRP1555C1H1R8B
C7, C8, C13, C24	4	1000pF ±10% capacitors Murata GRP155R71H102K
C11	1	1000nF ±10% capacitor Murata GRM188F51A105Z
C12, C16	2	100pF ±5% capacitors Murata GRP1555C1H101J
C15	1	1.2pF ±0.1pF capacitor Murata GRP1555C1H1R2B

DESIGNATION	QTY	DESCRIPTION
C17	1	2.4pF ±0.1pF capacitor Murata GRP1555C1H2R4B
C25–C29	5	6800pF ±10% capacitors Murata GRP155R71E682K
CLNA_IN, CLNA_OUT, CMIX_IN, GLNA_IN, GLNA_OUT, GMIX_IN, GPS_IF, IF1, IFO, LO_IN, LO_OUT, PLL_OUT, PLNA_IN, PLNA_OUT, PMIX_IN	15	SMA connectors, edge mount
GND, VCC	2	2-pin headers
JU1, JU2	2	2-pin headers
L1, L3, L6, L7, L8, L13	6	120nH ±5% inductors (0603) Coilcraft 0603CS-R12XJB
L2, L14	2	3.3nH ±5% inductors (0402) Coilcraft 0402CS-3N3XJB
L4	1	1.0nH ±5% inductor (0402) Coilcraft 0402CS-1N0XJB

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## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
L5	1	7.5nH $\pm$ 5% inductor (0402) Coilcraft 0402CS-7N5XJB
R1, R3	2	3.3k $\Omega$ $\pm$ 1% resistors (0402)
R2	1	8.2k $\Omega$ $\pm$ 1% resistor (0402)
R4	1	10k $\Omega$ $\pm$ 5% resistor (0402)
R15	1	20k $\Omega$ $\pm$ 1% resistor (0402)
T1, T2, T3	3	4:1 balun transformers Toko 617DB-1018
U1	1	MAX2530ETI for MAX2530EVKIT MAX2531ETI for MAX2531EVKIT MAX2538ETI for MAX2538EVKIT

## Evaluation Kit Selector Guide

TO EVALUATE	USE
MAX2351	MAX2531EVKIT
MAX2354	MAX2530EVKIT
MAX2358	MAX2538EVKIT
MAX2359	MAX2538EVKIT
MAX2530	MAX2530EVKIT
MAX2531	MAX2531EVKIT
MAX2537	MAX2538EVKIT
MAX2538	MAX2538EVKIT

## Quick Start

The MAX2530/MAX2531/MAX2538 EV kits are fully assembled and factory tested. Follow the instructions in the *Connections and Setup* section for proper device evaluation. Figure 1 shows the schematic. Figures 2 through 7 are component placement guides and PC board layouts.

### Test Equipment Required

This section lists the test equipment recommended to verify operation of the MAX2530/MAX2531/MAX2538 EV kits. It is intended as a guide only, and some substitutions are possible.

- Two RF signal generators capable of delivering 0dBm of output power up to 2.5GHz (HP 8648C or equivalent)
- An RF spectrum analyzer capable of covering the operating frequency range of the devices as well as a few harmonics (HP 8561E, for example)

- A power supply capable of 50mA at 2.7V to 3.3V
- (Optional) An ammeter for measuring the supply current
- 50 $\Omega$  SMA cables
- (Optional) A network analyzer (HP 8753D, for example) to measure small-signal return loss and gain

### Connections and Setup

This section provides a step-by-step guide to operating the EV kits and testing the devices' functions. Do not turn on DC power or RF signal generators until all connections are made.

#### Testing the LNA

- 1) Set the jumpers for the desired mode according to Table 1 and Table 2.
- 2) Connect a DC supply (preset to 2.75V) to the V<sub>CC</sub> and GND terminals (through an ammeter, if desired) on the EV kit.
- 3) Set the RF generator and spectrum analyzer to operate at the frequency of 881MHz for cellular, 1960MHz for PCS, or 1575.42MHz for GPS at a power level of -30dBm.
- 4) Connect the output of the RF generator to the respective LNA SMA connector, and connect the coaxial cable from the LNA output SMA connector to the spectrum analyzer.
- 5) Turn on the DC supply and activate the RF generator's output.
- 6) The signal that appears on the spectrum analyzer should have a magnitude of approximately -15dBm in high-gain mode.
- 7) (Optional) Another method for determining the gain is using a network analyzer. This has the advantage of displaying gain vs. a swept frequency band, in addition to displaying input and output return loss. Refer to the user manual of the network analyzer for setup details.

#### Testing the Mixer

- 1) Set the jumpers for the desired mode according to Table 1 and Table 2.
- 2) Connect a DC supply (preset to 2.75V) to the V<sub>CC</sub> and GND terminals (through an ammeter, if desired) on the EV kit.
- 3) Set one RF generator for an output frequency of 881MHz for cellular, 1960MHz for PCS, or 1575.42MHz for GPS at a power level of -30dBm. Connect the output of this generator to the respective mixer input SMA connector.

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- 4) Set a second RF generator output frequency according to Table 3, and connect it to the LO input port (LO\_IN).
- 5) Connect the coaxial cable from the desired IF port SMA connector to the spectrum analyzer. See Table 2 for IF port and jumper settings.
- 6) Set the spectrum analyzer center frequency to 183.6MHz.
- 7) Turn on the DC supply and activate the RF generators' outputs.
- 8) The signal that appears on the spectrum analyzer should have an amplitude of approximately -17dBm in high-gain mode.

## Layout

A good PC board layout is an essential part of an RF circuit design. The EV kit PC board can serve as a guide for laying out a board using the MAX2351/MAX2354/MAX2358/MAX2359/MAX2530/MAX2531/MAX2537/MAX2538. Put a decoupling capacitor close to the device's VCC pin to minimize supply coupling. Proper grounding of the GND pin is essential. Connect the GND pin to the ground plane either directly or through vias as close to the pin as possible. Keep traces carrying RF signals as short as possible to minimize radiation and insertion loss. Keep the differential mixer output traces together and of equal length to ensure signal balance. Solder the entire bottom-side exposed pad evenly to the board ground plane for proper device operation. Run the LNA input trace on the top layer of the PC board to avoid via-induced coupling. Minimize parallel RF traces to improve coupling loss and isolation. Use abundant ground vias between RF traces to minimize undesired coupling.

Evaluate: MAX2351/4/8/9/MAX2530/1/7/8

**Table 1. Modes of Operation**

BAND	OPERATING MODE	IF_SEL	G2	G1	MODE	BAND
Cellular	High gain/high linearity	0 = IF0 1 = IF1	LO	LO	HI	LO
	High gain/low linearity	0 = IF0 1 = IF1	LO	LO	LO	LO
	Midgain	0 = IF0 1 = IF1	LO	HI	X	LO
	Low gain	0 = IF0 1 = IF1	HI	HI	X	LO
	Ultra-low gain	0 = IF0 1 = IF1	HI	LO	X	LO
PCS	High gain/high linearity	0 = IF0 1 = IF1	LO	LO	HI	HI
	Low gain	0 = IF0 1 = IF1	HI	HI	X	HI
	Ultra-low gain	0 = IF0 1 = IF1	HI	LO	X	HI
GPS	GPS	X	LO	LO	LO	HI

X = Don't care.

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**Table 2. Jumper Settings**

NAME	FUNCTION
BUF_EN	LO Buffer Enable. On enables the LO buffer output, off disables LO buffer.
G1, G2, MODE, BAND	Set device operating modes according to Table 1.
IF_SEL	Selects IF Port. 0 selects IF0 port, 1 selects IF1 port.
JU1	V <sub>CC</sub> for PCS LNA. Can be used for monitoring the LNA current.
JU2	V <sub>CC</sub> for IF Ports. Can be used for monitoring the mixer current.
PLL_EN	PLL Enable. On enables the PLL drive output, off disables the PLL drive output.
SHDN	Shutdown. On for normal operation, off to shut down the device.

**Table 3. LO input (LO\_IN) Frequency for Mixer Testing**

PART	CELL (MHz)	PCS (MHz)	GPS (MHz)	LO GENERATION
MAX2530	1064.6	2143.6	2087.73	—
MAX2531	1064.6	1071.8	1043.865	LO multiplier
MAX2538	2129.2	2143.6	2087.73	LO divider

## Component Suppliers

SUPPLIER	PHONE	FAX	WEBSITE
AVX	843-448-9411	803-626-3123	www.avxcorp.com
Coilcraft	847-639-6400	803-639-1469	www.coilcraft.com
Murata	770-436-1300	770-436-3030	www.murata.com
Taiyo Yuden	800-348-2496	847-925-0899	www.t-yuden.com
Toko	847-297-0070	847-699-7864	www.toko.com

# Quadruple-Mode LNA/Mixer Evaluation Kits

Evaluate: MAX2351/4/8/9/MAX2530/1/7/8

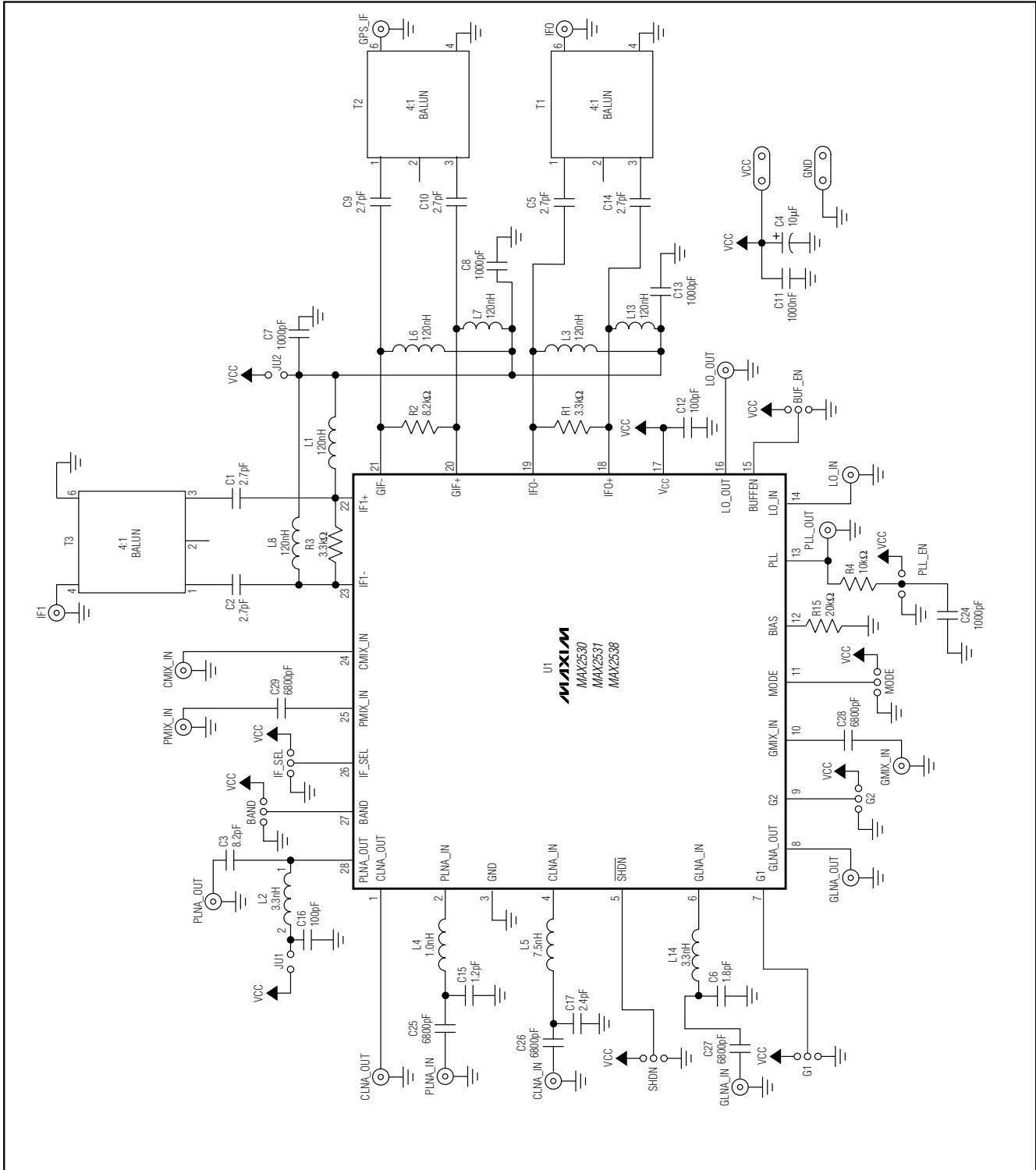


Figure 1. MAX2530/MAX2531/MAX2538 EV Kits Schematic



# Quadruple-Mode LNA/Mixer Evaluation Kits

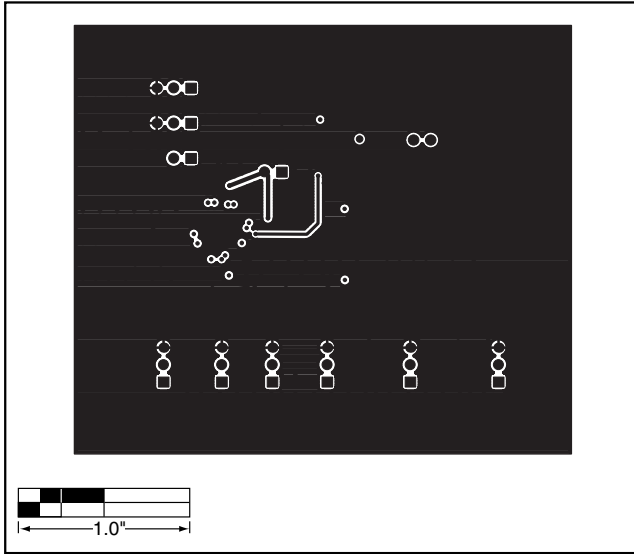


Figure 6. MAX2530/MAX2531/MAX2538 EV Kits PC Board Layout—Ground Plane Layer 3

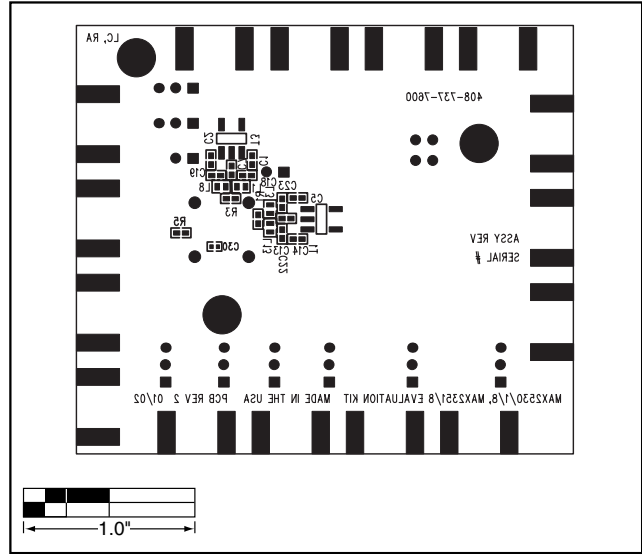


Figure 7. MAX2530/MAX2531/MAX2538 EV Kits Component Placement Guide—Solder Side

Evaluate: MAX2351/4/8/9/MAX2530/1/7/8

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