

## APPLICATION NOTE 887

# REP032: Lumped Element Output Match for the MAX2240 Nonlinear 2.45GHz Power Amplifier (PA)

*Abstract: This reference design (RD) uses lumped surface-mount components to improve the output matching network of a low-voltage RF nonlinear power amplifier (PA). The RD features the MAX2240 power amplifier which is compliant with Bluetooth®, HomeRF, and 802.11 standards.*

Rapid engineering prototypes are real circuits that Maxim application engineers have built and measured in our labs. They can provide a starting point for new RF designs. They are not available as evaluation kits.

**Additional information:**

- [Wireless product line page](#)
- [Data sheet for the MAX2240](#)
- [Applications technical support](#)



*Objective: To improve the low voltage 2.45GHz RF nonlinear PA's output matching network using mainly lumped surface-mount components.*

The MAX2240 is a 2.45GHz nonlinear RF power amplifier whose output match was originally developed with a series output transmission line and a sliding shunt capacitor. An open stub provided part of the match. A new output matching network for the MAX2240 was achieved by removing the open stub and replacing it with a capacitor series with inductor to ground. Then, the part was characterized for output power, supply current, and second-order harmonic with  $V_{CC} = 3.3V$  and  $P_{OUT} = 19dBm$ .

The MAX2240 is designed for applications in the 2.4GHz to 2.5GHz frequency range. It is compliant with Bluetooth, HomeRF, and 802.11 standards, as well as other FSK modulation systems. It features a high +20dBm output power, 2-bit digital power control with 4 output levels, and an integrated input match to 50Ω. Other features includes low 105mA operating current, 0.5mA low power shutdown mode current, and +2.7V to 5V single-supply operation. The MAX2240 is available in a UCSP™ package.

## Specifications Conformance Matrix Rev 1.0

**Test conditions:**

$V_{CC} = 3.3V$   
 $P_{OUT} = +19dBm$   
Temp = Room

All power levels have been called to input and output connectors

Frequency	P <sub>IN</sub>	I <sub>CC</sub>	Second-order harmonic		Third-order harmonic	
GHz	dBm	mA	dBm	dBm	dBm	dBm
2.4	-0.8	105	-26	-15	-14.5	NA
2.45	0.0	103	-23	-15	-14.8	NA
2.5	0.6	102	-21	-15	-14.7	NA

Note:

- Capacitor value: 1.1pF, Murata, GRM36C0G1r1B50
- Inductor value: 1.0nH, Murata, LQP10A1N0C00

## Bench Test Equipment List

Spectrum analyzer: HP8562EC x1

Signal Source: E4433B ESG-D

RF power meter: HP 438A

RF power sensor: HP 8482

## Circuit Modification Description Rev 1.0

- Remove the open stub section of output matching network of the MAX2240
- Shut a capacitor and inductor in series to ground
- Capacitor value: 1.1pF, Murata, GRM36C0G1r1B50
- Inductor value: 1.0nH, Murata, LQP10A1N0C00
- See the schematic for detail

## Schematic

[Schematic](#) (PDF, 131kB)

The Bluetooth word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Maxim is under license.

UCSP is a trademark of Maxim Integrated Products, Inc.

---

### Related Parts

[MAX2240](#) 2.5GHz, +20dBm Power Amplifier IC in UCSP Package

---

### Automatic Updates

Would you like to be automatically notified when new application notes are published in your areas of interest? [Sign up for EE-Mail™](#).

---

Application note 887: [www.maxim-ic.com/an887](http://www.maxim-ic.com/an887)

More information

For technical support: [www.maxim-ic.com/support](http://www.maxim-ic.com/support)

For samples: [www.maxim-ic.com/samples](http://www.maxim-ic.com/samples)

Other questions and comments: [www.maxim-ic.com/contact](http://www.maxim-ic.com/contact)

---

AN887, AN 887, APP887, Appnote887, Appnote 887

Copyright © by Maxim Integrated Products

Additional legal notices: [www.maxim-ic.com/legal](http://www.maxim-ic.com/legal)