

# PHS Power Amplifier Delivers +22dBm at -62/-75dBc ACPR

*This application note describes a power amplifier for the Personal Handy-Phone System (PHS), including a circuit design and bench test data. The design delivers +22dBm of output power using 160mA of supply current from a 3.0V supply voltage. It achieves +31dB of gain at 1.9GHz, and -62dBc and -75dBc of side-lobe suppression, exceeding PHS mask requirements of -55dBc and -60dBc. EVM contribution is only 2.5% at +22dBm.*

The MAX2247 SiGe Power Amplifier was originally designed for use in WLAN 802.11b and 802.11g applications. However, its excellent gain, power, and linearity make it suitable for other applications as well. This application note offers an application circuit and supporting bench test data for a PHS (Personal Handy-Phone System) application that uses the MAX2247.

The power amplifier is offered in the ultra-small 1.5mm x 2.0mm UCSP package, reducing board space and saving cost. The PA integrates a logic-level controlled shutdown feature, reducing supply current to less than 0.1uA. The PA also offers an adjustable bias current, offering an easy means to trade-off ACPR for supply current. The PA has been designed for single-cell Lithium-Ion applications that operate over the 3.0V to 4.2V supply range. Refer to the MAX2247 datasheet for further device information. Contact Maxim at [WLAN@maximhq.com](mailto:WLAN@maximhq.com) for layout files and further device information.

**Table 1. MAX2247 PHS Performance.**

$V_{CC} = 3.0V$ ,  $f = 1.9GHz$ ,  $T_A = +25C$ ,  $I_{BIAS} = 65mA$   
 Modulation = PHS  $\pi/4$  QPSK

Parameter	Performance
Output Power	22.0 dBm
Supply Current	160mA
Shutdown Supply Current	0.1uA
Gain	30.9 dB
ACPR (600kHz offset +/-100kHz)	-62.2dBc
ACPR (900kHz offset +/- 100kHz)	-75.2dBc

Error Vector Magnitude (EVM)(Total EVM = 3.0%, PHS Source EVM = 1.7%)	2.5%
2nd-Order Harmonic Level	-27dBc
3rd-Order Harmonic Level	-51dBc

**Table 2. MAX2247 PHS ACPR Performance Vs. Supply Voltage**

$P_{OUT} = +22\text{dBm}$ ,  $f = 1.9\text{GHz}$ ,  $T_A = +25\text{C}$

Supply Voltage(V)	Adjacent Channel Power Ratio(dBc)	
	600kHz +/- 100kHz	900kHz +/- 100kHz
3.0	-62.2	-75.2
3.6	-63.5	-74.0
4.2	-63.9	-75.1

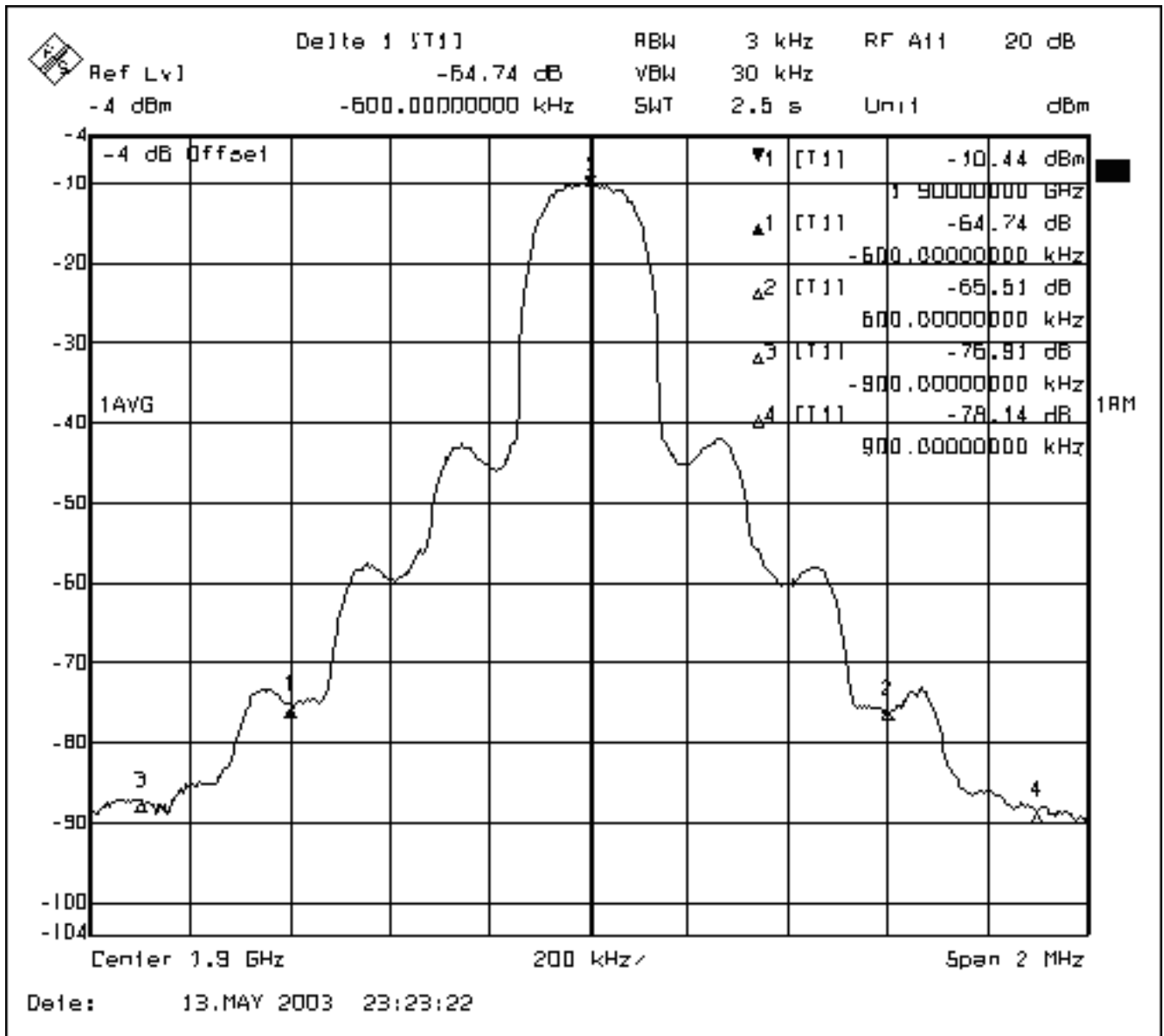


Figure 1. MAX2247 PHS Output Spectrum at +22dBm Output Power  
 $V_{CC} = +3.0\text{V}$ ,  $I_{CC} = 160\text{mA}$ ,  $f = 1.9\text{GHz}$ ,  $T_A = +25\text{C}$

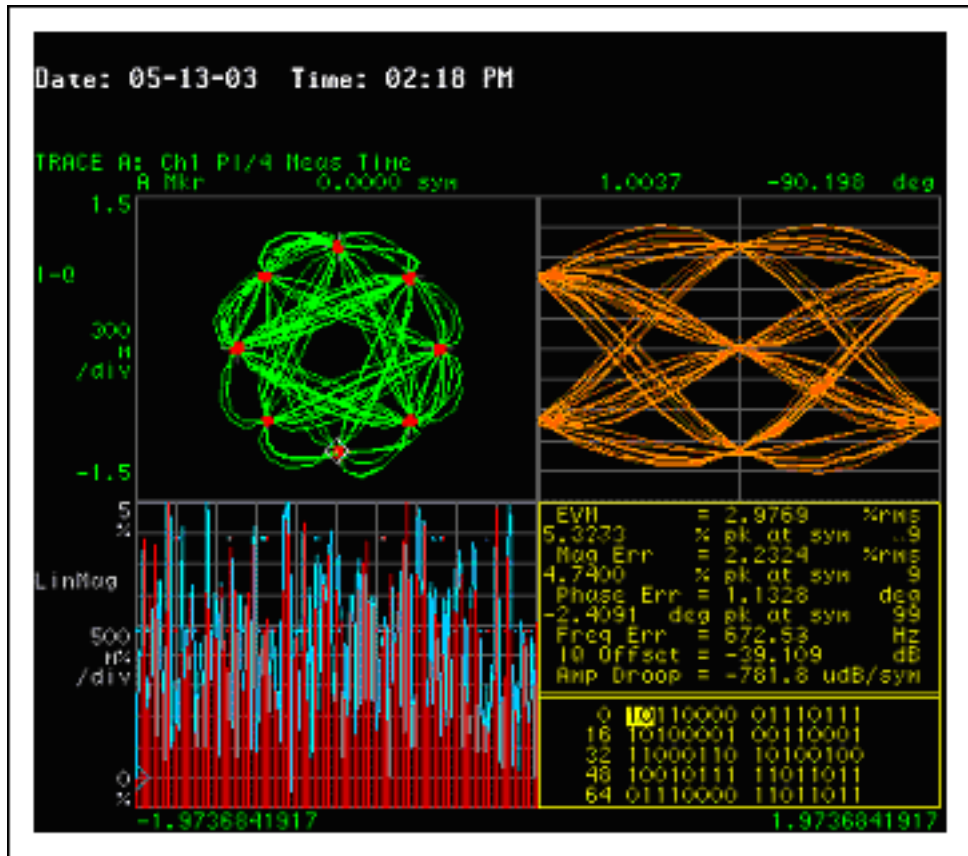


Figure 2. MAX2247 PHS EVM at +22dBm Output Power  
 $V_{CC} = +3.0V$ ,  $I_{CC} = 160mA$ ,  $f = 1.9GHz$   
 EVM of PHS signal source = 1.7%

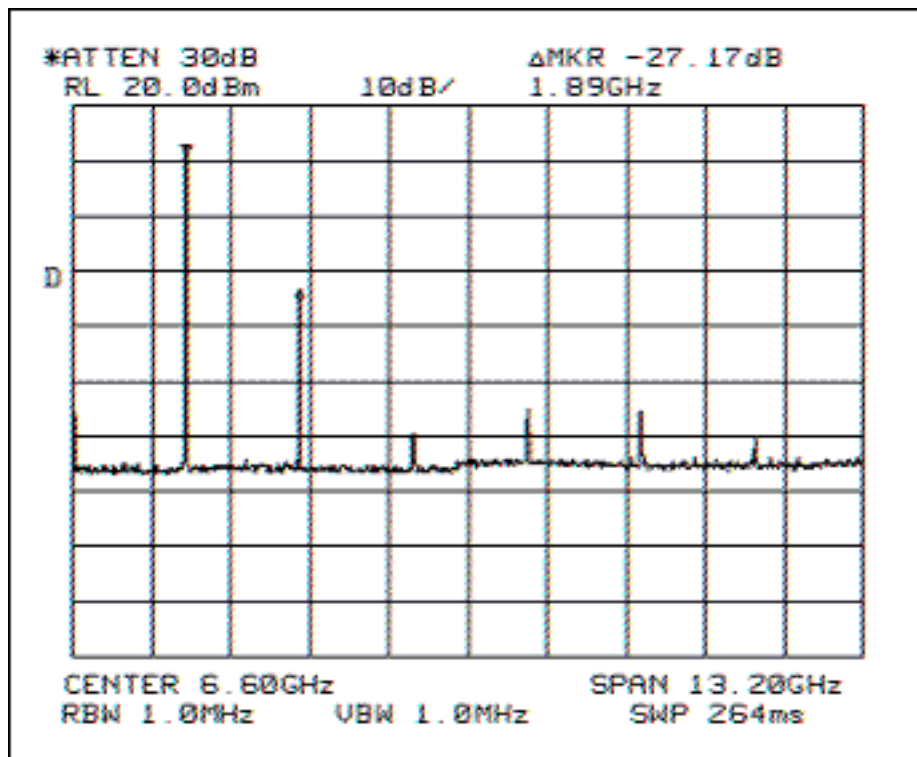


Figure 3. MAX2247 PA PHS Harmonic Levels  
 $P_{OUT} = +22dBm$ ,  $V_{CC} = +3.0V$ ,  $I_{CC} = 160mA$ ,  $f = 1.9GHz$

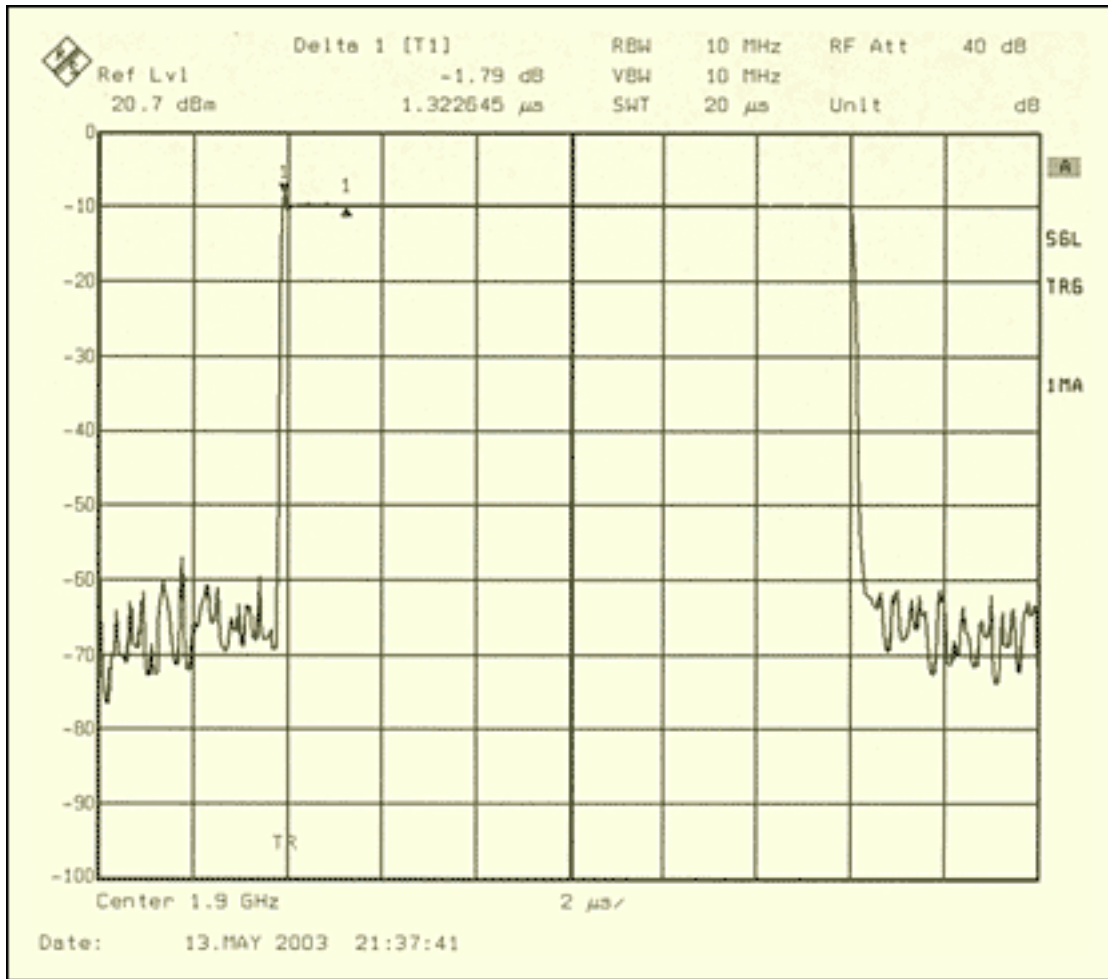


Figure 4. MAX2247 PHS Transient Response of Burst Transmission  
 $P_{OUT} = +22\text{dBm}$ ,  $V_{CC} = +3.0\text{V}$ ,  $I_{CC} = 160\text{mA}$ ,  $f = 1.9\text{GHz}$

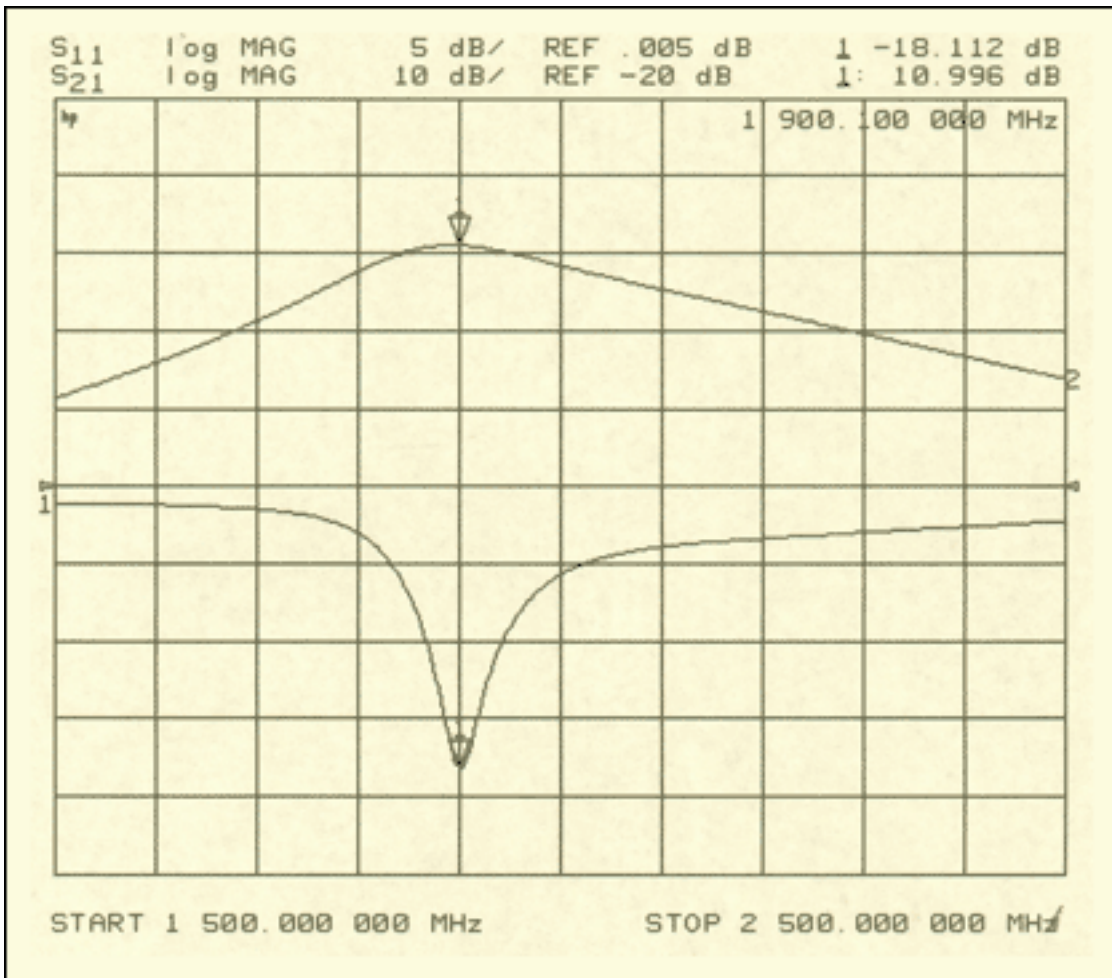


Figure 5. MAX2247 PA PHS Input Return Loss and Gain  
 $P_{OUT} = +22\text{dBm}$ ,  $V_{CC} = +3.0\text{V}$ ,  $I_{CC} = 160\text{mA}$ ,  $f = 1.9\text{GHz}$

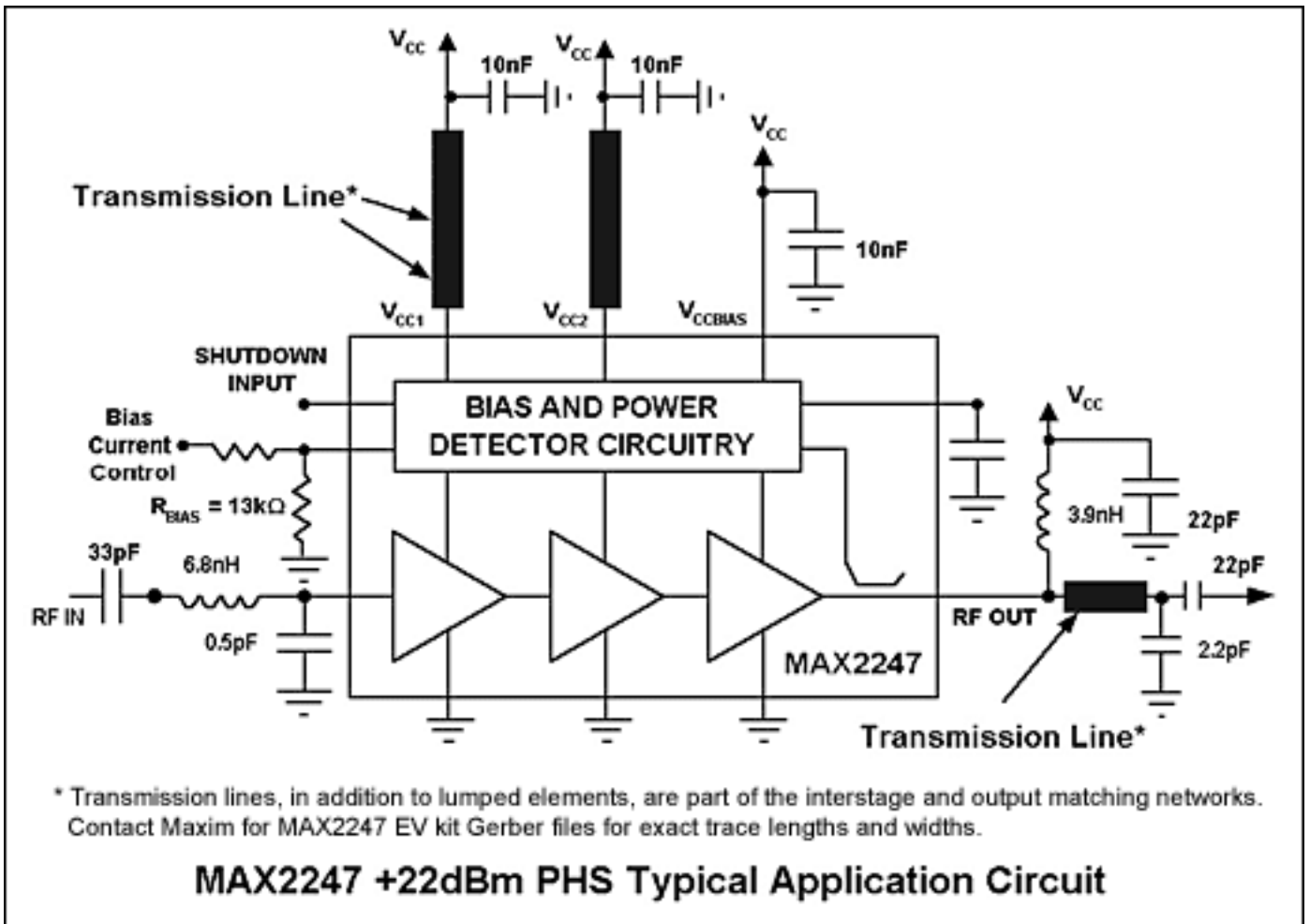


Figure 6. MAX2247 PHS +22dBm Power Amplifier Schematic

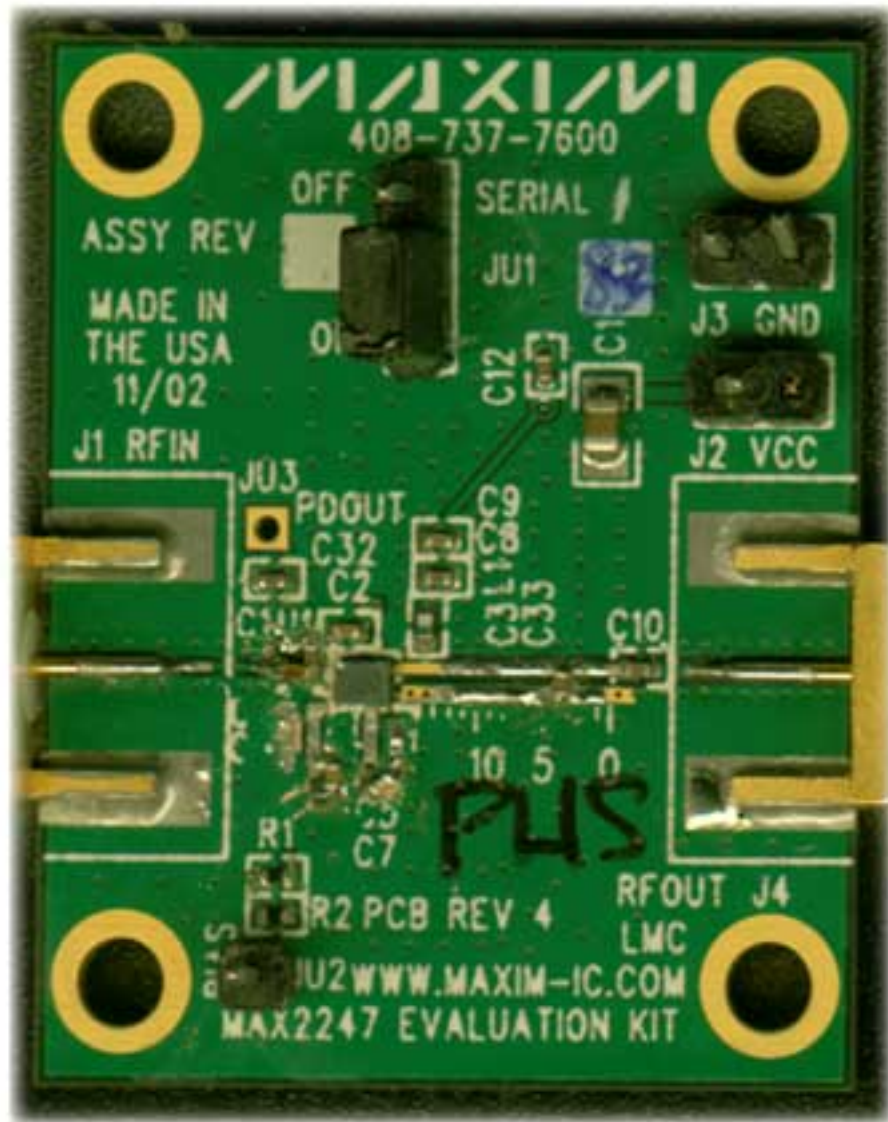


Figure 7. MAX2247 EV Kit Optimized for +22dB for PHS at 1.9GHz

### More Information

MAX2247: [QuickView](#) -- [Full \(PDF\) Data Sheet](#)