Keywords: PHS,Personal Handy System,Power Amplifier,PA,QPSK,1.9GHz,SiGe,Silicon Germanium

APPLICATION NOTE 3240

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

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Abstract: 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.

Click here for an overview of the wireless components used in a typical radio transceiver.

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 0.1µA. 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.comfor 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 π /4 QPSK

Parameter	Performance
Output Power	22.0dBm
Supply Current	160mA
Shutdown Supply Current	0.1µA
Gain	30.9dB
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} = +22dBm, f = 1.9GHz, T_A = +25C

SupplyVoltage (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

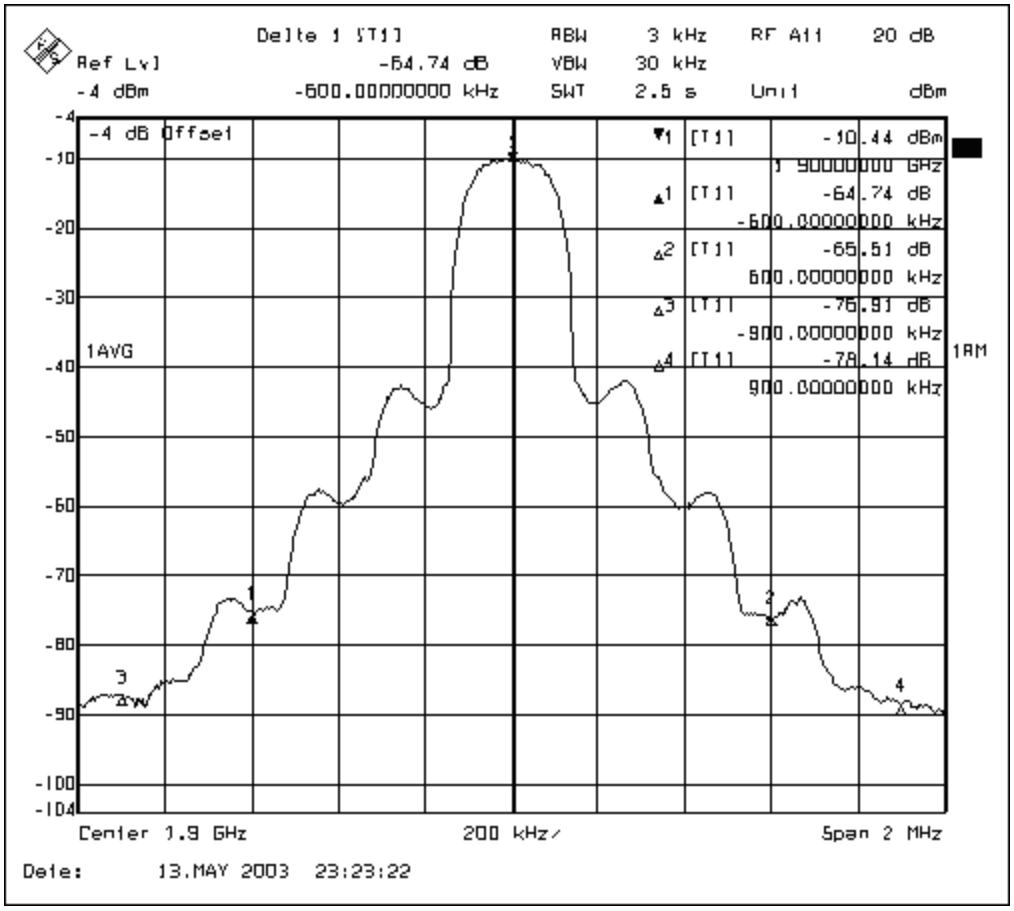

Figure 1. MAX2247 PHS output spectrum at +22dBm output power.
V_{CC} = +3.0V, I_{CC} = 160mA, f = 1.9GHz, T_A = +25C

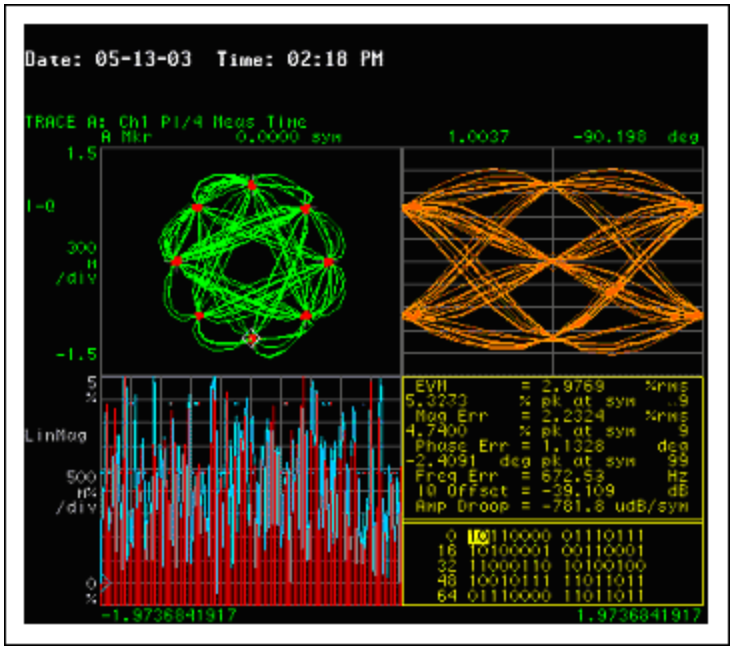

Figure 2. MAX2247 PHS EVM at +22dBm output power.
V_{CC} = +3.0V, I_{CC} = 160mA, f = 1.9GHz
EVM of PHS signal source = 1.7%

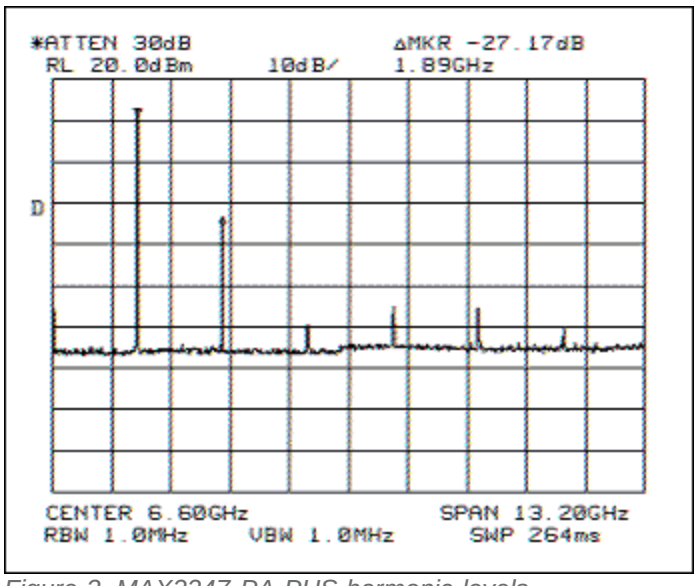

Figure 3. MAX2247 PA PHS harmonic levels.
P_{OUT} = +22dBm, V_{CC} = +3.0V, I_{CC} = 160mA, f = 1.9GHz

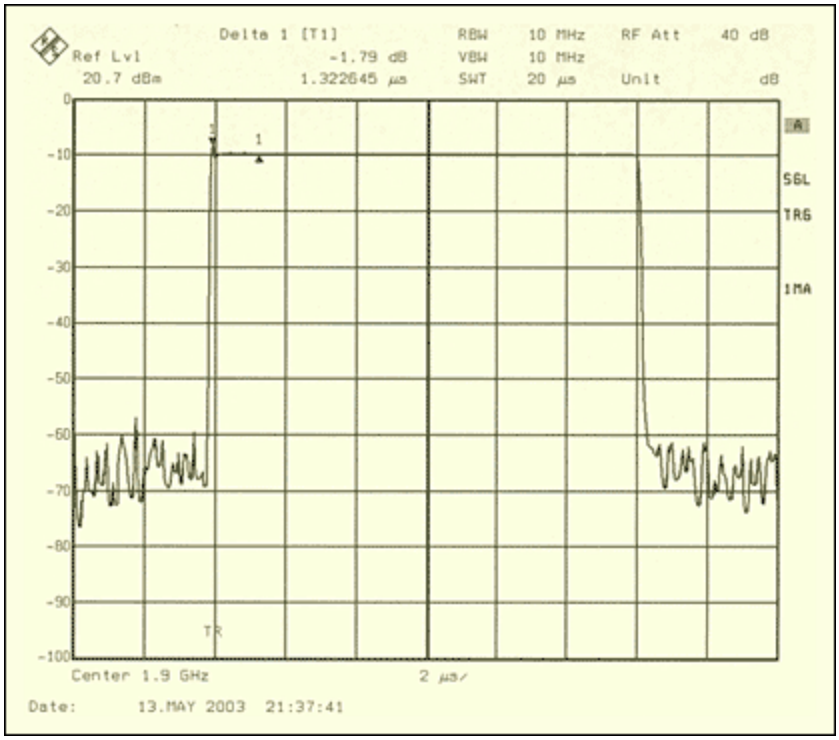

Figure 4. MAX2247 PHS transient response of burst transmission.
P_{OUT} = +22dBm, V_{CC} = +3.0V, I_{CC} = 160mA, f = 1.9GHz

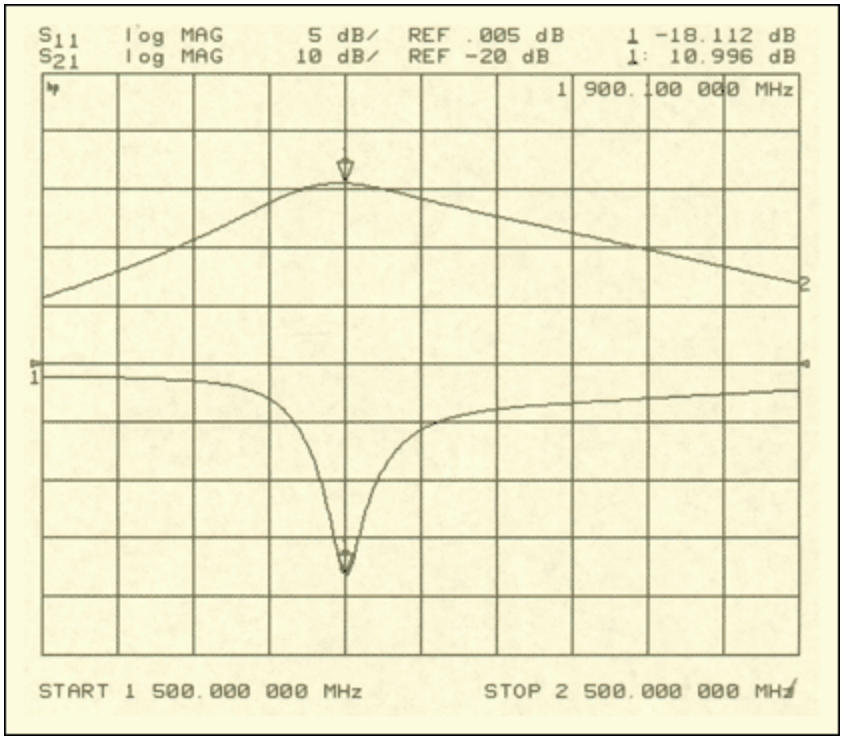

Figure 5. MAX2247 PA PHS input return loss and gain.
P_{OUT} = +22dBm, V_{CC} = +3.0V, I_{CC} = 160mA, f = 1.9GHz

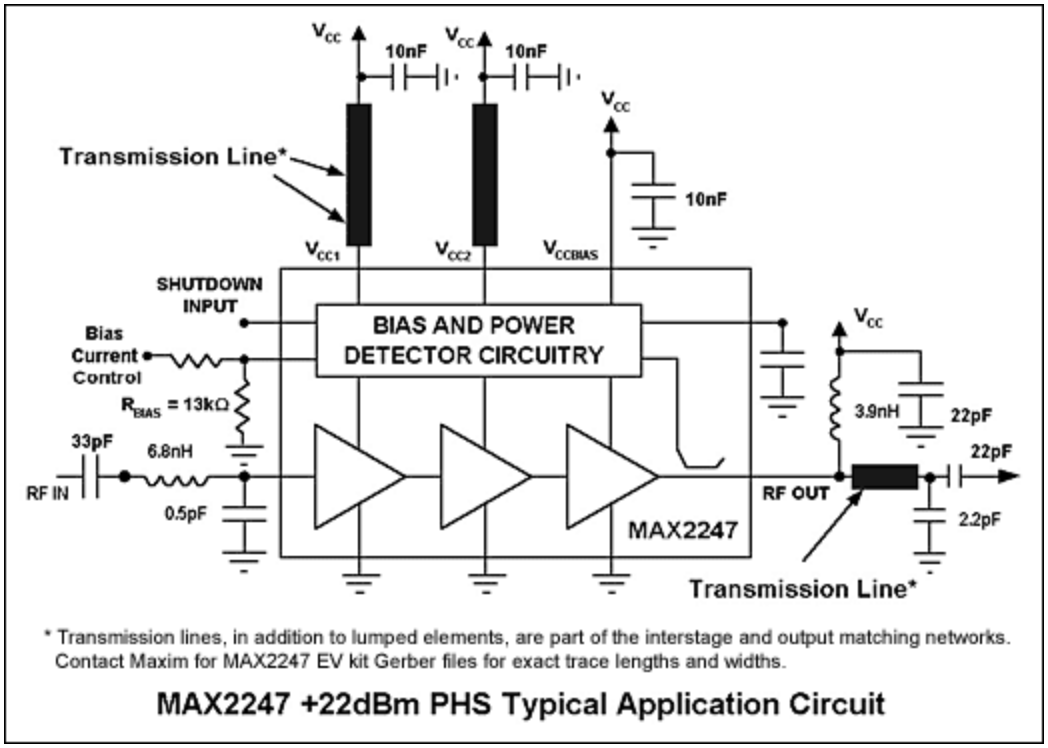

Figure 6. MAX2247 PHS +22dBm power amplifier schematic.

Figure 7. MAX2247 EV kit optimized for +22dB for PHS at 1.9GHz.

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Related Parts	
MAX2247	2.4GHz SiGe Linear Power Amplifier

More Information
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