

RF ICs for 2.4GHz ISM-Band FHSS Solutions: Bluetooth, HomeRF, DECT Applications

WLANS and related systems are compared. IEEE802.11b FHSS supports 1.6Mbps data transmission. MAX2644 SiGe LNA serves as the PA driver and the receiver low noise amplifier (LNA) in the 2.5GHz band. The MAX2240 and MAX2242 power amplifiers (PA) produced the ~+20dBm output with the needed linearity. The MAX2754 VCO offers highly linear modulation and on-chip varactors.

Additional Information: [Wireless Product Line Page](#)

[Quick View Data Sheet for the MAX2240](#)

[Quick View Data Sheet for the MAX2242](#)

[Quick View Data Sheet for the MAX2244](#)

[Quick View Data Sheet for the MAX2644](#)

[Quick View Data Sheet for the MAX2754](#)

[Applications Technical Support](#)

Overview

In the unlicensed 2.4GHz ISM band, the FCC dictates the use of either frequency-hopping spread spectrum (FHSS) or direct-sequence spread spectrum (DSSS) technology. FHSS systems are targeted at low-cost low-power low-range low-data-rate applications, and include Bluetooth, HomeRF (SWAP), 2.4GHz DECT (digital European cordless telephone), and FHSS IEEE802.11. The DSSS IEEE802.11b systems are intended for higher-data-rate and higher-range applications, and typically cost more and consume more power. Bluetooth systems are directed at data transfer, such as transferring an e-mail message from a cell phone to a PDA, and support data rates up to 721kbps. HomeRF supports both data and voice transmission, and allows data rates up to 1.6Mbps. Carrying over from its past incarnation at 1.9GHz, 2.4GHz DECT is intended for 2.4GHz cordless phones with a data rate of 552kbps. IEEE802.11 FHSS systems currently support data rates up to 1.6Mbps, but a new 5-MHz channel bandwidth allocation, wideband FH, will allow symbol rates up to 10Mbps. This will let FHSS compete with the current 11Mbps symbol rates supported by DSSS systems.

For FHSS, the 2.40GHz to 2.835GHz ISM band is broken into 75 1MHz channels, with a 2MHz lower guard band and a 3.5MHz upper guard band. All FHSS systems are based on TDMA, with

the number of frequency hops per second varying from one standard to another. Bluetooth and DECT utilize Gaussian frequency-shift keying (GFSK) modulation, whereas HomeRF and FHSS 802.11 use 2-level and 4-level frequency-shift keying (FSK), to take advantage of the higher efficiencies offered from saturated power amplifiers (PAs). The following block diagram shows a typical application.

RF Receiver ICs

There are many single RF IC transceiver solutions for FHSS radios; however, quite a few of these solutions lack a low-noise amplifier (LNA), a PA, a PA predriver, or a voltage-controlled oscillator (VCO). On the receiver side of the radio, Maxim offers the MAX2644 LNA, with 17dB of gain and a 2.0dB noise figure at 2.45GHz. Adding the MAX2644 before a CMOS transceiver can greatly improve the receiver's sensitivity. The MAX2644 is an extremely flexible amplifier with an output P1dB point of +4dBm, allowing it to be used as a PA predriver.

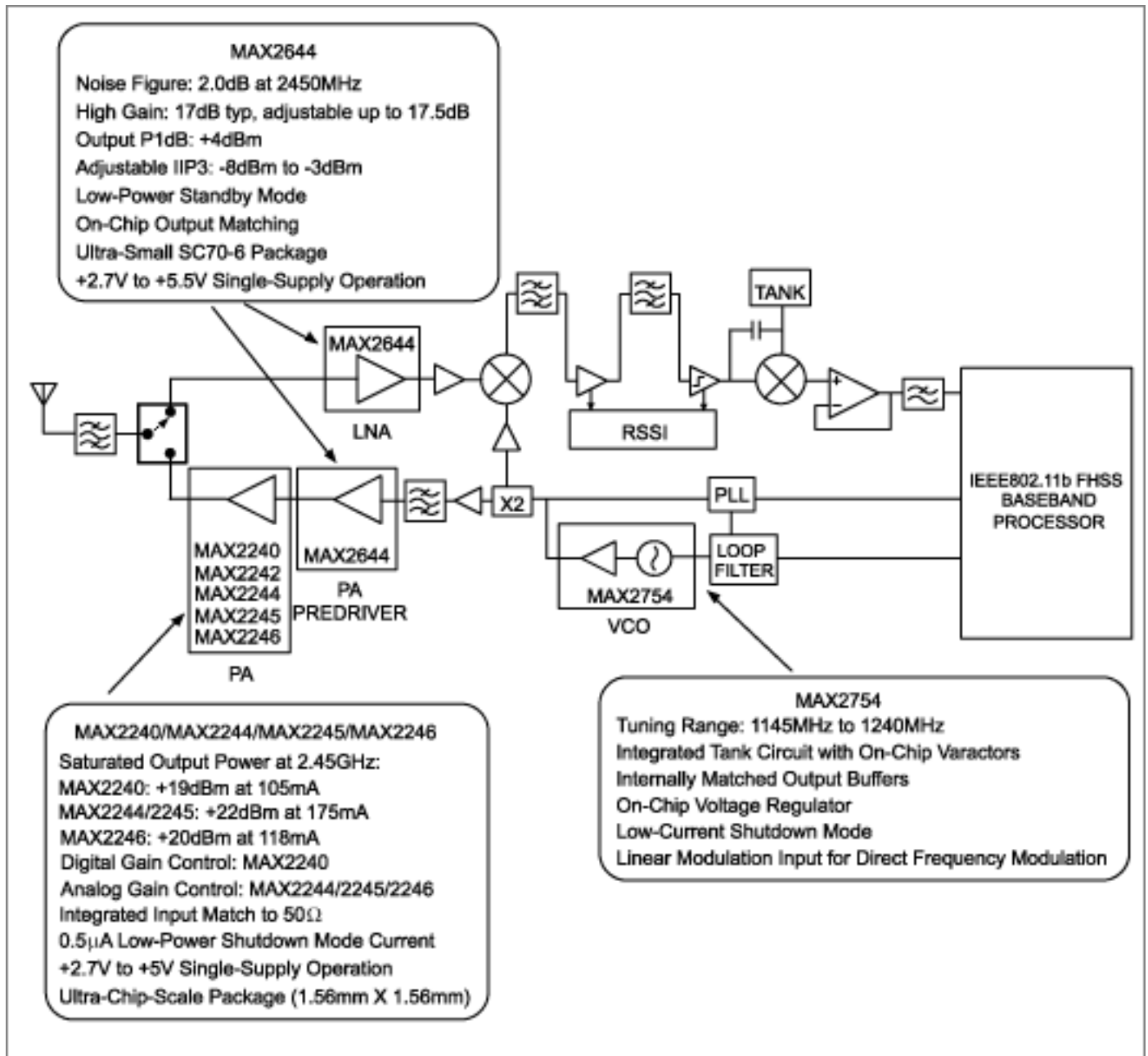
RF Transmitter ICs

The MAX2244/MAX2245 Bluetooth PAs deliver +22dBm saturated output power from a 3.0V power supply at a current draw of 175mA. The MAX2246 delivers +20dBm of saturated output power from a 3.0V power supply at a current draw of 118mA. The PAs integrate a power detector and closed-loop power-control to provide nearly constant output power over the full range of supply voltage, temperature and input power level. All 3 PAs feature analog gain control, integrated input match, low-power shutdown mode, and are featured in the ultra chip-scale package (1.56mm x 1.56mm).

The MAX2240 power amplifier delivers +19dBm saturated output power from a 3.2V supply at 105mA, and it features a 2-bit digital gain control, which makes it an excellent solution for Bluetooth applications.

Another PA option for FHSS applications is the MAX2242, which was initially optimized to deliver +22.5dBm linear output power at -33dBc ACPR performance for 802.11b DSSS applications. Because the MAX2242 features an external bias adjust, the MAX2242 can be tuned for nonlinear applications requiring +20dBm to +27dBm output power. At +23dBm saturated output power, the MAX2242 achieves 37% power-added efficiency (PAE) at 3V. Refer to the application note, [+23dBm PA and PA Predriver with 37% Efficiency for 2.4GHz FHSS WLAN Applications](#), for further information on the MAX2242's nonlinear operation.

The MAX2754 is an 1145MHz to 1240MHz VCO with integrated tank circuit and on-chip varactors. It features a linear modulation input, optimizing it for direct-frequency-modulation applications. A frequency doubler following the VCO converts the LO frequency to the 2.4GHz range. (Information on the MAX2754 is preliminary.)



A 2.4GHz FHSS transceiver for Bluetooth, HomeRF, and DECT

June 2001

More Information

MAX2240: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2242: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2244: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2644: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2680: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2681: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2682: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
MAX2754: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)