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APPLICATION NOTE 2243

MAX2371 Makes a Terrific IF AGC Amplifier at 220MHz

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Abstract: The MAX2371 is an ideal low-noise amplifier (LNA) at low IF frequencies when a large dynamic range of gain is needed. This part works at frequencies not specified in the data sheet. Specific to this note is the 220MHz frequency.

General Description

The MAX2371 is a low-noise amplifier (LNA) IC designed for very low intermediate frequency receiver applications. The LNA features both a switched attenuator and an automatic gain control (AGC) intended as a low-noise gain stage. Between these two features, the device provides over 65dB of gain-control range. The LNA has a selectable current mode. When high current mode is selected, the IC will perform with maximum gain, IP3 and low noise figure. When peak performance is not required, low-current mode slightly degrades the aforementioned parameters while reducing current consumption.

Wireless Technology Overview

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

Although the MAX2371 is specified in its data sheet as operating between 136 and 174 MHz, the part also functions well at other frequencies. The data in this note documents performance at 220MHz. The only change required to use the MAX2371 at this alternative frequency is to update the component values for the input and output matching networks. The values used are represented in the MAX2371 EVKit Schematic and BOM included at the end of this note.

Test Setup

Test Conditions:
1) Vcc = 2.85 V
2) Frequency = 220 MHz
3) Input Power = -30 dBm
4) Two Tone Spacing = 625 kHz
5) RF_ATTN = LOW
6) LNA_I = HIGH

Test Setup Diagram:

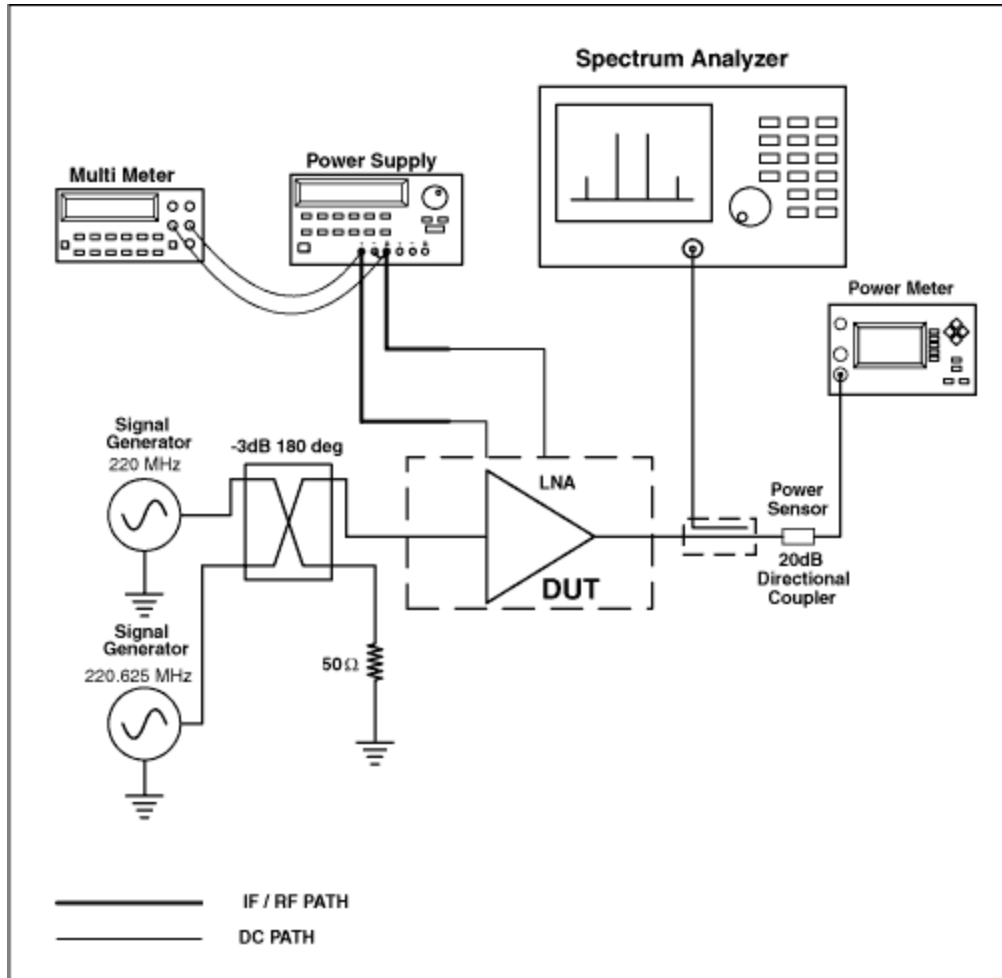*Figure 1. Diagram of the LNA test setup used to evaluate the MAX2371.*

Measurement Results

Parameter	Measured Data	Comment
Max. Gain(dB)	12.5	Vgc = 1/2 Vcc
Noise Figure(dB)	2.2	Vgc = 1/2 Vcc
IIP3(dBm)	1.5	Vgc = 1/2 Vcc
Dynamic Range(dB)	55.0	From VGC
Gain Step (dB)	17.5	From RF_ATTN
Icc over Gain(mA)	3.7	

Gain, IIP3, P1dB

IIP3, P1dB and Gain were measured for the MAX2371 over control voltage and temperature to show all operating conditions. Three temperatures were tested (-10°C, +25°C, +70°C) along with 8 AGC voltages. The results are plotted below.
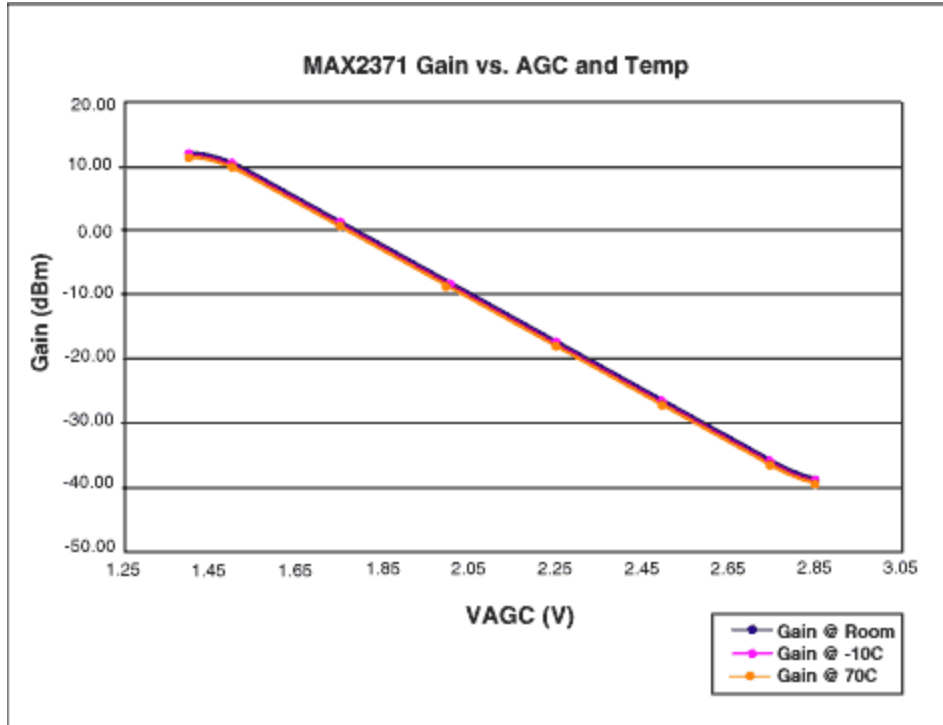
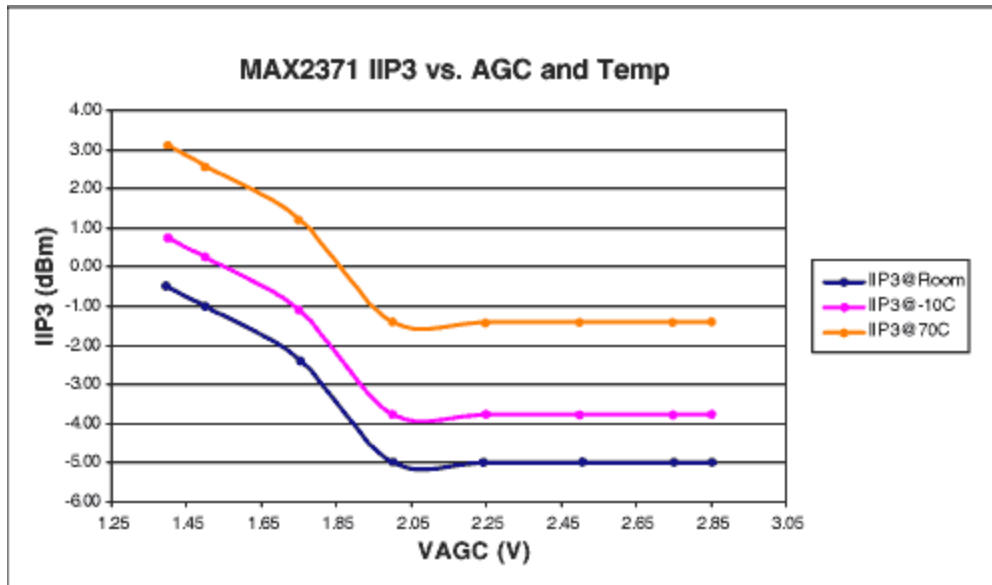*Figure 2. The downward sloped curve set shows that Gain varies less than 0.3dB over temperature.*

Figure 3. IIP3 has a variance of approximately 3.5dB over temperature.
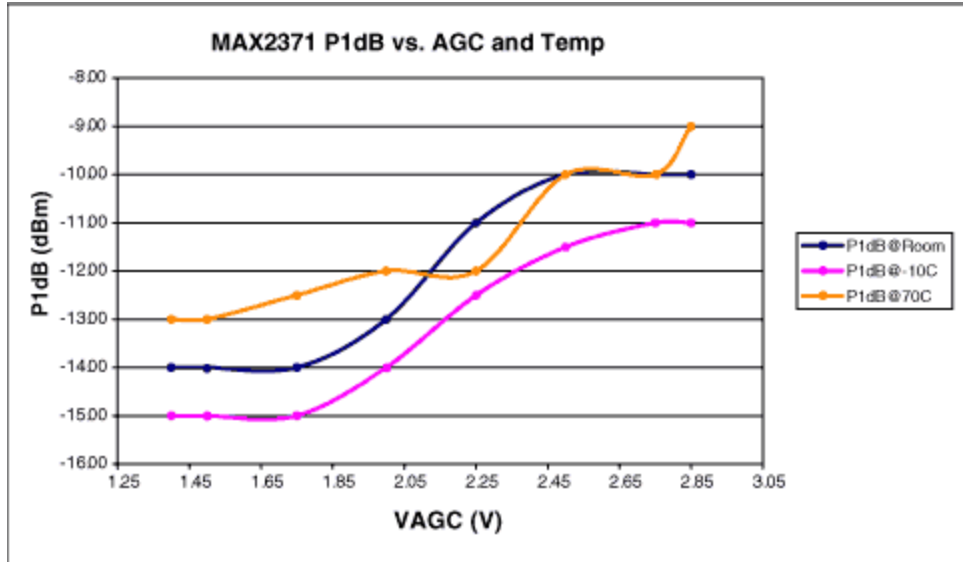
Figure 4. Input P1dB varies by less than 2dB over temperature.

MAX2371 IF Amplifier Circuit S11 and Circuit S22

S11 and S22 were measured against control voltage. The results are plotted below. The input and output were each matched to 50 ohms using single section L-C matches.
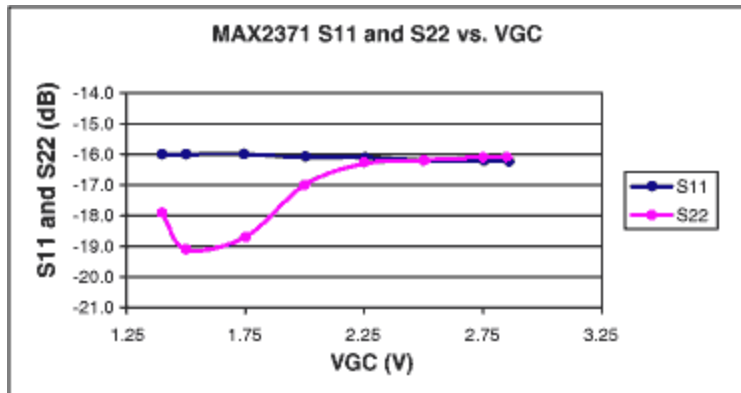

Figure 5. Variance of S11 and S22 over VGC range.

Conclusion

This study of the MAX2371 illustrates its effectiveness and viability as an LNA at 220MHz. The IC provides good noise figure and low current consumption while offering a wide gain range.
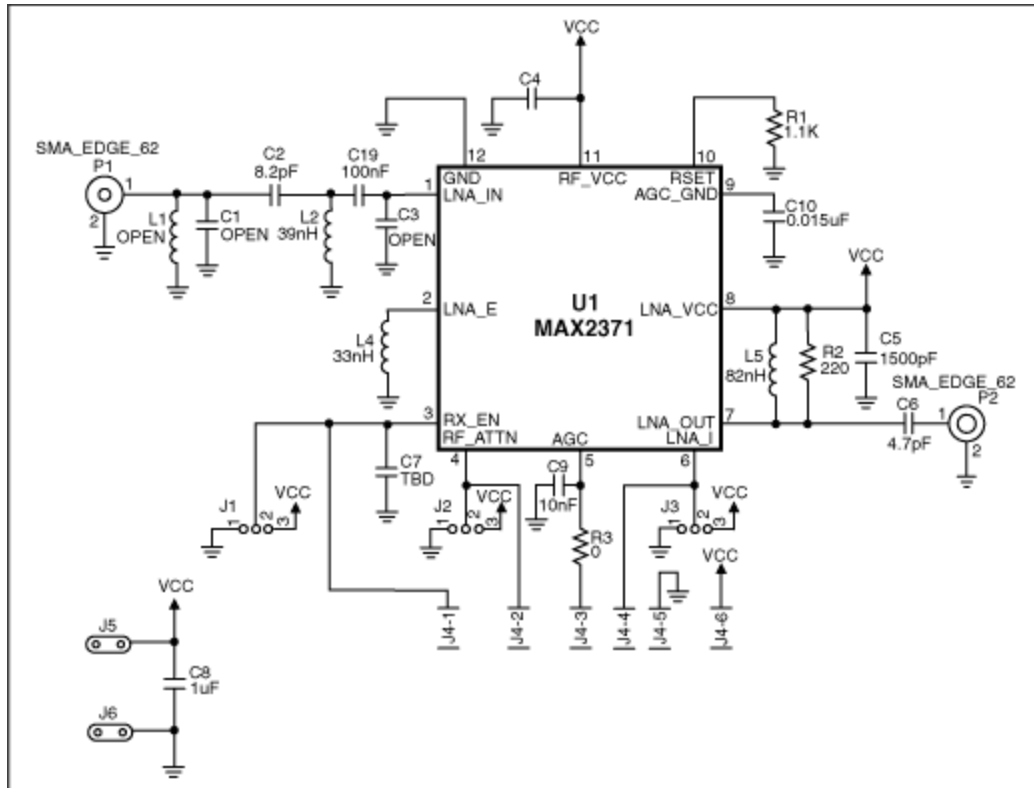
MAX2371 EVKit Schematic

Figure 6.

MAX2371 EVKit BOM

Item	Reference	Description	Value
1	C1	0402 Capacitor	Open
2	C10	0402 Capacitor	0.015uF
3	C19	Capacitor	100nF
4	C2	0402 Capacitor	8.2pF
5	C3	0402 Capacitor	Open
6	C4	0402 Capacitor	1500pF
7	C5	0402 Capacitor	1500pF
8	C6	0402 Capacitor	4.7pF
9	C7	0402 Capacitor	Open
10	C8	0805 Capacitor	1.0uF
11	C9	Capacitor	10nF
12	J1-3	Three PIN INLINE HEADER	
13	J4	SIX PIN INLINE HEADER	
14	J5-6	Two PIN INLINE HEADER	
15	L1	0603 Inductor	Open
16	L2		39nH
17	L4	0603 Inductor	33nH
18	L5	Inductor	82nH

19	P1-2	SMA Connector	
20	R1		1.1K
21	R2		220
22	R3		0
23	U1	MAX2371EGC LNA/AGC Attenuator	

Related Parts		
MAX2371	LNAs with Step Attenuator and VGA	Free Samples

More Information
For Technical Support: http://www.maximintegrated.com/support
For Samples: http://www.maximintegrated.com/samples
Other Questions and Comments: http://www.maximintegrated.com/contact