Keywords: Wibro, MAX2837, 2.3GHz, 2.4GHz, CPE, CardBus, card bus, miniPCI, wman, WMAN

REFERENCE DESIGN 4274 INCLUDES: √Tested Circuit √Board Available √Description √Test Data

WiBro Reference Design with the MAX2837

Sep 11, 2008

Abstract: The WiBro™ reference design is a complete RF front-end solution designed to meet requirements for the WiBro 2.3GHz to 2.4GHz mobile WMAN (Wireless Metropolitan Area Network) standard. This reference design uses the MAX2837 direct-conversion transceiver and demonstrates a complete WiBro single-band RF-to-baseband solution. It serves as a platform for designs in multiple form factors such as CardBus, miniPCI, and custom CPE modules. The design can be easily adapted for WiBro-only 3.3V laptop applications, or WiBro-only 5.0V CPE applications.

More Information
- Wireless Home
- Application Notes and Tutorials
- EV Kit Software
- Technical Support

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

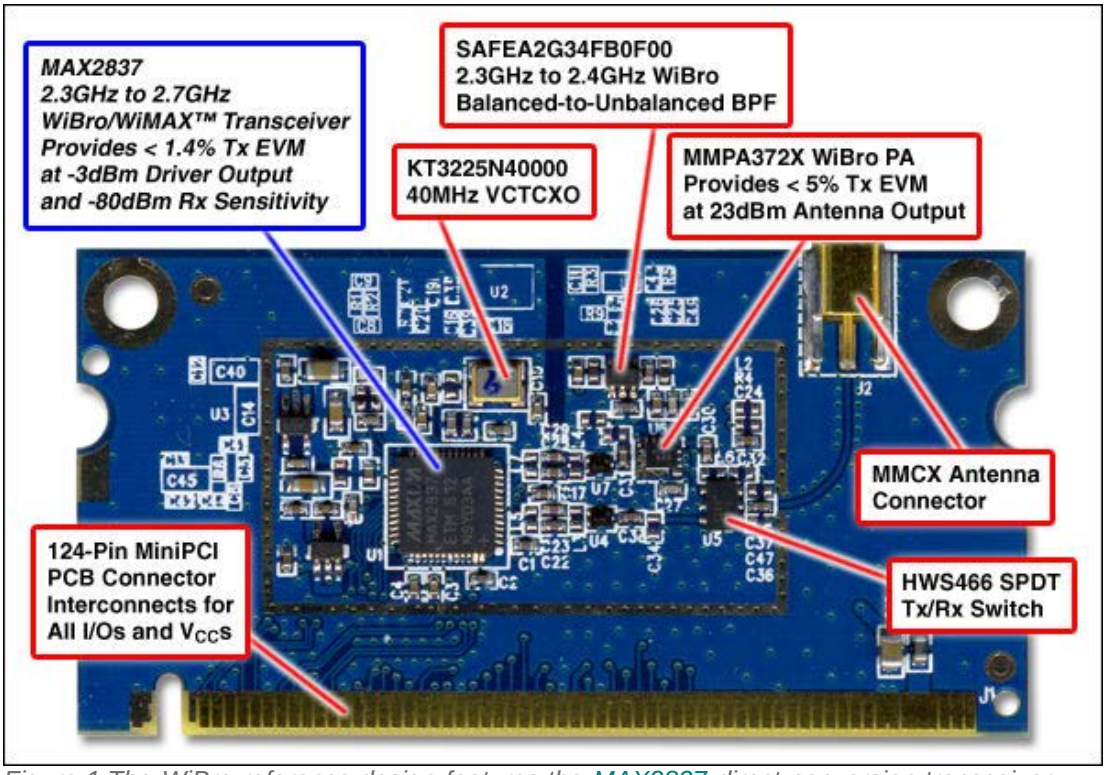
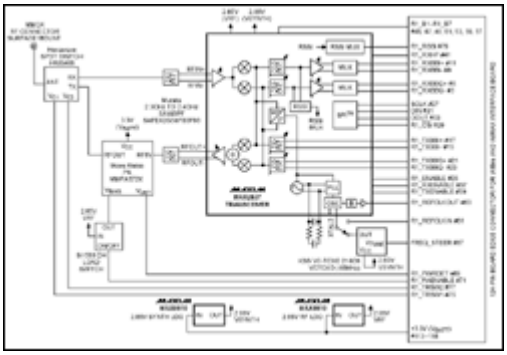


Figure 1.The WiBro reference design features the MAX2837 direct-conversion transceiver.

Important Design Features

- Complete RF-to-Baseband WiBro Solution
- +23dBm Transmit Power at 5% EVM and Meets Spectral Mask Requirements
- -79dBm Receive Sensitivity at 10% EVM
- 60dB of Transmit Gain-Control Range
- 94dB of Receive Gain-Control Range
- Optimized Low-Current Modes



More detailed image (PDF, 324kB)

Figure 2. Block diagram for the WiBro reference design.

Lab Measurements

Supply Current Summary

V_{BATT} = +3.6V, V_{CC} = +2.85V, T_A = +25°C

Parameter	Test Conditions	Measured	Units
Shutdown Supply Current	MAX2837 and PA in shutdown; regulators and VCTCXO still active	1.8	mA
Idle Supply Current	MAX2837 in idle mode; PA in shutdown; regulators and VCTCXO active	34.8	mA
Transmit Supply Current	16 QAM, ¾ FEC coding rate, P_{OUT} = +24dBm, EVM = 5%	392.6	mA
Receive Supply Current In	Low-current mode	79	mA
	Nominal current mode	96.2	

Receive Summary

V_{BATT} = +3.6V, V_{CC} = +2.85V, f_{RF} = 2347MHz, V_{OUT} = 90mV_{RMS}, WiBro signal, RF specs are antenna referred, T_A = +25°C

Parameter	Test Conditions		Measured	Units
DC Offset	I channels		6.8	mV
	Q channels		4.5	
VGA Gain Step Size			2	dB
Receive Gain-Control Range	Max to min VGA gain		61.7	dB
Receive LNA Gain Step	Attenuation from 0dB to -16dB		-15.9	dB
	Attenuation from 0dB to -32dB		32.1	
Gain Variation over Temperature	T_A = -40°C to +85°C	LNA gain = 0dB	-5.2	dB
		LNA gain = -16dB	-5.3	
		LNA gain = -32dB	-3	
Gain Variation over Frequency	f_{LO} = 2304MHz to f_{LO} = 2396MHz		0.2	dB
Sensitivity at Low Supply Current[1]	64 QAM, ¾ FEC coding rate, 10% EVM at sensitivity		-79.8	dBm
	16 QAM, ¾ FEC coding rate, 20% EVM at sensitivity		-90.7	
Sensitivity at Nominal Supply Current[1]	64 QAM, ¾ FEC coding rate, 10% EVM at sensitivity		-80.4	dBm
	16 QAM, ¾ FEC coding rate, 20% EVM at sensitivity		-91.3	

[1]Rx EVM limits are at BB I/Q Rx outputs, and are given in the IEEE® 802.16e specification Table 338, "Receiver SNR Assumptions." The assumption is that this EVM for this modulation rate is sufficient to meet 1e-6 BER.

Transmit Summary

V_{BATT} = +3.6V, V_{CC} = +2.85V, f_{RF} = 2347MHz, V_{IN} = 90mV_{RMS}, WiBro signal, RF specs are antenna referred, T_A = +25°C

Parameter	Test Conditions	Measured	Units
LO Leakage	Q = 640/352µA, I = 576/416µA	-39.6	dBc
Sideband Suppression	I/Q phase = -0.5°	-52.5	dBc
Transmit Power-Control Range	Including PA gain step	64.5	dB
Gain Variation over Frequency	f_{LO} = 2304MHz to f_{LO} = 2396MHz	1.9	dB
Transmit EVM	16 QAM, ¾ FEC coding rate, P_{OUT} = +24dBm, meeting spectral mask	4.1	%
	16 QAM, ¾ FEC coding rate, P_{OUT} = +23dBm, meeting spectral mask	3.5	

Transmit Operating Characteristics

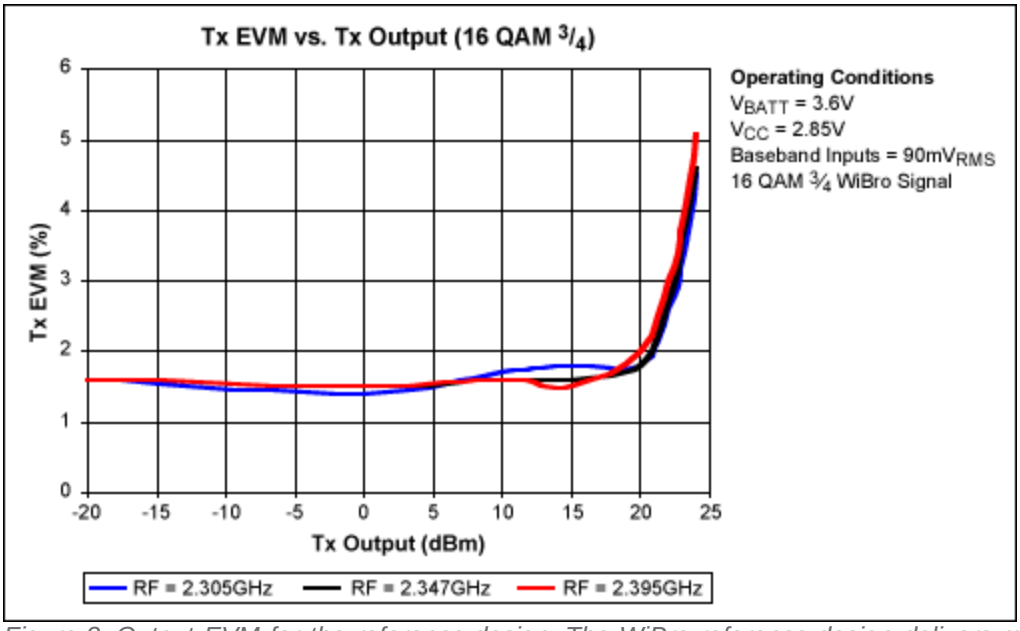
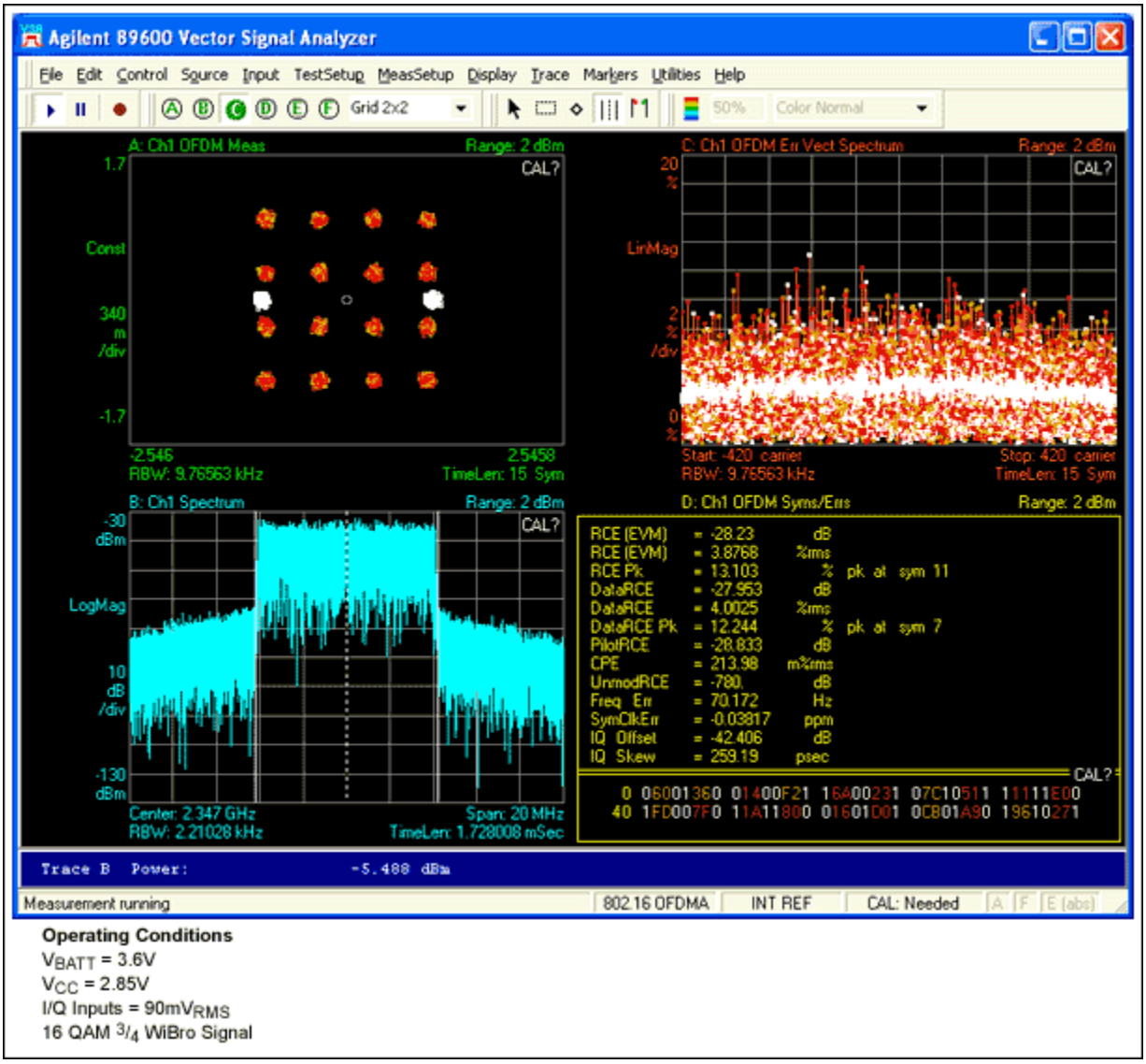


Figure 3. Output EVM for the reference design. The WiBro reference design delivers more than 23dBm of output power at the antenna, while meeting the required EVM specification of 5.5% over the entire 2.3GHz to 2.4GHz band.



Operating Conditions

V_{BATT} = 3.6V

V_{CC} = 2.85V

I/Q Inputs = 90mV_{RMS}

16 QAM $^{3}/_{4}$ WiBro Signal

Figure 4. Transmit capture for the reference design. This capture shows the transmit spectrum, EVM constellation, and spectrum of the reference design at 23dBm of output power at the antenna. Measured EVM = 3.9% at 23dBm at 2.347GHz.

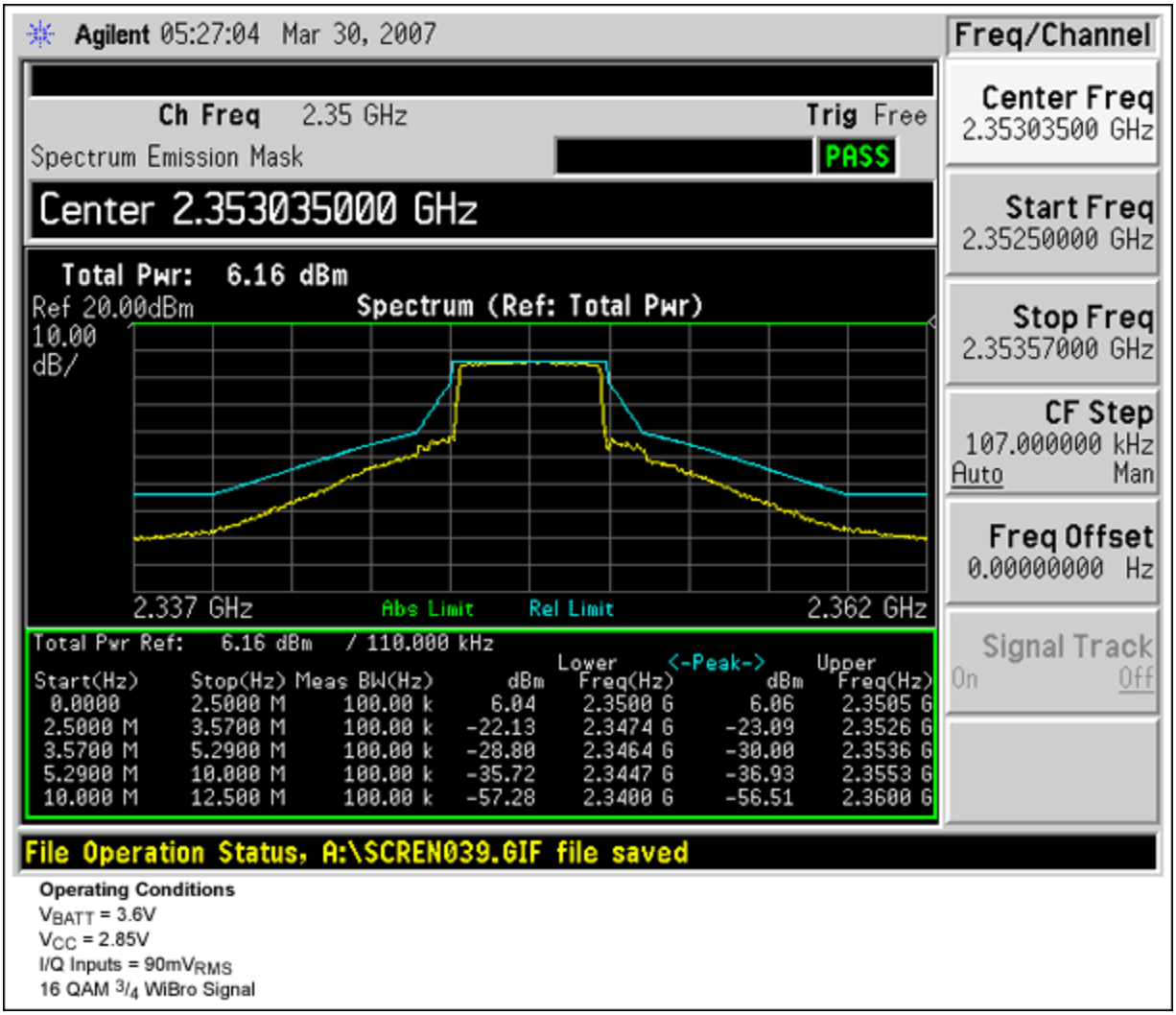


Figure 5. 2.35GHz, 10MHz spectral mask using ETSI-EN-301-021F mask. This capture shows that the WiBro reference design meets the ETSI-EN-301-021F spectral mask at 23dBm of output power at the antenna.

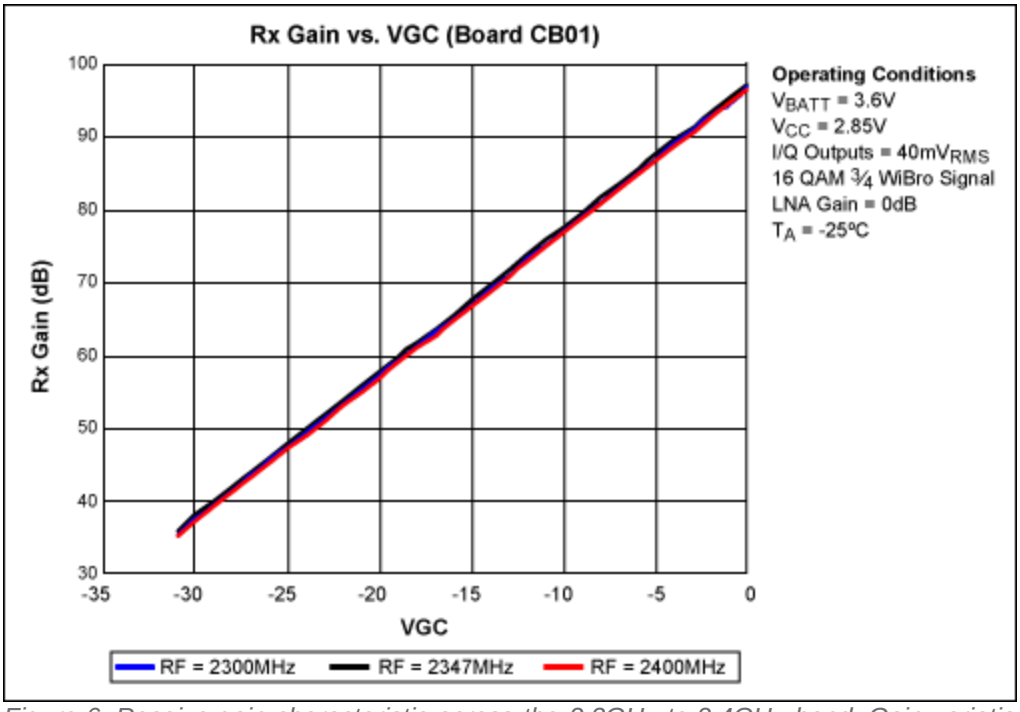


Figure 6. Receive gain characteristic across the 2.3GHz to 2.4GHz band. Gain variation over frequency is less than 0.2dB. Gain-control range, not including LNA gain steps, is 62dB, approximately 2dB per gain step.

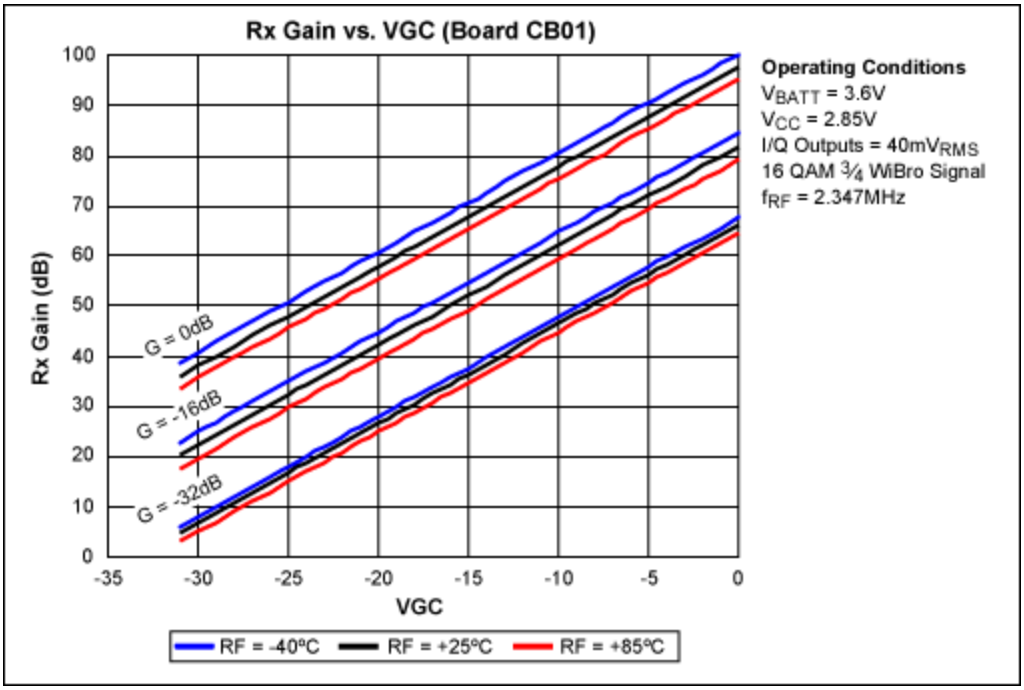


Figure 7. Gain characteristic across three LNA gain attenuations and temperatures. Gain variation over temperature for LNA attenuations 0dB and -16dB is approximately 5dB, and roughly 3dB for -32dB gain attenuation.

Detailed Description

The WiBro reference design includes the following components: MAX2837 direct-conversion transceiver, Micro Mobio MMPA372X PA, MAX8510 regulators, Murata balanced-to-unbalanced SAW bandpass filters, Hexawave HWS466 SPDT Tx/Rx switch, and Vishay Si1563DH load switch.

The MAX2837 is a single-chip, wideband, direct-conversion transceiver designed for 2.3GHz to 2.7GHz WiBro and WiMax radios. The transceiver is fully equipped with an on-chip broadband VCO, fast settling sigma delta RF synthesizer, crystal oscillator, programmable lowpass filters, proprietary DC offset cancellation, I/Q error and carrier leakage detection circuits. The MAX2837 offers less than 1.4% of transmit EVM at -3dBm driver output power, and receive sensitivity better than -79dBm. When integrated with the MMPA372X PA and Murata BPF, the reference design can deliver at least 23dBm of output power at the antenna, while meeting WiBro EVM and spectral-mask requirements with margin.

Related Parts		
MAX2837	2.3GHz to 2.7GHz Wireless Broadband RF Transceiver	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

Application Note 4274: http://www.maximintegrated.com/an4274
REFERENCE DESIGN 4274, AN4274, AN 4274, APP4274, Appnote4274, Appnote 4274