

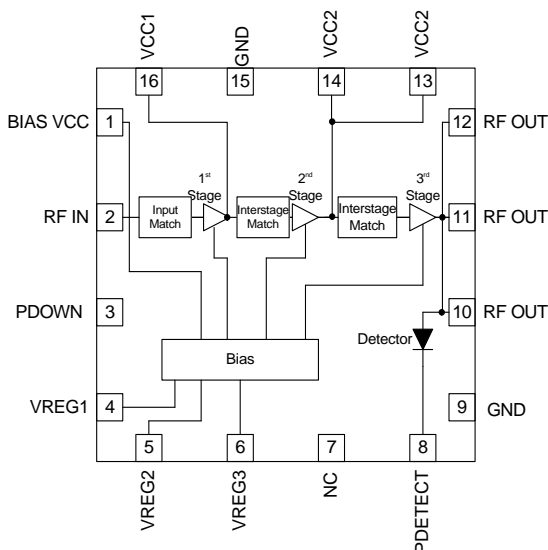


**Features**

- Single 3.3V to 5V Supply
- 32dB to 34dB Small Signal Gain (Typ.)
- 2% EVM (RMS) at 26dBm, 5.0V
- 2% EVM (RMS) at 25dBm, 4.2V
- 3% EVM (RMS) at 23.5dBm, 3.3V
- Include Power Detector on Die
- Multiple Frequency Ranges

**Applications**

- 802.11b/g/n Access Points
- PCS Communication Systems
- 2.4GHz ISM Band Applications
- Commercial and Consumer Systems
- WiBro 2.3GHz to 2.4GHz Band Applications
- WLAN 2.4GHz to 2.5GHz Band Applications
- WiMAX 2.5GHz to 2.7GHz Band Applications



Functional Block Diagram

**Product Description**

The RF5602 is a linear power amplifier IC designed specifically for medium power applications. The device is manufactured on an advanced InGaP Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as the final RF amplifier in 802.11b/g/n access point transmitters. The device is provided in a 3mmx3mmx0.45mm, 16-pin, leadless chip carrier with a backside ground. The RF5602 is designed to maintain linearity over a wide range of supply voltages and power outputs.

**Ordering Information**

- RF5602                      3.3V to 5.0V, 2.3GHz to 2.7GHz Linear Power Amplifier, Matte-Sn (Pb-free) Finish
- RF5602WLPC-410        2.4GHz to 2.5GHz WLAN Fully Assembled Eval PCB at 5V
- RF5602WBPC-410        2.3GHz to 2.4GHz WiBro Fully Assembled Eval PCB at 5V
- RF5602WMP-410         2.5GHz to 2.7GHz WiMAX Fully Assembled Eval PCB at 5V

**Optimum Technology Matching® Applied**

- |   |                                      |                                     |                                   |
|---|--------------------------------------|-------------------------------------|-----------------------------------|
| <input type="checkbox"/> GaAs HBT             | <input type="checkbox"/> SiGe BiCMOS | <input type="checkbox"/> GaAs pHEMT | <input type="checkbox"/> GaN HEMT |
| <input type="checkbox"/> GaAs MESFET          | <input type="checkbox"/> Si BiCMOS   | <input type="checkbox"/> Si CMOS    | <input type="checkbox"/> RF MEMS  |
| <input checked="" type="checkbox"/> InGaP HBT | <input type="checkbox"/> SiGe HBT    | <input type="checkbox"/> Si BJT     | <input type="checkbox"/> LDMOS    |

RF MICRO DEVICES®, RFMD®, Optimum Technology Matching®, Enabling Wireless Connectivity™, PowerStar®, POLARIS™ TOTAL RADIO™ and UltimateBlue™ are trademarks of RFMD, LLC. BLUETOOTH is a trademark owned by Bluetooth SIG, Inc., U.S.A. and licensed for use by RFMD. All other trade names, trademarks and registered trademarks are the property of their respective owners. ©2006, RF Micro Devices, Inc.

### Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.5 to +5.5	V <sub>DC</sub>
DC Supply Current	TBD	mA
Input RF Power	+10	dBm
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Moisture Sensitivity	TBD	



Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EU Directive 2002/95/EC (at time of this document revision).

The information in this publication is believed to be accurate and reliable. However, no responsibility is assumed by RF Micro Devices, Inc. ("RFMD") for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. No license is granted by implication or otherwise under any patent or patent rights of RFMD. RFMD reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>WLAN IEEE802.11b/g</b>					Nominal Condition T=25 °C, V <sub>CC</sub> =3.3V, 4.2V, and 5V, V <sub>REG</sub> =2.85V, Freq=2450MHz, Duty Cycle 10 to 100% unless otherwise noted
Frequency Range	2400		2500	MHz	
Compliance					IEEE802.11g and IEEE802.11b
Output Power		26		dBm	With a standard IEEE802.11g waveform (54Mbit/s), V <sub>CC</sub> =5.0V
EVM		2	3	%	RMS, Mean
IEEE802.11b P <sub>OUT</sub>		TBD		dBm	
ACP1		-34	-30		using a standard IEEE802.11b waveform at 1Mbps
ACP2		-54	-50		using a standard IEEE802.11b waveform at 1Mbps
Output Power		25		dBm	With a standard IEEE802.11g waveform (54Mbit/s), V <sub>CC</sub> =4.2V
EVM		2	3	%	RMS, Mean
IEEE802.11b P <sub>OUT</sub>		TBD		dBm	
ACP1		-34	-30		using a standard IEEE802.11b waveform at 1Mbps
ACP2		-54	-50		using a standard IEEE802.11b waveform at 1Mbps
Output Power		23.5		dBm	With a standard IEEE802.11g waveform (54Mbit/s), V <sub>CC</sub> =3.3V
EVM		3	3.5	%	RMS, Mean
IEEE802.11b P <sub>OUT</sub>		TBD		dBm	
ACP1		-34	-30		using a standard IEEE802.11b waveform at 1Mbps
ACP2		-54	-50		using a standard IEEE802.11b waveform at 1Mbps
Gain		34		dB	At nominal condition and V <sub>CC</sub> =5.0V
		34		dB	At nominal condition and V <sub>CC</sub> =4.2V
		34		dB	At nominal condition and V <sub>CC</sub> =3.3V
Gain variation over temperature		1.5		±dB	-10 °C to +85 °C
Input Impedance		50		Ω	Input matched to 50Ω

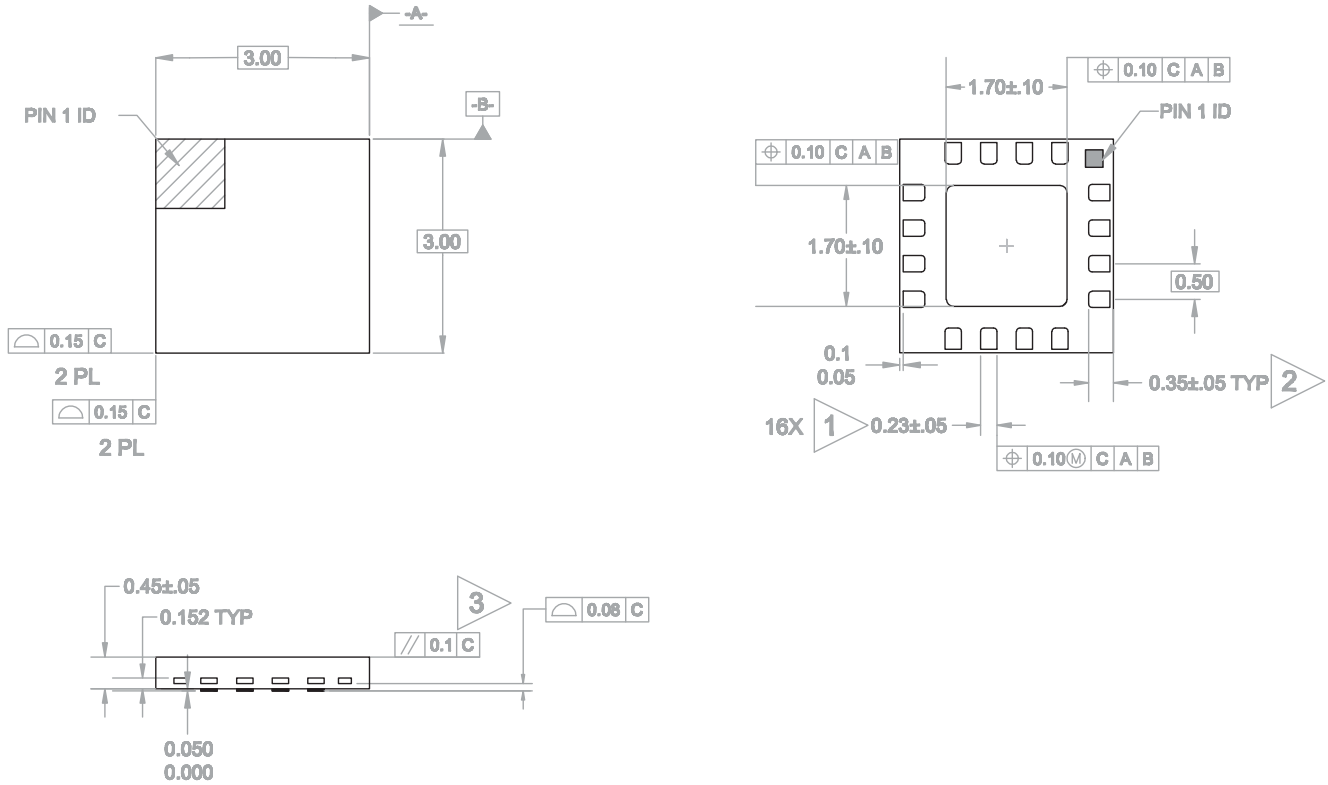
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>WLAN IEEE802.11b/g, cont.</b>					Nominal Condition T=25 °C, V <sub>CC</sub> =3.3V, 4.2V, and 5V, V <sub>REG</sub> =2.85V, Freq=2450MHz, Duty Cycle 10 to 100% unless otherwise noted
Output P1dB		33		dBm	At nominal conditions with CW signal and V <sub>CC</sub> =5.0V
		32		dBm	At nominal conditions with CW signal and V <sub>CC</sub> =4.2V
		30.5		dBm	At nominal conditions with CW signal and V <sub>CC</sub> =3.3V
<b>Power Down</b>					
PA is "OFF"			0.6	V <sub>CC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
PA is "ON"	1.75	2.85	5.0	V <sub>DC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
<b>Power Supply</b>					
Operating Voltage		3 to 5		V	
Current Consumption		500		mA	RF P <sub>OUT</sub> =+26dBm and V <sub>CC</sub> =5.0V
		200		mA	Idle current, No RF and V <sub>CC</sub> =5.0V
		425		mA	RF P <sub>OUT</sub> =+25dBm and V <sub>CC</sub> =4.2V
		180		mA	Idle current, No RF and V <sub>CC</sub> =4.2V
		370		mA	RF P <sub>OUT</sub> =+23.5dBm and V <sub>CC</sub> =3.3V
		170		mA	Idle current, No RF and V <sub>CC</sub> =3.3V
Power Down Current			10	mA	V <sub>REG</sub> =0.0V
Power Down Current Leakage			1	mA	P <sub>DOWN</sub> =Low, V <sub>REG</sub> =High
VREG1, 2, 3 Voltage	2.75	2.85	3	VDC	Higher V <sub>REG</sub> voltage is possible but with adjusting the series resistors to keep the voltage constant at the pins.
			10	mA	I <sub>REG</sub> Current
<b>WiMax IEEE802.16e</b>					Nominal Condition T=25 °C, V <sub>CC</sub> =3.3V, 4.2V, 5V, V <sub>REG</sub> =2.85V, Freq=2600MHz, Duty Cycle 1 to 100% unless otherwise noted
Frequency Range	2500		2700	MHz	
Compliance					IEEE802.16e
Output Power		26		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =5.0V
EVM		2	TBD	%	RMS, Mean
Output Power		25		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =4.2V
EVM		2	TBD	%	RMS, Mean
Output Power		23.5		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =3.3V
EVM		3	TBD	%	RMS, Mean
Gain		32		dB	At nominal condition and V <sub>CC</sub> =5.0V
		32		dB	At nominal condition and V <sub>CC</sub> =4.2V
		32		dB	At nominal condition and V <sub>CC</sub> =3.3V
Gain variation over temperature		1.5		±dB	-10 °C to +85 °C
Input Impedance		50		Ω	Input matched to 50Ω

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>WiMax IEEE802.16e, cont.</b>					Nominal Condition T=25 °C, V <sub>CC</sub> =3.3V, 4.2V, 5V, V <sub>REG</sub> =2.85V, Freq=2600MHz, Duty Cycle 1 to 100% unless otherwise noted
Output P1dB		33		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =5.0V
		32		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =4.2V
		30.5		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =3.3V
<b>Power Down</b>					
PA is "OFF"			0.6	V <sub>CC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
PA is "ON"	1.75	2.85	5.0	V <sub>DC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
<b>Power Supply</b>					
Operating Voltage		3 to 5		V	
Current Consumption		500		mA	RF P <sub>OUT</sub> =+26dBm and V <sub>CC</sub> =5.0V
		200		mA	Idle current, No RF and V <sub>CC</sub> =5.0V
		425		mA	RF P <sub>OUT</sub> =+25dBm and V <sub>CC</sub> =4.2V
		180		mA	Idle current, No RF and V <sub>CC</sub> =4.2V
		370		mA	RF P <sub>OUT</sub> =+23.5dBm and V <sub>CC</sub> =3.3V
		170		mA	Idle current, No RF and V <sub>CC</sub> =3.3V
Power Down Current			10	mA	V <sub>REG</sub> =0.0V
Power Detect Leakage Current			1	mA	P <sub>DOWN</sub> =Low, V <sub>REG</sub> =High
VREG1, 2, 3 Voltage	2.75	2.85	3	V <sub>DC</sub>	Higher V <sub>REG</sub> voltage is possible but with adjusting the series resistors to keep the voltage constant at the pins.
			10	mA	I <sub>REG</sub> Current

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>WiBro IEEE802.16e</b>					Nominal Condition T=25 °C, V <sub>CC</sub> =3.3V, 4.2V, 5.0V, V <sub>REG</sub> =2.85V, Freq=2350MHz, Duty Cycle 1 to 100% unless otherwise noted
Frequency Range	2300		2400	MHz	
Compliance					IEEE802.16e
Output Power		26		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =5.0V
EVM		2	TBD	%	RMS, Mean
Output Power		25		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =4.2V
EVM		2	TBD	%	RMS, Mean
Output Power		23.5		dBm	Measured standard IEEE802.16e waveform (16QAM, 10MHz BW), V <sub>CC</sub> =3.3V
EVM		3	TBD	%	RMS, Mean
Gain		34		dB	At nominal condition and V <sub>CC</sub> =5.0V
		34		dB	At nominal condition and V <sub>CC</sub> =4.2V
		34		dB	At nominal condition and V <sub>CC</sub> =3.3V
Gain variation over temperature		1.5		±dB	-10 °C to +85 °C
Input Impedance		50		Ω	Input matched to 50Ω
Output P1dB		33		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =5.0V
		32		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =4.2V
		30.5		dBm	At nominal conditions with CW Signal and V <sub>CC</sub> =3.3V
<b>Power Down</b>					
PA is OFF			0.6	V <sub>CC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
PA is ON	1.75	2.85	5.0	V <sub>DC</sub>	Pin 3 (PDOWN) Voltage < 0.6V <sub>DC</sub>
<b>Power Supply</b>					
Operating Voltage		3 to 5		V	
Current Consumption		500		mA	RF P <sub>OUT</sub> =+26dBm and V <sub>CC</sub> =5.0V
		200		mA	Idle Current, No RF and V <sub>CC</sub> =5.0V
		425		mA	RF P <sub>OUT</sub> =+25dBm and V <sub>CC</sub> =4.2V
		180		mA	Idle Current, No RF and V <sub>CC</sub> =4.2V
		370		mA	RF P <sub>OUT</sub> =+23.5dBm and V <sub>CC</sub> =3.3V
		170		mA	Idle Current, No RF and V <sub>CC</sub> =3.3V
Power Down Current			10	mA	V <sub>REG</sub> =0.0V
Power down current leakage			1	mA	P <sub>DOWN</sub> =Low, V <sub>REG</sub> =High
VREG1, 2, 3 Voltage	2.75	2.85	3	V <sub>DC</sub>	Higher V <sub>REG</sub> voltage is possible but with adjusting the series resistors to keep the voltage constant at the pins.
			10	mA	I <sub>REG</sub> Current

Pin	Function	Description
1	BIAS VCC	Supply voltage for the bias reference and control circuits. May be connected with VCC1 and VCC2 as long as $V_{CC}$ does not exceed $5.0V_{DC}$ in this configuration.
2	RF IN	RF input.
3	PDOWN	Power down pin. Apply $<0.6V_{DC}$ to power down the three power amplifier stages. Apply $2.5V_{DC}$ to $3.5V_{DC}$ to power up. If function is not desired, pin may be connected to $V_{CC}$ or $V_{REG}$ .
4	VREG1	First stage input bias voltage. This pin requires a regulated supply to maintain nominal bias current.
5	VREG2	Second stage input bias voltage. This pin requires a regulated supply to maintain nominal bias current.
6	VREG3	Third stage input bias voltage. This pin requires a regulated supply to maintain nominal bias current.
7	NC	Not connected. May be connected to ground.
8	P DETECT	Power detector provides an output voltage proportional to the RF output power level.
9		Not connected. May be connected to ground.
10	VCC3/ RF OUT	RF output and bias for the output stage. Output is externally matched to $50\Omega$ and needs DC block.
11	VCC3/ RF OUT	Same as pin 10.
12	VCC3/ RF OUT	Same as pin 10.
13	VCC2	Second stage supply voltage.
14	VCC2	Same as pin 13.
15	NC	Not connected. May be connected to ground.
16	VCC1	First stage supply voltage.
Pkg Base	GND	Ground connection. The back side of the package should be connected to the ground plane through as short a connection as possible, e.g., PCB vias under the device are recommended.

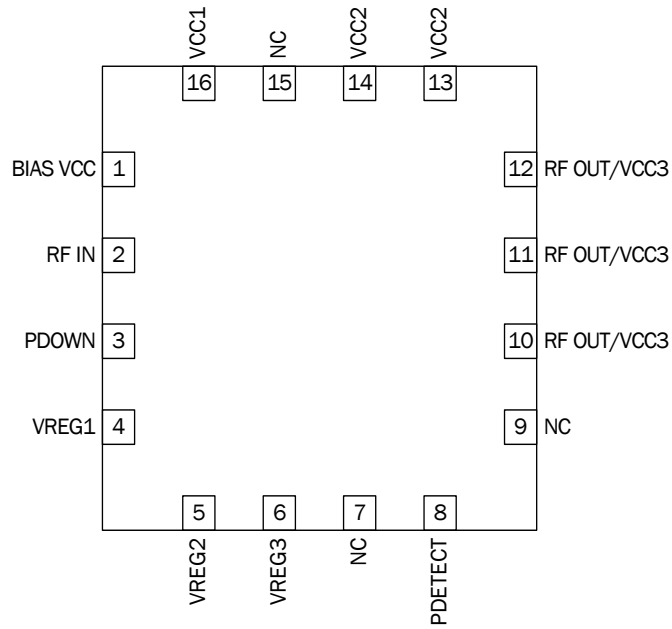
Package Outline



Notes:

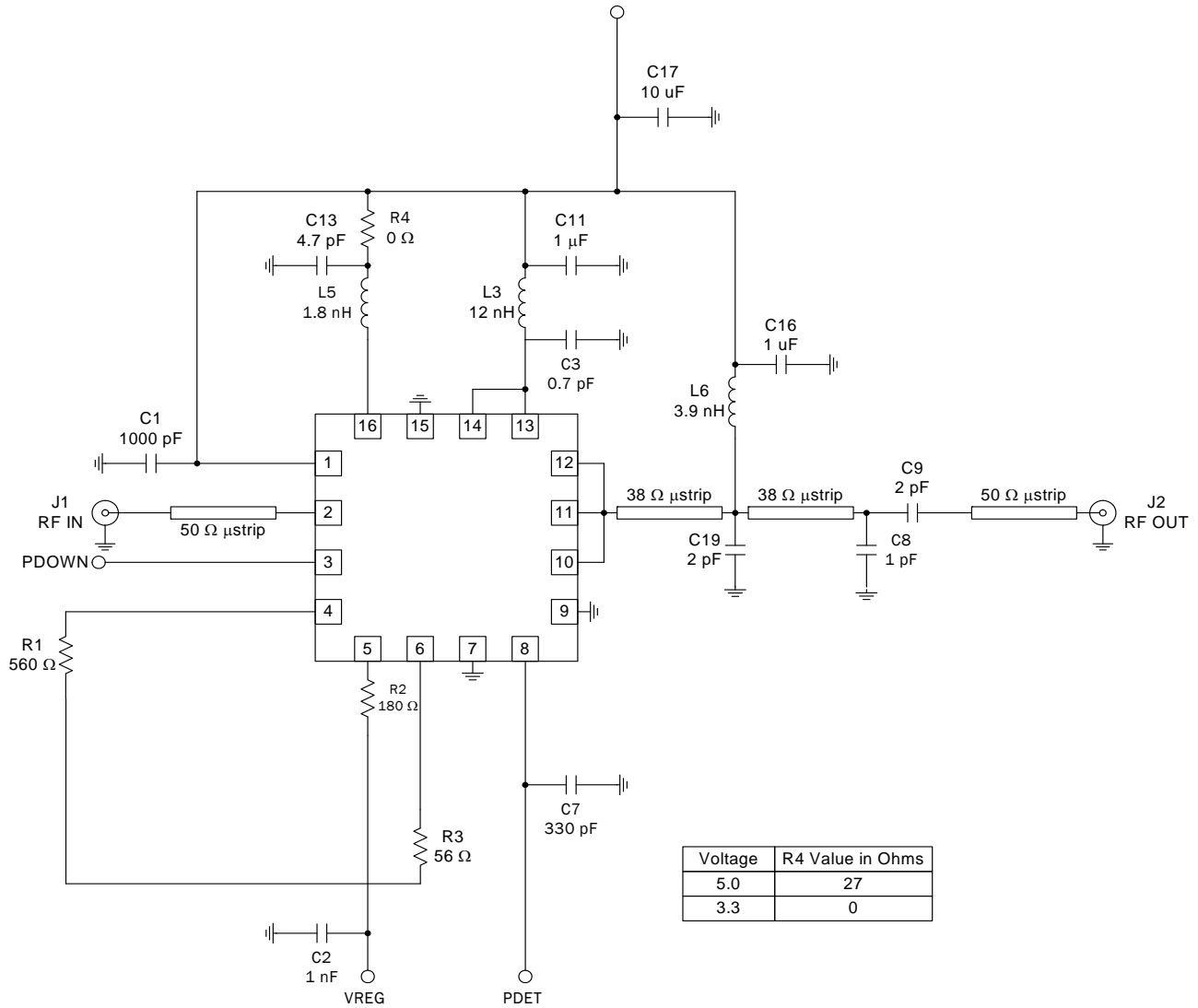
1. Dimension applies to metallized terminal and is measured between 0.25mm and 0.30mm from terminal tip.
2. Dimension represents terminal pull back from package edge up to 0.1mm is acceptable.
3. Complanarity applies to the exposed heat slug, as well as the terminal.
4. Radius on terminal is optional.

**Pin Out**



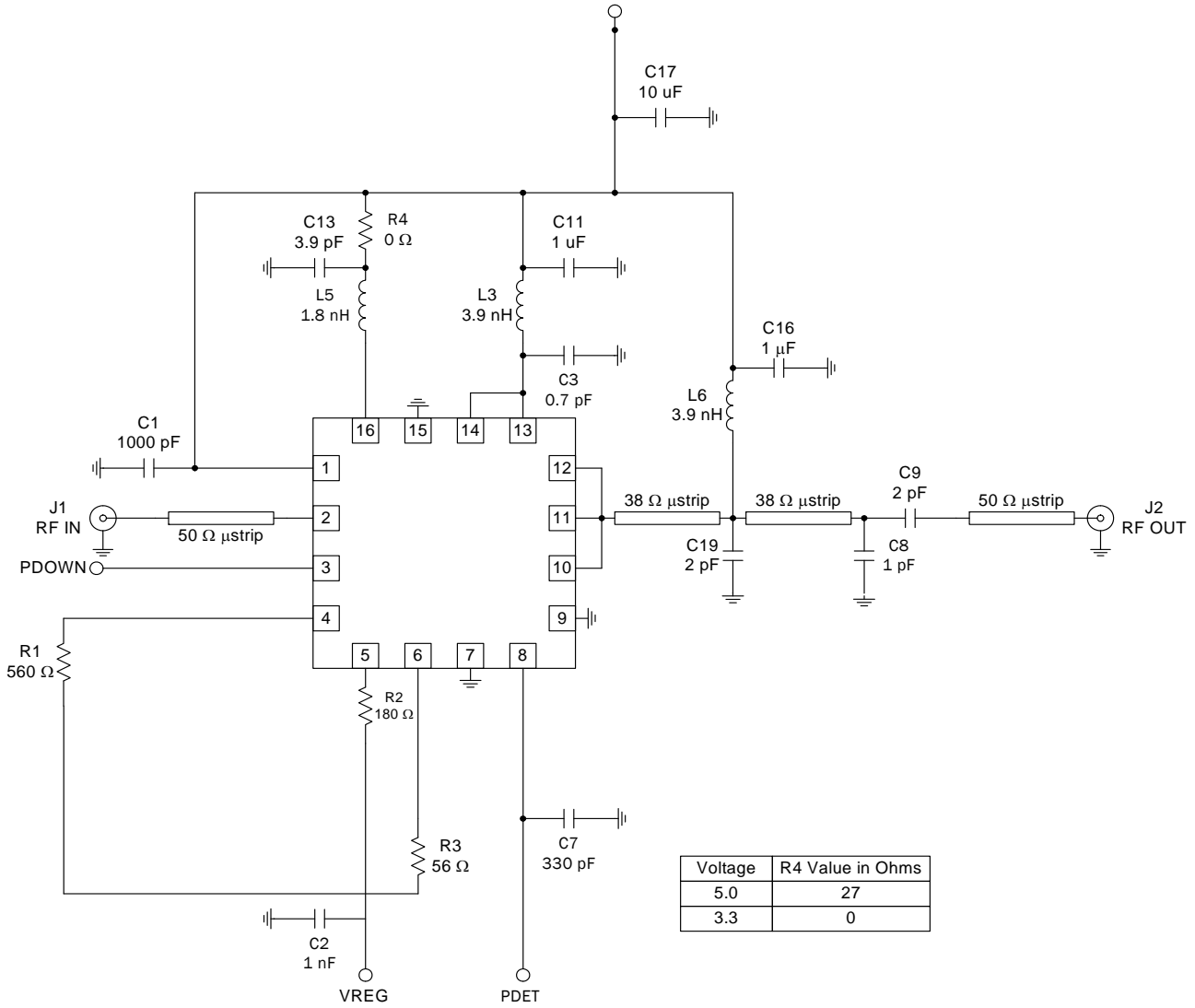


**Evaluation Board Schematic**  
 WLAN 2.4GHz to 2.5GHz Operation

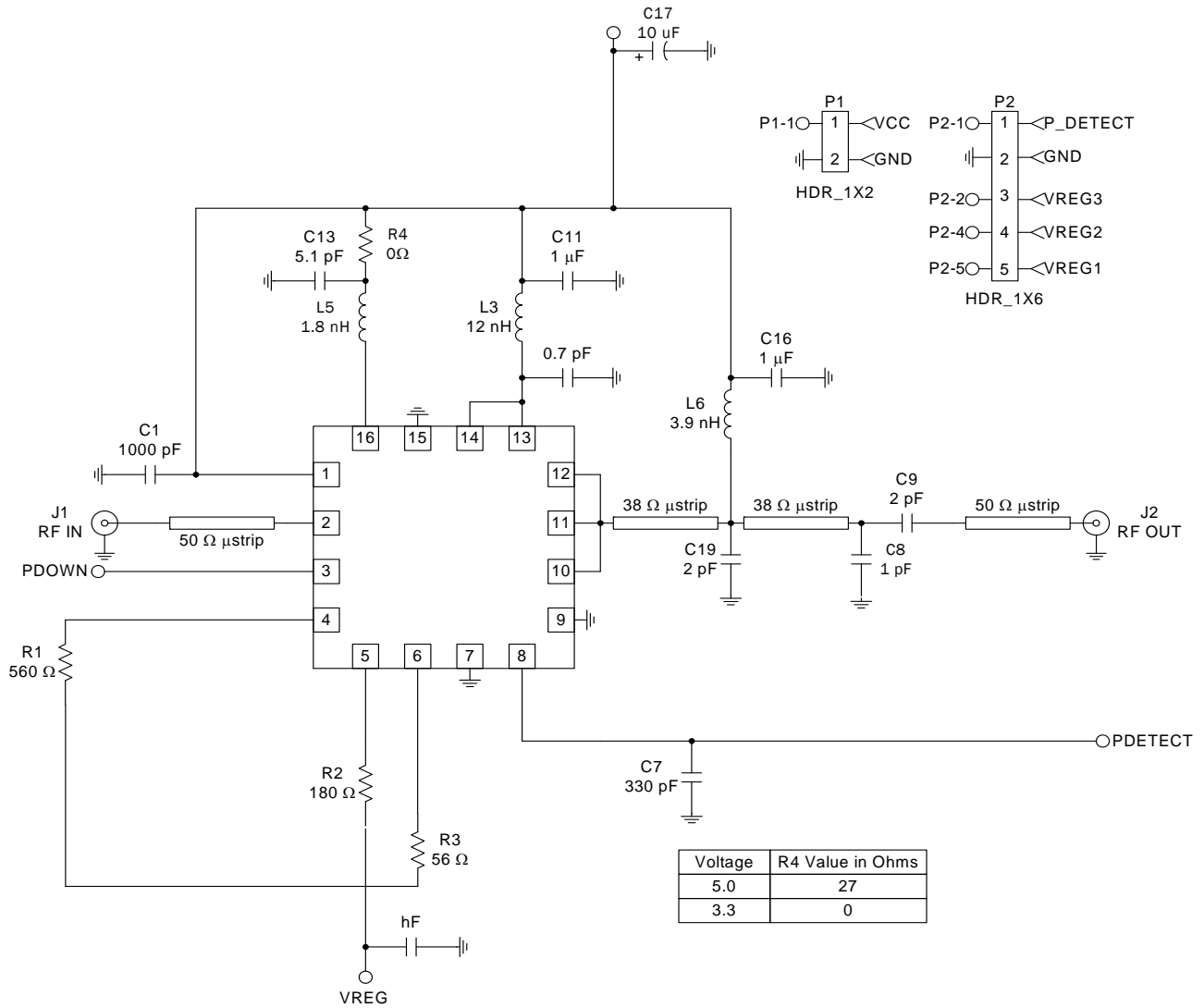


Voltage	R4 Value in Ohms
5.0	27
3.3	0

**Evaluation Board Schematic**  
WiMAX 2.5GHz to 2.7GHz Operation

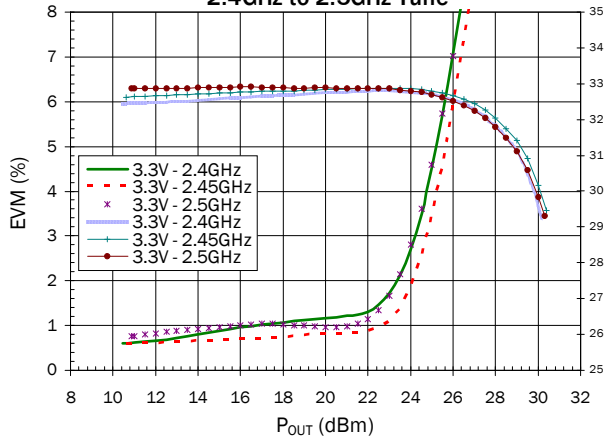


**Evaluation Board Schematic**  
 WiBro 2.3GHz to 2.4GHz Operation

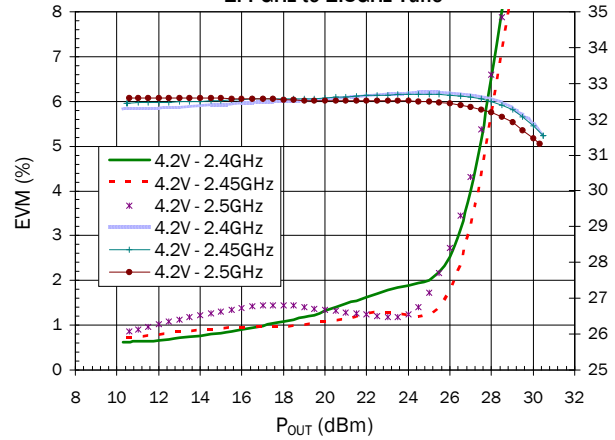


## WLAN 2.4GHz to 2.5GHz Operation

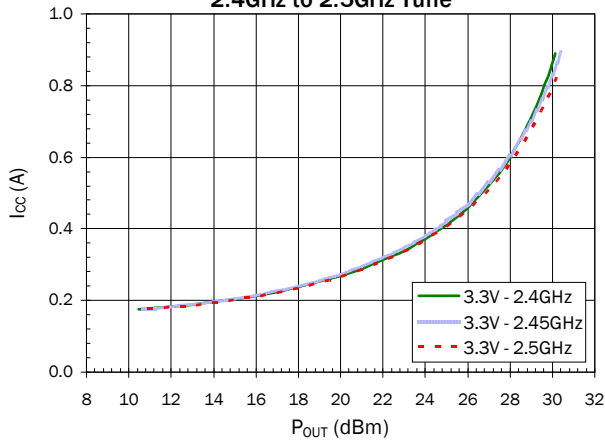
100% WLAN EVM and GT versus  $P_{OUT}$ ,  
2.4GHz to 2.5GHz Tune



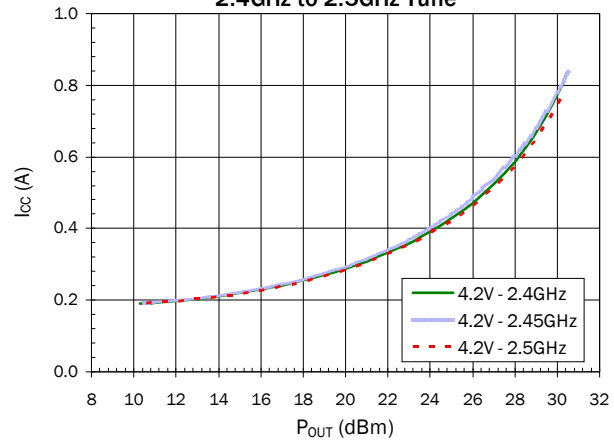
100% WLAN EVM and Gt versus  $P_{OUT}$ ,  
2.4 GHz to 2.5GHz Tune



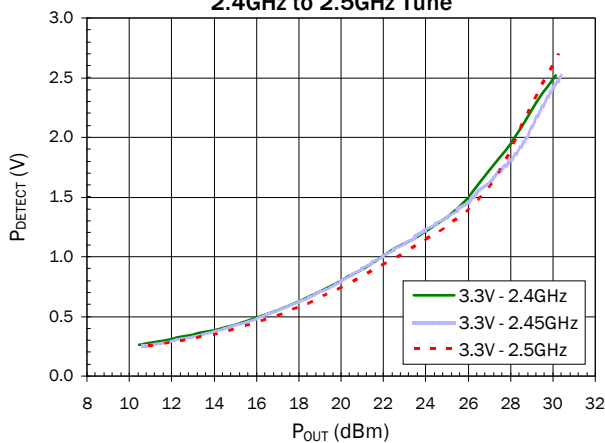
$I_{CC}$  versus  $P_{OUT}$ ,  
2.4GHz to 2.5GHz Tune



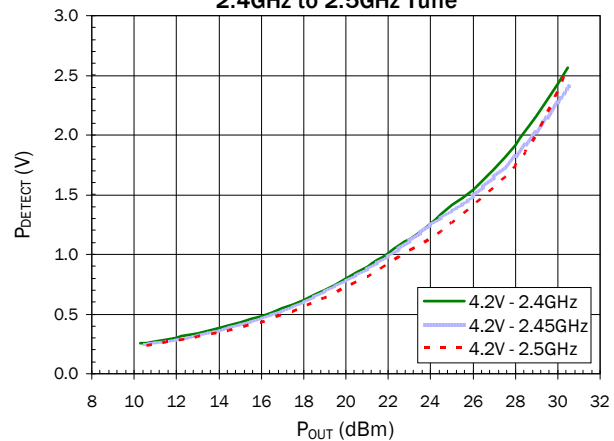
$I_{CC}$  versus  $P_{OUT}$ ,  
2.4GHz to 2.5GHz Tune



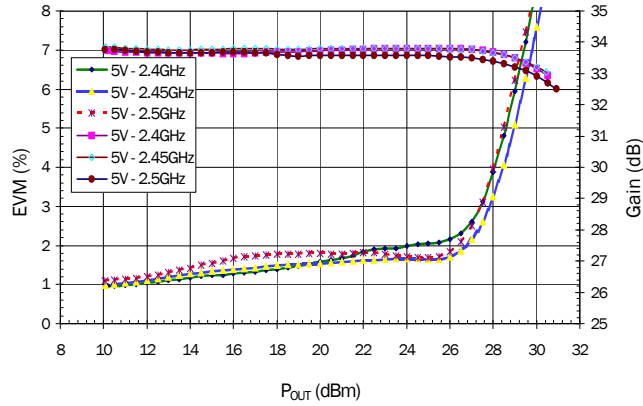
$P_{DETECT}$  versus  $P_{OUT}$ ,  
2.4GHz to 2.5GHz Tune



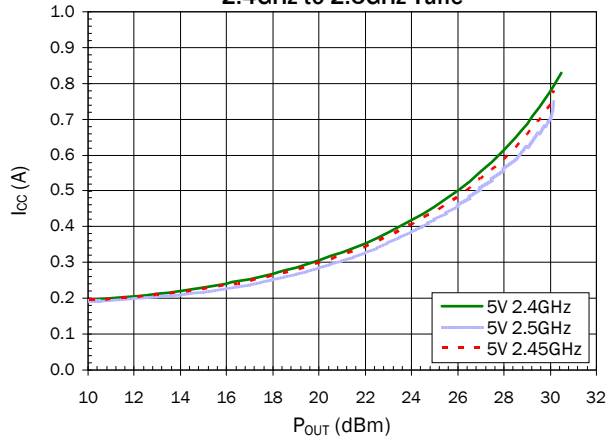
$P_{DETECT}$  versus  $P_{OUT}$ ,  
2.4GHz to 2.5GHz Tune



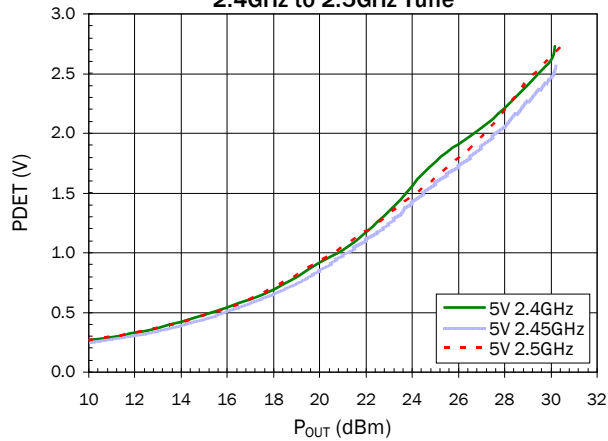
WLAN EVM and Gain versus P<sub>OUT</sub>  
2.4GHz to 2.5GHz Tune



WLAN I<sub>CC</sub> versus P<sub>OUT</sub>  
2.4GHz to 2.5GHz Tune

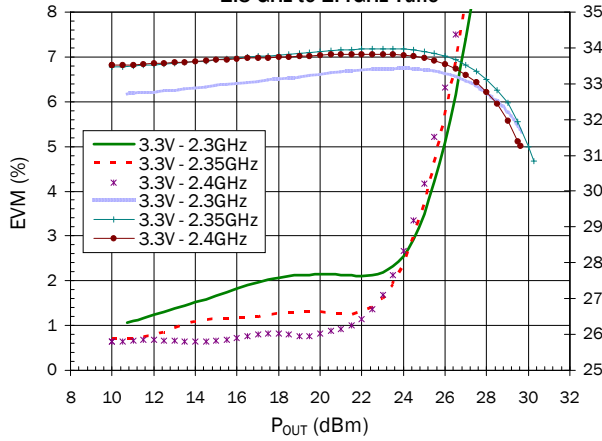


WLAN PDET versus P<sub>OUT</sub>  
2.4GHz to 2.5GHz Tune

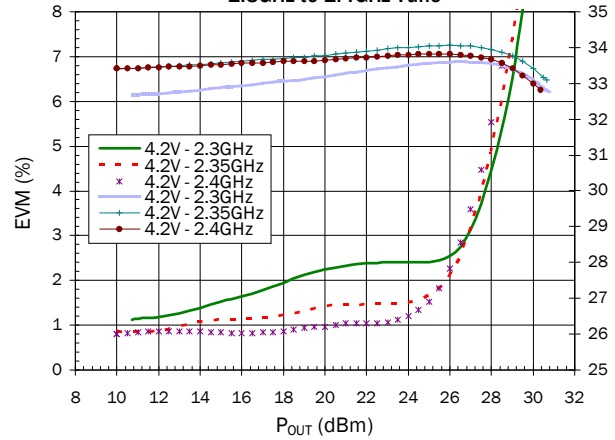


## WiBro 2.3GHz to 2.4GHz Operation

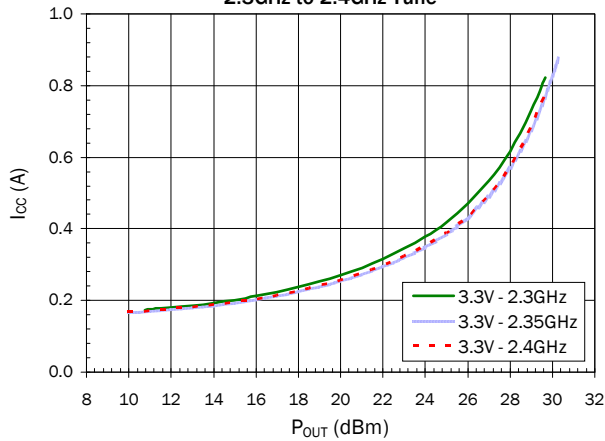
WiMAX EVM and Gt versus P<sub>OUT</sub>,  
2.3 GHz to 2.4GHz Tune



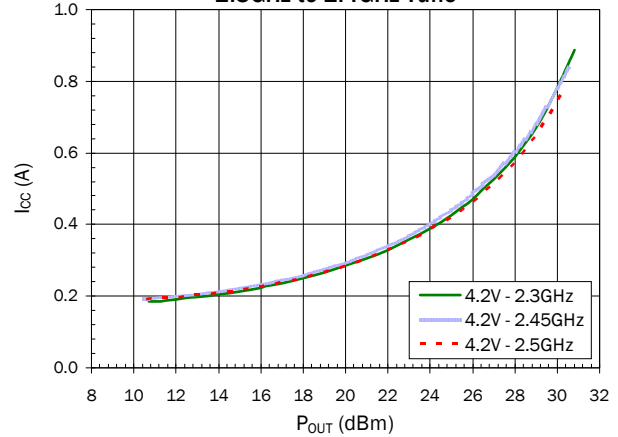
WiMAX EVM and Gt versus P<sub>OUT</sub>,  
2.3GHz to 2.4GHz Tune



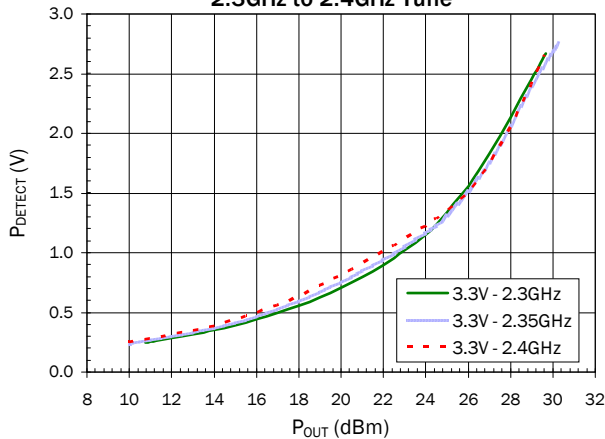
I<sub>CC</sub> versus P<sub>OUT</sub>,  
2.3GHz to 2.4GHz Tune



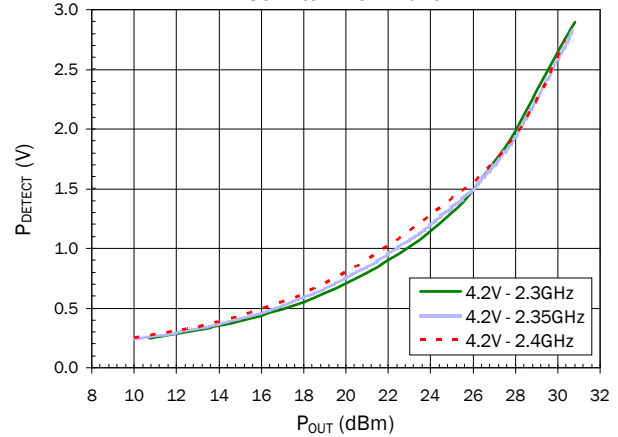
I<sub>CC</sub> versus P<sub>OUT</sub>,  
2.3GHz to 2.4GHz Tune



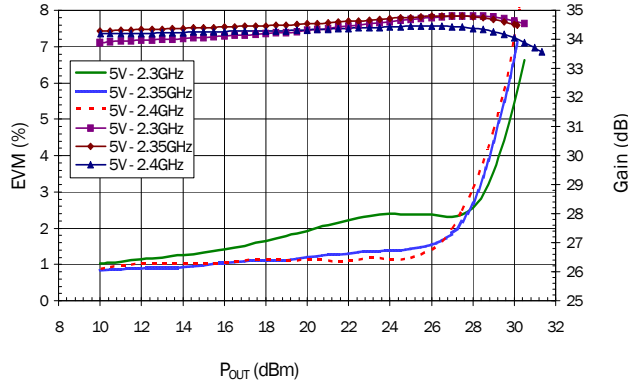
P<sub>DETECT</sub> versus P<sub>OUT</sub>,  
2.3GHz to 2.4GHz Tune



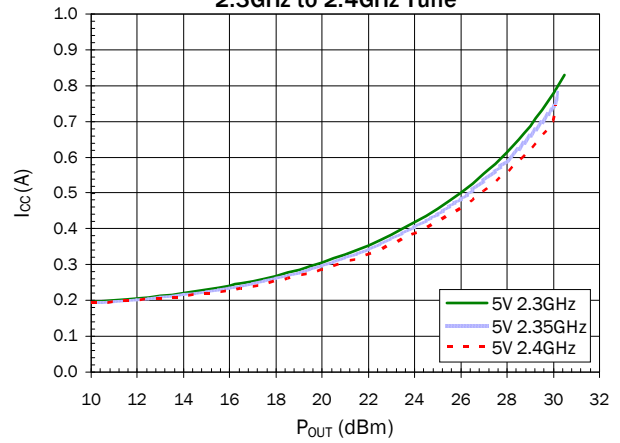
P<sub>DETECT</sub> versus P<sub>OUT</sub>,  
2.3GHz to 2.4GHz Tune



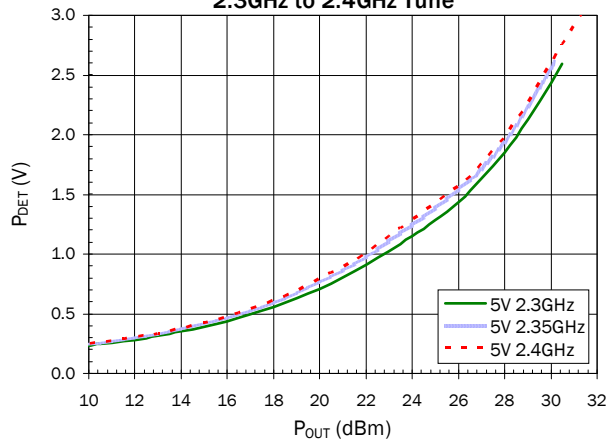
WiBro EVM and Gain versus P<sub>OUT</sub>  
2.3GHz to 2.4GHz Tune



WiBro I<sub>CC</sub> versus P<sub>OUT</sub>  
2.3GHz to 2.4GHz Tune

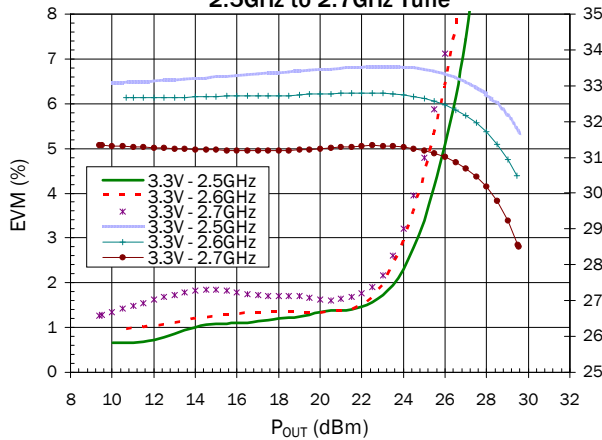


WiBro PDET versus P<sub>OUT</sub>  
2.3GHz to 2.4GHz Tune

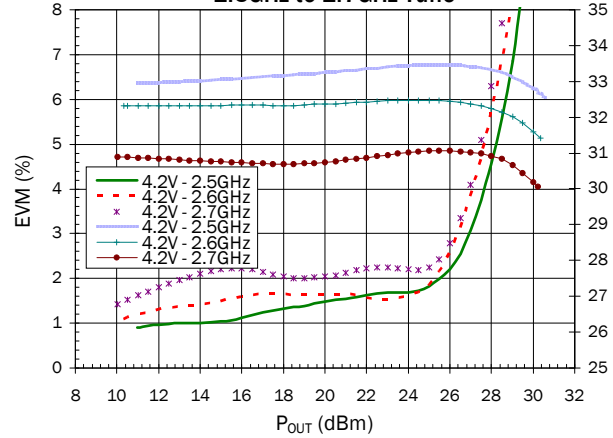


## WiMAX 2.5GHz to 2.7GHz Operation

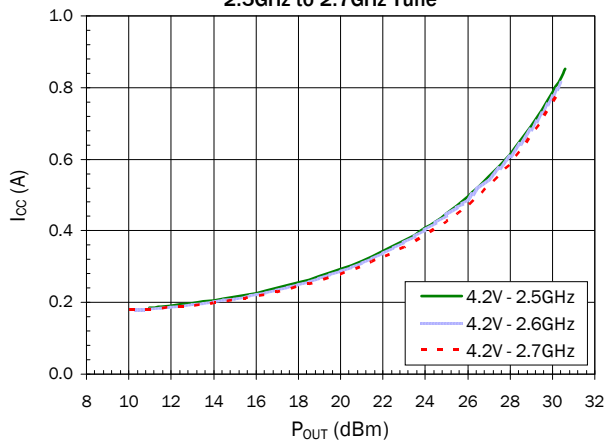
WiMAX EVM and GT versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune



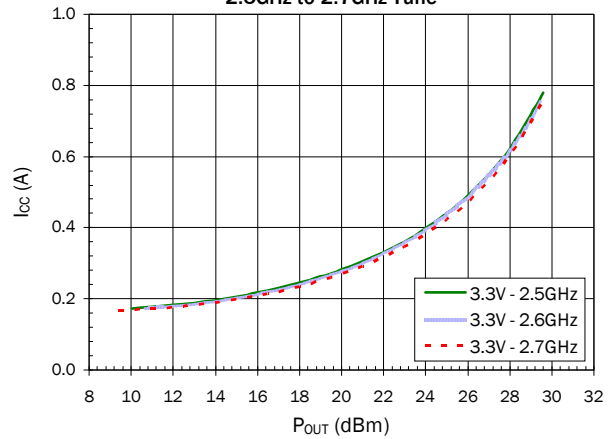
WiMAX EVM and GT versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune



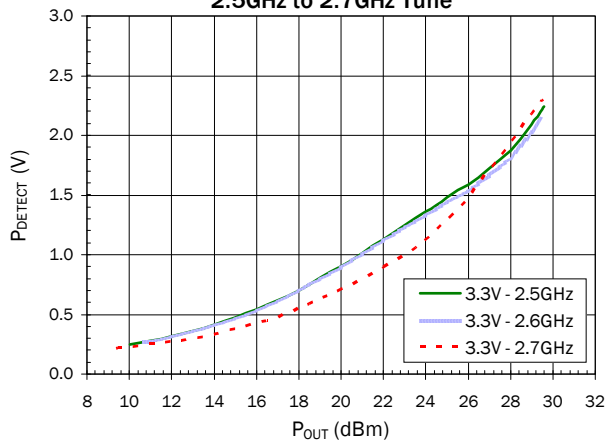
$I_{CC}$  versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune



$I_{CC}$  versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune



$P_{DETECT}$  versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune



$P_{DETECT}$  versus  $P_{OUT}$ ,  
2.5GHz to 2.7GHz Tune

