

Package Style: QFN, 8-Pin, 2.2mmx2.2mmx0.45mm

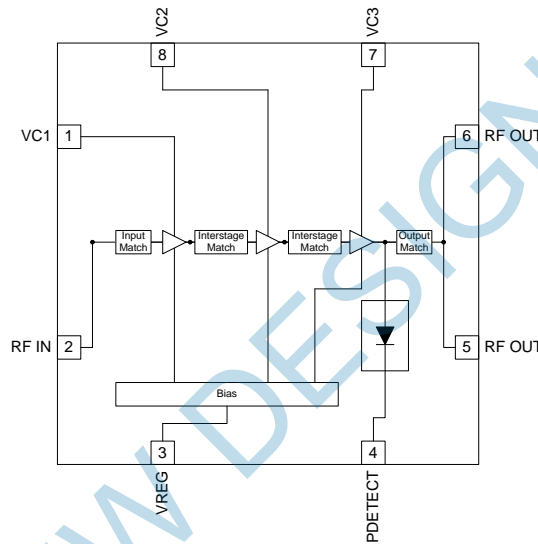


Features

- Single Supply Voltage 3.0V to 5.0V
- No external matching components
- 28dB Typical Gain Across Band
- P_{OUT} = 17 dBm @ <4% TYP EVM across Operating Band
- 4900MHz to 5850MHz Frequency Range

Applications

- IEEE802.11a/n and IEEE802.16e Applications
- HyperLAN
- WiFi Systems
- Commercial and Consumer Systems
- Portable Battery-Powered Equipment
- Spread-Spectrum and MMDS Systems



Functional Block Diagram

Product Description

The RF5355 is a linear, medium-power, high-efficiency power amplifier IC designed specifically for battery-powered WiFi applications such as PC cards, mini PCI, and compact flash applications. It is also designed to meet IEEE802.11a, IEEE802.11n, IEEE802.16e (4.9GHz to 5.850GHz only) WiMax, FCC, and ETSI requirements for operation in the 4.9GHz to 5.850GHz band. The device is manufactured on an advanced InGaP GaAs Heterojunction Bipolar Transistor process, and has been designed for use as the final RF amplifier in 5GHz WiFi and other spread-spectrum transmitters. The device is provided in a QFN, 8-pin, 2.2mmx2.2mmx0.45mm, leadless chip carrier with backside ground. The RF5355 operates from a single supply and will be easily incorporated into WiFi and other designs with minimal external components.

Ordering Information

| | |
|---------------|---|
| RF5355 | Standard 25 piece bag |
| RF5355SR | Standard 100 piece reel |
| RF5355TR7 | Standard 2500 piece reel |
| RF5355PCK-410 | Fully Assembled Evaluation Board and 5 loose sample pieces. |

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 |

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Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---------------|-----------------|
| Supply Voltage (No RF Applied) | -0.5 to +6.0 | V _{DC} |
| Supply voltage (RF Applied) | -0.5 to 5.25 | V _{DC} |
| Power Control Voltage (V _{REG}) | -0.5 to 3.5 | V |
| DC Supply Current | 400 | mA |
| Input RF Power | +10 | dBm |
| Operating Ambient Temperature | -30 to +85 | °C |
| Storage Temperature | -40 to +150 | °C |
| Moisture sensitivity | JEDEC Level 3 | |



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).

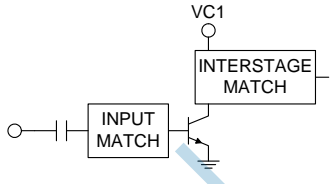
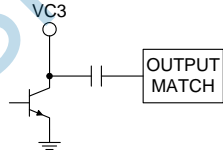
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| Parameter | Specification | | | Unit | Condition |
|--------------------------|---------------|------|------|------|--|
| | Min. | Typ. | Max. | | |
| Compliance | | | | | T = +25 °C; V _{CC} = 3.3V; V _{REG} = 2.85V; pulsed at 1% to 100% duty cycle; Freq = 4.9GHz to 5.85GHz; unless otherwise noted. IEEE802.11a; IEEE802.11n; IEEE802.16e (4.9GHz to 5.85GHz) |
| Frequency Range | 4.90 | | 5.85 | GHz | Lower, middle and upper U-NII |
| Output Power | 16 | 17 | | dBm | -30 to +85C, over V _{CC} range, over frequency, and nominal V _{REG} |
| EVM* | | 3 | 4 | % | RMS, mean @ P _{OUT} = 17 dBm at nominal conditions. Measured with a standard IEEE802.11a waveform, 54Mbps, 64QAM. |
| Gain | | | | | At P _{OUT} = 17 dBm |
| | 25 | 28 | 33 | dB | 4.9GHz to 5.1GHz |
| | 25 | 28 | 33 | dB | 5.15GHz to 5.35GHz |
| | 25 | 28 | 32 | dB | 5.70GHz to 5.85GHz |
| Gain Variance | | | 1.5 | ±dB | 4.9GHz to 5.850GHz, -30 °C to +85 °C (in any 200MHz frequency) |
| OP1dB | | 25 | | dBm | V _{CC} = 3.3V, V _{REG} = 2.85V, and using CW waveform at 5.85 GHz |
| Power Detector | | | | | |
| P _{OUT} @8dBm | 0.7 | 0.8 | 0.9 | V | At nominal conditions, over operating temperature |
| P _{OUT} @17dBm | 1.4 | 1.6 | 1.7 | V | At nominal conditions, over operating temperature |
| Power Added Efficiency | 6.6 | 10.8 | 13.7 | % | At P _{OUT} = +17 dBm, over temperature -30 °C to +85 °C, over V _{CC} range, and over frequency at nominal V _{REG} |
| Power Supply | 3.0 | 3.3 | 4.0 | V | |
| V _{REG} Voltage | 2.75 | 2.85 | 2.95 | V | Recommended Operating V _{REG} range |
| | | | 3.3 | V | V _{REG} should not exceed this level |
| Current | | | | | |
| Operating | 120 | 140 | 170 | mA | At RF P _{OUT} = +17 dBm with IEEE802.11a waveform and 54Mbps data rate over operating temperature range |
| Quiescent | | 95 | 110 | mA | At nominal conditions, over operating temperature range |
| I _{REG} | | 10 | | mA | |
| Shutdown | | | 5 | µA | |
| Output VSWR | | | 4:1 | | Stable and no spurs above -47 dBm |
| | | | 10:1 | | No damage |

*The EVM specification includes a source EVM level of 0.5% to 0.7%.

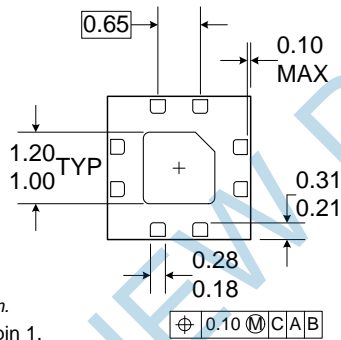
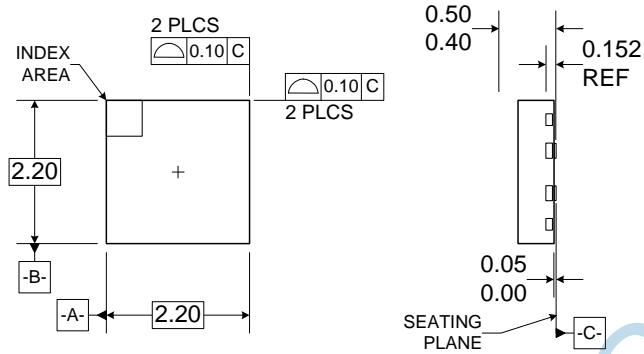
| Parameter | Specification | | | Unit | Condition |
|---|---------------|------|------|---------------|---|
| | Min. | Typ. | Max. | | |
| IEEE802.11a Spectral Mask per FCC Part 15.205 | -43 | | | dBm | Amplifier set up for best IEEE802.11a performance; $F_C=5180\text{MHz}$; RF $P_{OUT}=+17\text{ dBm}$; $T=+25^\circ\text{C}$, Measured @ 5150MHz |
| | -43 | | | dBm | Amplifier set up for best IEEE802.11a performance; $F_C=5320\text{MHz}$; RF $P_{OUT}=+17\text{ dBm}$; $T=+25^\circ\text{C}$, Measured @ 5350MHz |
| Second Harmonic | -14 | | | dBm | At nominal conditions, at $P_{OUT}=+17\text{ dBm}$, measured in 1MHz RBW with 6Mbps 11a signal, Fundamental Frequency is between 4.9GHz to 5.299GHz. |
| | -23 | | | dBm | At nominal conditions, at $P_{OUT}=+17\text{ dBm}$, measured in 1MHz RBW with 6Mbps 11a signal, Fundamental Frequency is between 5.3GHz to 5.85GHz. |
| Input Return Loss | | -10 | | dB | |
| Turn-on Time | | 0.5 | 1.5 | μs | Output stable to within 90% of final gain |

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| Pin | Function | Description | Interface Schematic |
|----------|----------|---|---|
| 1 | VC1 | First stage supply voltage. | |
| 2 | RF IN | RF input. Input is matched to 50Ω and DC block is provided internally. |  |
| 3 | VREG | First, second and third stage bias voltage combined on the die to one external voltage. This pin requires regulated supply for best performance. | |
| 4 | PDETECT | Power detector voltage is proportional to RF output power. May need external decoupling capacitor for module stability. May need external circuitry to bring output voltage to desired level. | |
| 5 | RF OUT | RF output is internally matched to 50Ω and DC-blocking capacitor of about 1.8 pF to 5.6 pF depending on the layout is required externally if a switch is used immediately after the PA that has DC voltage at the switch input which is the same node at the RF output of the PA. |  |
| 6 | RF OUT | Same as pin 5. | See pin 5. |
| 7 | VC3 | Supply voltage for the third stage. | |
| 8 | VC2 | Supply voltage for the second stage. | |
| Pkg Base | GND | Ground connection. The backside of the package should be connected to the ground plane through a short path (i.e., vias under the device will be required). | |

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Package Drawing
QFN, 8-Pin, 2.2x2.2x0.45mm



Dimensions in mm.
 Shaded lead is pin 1.

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PCB Design Requirements

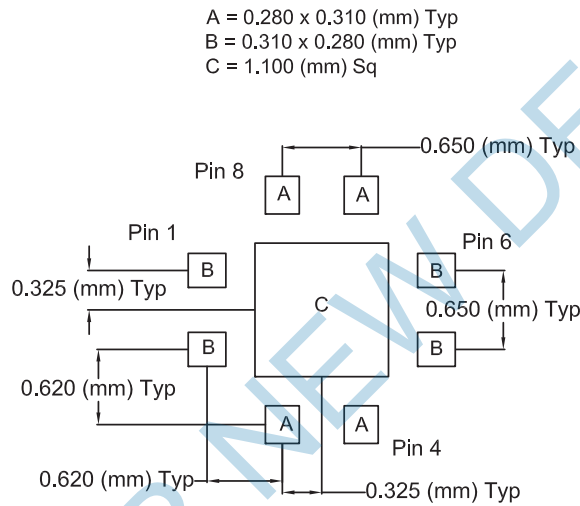
PCB Surface Finish

The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3 micro-inch to 8 micro-inch gold over 180 micro-inch nickel.

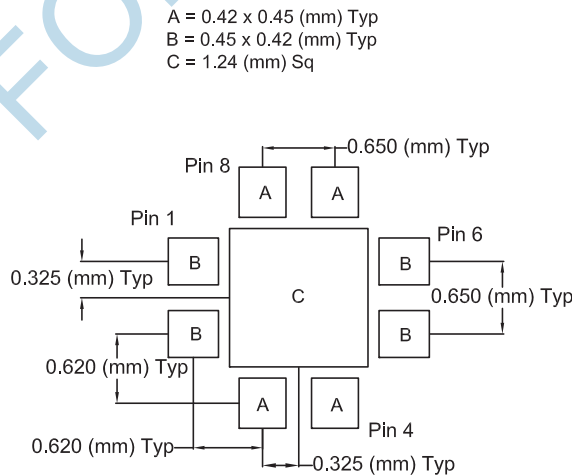
PCB Land Pattern Recommendation *

PCB land patterns for RFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

PCB Metal Land Pattern

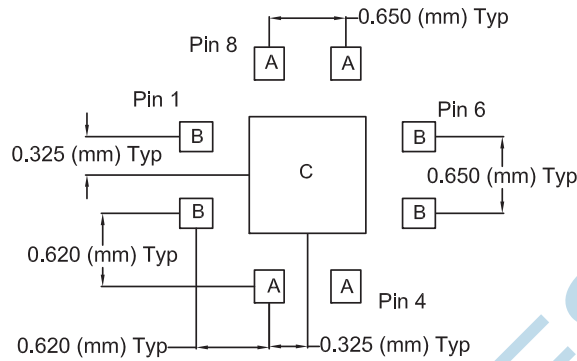


PCB Solder Mask Pattern



PCB Stencil Pattern

A = 0.25 x 0.28 (mm) Typ
 B = 0.28 x 0.25 (mm) Typ
 C = 0.99 (mm) Sq



Note: Thermal vias for center slug “C” should be incorporated into the PCB design. The number and size of thermal vias will depend on the application. Example of the number and size of vias can be found on the RFMD evaluation board layout.

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Theory of Operation

The RF5355 is a three-stage device with a minimum gain of 28dB in the 4.9GHz to 5.850GHz ISM band. The RF5355 is designed primarily for IEEE802.11a, IEEE802.11n, and IEEE802.16e in the 4.9GHz to 5.850GHz band where the available supply voltage and current are limited. This amplifier will operate to (and below) the lowest expected voltage made available by a typical PCMCIA slot in a laptop PC, and will maintain required linearity at decreased supply voltages.

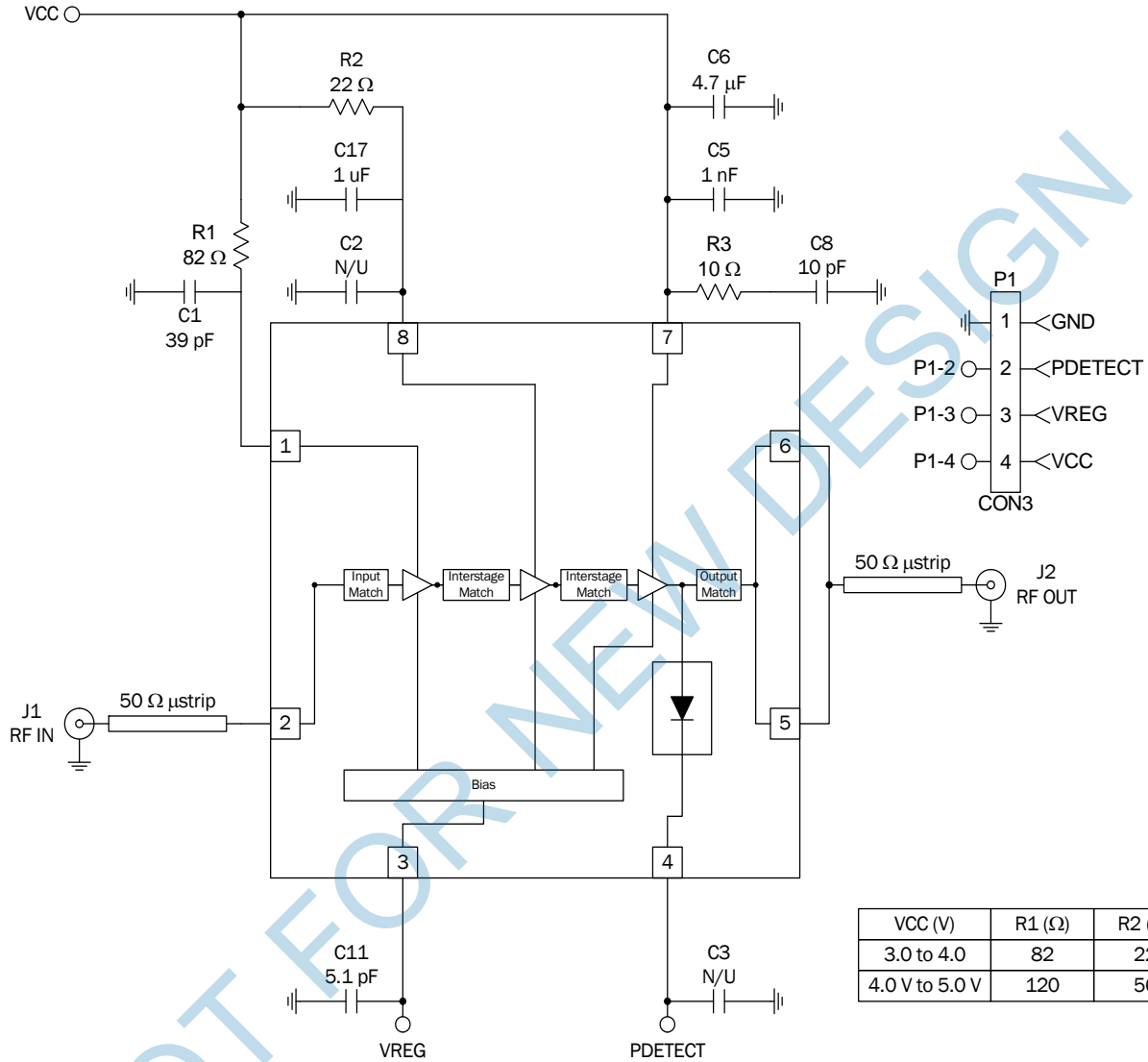
The RF5355 requires only a single positive supply of 3.3V nominal (or greater) to operate to full specifications. Power control is provided through one bias pin, V_{REG} . The three bias voltages for the three stages are connected together on the die and only one bias control voltage is needed (V_{REG}). There is no external matching required on the input and output of the part, thus allowing a minimal bill of material (BOM) parts count in end applications. Both the input and the output of the device are DC-blocked.

For best results, the PA circuit layout from the evaluation board should be copied as closely as possible, particularly the ground layout and ground vias. Other configurations may also work, but the design process is much easier and quicker if the layout is copied from the RF5355 evaluation board. Gerber files of our designs are available on request. The RF5355 is not a difficult part to implement, but care in circuit layout and component selection is always advisable when designing circuits to operate at 5GHz.

The RF5355 has primarily been characterized with a voltage on V_{REG} of $2.85V_{DC}$. However, the RF5355 will operate from a wide range of control voltages. If you prefer to use a control voltage that is significantly different than $2.85V_{DC}$, contact RFMD Sales or Applications Engineering for additional data and guidance.

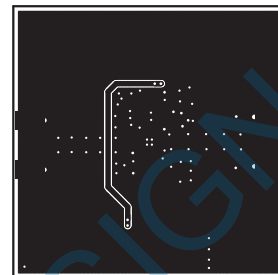
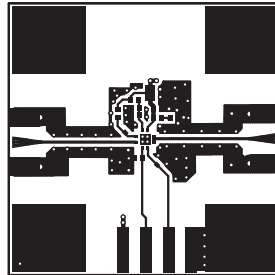
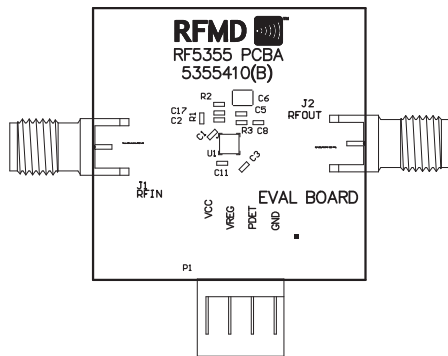
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Evaluation Board Schematic
RF5355PCBA Evaluation Board (4.9GHz to 5.85GHz)



The following components C11, R3, and C8 may be left unpopulated without degradation in performance depending on the layout.

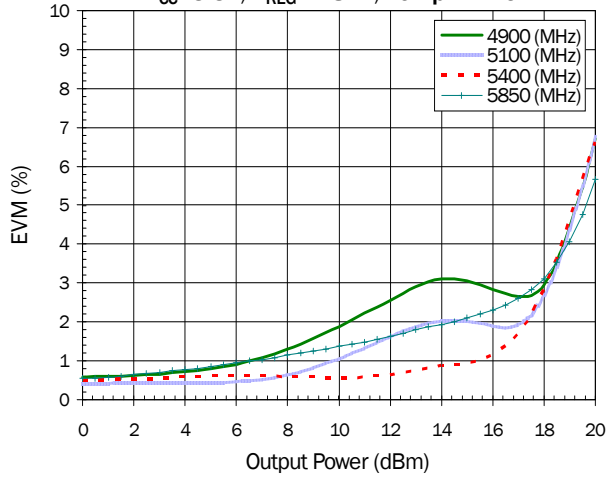
Evaluation Board Layout Board Size 1.2" x 1.2" Board Thickness 0.032", Board Material FR-4, Multi-Layer



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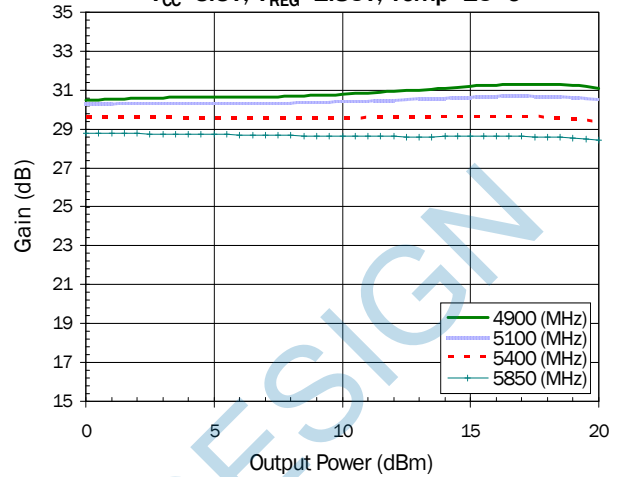
EVM versus Output Power

$V_{CC}=3.3V$; $V_{REG}=2.85V$; Temp= $25^{\circ}C$



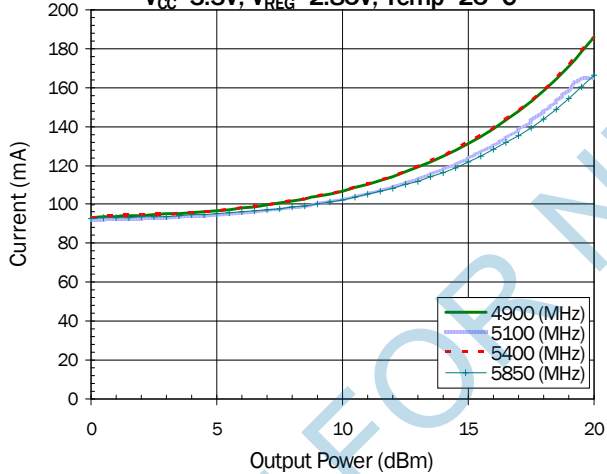
Gain versus Output Power

$V_{CC}=3.3V$; $V_{REG}=2.85V$; Temp= $25^{\circ}C$



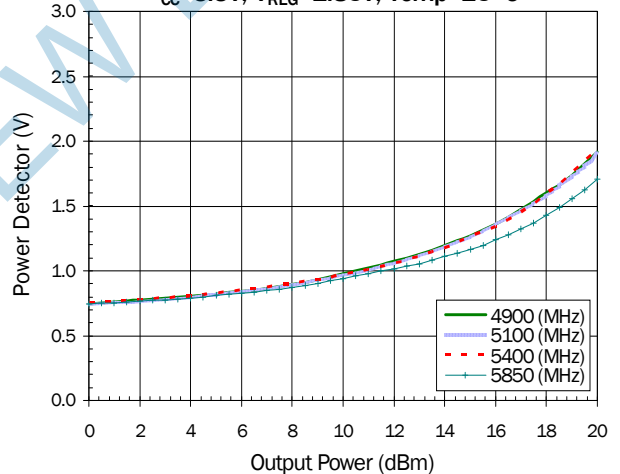
I_{CC} versus Output Power

$V_{CC}=3.3V$; $V_{REG}=2.85V$; Temp= $25^{\circ}C$



Power Detector versus Output Power

$V_{CC}=3.3V$; $V_{REG}=2.85V$; Temp= $25^{\circ}C$



I_{REG} versus Output Power

$V_{CC}=3.3V$; $V_{REG}=2.85V$; Temp= $25^{\circ}C$

