



## Product Description

GRF4014 is a broadband low noise gain block designed for small cell, wireless infrastructure and other high performance applications. With simple external matching, it exhibits outstanding broadband NF, linearity and return losses over wide fractional bandwidths with a single match.

Configured as a first stage LNA, linear driver or cascaded gain block, GRF4014 offers high levels of reuse both within a design and across platforms. The device is operated from a supply voltage ( $V_{DD}$ ) of 3.0 to 8.0V.  $I_{DDQ}$  can be adjusted over a wide range for optimal efficiency and linearity.

Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

## Features

Reference: 5V/60mA/2.5 GHz

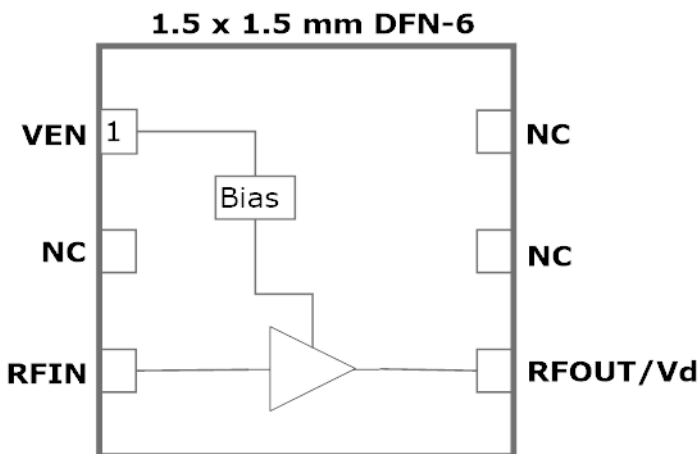
- EVB NF: 0.80 dB
- Gain: 16.5 dB
- OP1dB: 24.0 dBm
- OIP3: 39.0 dBm

Reference: 8V/110mA/2.5 GHz

- EVB NF: 0.83 dB
- Gain: 17.0 dB
- OP1dB: 28.3 dBm
- OIP3: 44.0 dBm
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

## Applications

- Linear Driver/LNA
- Small Cells and Cellular Repeaters
- Distributed Antenna Systems
- Microwave Backhaul



## Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V <sub>DD</sub>	0	9.0	V
RF Input Power CW : (Load VSWR < 2:1; V <sub>D</sub> : 5.0 volts)	P <sub>IN MAX</sub>		22	dBm
Operating Temperature (Package Heat Sink)	T <sub>AMB</sub>	-40	105	°C
Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)	T <sub>MAX</sub>		170	°C
Maximum Dissipated Power	P <sub>DISS MAX</sub>		1100	mW
<b>Electrostatic Discharge:</b>				
Charged Device Model:	CDM	1000		V
Human Body Model:	HBM	250		V
<b>Storage:</b>				
Storage Temperature	T <sub>STG</sub>	-65	150	°C
Moisture Sensitivity Level	MSL		1	--



**Caution!** ESD Sensitive Device



Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For package dimensions and manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF4014 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.

[Link to manufacturing note](#)

## Pin Out (Top View)



## Pin Assignments:

Pin	Name	Description	Note
1	V <sub>ENABLE</sub>	Enable Voltage Input	V <sub>ENABLE</sub> and series resistor set I <sub>DDQ</sub> . V <sub>ENABLE</sub> < =0.2 volts disables device. On -die pull-down resistor will turn the part off if this node is allowed to float.
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	LNA RF input	An external DC blocking cap must be used.
4	RF_Out	LNA RF output	V <sub>DD</sub> must be applied through a choke to this pin.
5	NC	No Connect or Ground	No internal connection to die
6	NC	No Connect or Ground	No internal connection to die
PKG BASE	GND	Ground	Provides DC and RF ground for LNA, as well as thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to evaluation board top layer graphic on schematic page.



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# GRF4014

Broadband LNA/Linear Driver  
Tuning Range: 0.1 to 6.0 GHz

## Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	$F_{TEST}$		2500		MHz	$V_{DD} = 5.0\text{ V}$ , $T_A = 25^\circ\text{C}$
Gain	S21	15.5	16.5		dB	
Evaluation Board Noise Figure	NF		0.80	1.0	dB	Includes Board Losses
Output 1dB Compression Power	OP1dB	22.5	24.0		dBm	
Output 3rd Order Intercept	OIP3		39.0		dBm	8.0 dBm $P_{OUT}$ per tone at 2 MHz Spacing (2499 and 2501 MHz)
Switching Rise Time	$T_{RISE}$		200		ns	
Switching Fall Time	$T_{FALL}$		200		ns	
Supply Current	$I_{DD}$		60		mA	Adjustable for optimal IP3
Leakage Current	$I_{LEAKAGE}$		250		uA	$V_{DD}: 5.0\text{V}$ ; $V_{ENABLE}: 0.0\text{V}$
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	$\Theta_{jc}$		50		$^\circ\text{C}/\text{W}$	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	$T_{CHANNEL}$		100		$^\circ\text{C}$	$V_{DD}: 5.0\text{ V}$ ; $I_{DDQ}: 60\text{ mA}$ ; No RF; $P_{DISS}: 300\text{ mW}$

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Test Frequency	$F_{TEST}$		2500		MHz	$V_{DD} = 8.0\text{ V}$ , $T_A = 25^\circ\text{C}$
Gain	S21		17.0		dB	
Evaluation Board Noise Figure	NF		0.83		dB	Includes Board Losses
Output 1dB Compression Power	OP1dB		28.3		dBm	
Output 3rd Order Intercept	OIP3		44.0		dBm	8.0 dBm $P_{OUT}$ per tone at 2 MHz Spacing (2499 and 2501 MHz)
Switching Rise Time	$T_{RISE}$		200		ns	
Switching Fall Time	$T_{FALL}$		200		ns	
Supply Current	$I_{DD}$		110		mA	
Leakage Current	$I_{LEAKAGE}$		325		uA	$V_{DD}: 5.0\text{V}$ ; $V_{ENABLE}: 0.0\text{V}$
Thermal Data						
Thermal Resistance: (Infra-Red Scan)	$\Theta_{jc}$		50		$^\circ\text{C}/\text{W}$	On standard Evaluation Board
Channel Temperature @ +85 C Reference (Package heat sink)	$T_{CHANNEL}$		129		$^\circ\text{C}$	$V_{DD}: 8.0\text{ V}$ ; $I_{DDQ}: 110\text{ mA}$ ; No RF; $P_{DISS}: 880\text{ mW}$

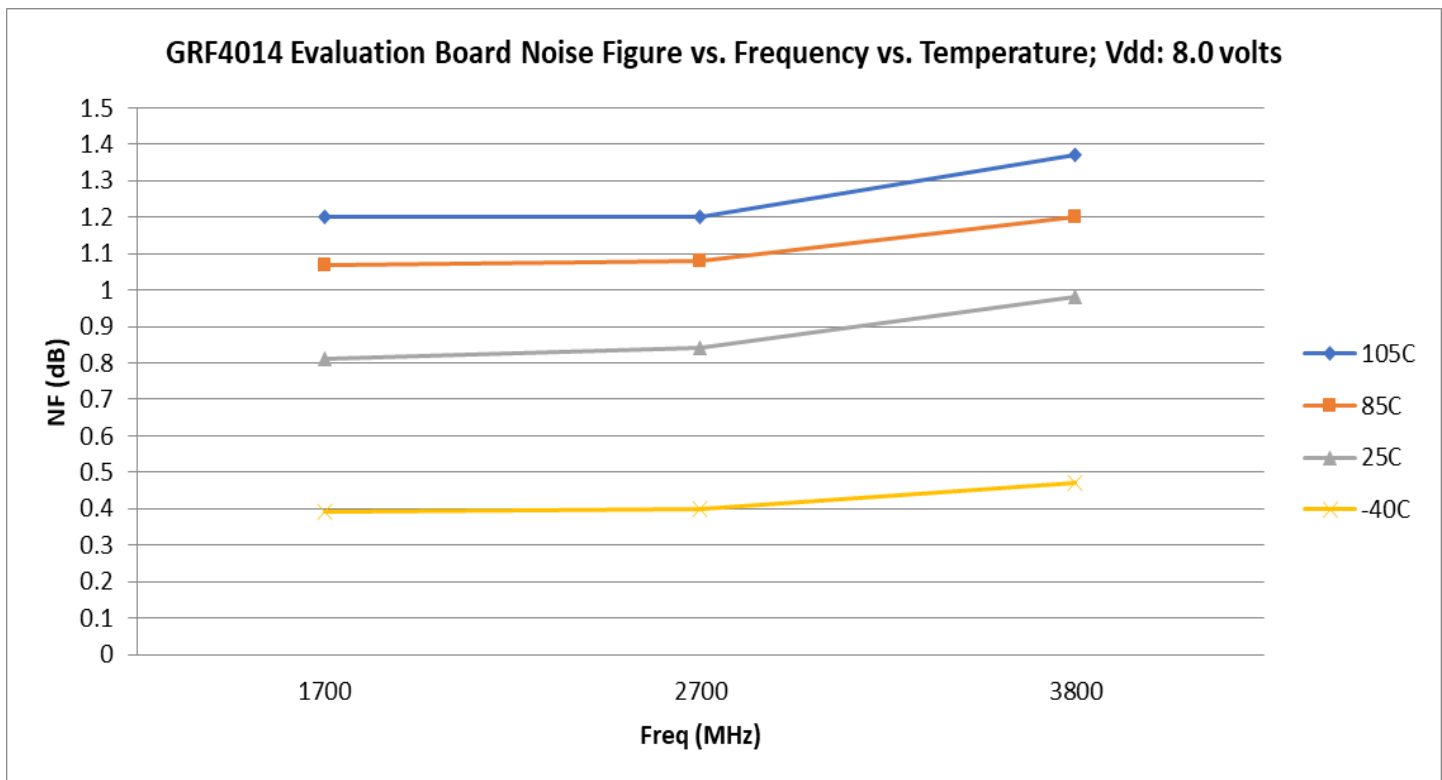
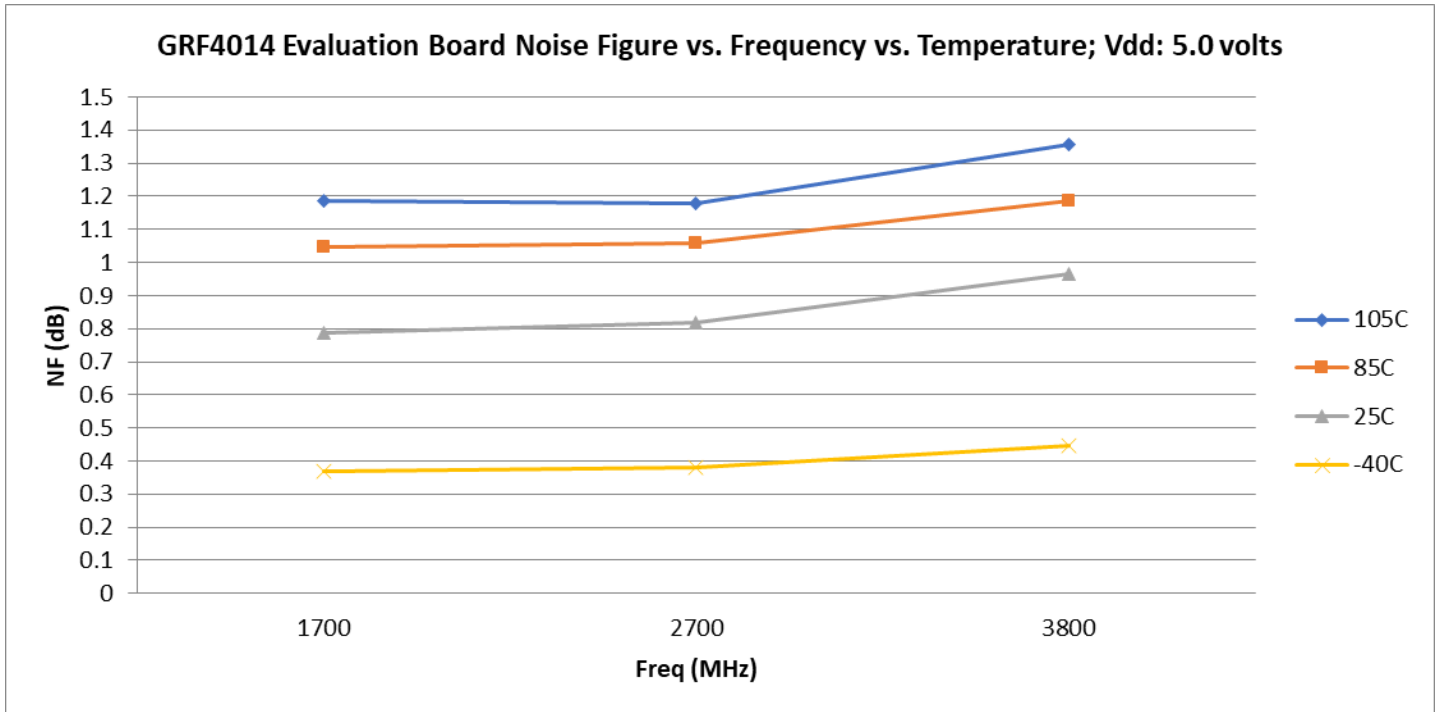


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# GRF4014

Broadband LNA/Linear Driver  
Tuning Range: 0.1 to 6.0 GHz

## GRF4014 Evaluation Board Data:



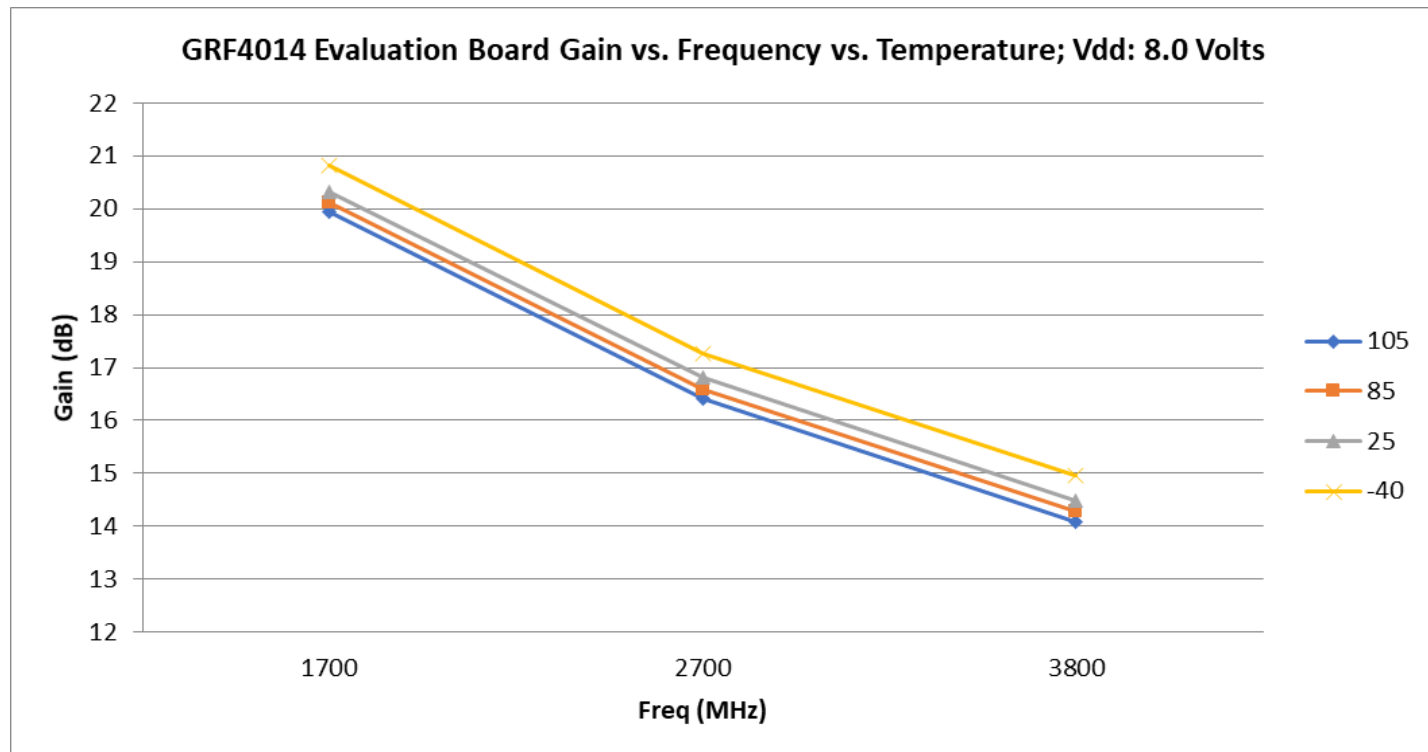
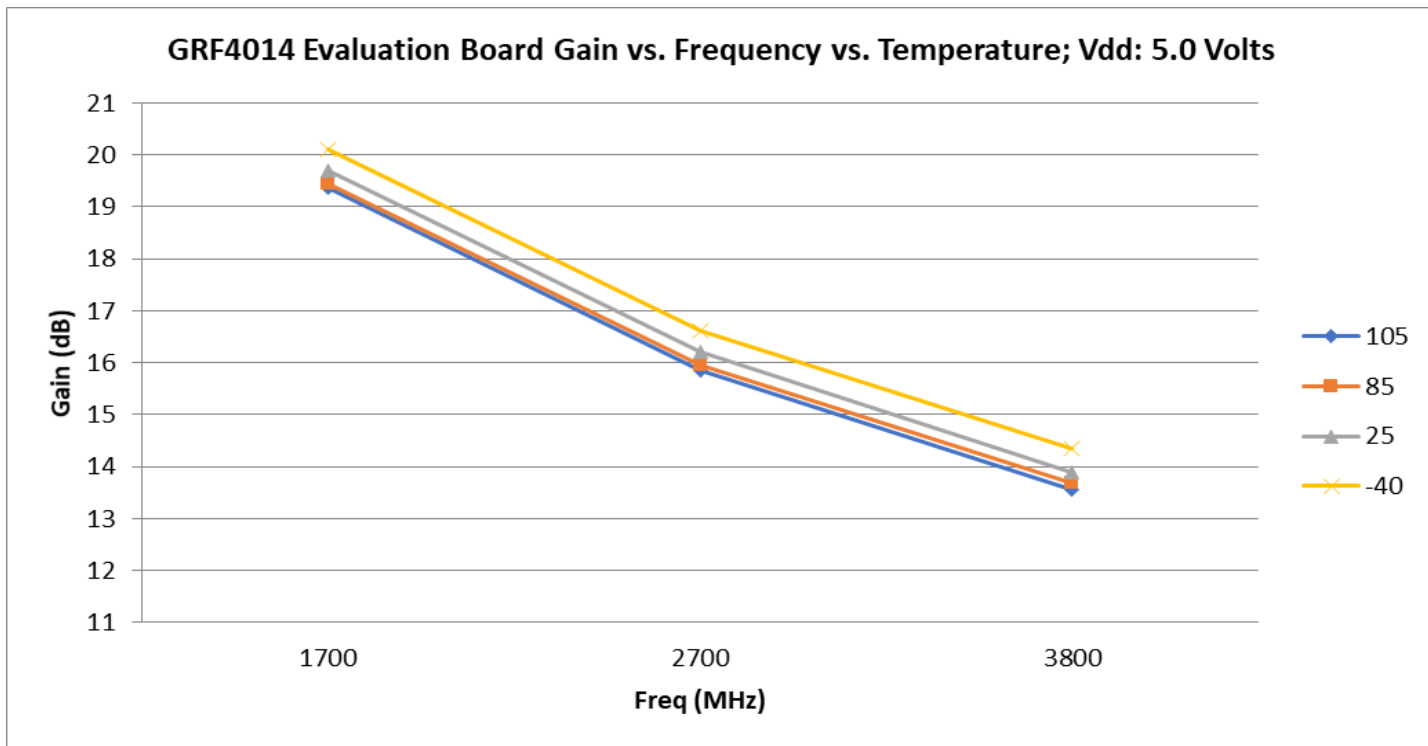


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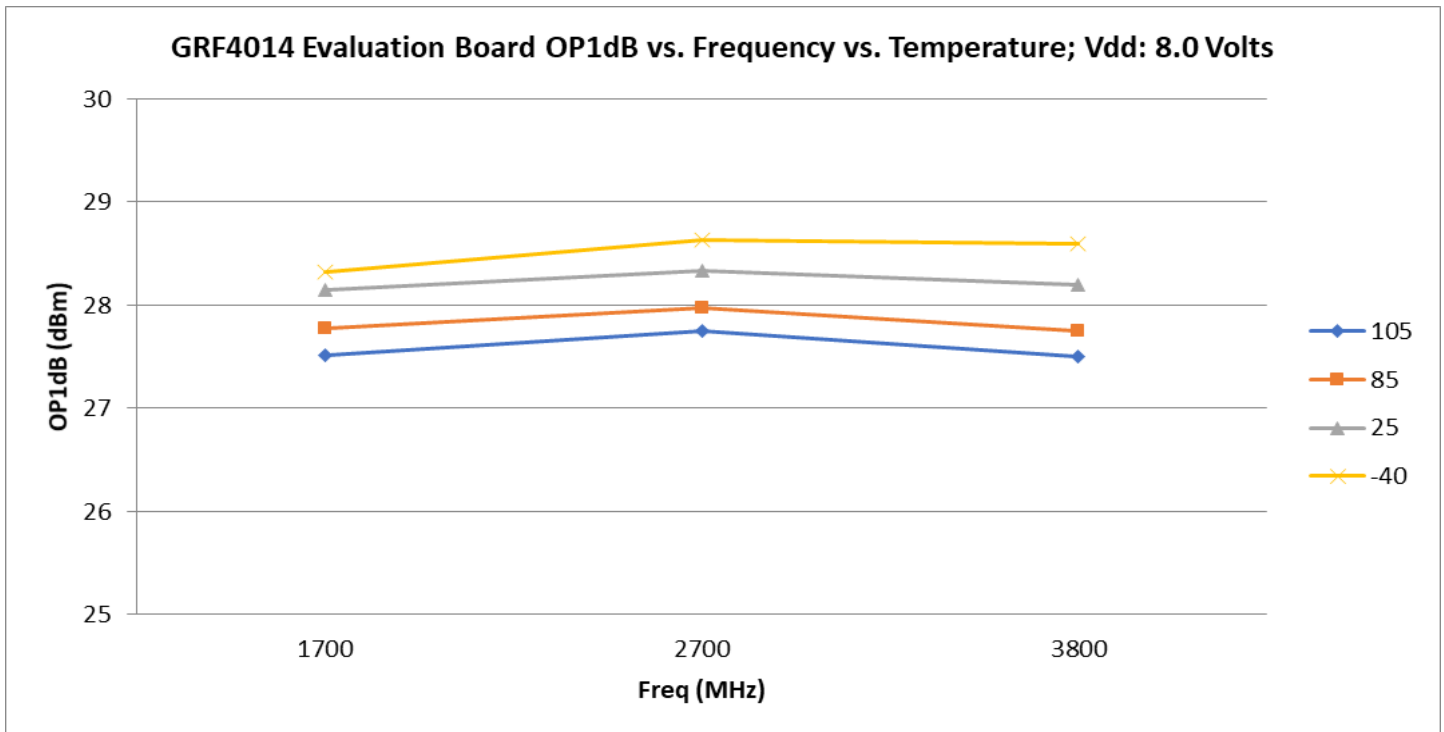
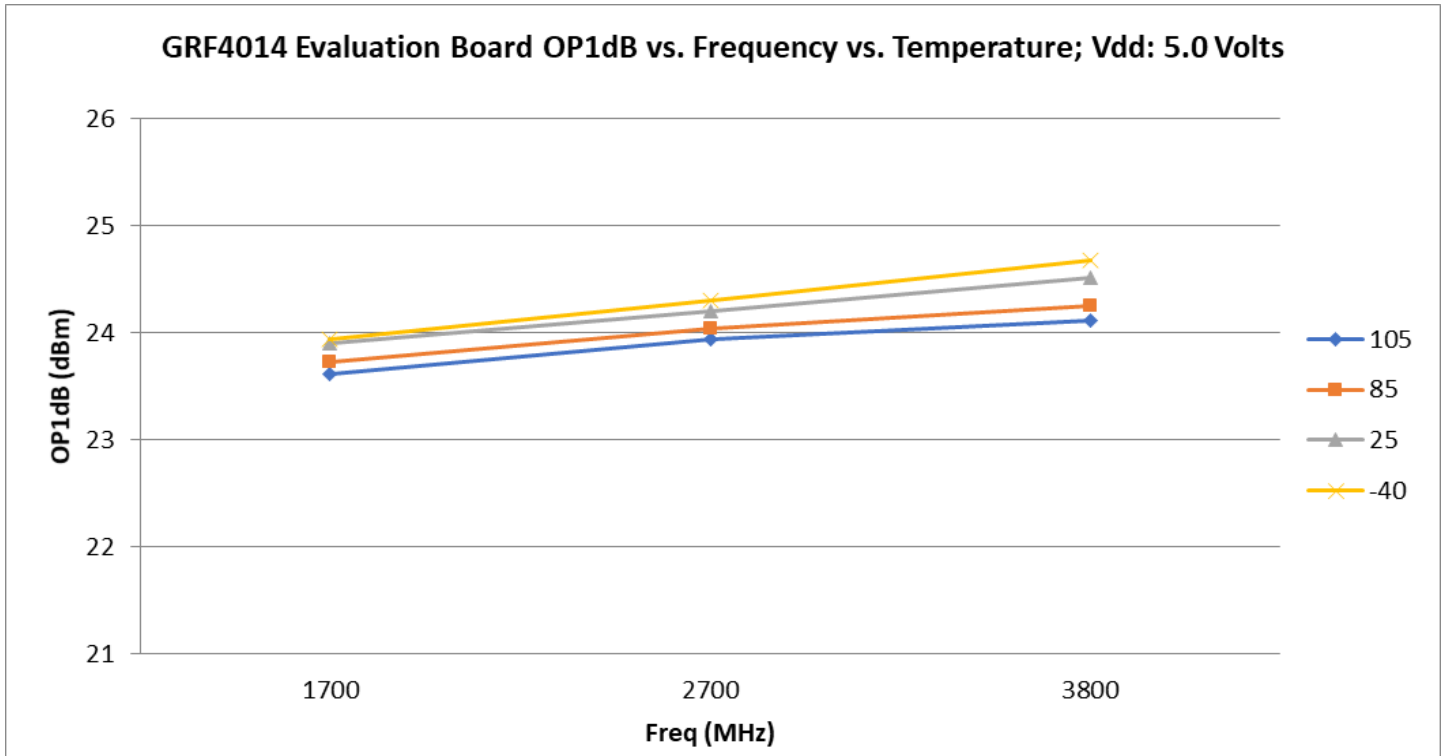


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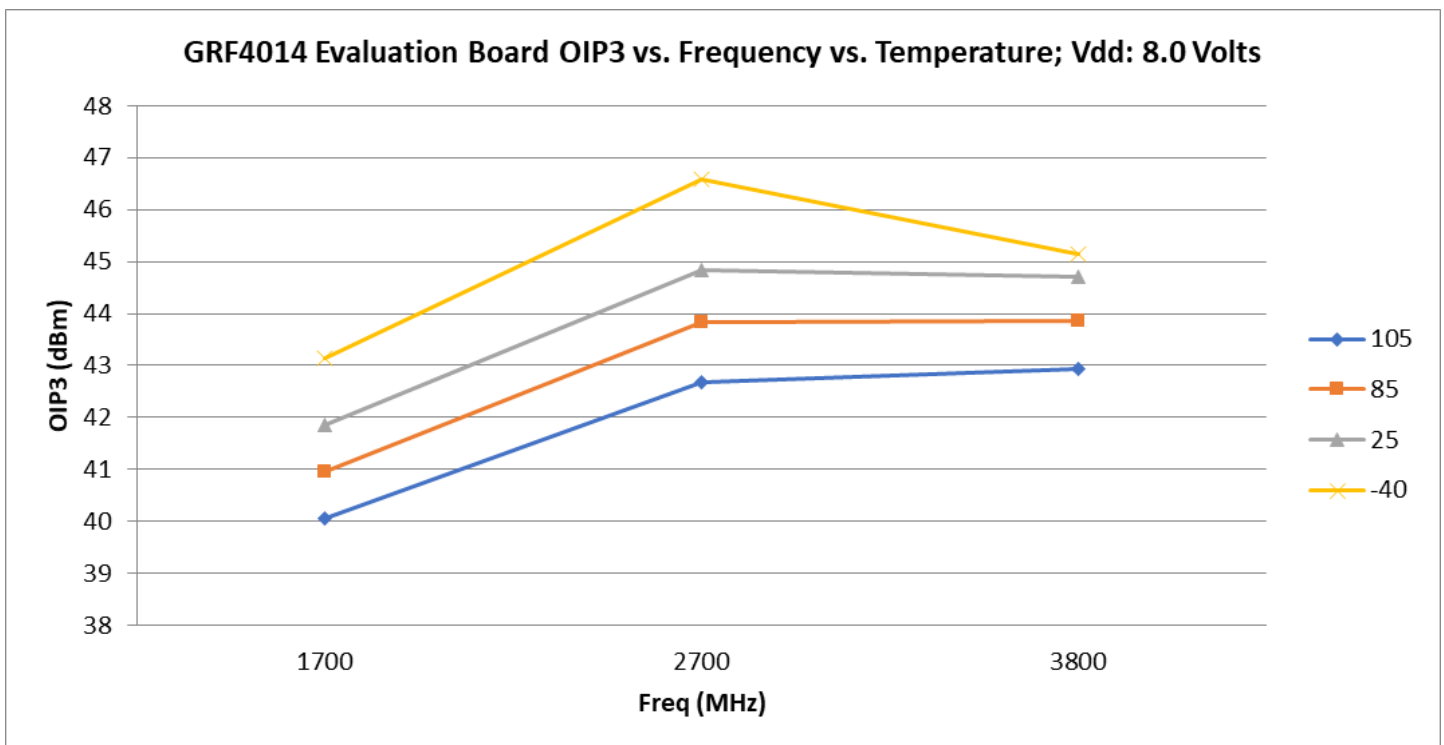
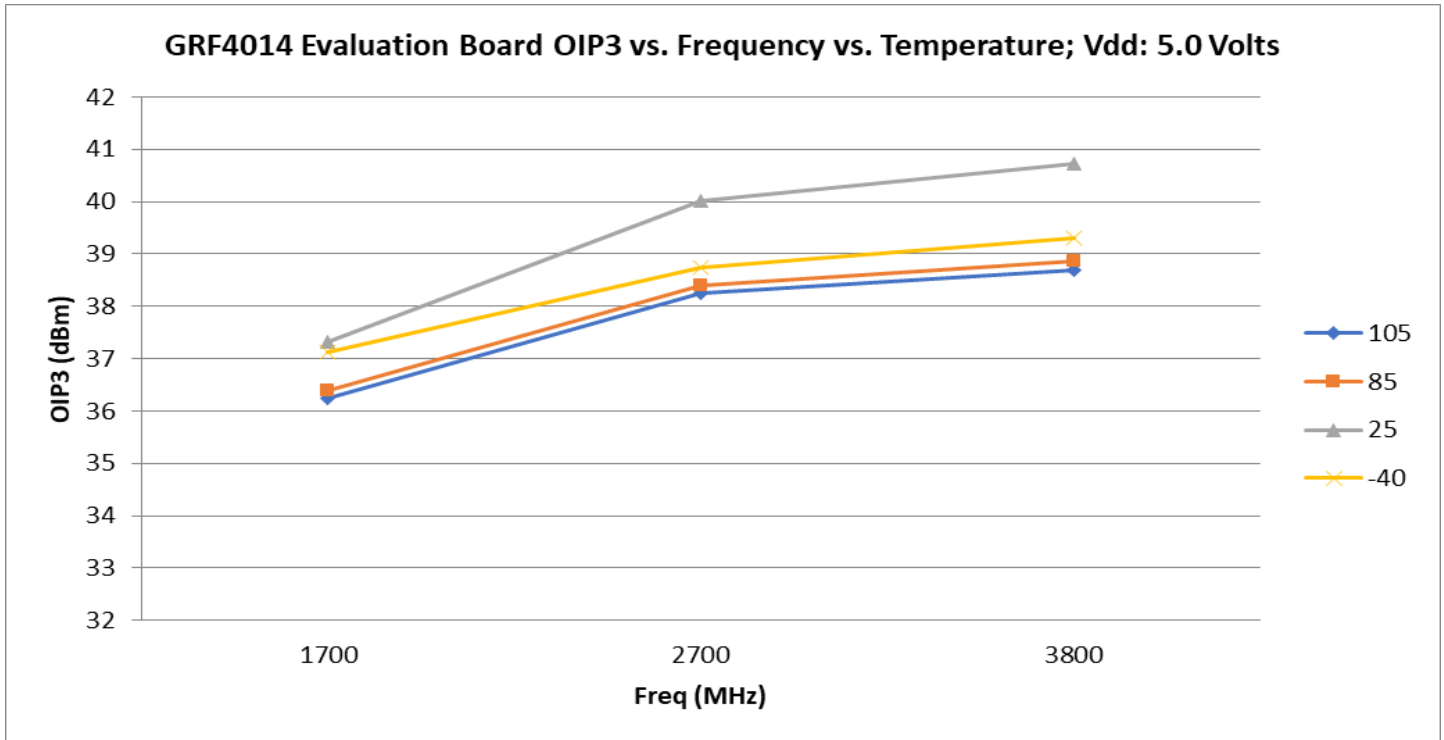


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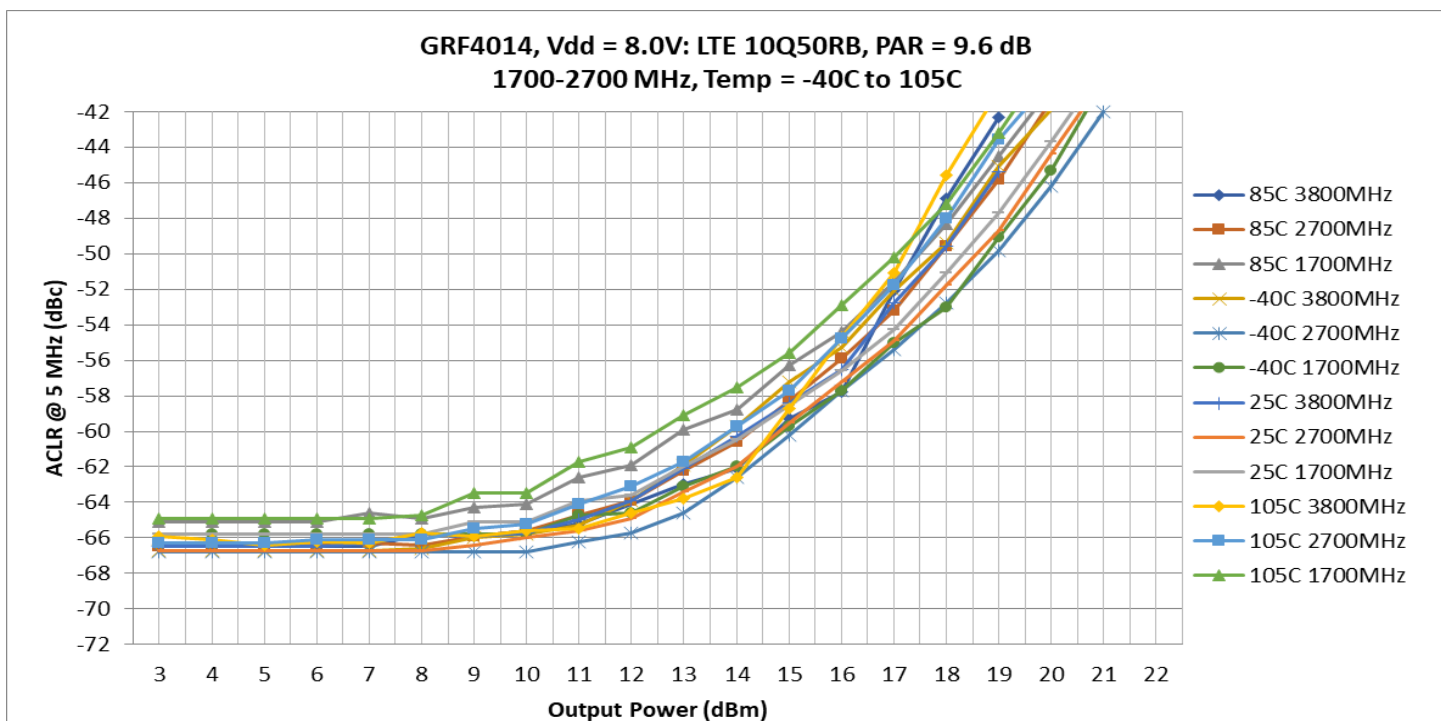
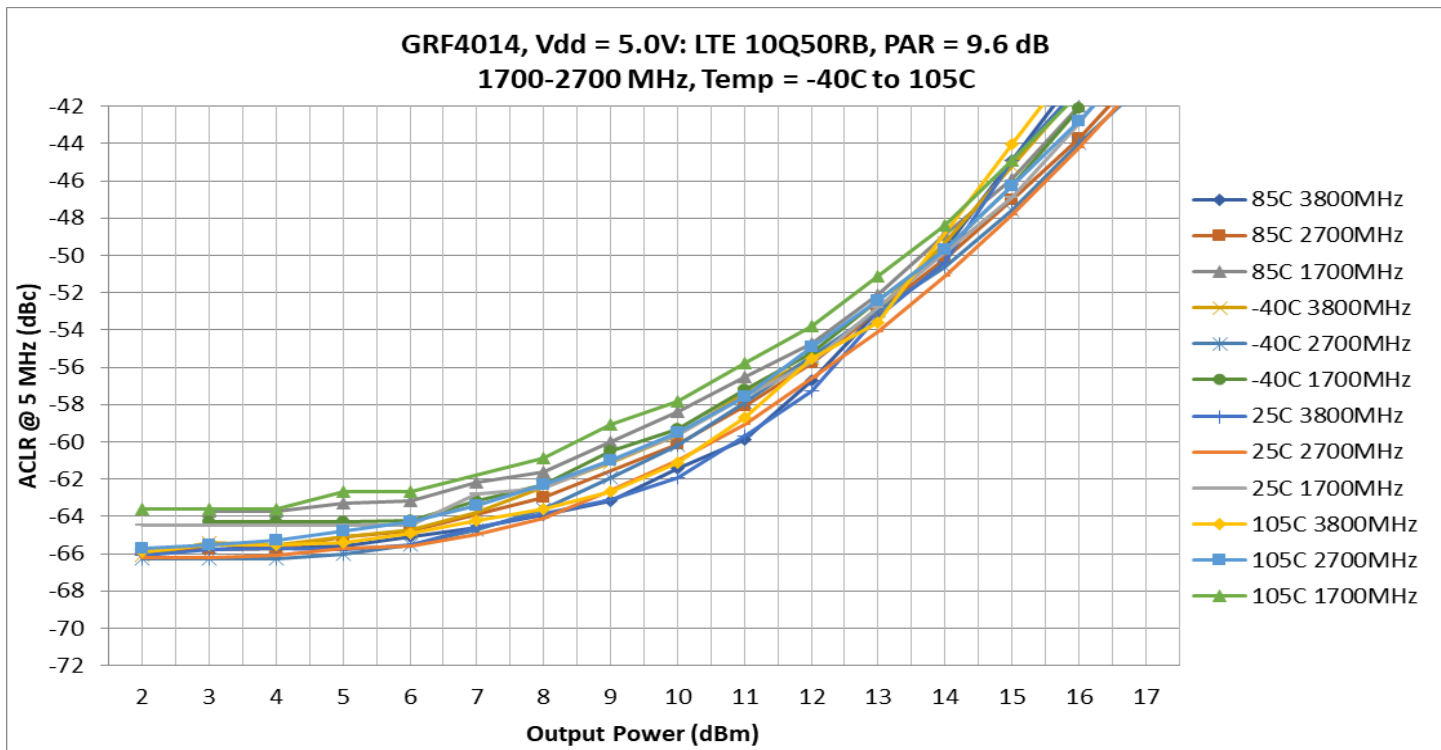
Broadband LNA/Linear Driver  
Tuning Range: 0.1 to 6.0 GHz

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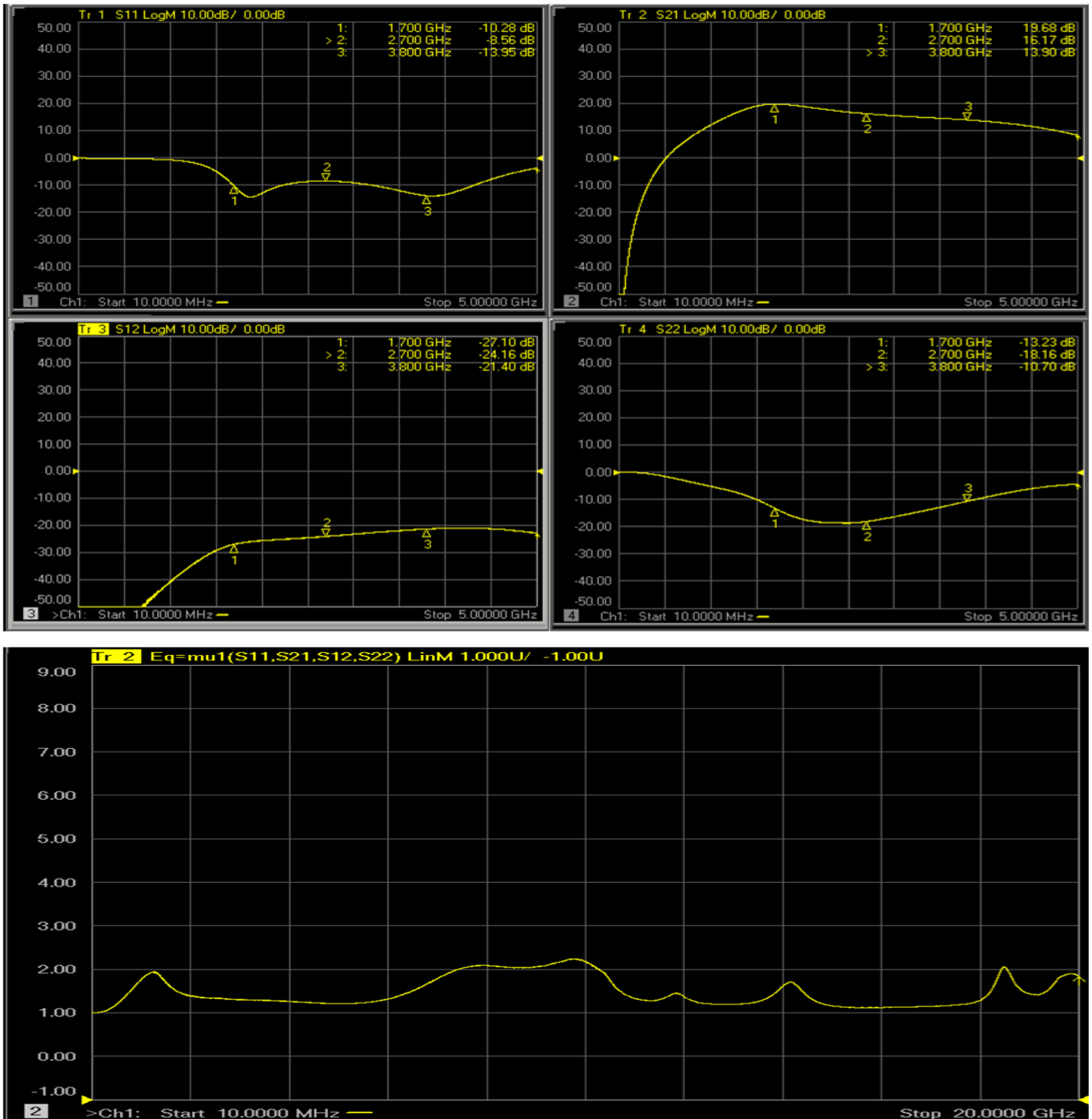




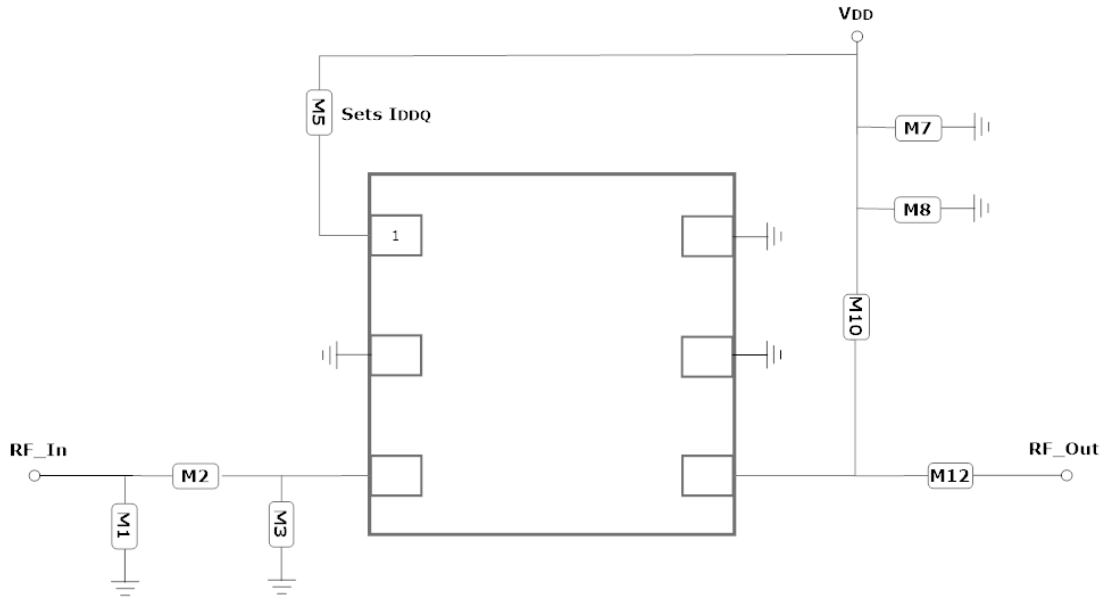
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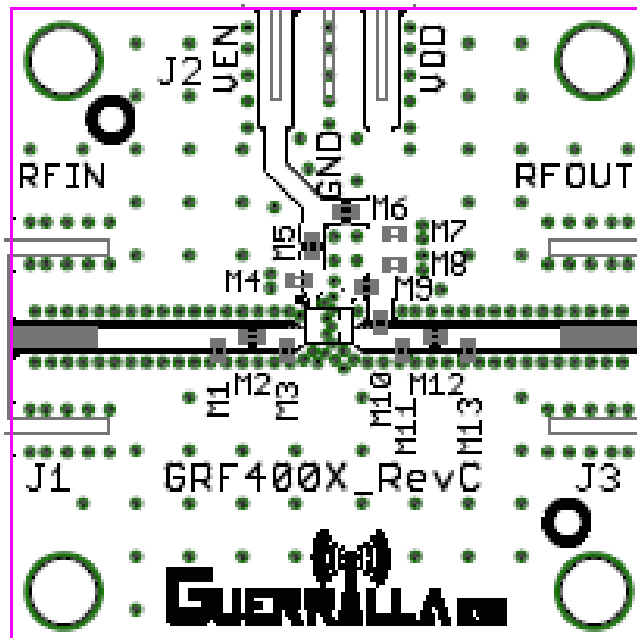
## GRF4014 Evaluation Board S-Pars and Stability Mu Factor: (1.7 – 3.8 GHz Match)



Note: Mu factor  $\geq 1.0$  implies unconditional stability.



GRF4014 Application Schematic



GRF4014 Evaluation Board Assembly Diagram



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# GRF4014

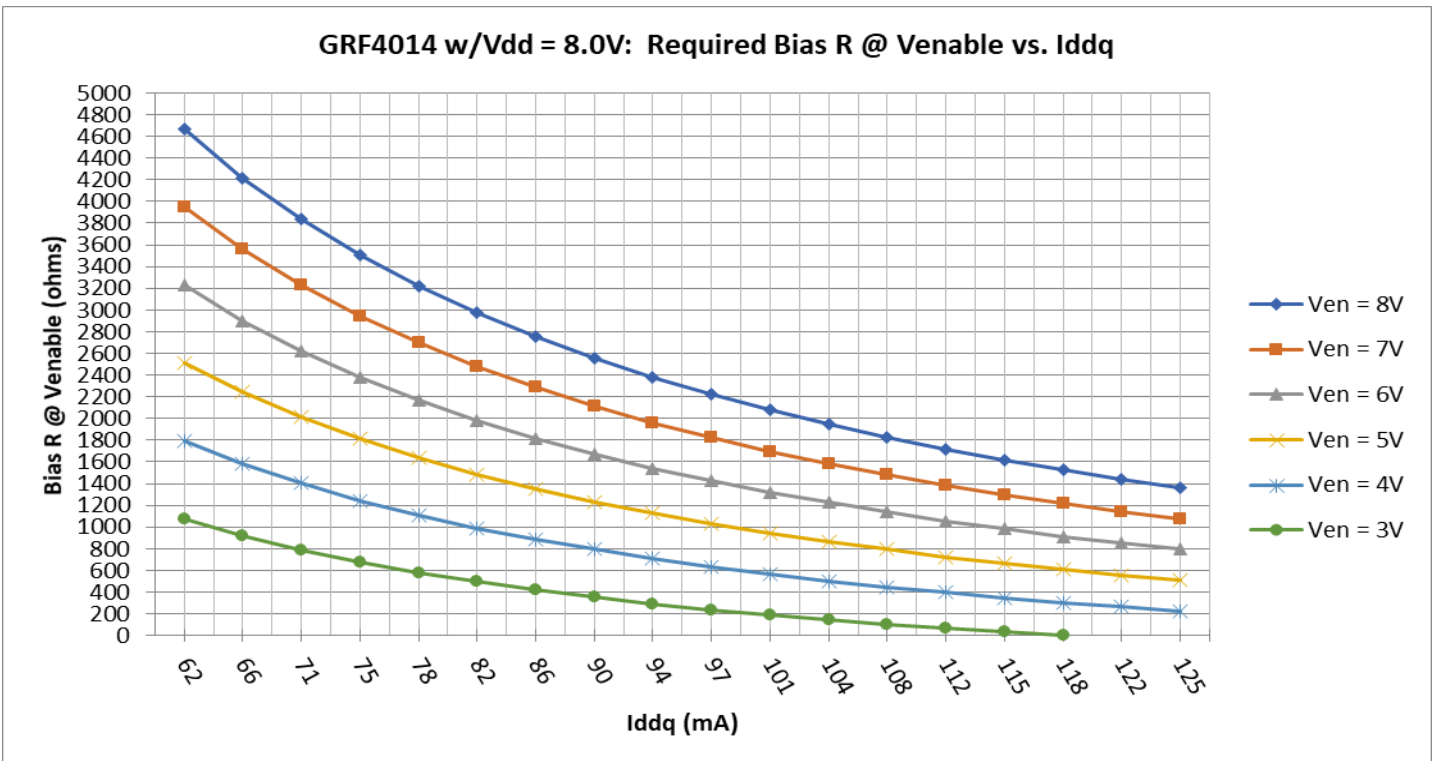
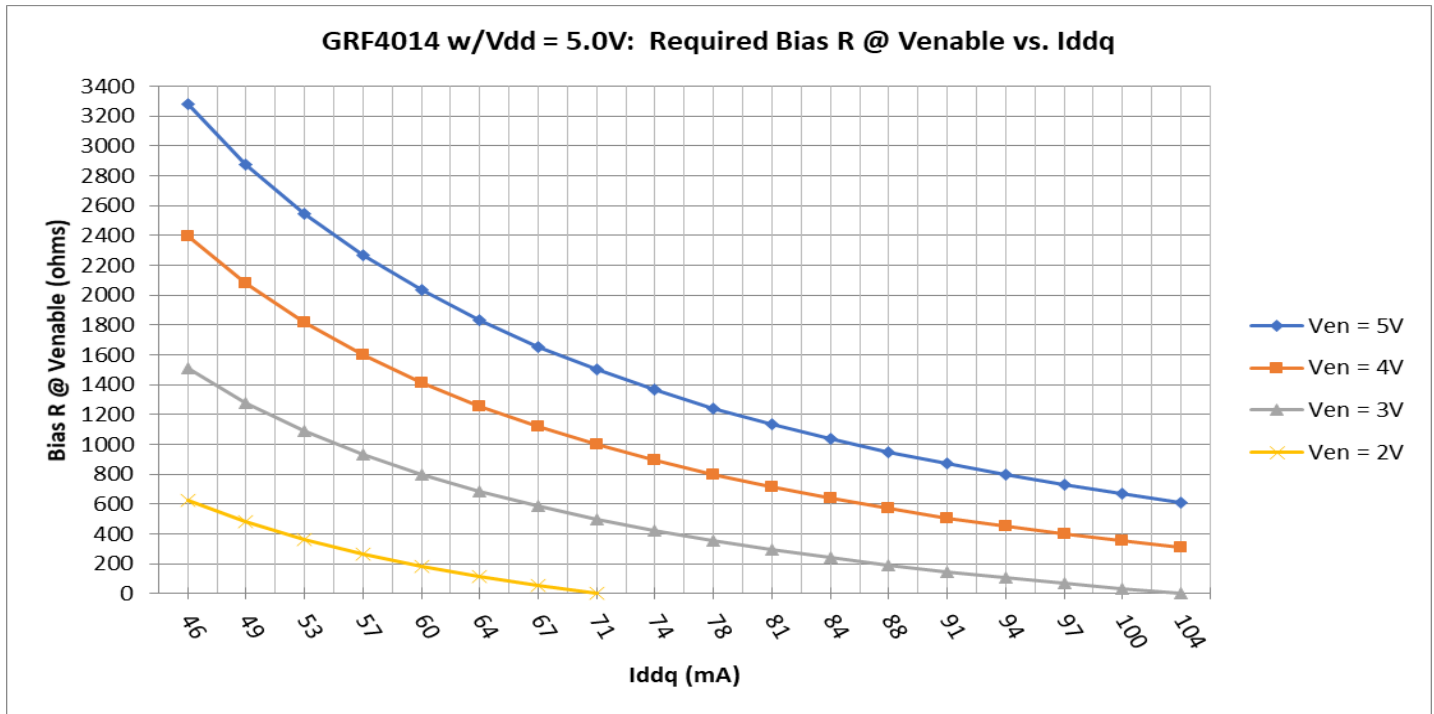
Broadband LNA/Linear Driver  
Tuning Range: 0.1 to 6.0 GHz

## GRF4014 Standard Evaluation Board BOM: (1.7 to 3.8 GHz Tune)

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Inductor	Coilcraft	HP	3.6 nH	0402	ok
M2	Capacitor	Murata	GJM	2.0 pF	0402	ok
M3	Capacitor	Murata	GJM	1.0 pF	0402	ok
M5 (See curves)	Resistor: 5%	Various	—	—	0402	ok
M7	Capacitor	Murata	GRM	0.1 uF	0402	ok
M8	Capacitor	Murata	GRM	100 pF	0402	ok
M10	Inductor	Murata	LQP	6.8 nH	0402	ok
M12	Capacitor	Murata	GJM	8.2 pF	0402	ok
Evaluation Board	GRF400X_RevC					

Note: Standard evaluation board bias: Vdd: 5.0V; Venable: 5.0V; M5: 2k ohms

GRF4014 Bias Resistor Selection Curves:





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# GRF4014

Broadband LNA/Linear Driver  
Tuning Range: 0.1 to 6.0 GHz

Data Sheet Release Status:	Notes
Advance	S-parameter and NF data based on EM simulations for the fully packaged device using foundry supplied transistor s-parameters. Linearity estimates based on device size, bias condition and experience with related devices.
Preliminary	All data based on evaluation board measurements in the Guerrilla RF Applications Lab.
Released	All data based on device qualification data. Typically, this data is nearly identical to the data found in the preliminary version. Max and min values for key RF parameters are included.

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