



Product Description

The GRF5020 is a high linearity PA with ultra-low noise figure (NF). Wideband tunes deliver excellent P1dB, IP3 and NF over the various bands. The device can be tuned to deliver outstanding performance over 0.01 GHz to 6.0 GHz with fractional bandwidths >30%.

In addition to use as a PA or linear driver, GRF5020 is well suited to demanding first, second or third stage LNA applications requiring high linearity, ruggedness and low NF. Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

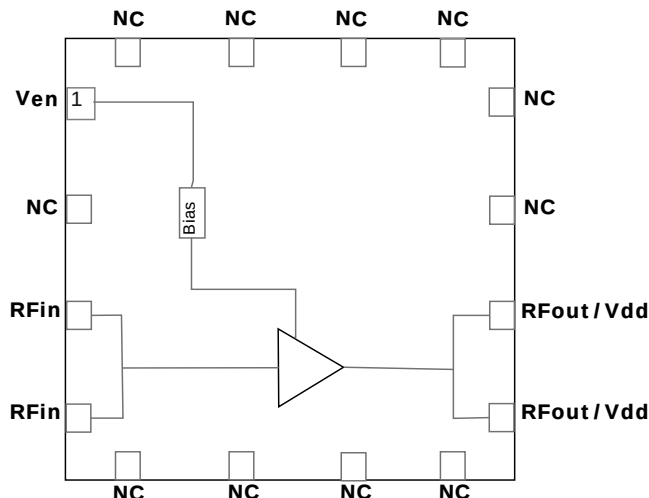
Features

- Bandwidth: 1.7 – 2.7 GHz (Single Match)
- Bandwidth: 3.0 – 4.0 GHz (Single Match)
- Bandwidth: 5.1 - 5.9 GHz (Single Match)
- Gain: 17.0 dB at 2.5 GHz
- EVB NF: 0.80 dB at 2.5 GHz
- OP1dB: +30.5 dBm at Vdd: 10.0 volts
- OIP3: +47.0 dBm at Vdd: 8.0 volts
- Flexible Bias Voltage and Current
- Process: GaAs pHEMT

Applications

- Second or Third Stage LNA Requiring Ultra-High Linearity and Low Noise
- Linear Driver Amp for High PAR waveforms: such as LTE and WCDMA
- Small Cells
- Cellular Repeaters and Signal Boosters
- Microwave Backhaul

Functional Block Diagram



Absolute Ratings:

Parameter	Symbol	Min.	Max.	Unit
Drain Voltage	V _d	0	12	V
Transient Average RF Input Power: (Load VSWR < 2:1; Duration: <1 hour)	P _{IN MAX}		+26	dBm
Average RF Output Power: (Load VSWR < 2:1; V _D : > 10.0 volts; Duration: Continuous)	P _{OUT MAX}		+26	dBm
Average RF Output Power: (Load VSWR < 2:1; V _D : ≤ 10.0 volts; Duration: Continuous)	P _{OUT MAX}		NA	dBm
Operating Temperature (Package Heat Sink)	T _{AMB}	-40	+105	°C
Storage Temperature	T _{STG}	-40	+150	°C
Maximum Channel Temperature (MTTF > 10 ⁶ Hours)	T _{max}		+190	°C
Maximum Dissipated Power	P _{DISS MAX}		1.9	W
Electrostatic Discharge:				
Charged Device Model: (TBD)	CDM	Class 4: 1000		V
Human Body Model: (TBD)	HBM	Class 1B: 500		V
Machine Model: (TBD)	MM	Class A: 50		V

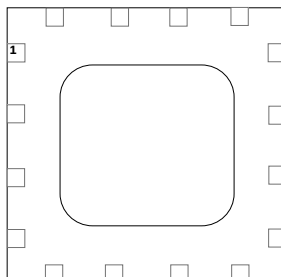


Caution! ESD Sensitive Device



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

Pin Out (Top View)



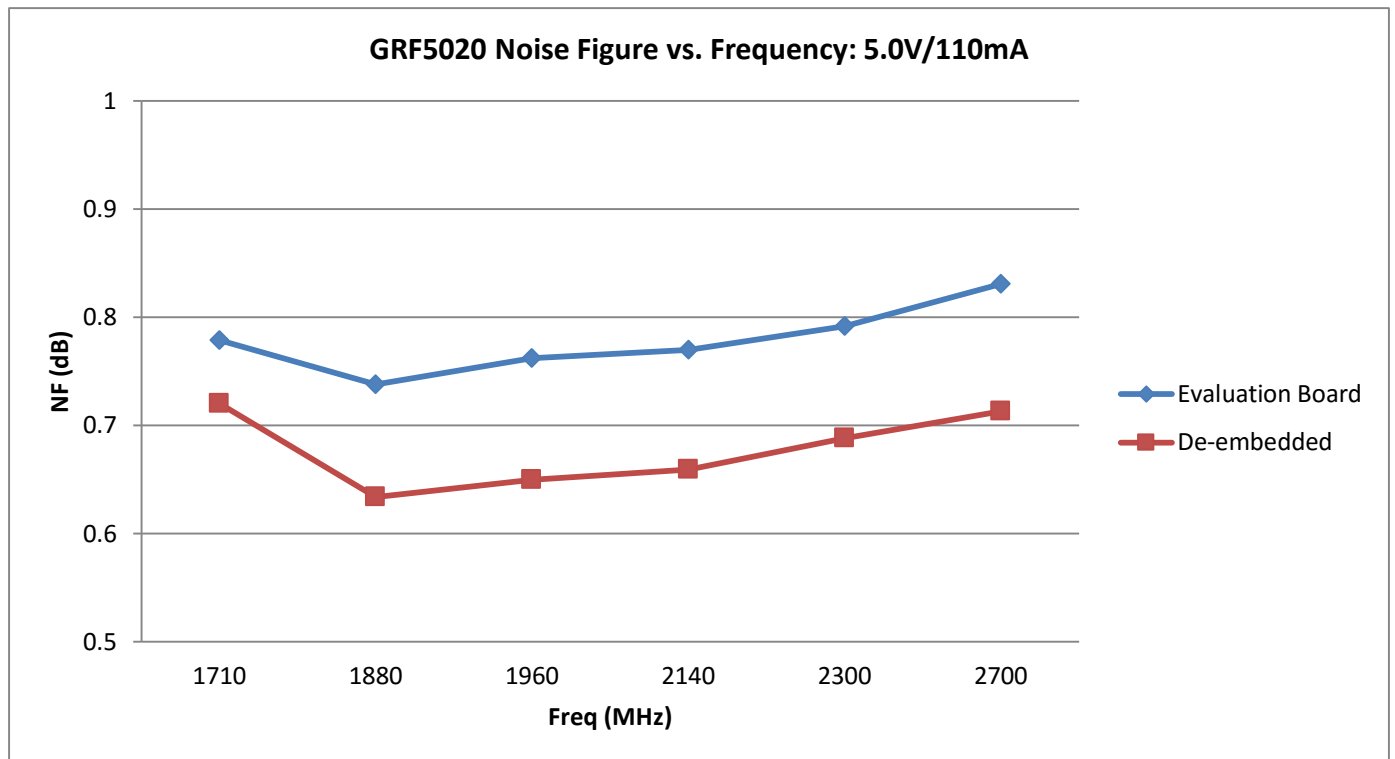
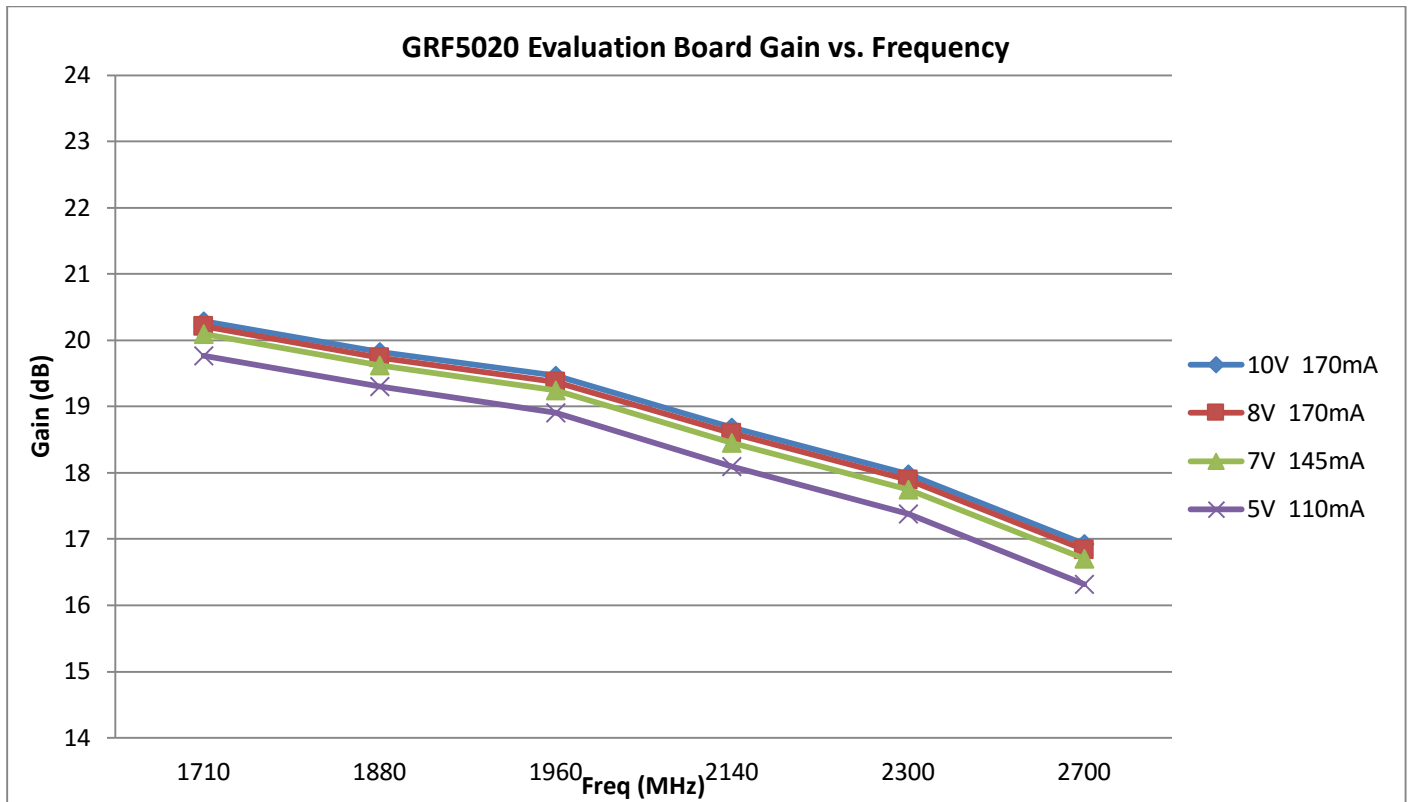
Pin Assignments:

Pin	Name	Description	Note
1	V_{ENABLE}	Enable Voltage Input	Venable and series resistor M5 set the device Iddq.
2	NC	No Connect or Ground	No internal connection to die
3	RF_In	RF Input	Pins 3-4 tied together on system board
4	RF_In	RF Input	Pins 3-4 tied together on system board
5	NC	No Connect or Ground	No internal connection to die
6	NC	No Connect or Ground	No internal connection to die
7	NC	No Connect or Ground	No internal connection to die
8	NC	No Connect or Ground	No internal connection to die
9	RF_Out/V_{DD}	PA Output/Bias	Pins 9-10 tied together on system board. Supply Vdd here.
10	RF_Out/V_{DD}	PA Output/Bias	Pins 9-10 tied together on system board. Supply Vdd here.
11	NC	No Connect or Ground	No internal connection to die
12	NC	No Connect or Ground	No internal connection to die
13	NC	No Connect or Ground	No internal connection to die
14	NC	No Connect or Ground	No internal connection to die
15	NC	No Connect or Ground	No internal connection to die
16	NC	No Connect or Ground	No internal connection to die
PKG BASE	GND	Ground	Connect to system board ground

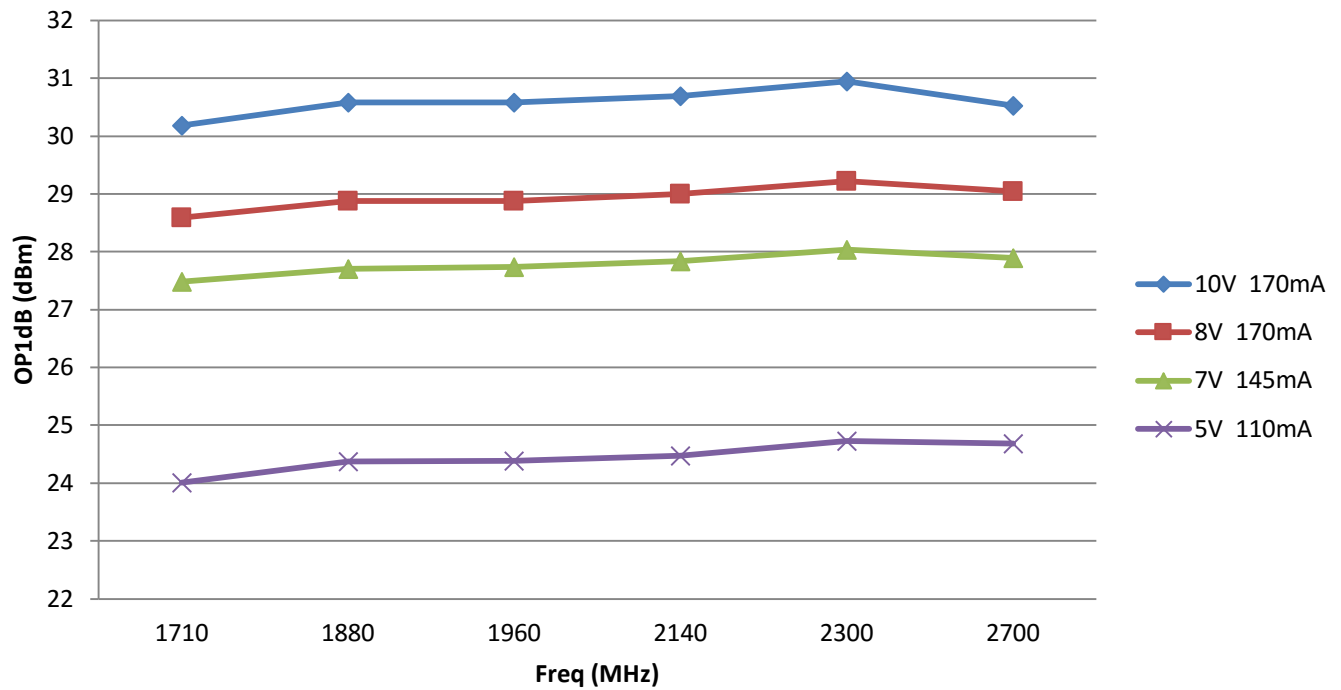
Nominal Operating Parameters:

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Target Performance (1700-2700 MHz Tune)						Bias: 5.0 V and 110 mA unless otherwise noted. (+25C)
Test Frequency	Ftest		2.5		GHz	
Gain	S(2,1)		17.0		dB	
Noise Figure (De-embedded)	NF		0.70		dB	
Noise Figure (Evaluation Board)	NF		0.80		dB	
Output 1dB Compression Point	OP1dB		+24.7		dBm	Vdd: 5.0 volts; Iddq: 110 mA
Output 1 dB Compression Point	OP1dB		+28.0		dBm	Vdd: 7.0 volts; Iddq: 145 mA
Output 1dB Compression Point	OP1dB		+29.1		dBm	Vdd: 8.0 volts; Iddq: 170 mA
Output 1dB Compression Point	OP1dB		+30.5		dBm	Vdd: 10.0 volts; Iddq: 170 mA
Output Third Order Intercept Point	OIP3		+44.0		dBm	Vdd: 5.0 volts; Iddq: 110 mA
Output Third Order Intercept Point	OIP3		+47.0		dBm	Vdd: 7.0 volts; Iddq: 145 mA
Output Third Order Intercept Point	OIP3		+47.0		dBm	Vdd: 8.0 volts; Iddq: 170 mA
Output Third Order Intercept Point	OIP3		+44.0		dBm	Vdd: 10.0 volts; Iddq: 170 mA
Input Return Loss	S(1,1)		-14.0		dB	
Output Return Loss	S(2,2)		-14.0		dB	
Switching Rise Time	T_rise		400		ns	
Switching Fall Time	T_fall		400		ns	
Quiescent Supply Current	Iddq		110		mA	No RF Applied
Disabled Mode						
Supply Current (Leakage)	I _{DD}		TBD		uA	
Enable Current	I _{enable}		TBD		uA	
Thermal Data						
Thermal Resistance (IR Scan Method)	Θ _{jc}		43		°C/W	
Channel Temperature @ +85C Reference (package heat sink)	T _{ch}		158		°C	Vdd: 10.0 volts; Iddq: 170 mA Pdiss: 1.7 W; No RF

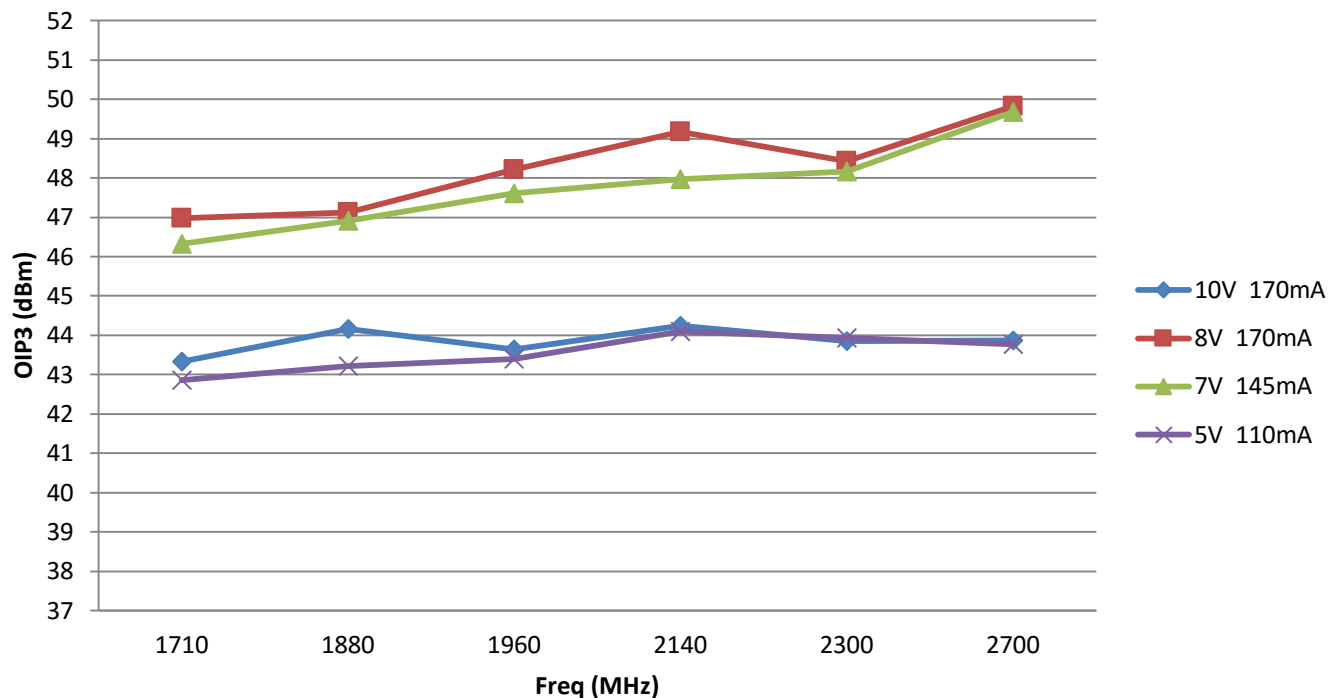
Evaluation Board Data: (1.7 to 2.7 GHz Tune)



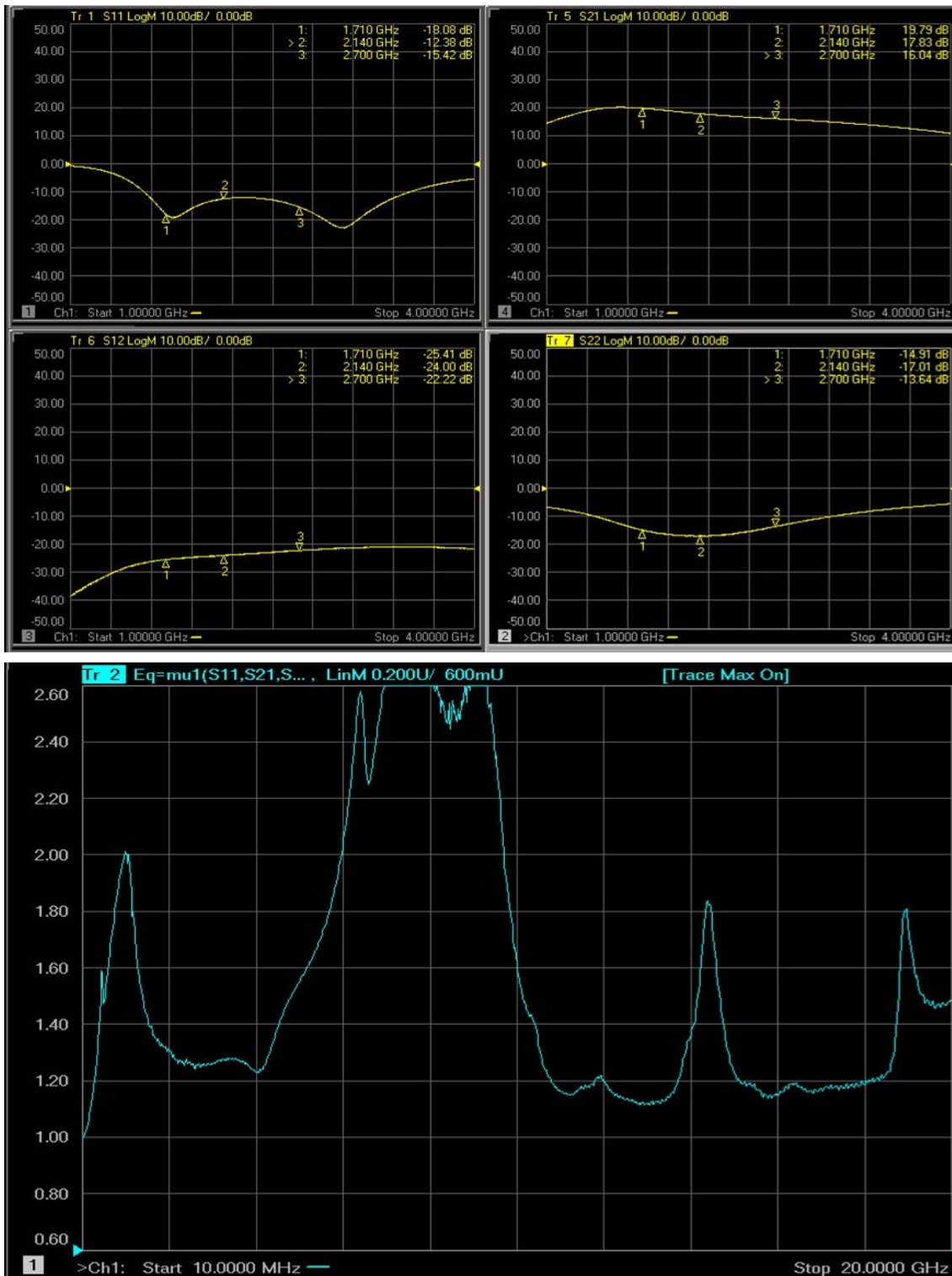
GRF5020 Evaluation Board OP1dB vs. Frequency



GRF5020 Evaluation Board OIP3 vs. Frequency

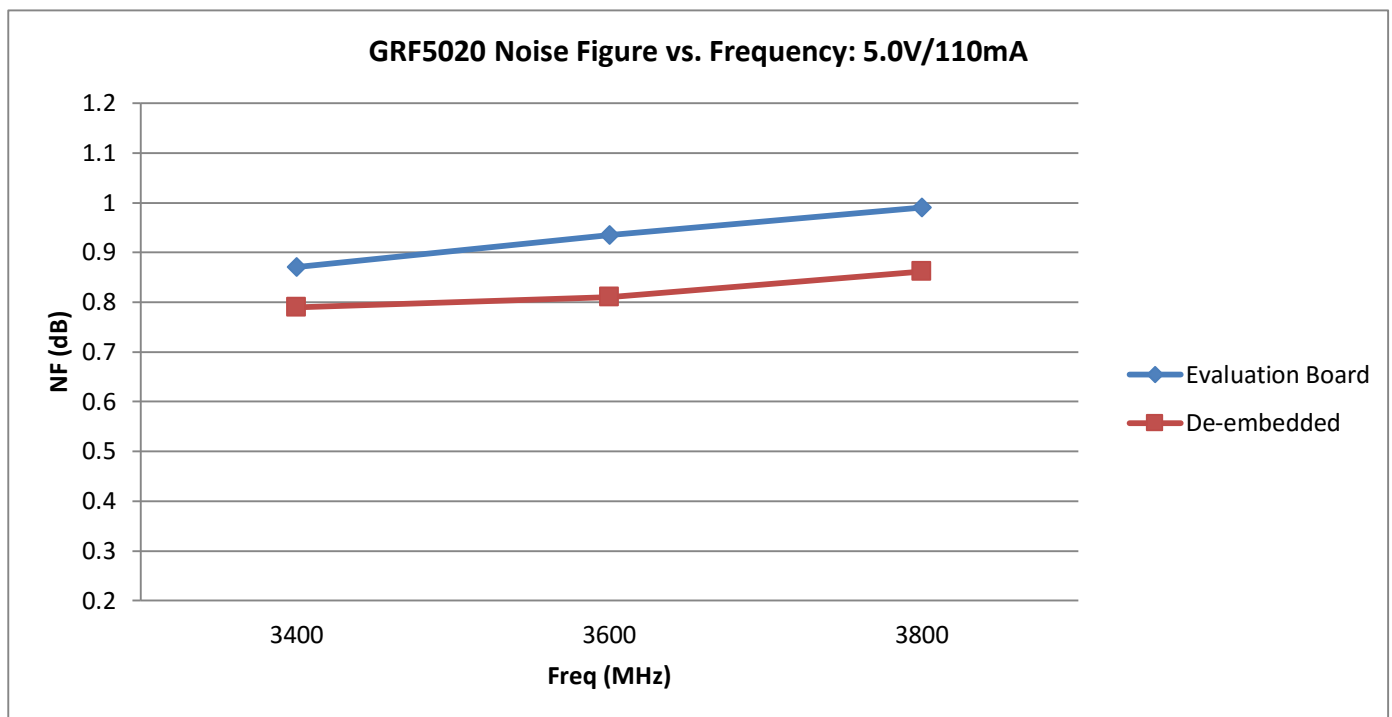
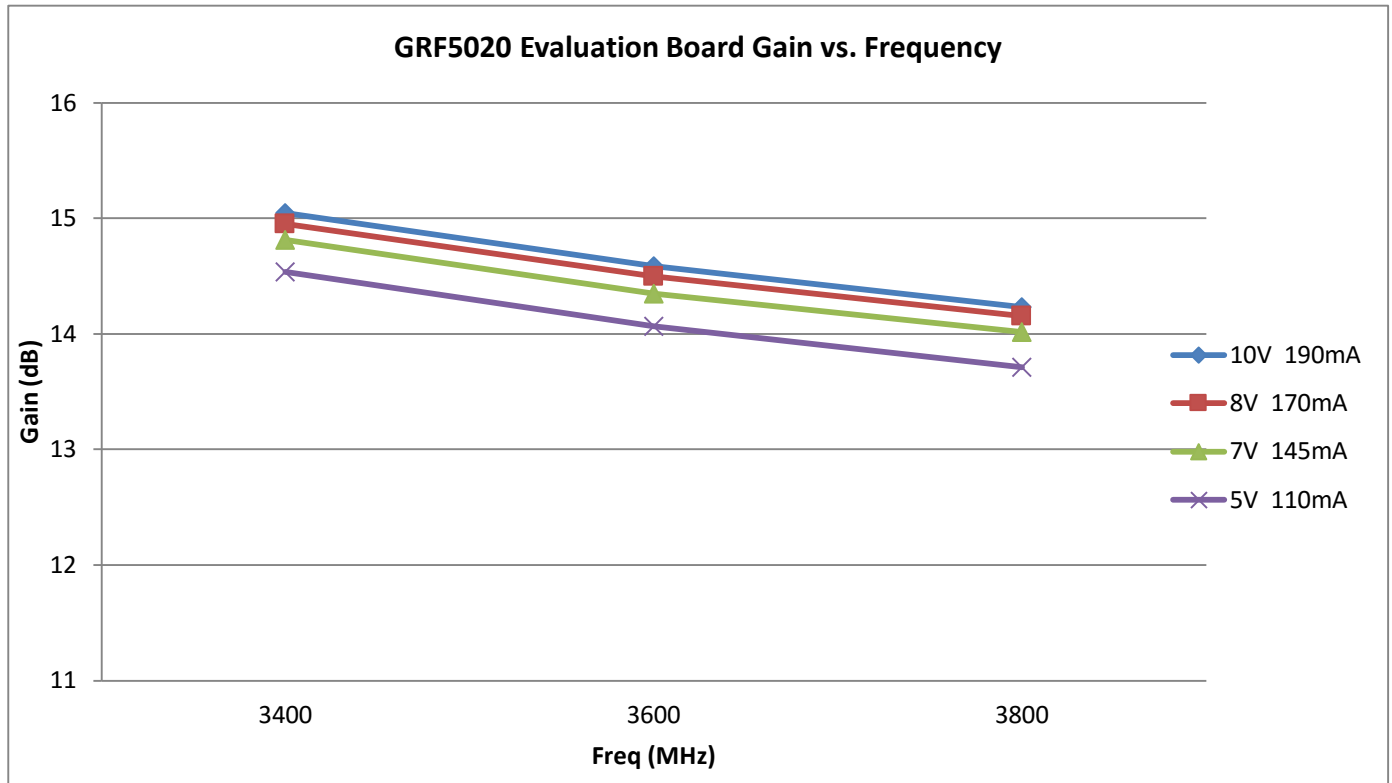


GRF5020 Evaluation Board S-Parameters and Stability Mu Factor Plots (1.7 – 2.7 GHz Tune)

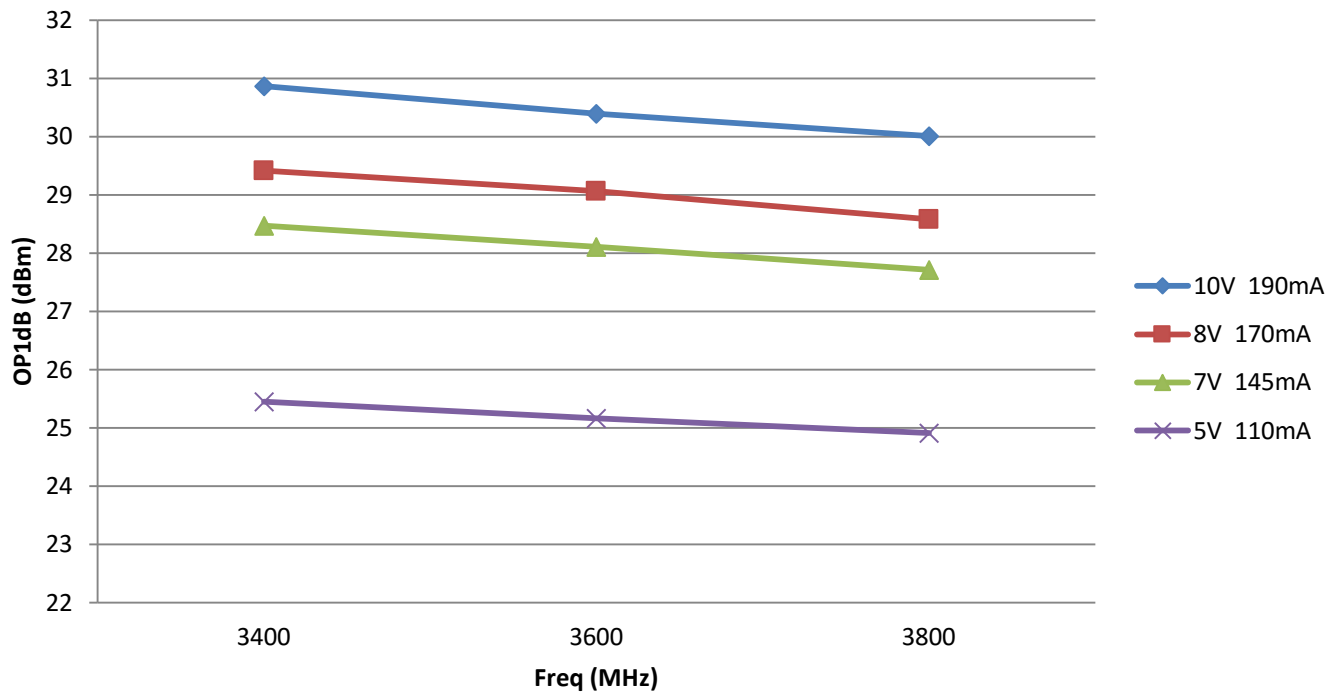


Note: $\mu \geq 1.0$ implies unconditional stability

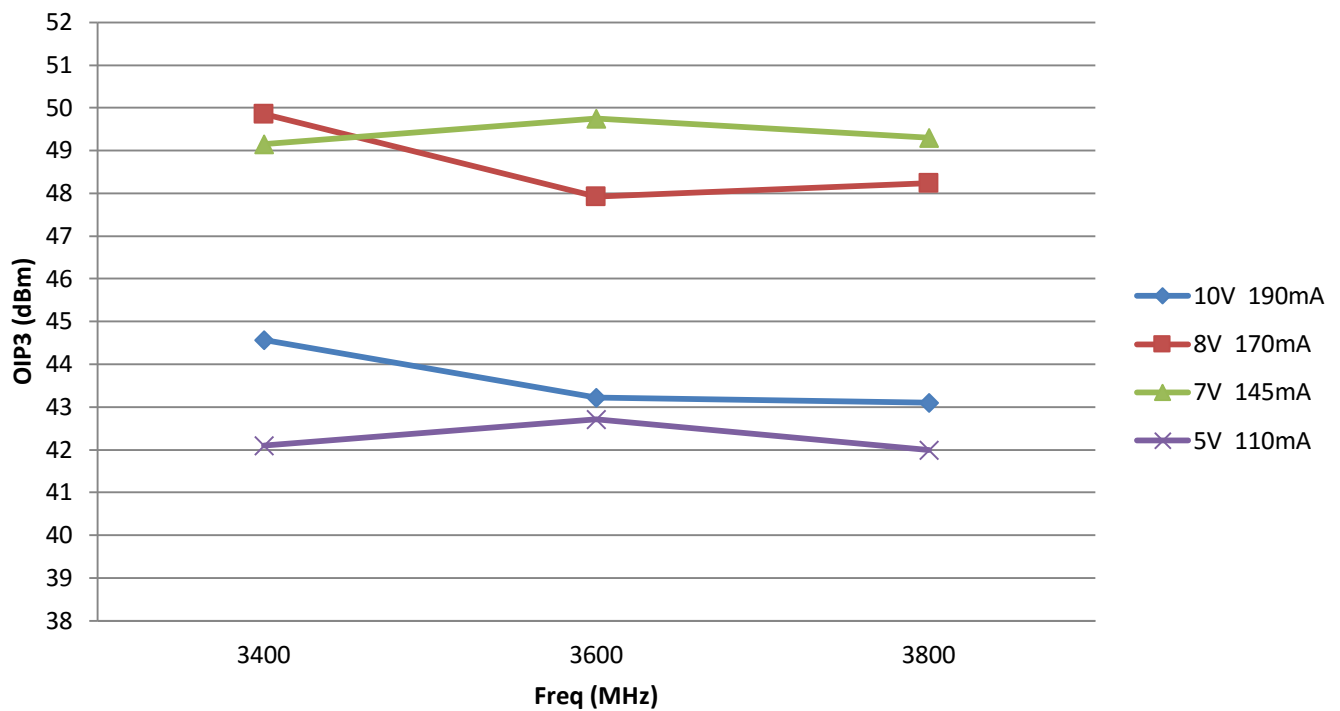
Evaluation Board Data: (3.0 to 4.0 GHz Tune)



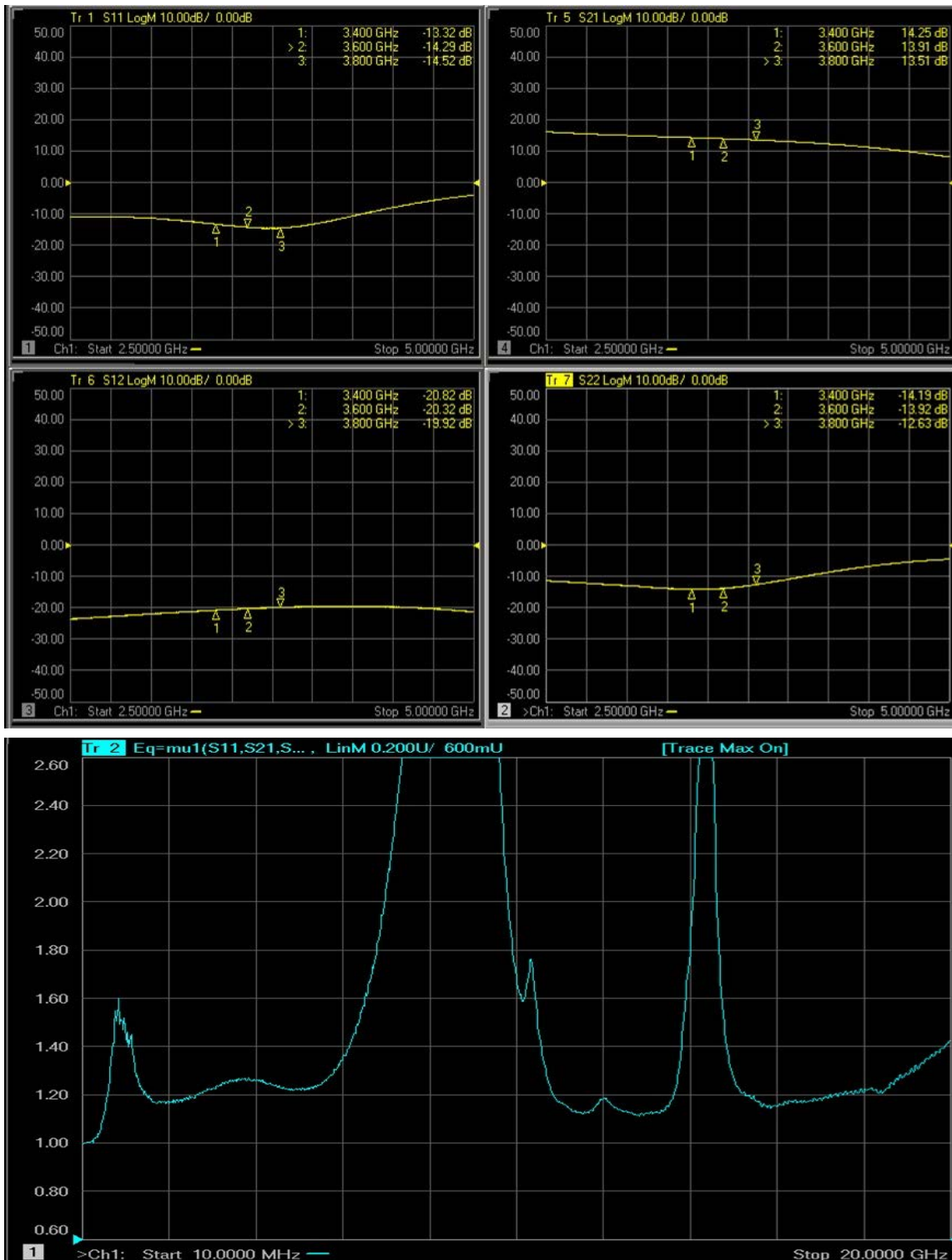
GRF5020 Evaluation Board OP1dB vs. Frequency



GRF5020 Evaluation Board OIP3 vs. Frequency

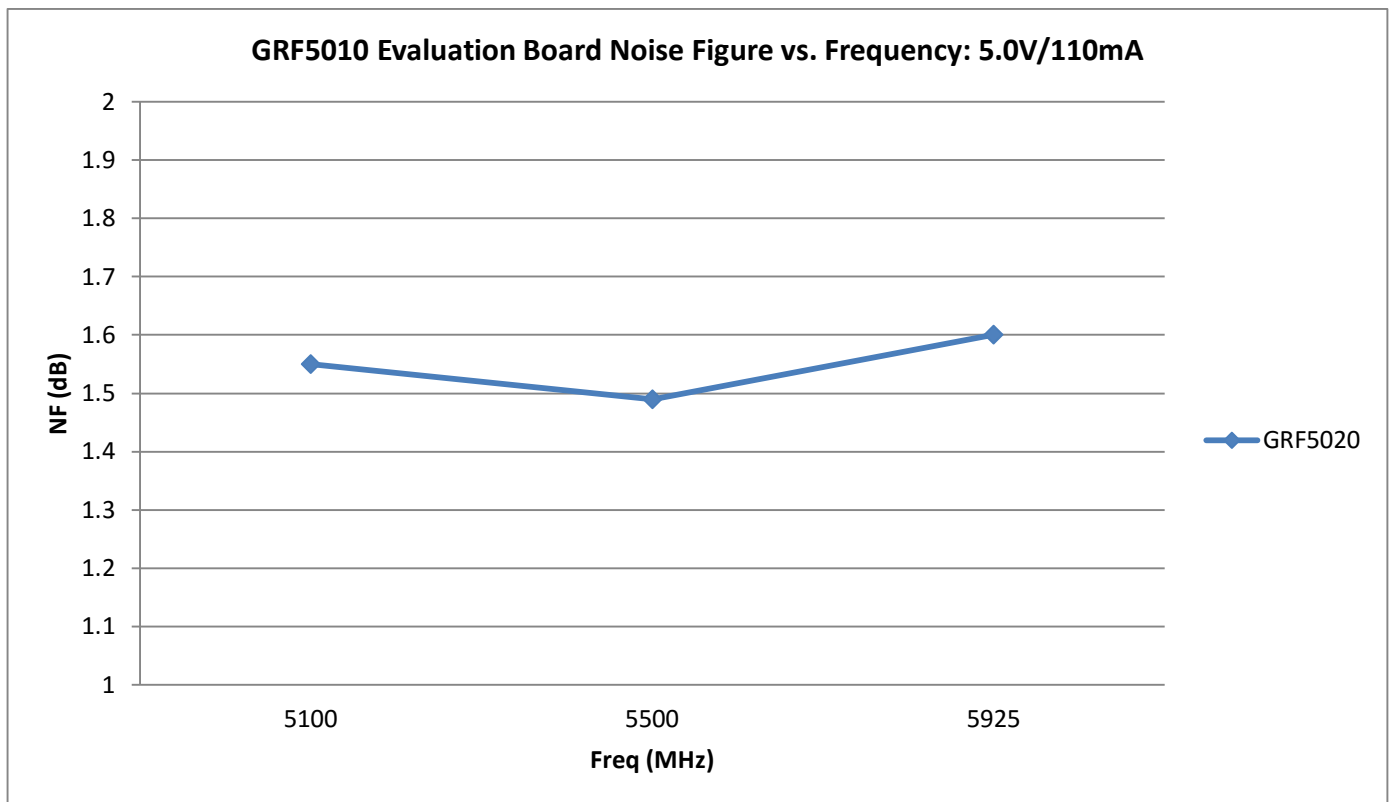
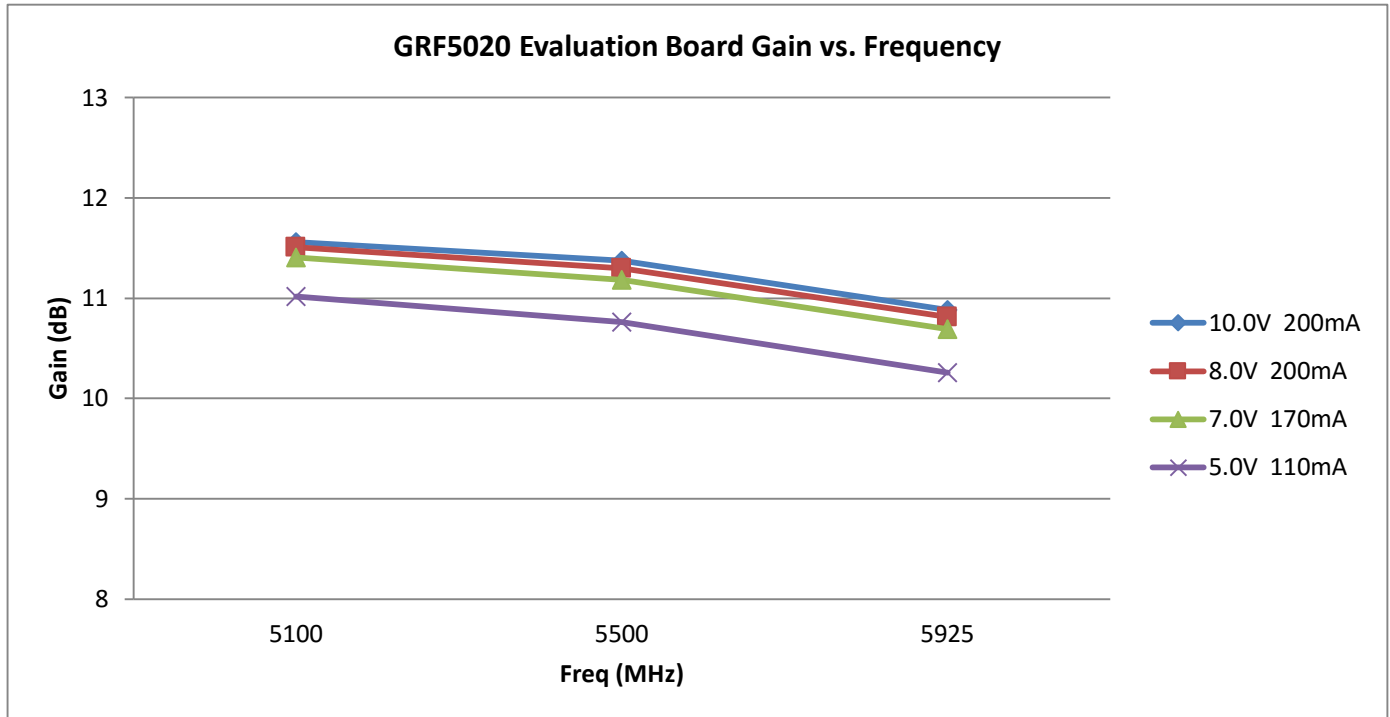


GRF5020 Evaluation Board S-Parameters and Stability Mu Factor Plots (3.0 – 4.0 GHz Tune)

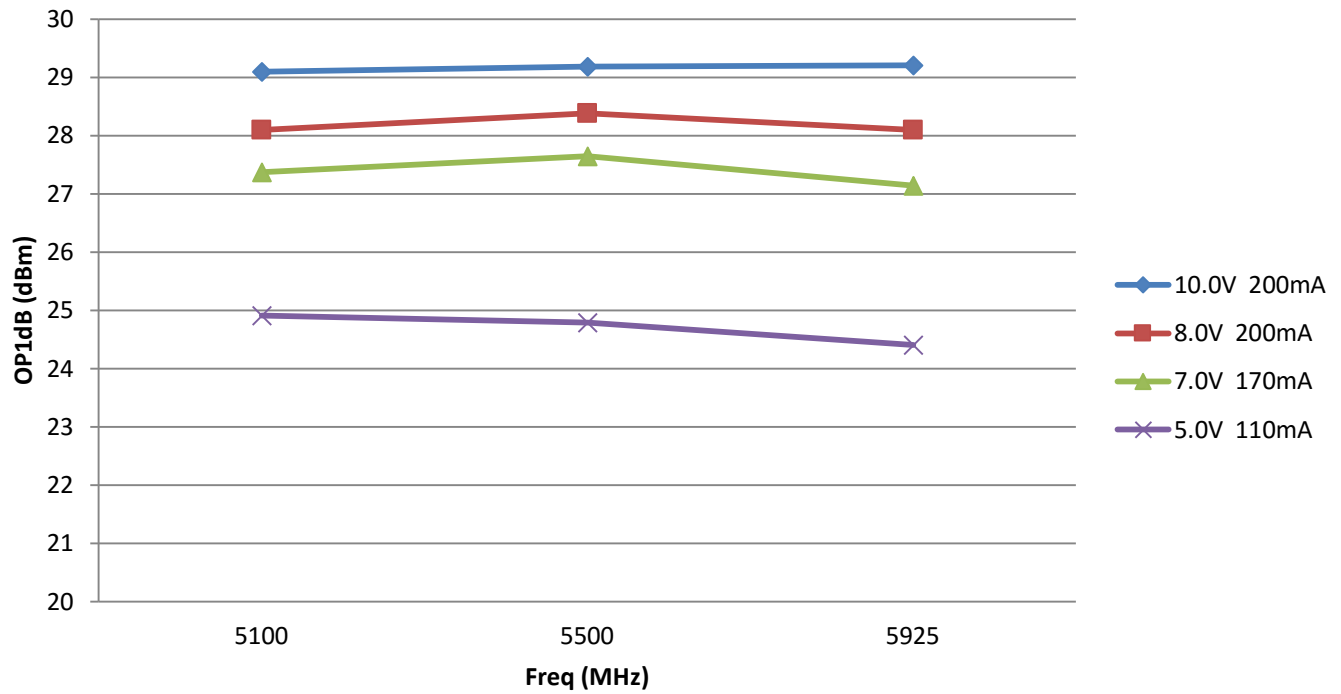


Note: $\mu \geq 1.0$ implies unconditional stability

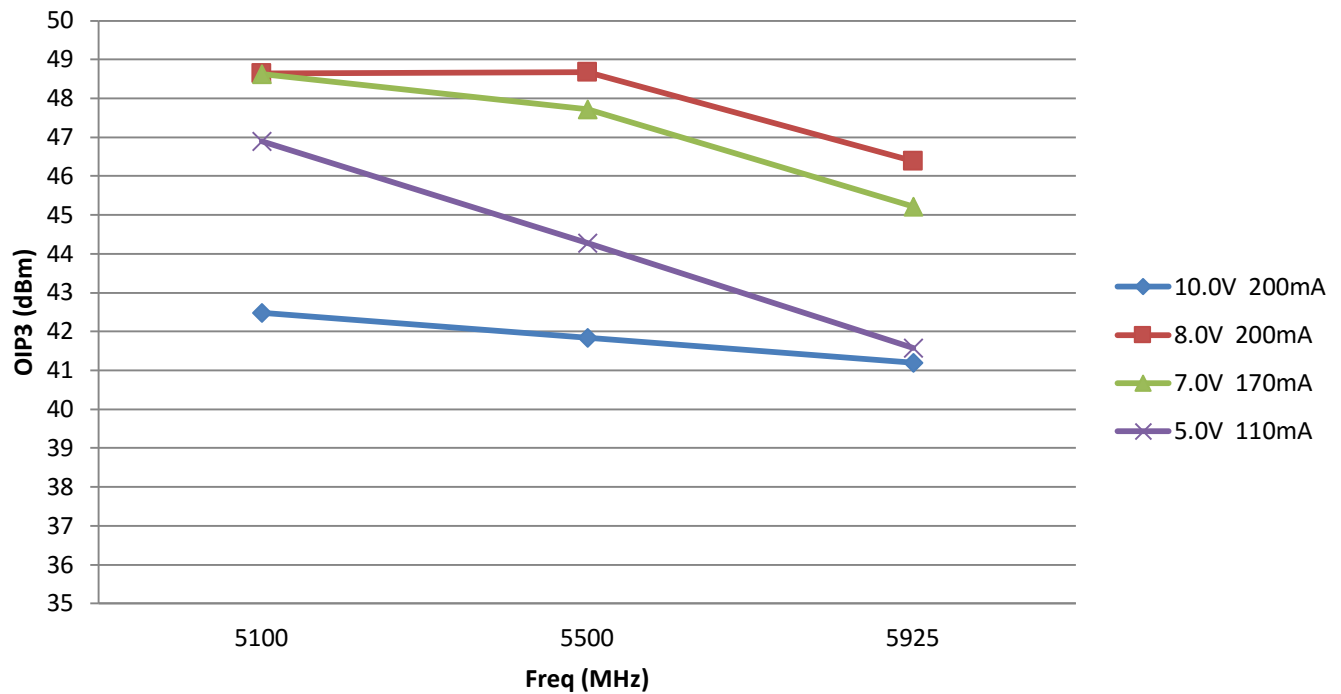
Evaluation Board Data: (5.1 to 5.9 GHz Tune)



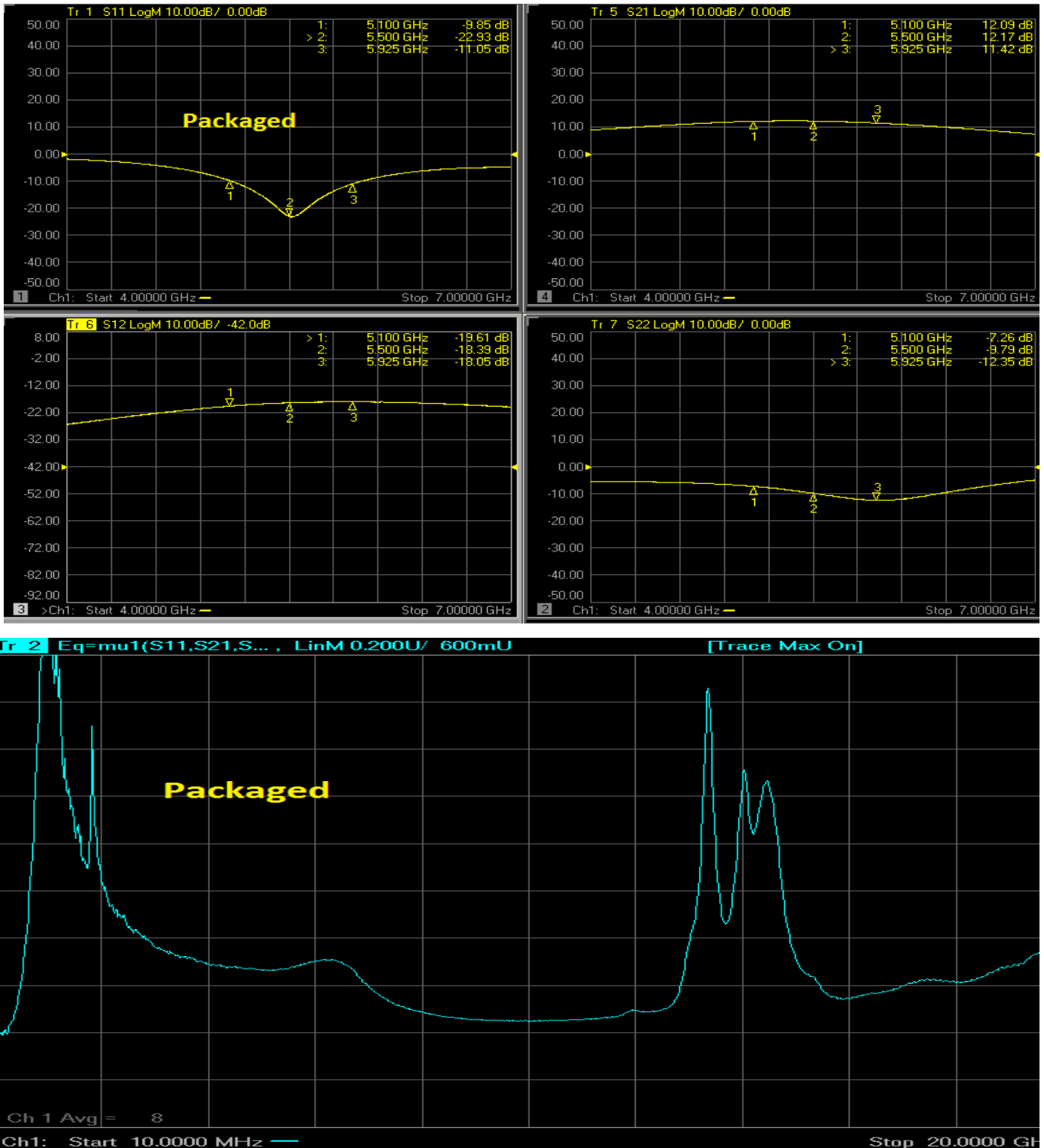
GRF5020 Evaluation Board OP1dB vs. Frequency



GRF5020 Evaluation Board OIP3 vs. Frequency



GRF5020 Evaluation Board S-Parameters and Stability Mu Factor Plots (5.1 – 5.9 GHz Tune)

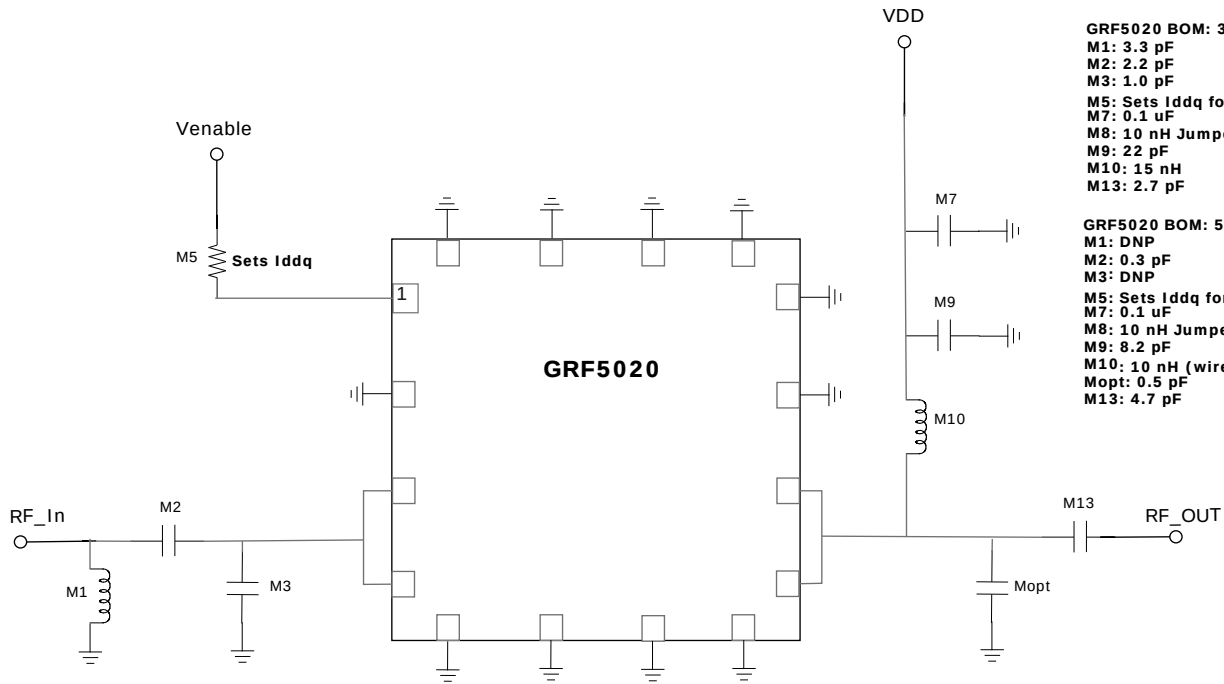


Note: $\mu \geq 1.0$ implies unconditional stability

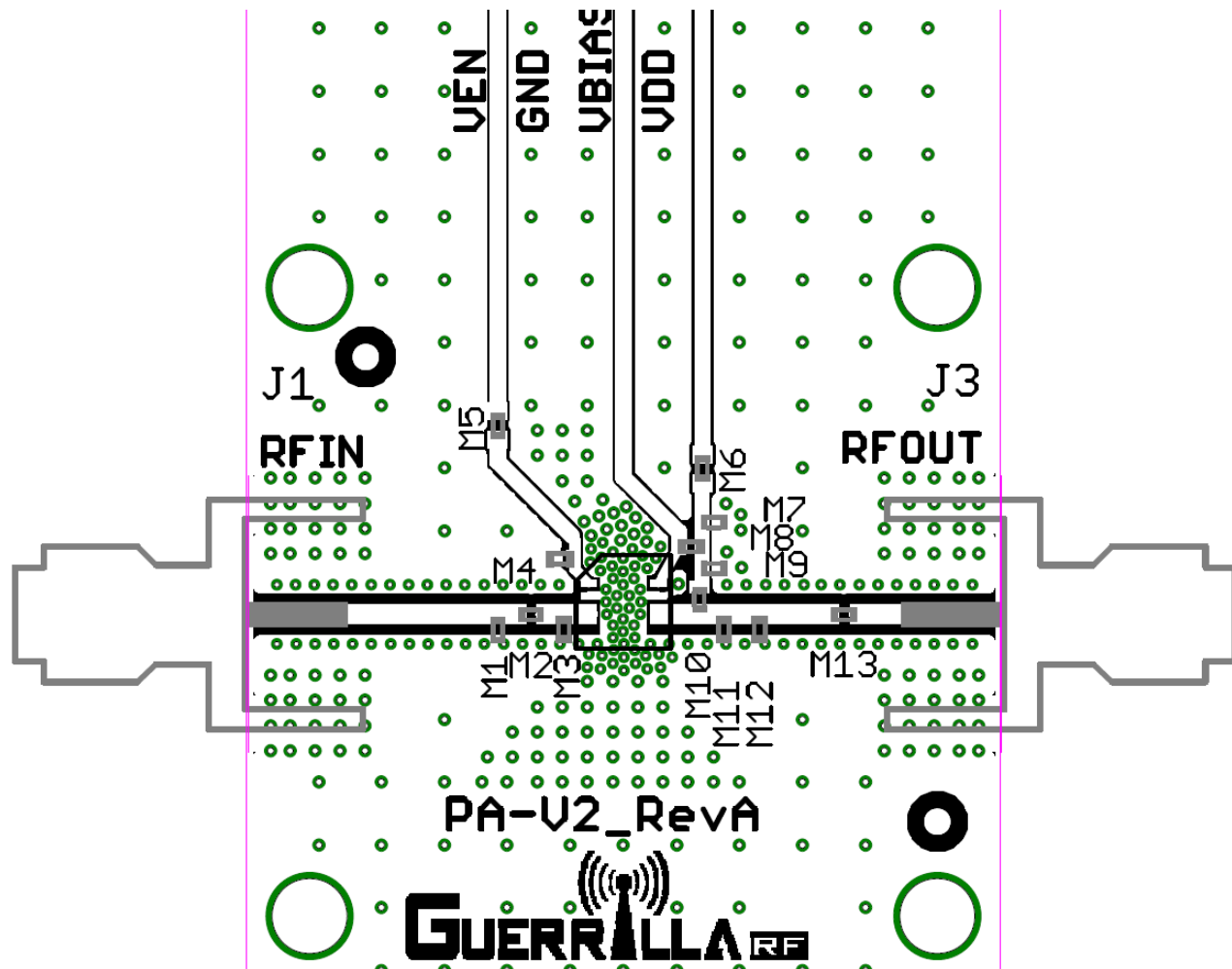
GRF5020 BOM: 1700-2700 MHz
M1: 3.3 nH wire wound
M2: 2.2 pF
M3: 1.5 pF
M5: Sets Iddq for a given Venable
M7: 0.1 uF
M8: 10 nH Jumper
M9: 100 pF
M10: 15 nH
M13: 22 pF

GRF5020 BOM: 3000-4000 MHz
M1: 3.3 pF
M2: 2.2 pF
M3: 1.0 pF
M5: Sets Iddq for a given Venable
M7: 0.1 uF
M8: 10 nH Jumper
M9: 22 pF
M10: 15 nH
M13: 2.7 pF

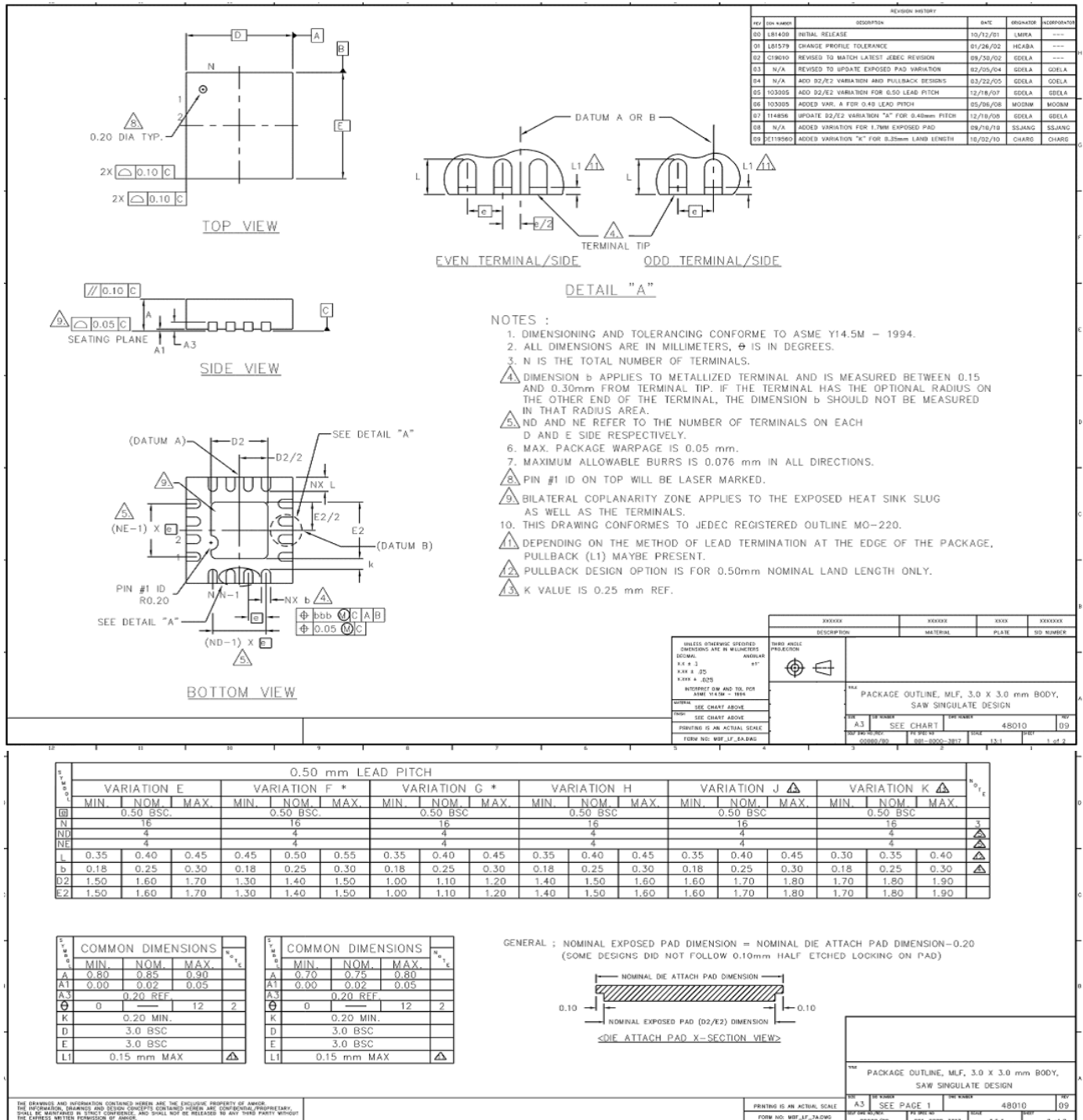
GRF5020 BOM: 5100-5900 MHz
M1: DNP
M2: 0.3 pF
M3: DNP
M5: Sets Iddq for a given Venable
M7: 0.1 uF
M8: 10 nH Jumper
M9: 8.2 pF
M10: 10 nH (wire wound)
Mopt: 0.5 pF
M13: 4.7 pF



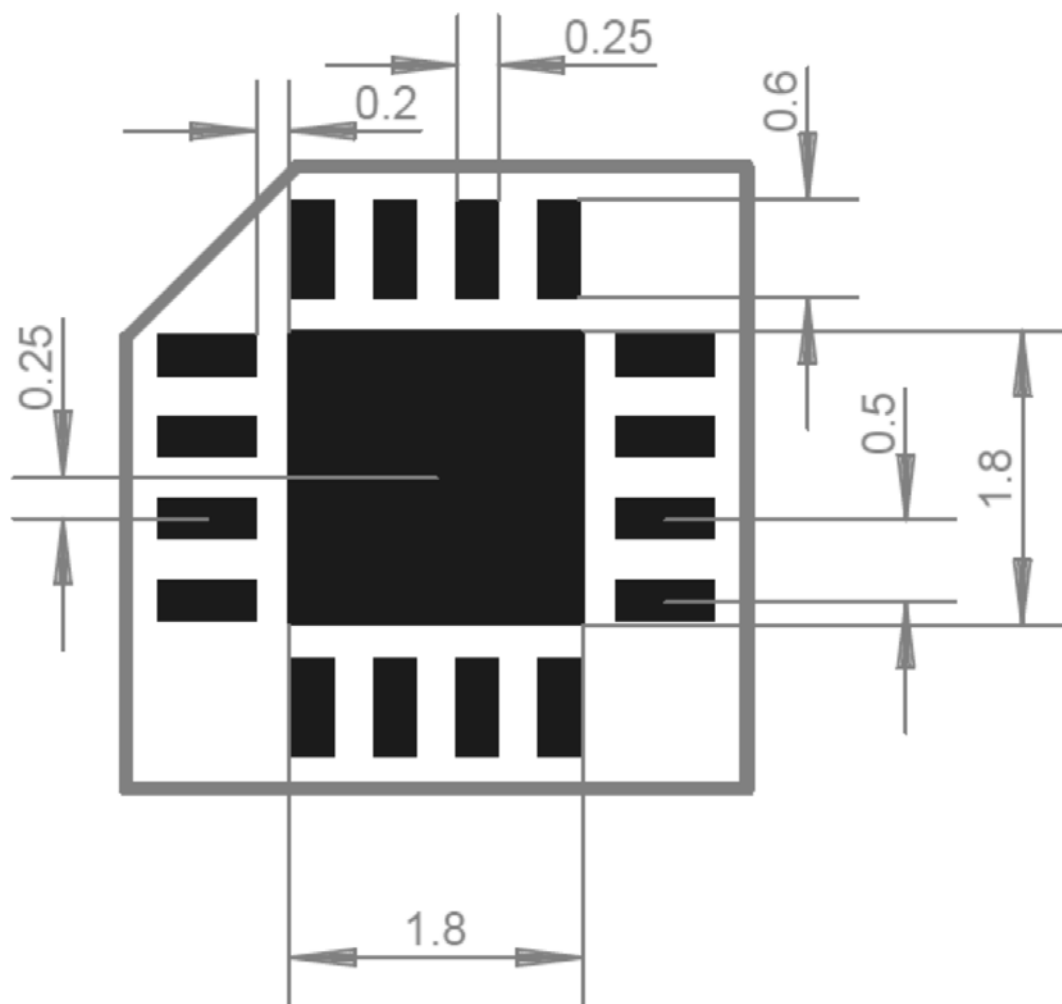
GRF5020 Evaluation Board Application Schematic



GRF5020 Evaluation Board Assembly Diagram



GRF5020 QFN-16 (Variation F) Package Dimensions (mm)



GRF5020 3.0 x 3.0 mm 16-Pin QFN PCB Layout Footprint (mm)

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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