DATA SHEET

PRELIMINARY DATA SHEET

GRF5710

High Linearity Power Amplifier 0.4 to 1.8 GHz

FEATURES

- High Linearity
- Standard tunes cover 20 – 30% bandwidth
- Flexible Biasing
- 500 mA Native Mode Quiescent Current Consumption
- 5 V Supply Voltage
- -40 to 85 °C Operating Temperature Range
- Rugged Design is Extremely Resilient to Mismatched Loads
- Compact 4 x 4 mm QFN-24 Package

Reference: 5 V / 500 mA I_{CCQ} / 0.475 GHz

- Gain: 17.4 dB
- OP1dB: 33.8 dBm
- OIP3: 49.3 dBm
- PAE at OP1dB: 47.2 %

APPLICATIONS

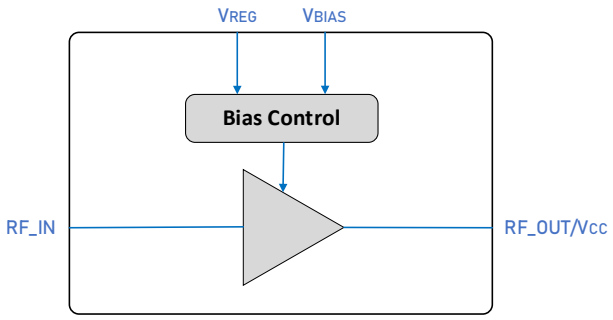
- Mobile infrastructure
- Repeaters
- Driver amplifier
- General purpose wireless

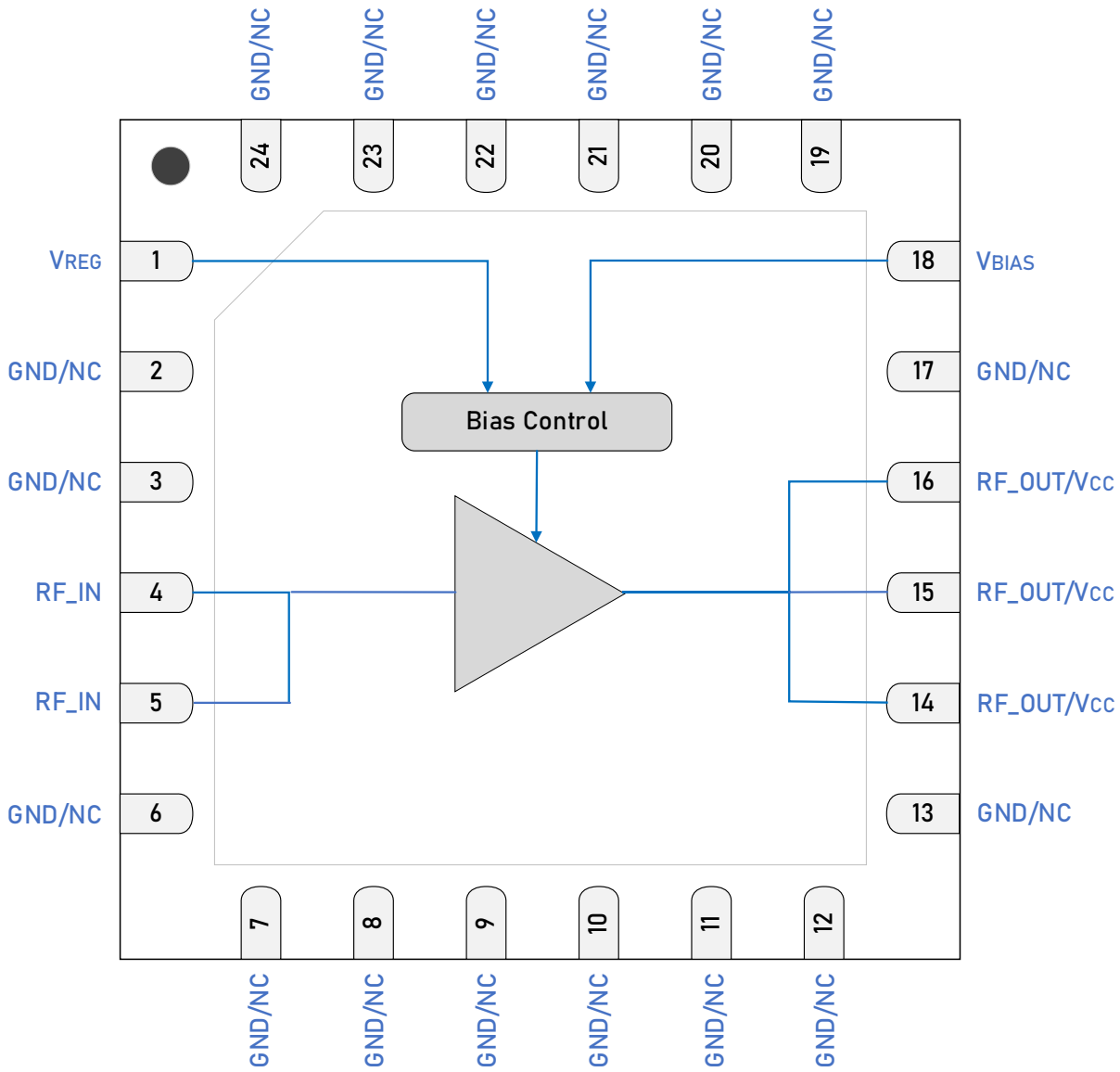
DESCRIPTION

The GRF5710 is a high linearity power amplifier packaged in an industry standard QFN-24 package.

Please consult with the GRF applications engineering team for custom tuning/evaluation board data.

BLOCK DIAGRAM





4 x 4 mm QFN-24 Pin Out (Top View)

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Pin Assignments

Pin	Name	Description	Note
1	V_{REG}	Current Reference	Current reference for internal bias circuit created by an external regulated voltage and a precision resistor. Sets quiescent current for the amplifier. Can also be used to enable / disable the amplifier.
2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 17, 19, 20, 21, 22, 23, 24	GND/NC	Ground	No internal connection to die. These pins should be connected to ground.
4, 5	RF_IN	RF Input	Pins 4 and 5 are tied together on the system board. An external DC blocking capacitor must be used.
14, 15, 16	RF_OUT/V_{CC}	PA Output/Bias Voltage	Pins 14, 15 and 16 are tied together on the system board. V_{CC} must be applied to this pin via an RF choke.
18	V_{BIAS}	Bias Circuit Supply	Voltage supply for active bias circuit. Connect to V_{CC}.
PKG BASE	GND	Ground	Provides DC and RF ground for the amplifier, 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.

Absolute Ratings

Parameter		Symbol	Min.	Max.	Unit
Supply Voltage		V_{CC}		5.25	V
RF Input Power	50 Ω, V_{CC} = 5 V, CW Tone, 100% Duty Cycle, $T_{PKG\ BASE}$ = 25 °C.	$P_{IN\ MAX-1:1}$		TBD	dBm
	Load VSWR ≤ 8:1, all phase angles, V_{CC} = 5 V, CW Tone, 100% Duty Cycle, $T_{PKG\ BASE}$ = -40 to 85 °C.	$P_{IN\ MAX-8:1}$		TBD	
Operating Temperature (evaluation board base).		$T_{EVB\ BASE}$	-40	85	°C
Maximum Junction Temperature (MTTF > 10^6 hours).		$T_{J\ MAX}$		190	°C
Maximum Dissipated Power		$P_{DISS\ MAX}$		3900	mW

Electrostatic Discharge

Human Body Model	HBM	TBD		V

Storage

Storage Temperature	T_{STG}	-65	150	°C
Moisture Sensitivity Level	MSL		1	--

Caution! ESD Sensitive Device.
Exceeding Absolute Maximum Rating conditions may cause permanent damage.

Note: For additional information, please refer to *Manufacturing Note MN-001 — Package and Manufacturing Information.*

All Guerrilla RF products are provided in RoHS compliant lead (Pb)-free packaging requiring no exemptions. Additional information for this topic can be found at this link - *Environmental and Restricted Substance Statement Library*

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Recommended Operating Conditions

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{CC}		5	5.25	V	
RF Frequency Range	F_{RF}	400		1800	MHz	Refer to standard tuning sets **(notes 1 & 2)**.
Operating Temperature (EVB base)	$T_{EVB\ BASE}$	-40		85	°C	
RF_IN Port Impedance	Z_{RFIN}		50		Ω	Single-ended with external matching network.
RF_OUT Port Impedance	Z_{RFOUT}		50		Ω	Single-ended with external matching network.

Note 1: Operation outside of this range is possible although some parameters may degrade.
Note 2: Contact the Guerrilla RF applications team for guidance on optimizing device tuning for alternative bands.

Nominal Operating Parameters

The following conditions apply unless noted otherwise: typical application schematic using the 400 to 550 MHz tuning set. $V_{CC}/V_{BIAS}/V_{REF}$ = 5 V, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C, Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		Min.	Typ.	Max.		
Supply Quiescent Current	I_{CCQ}		500		mA	no RF applied.
Vref Current	I_{REF}		6.5		mA	no RF applied.
Vbias Current	I_{BIAS}		4		mA	no RF applied.
Small Signal Gain	S21		17.4		dB	RF test frequency = 475 MHz
Input Return Loss	S11		12		dB	RF test frequency = 475 MHz
Output Return Loss	S22		10		dB	RF test frequency = 475 MHz
Reverse Isolation	S12		29.5		dB	RF test frequency = 475 MHz
Noise Figure	NF		6.2		dB	RF test frequency = 475 MHz
Output 1dB Compression Power	OP1dB		33.8		dBm	RF test frequency = 475 MHz
Output 3rd Order Intercept Point	OIP3		49		dBm	RF test frequencies = 475 MHz, 475.5 MHz, +24 dBm per tone

Thermal Data:

Thermal Resistance (Infrared Scan). DC only (no RF applied).	Θ_{Jref}		26.5		°C/W	

Note: MTTF > 10^6 hours for $T_J \leq 190$ °C.

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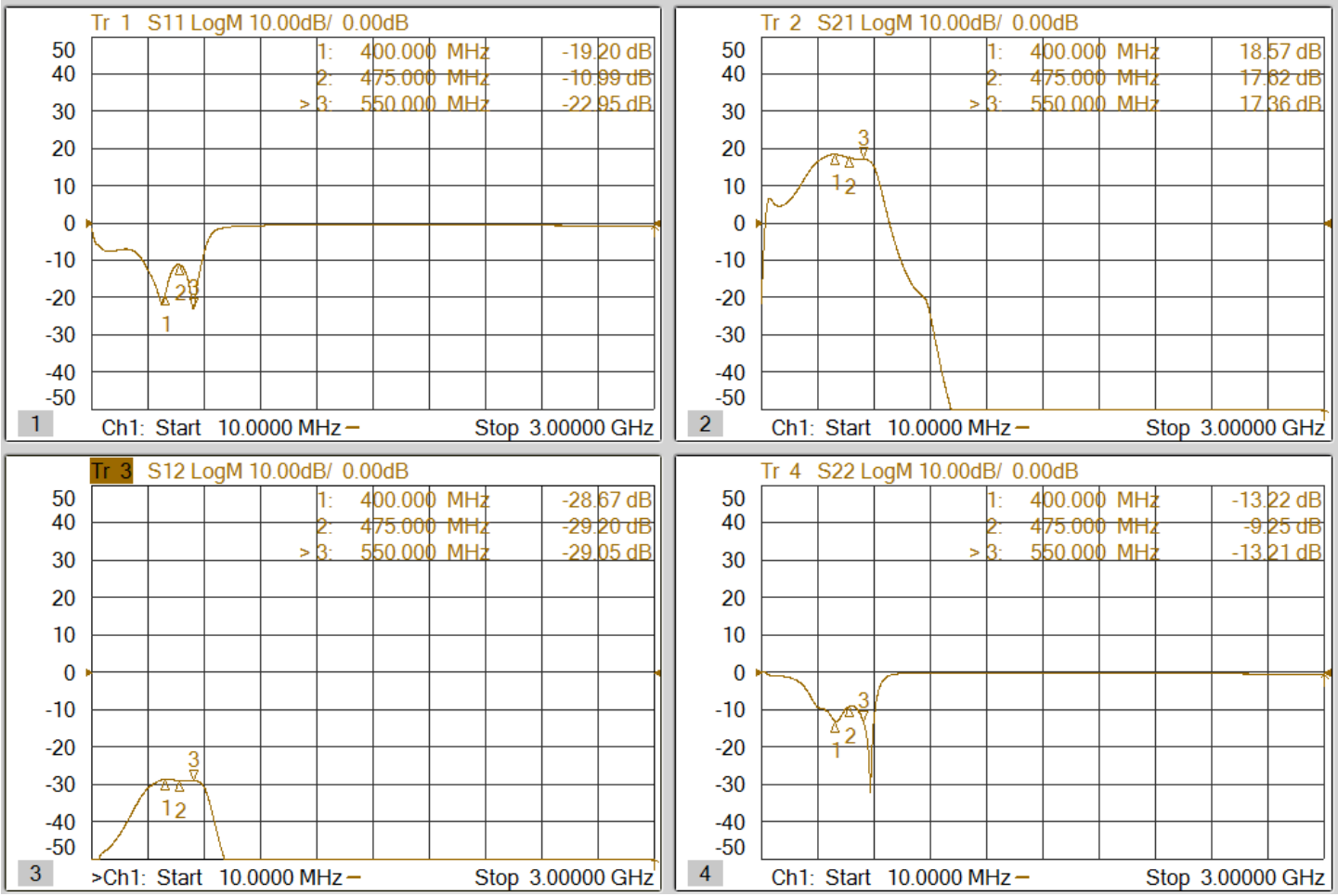
Typical Performance – RF: 400 to 550 MHz

The following conditions apply unless noted otherwise: typical application schematic using the 400 to 550 MHz tuning set. $V_{CC}/V_{BIAS}/V_{REF}$ = 5 V, Icq = 500 mA, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C, Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		400 MHz	475 MHz	550 MHz		
Small Signal Gain	S21	18.2	17.4	17	dB	Pin = -20 dBm
Input Return Loss	S11	18.8	11.7	19.6	dB	Pin = -20 dBm
Output Return Loss	S22	13.0	9.8	14.3	dB	Pin = -20 dBm
Reverse Isolation	S12	28.9	29.4	29.3	dB	Pin = -20 dBm
Noise Figure	NF	6.3	6.2	6.4	dB	On standard evaluation board.
Output 1 dB Compression Power	OP1dB	33.7	33.8	34.6	dBm	
Output 3rd Order Intercept Point	OIP3	48.9	49.3	47.7	dBm	Pout = 24 dBm, Δf = 0.5 MHz

GRF5710 Typical Operating Curves: S-parameters (400 to 550 MHz Tune)



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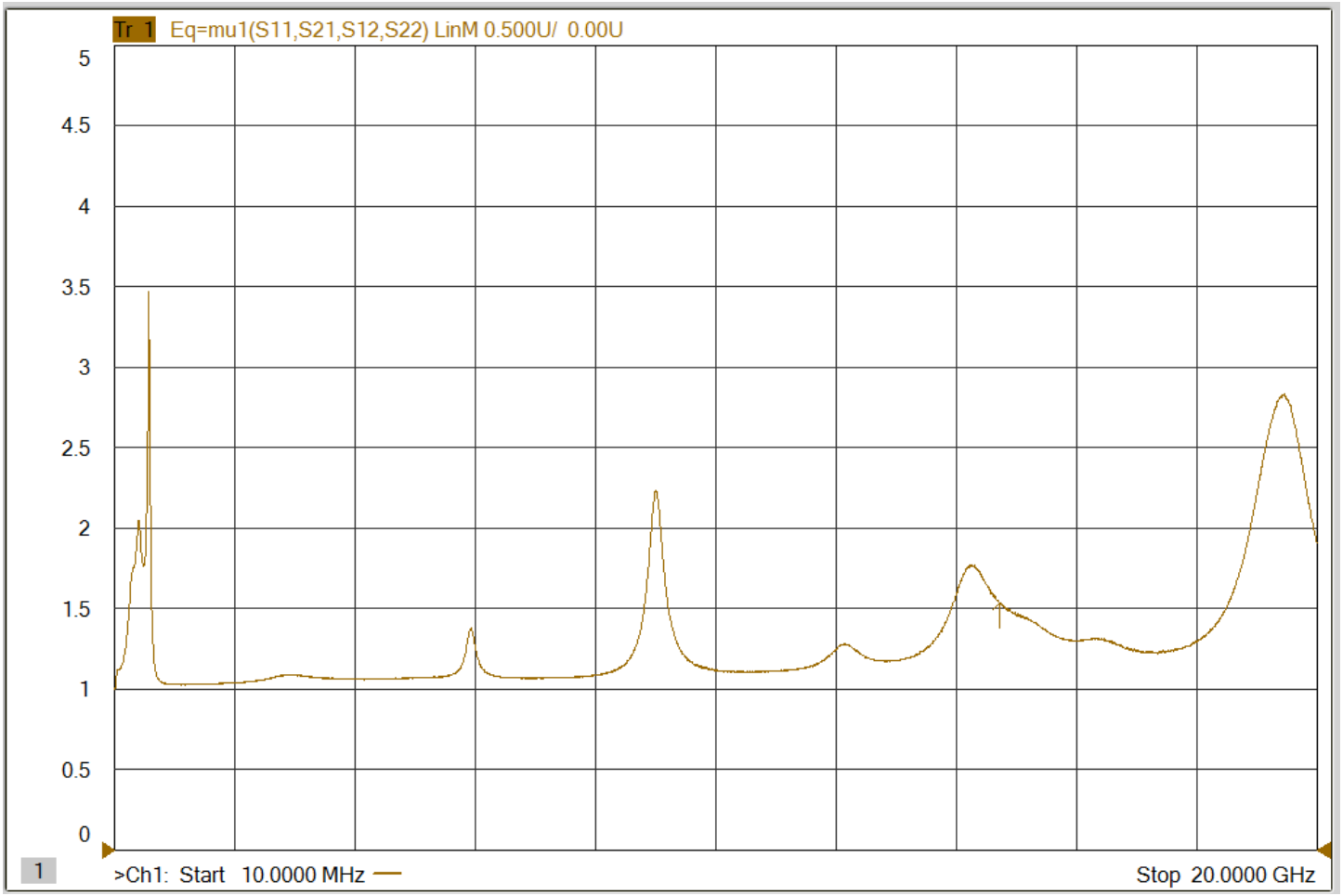
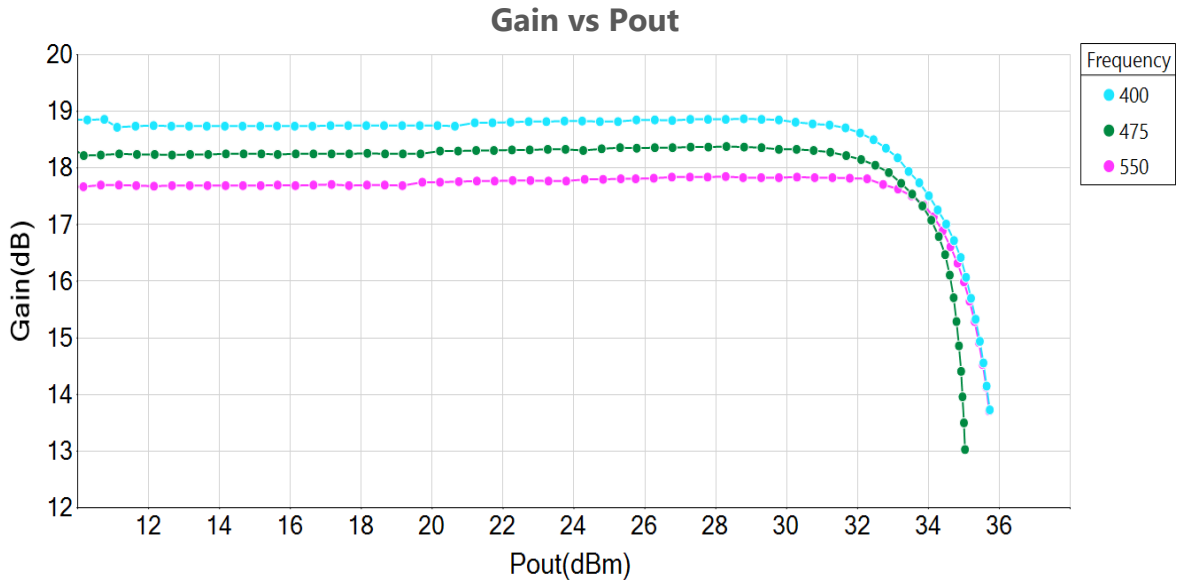
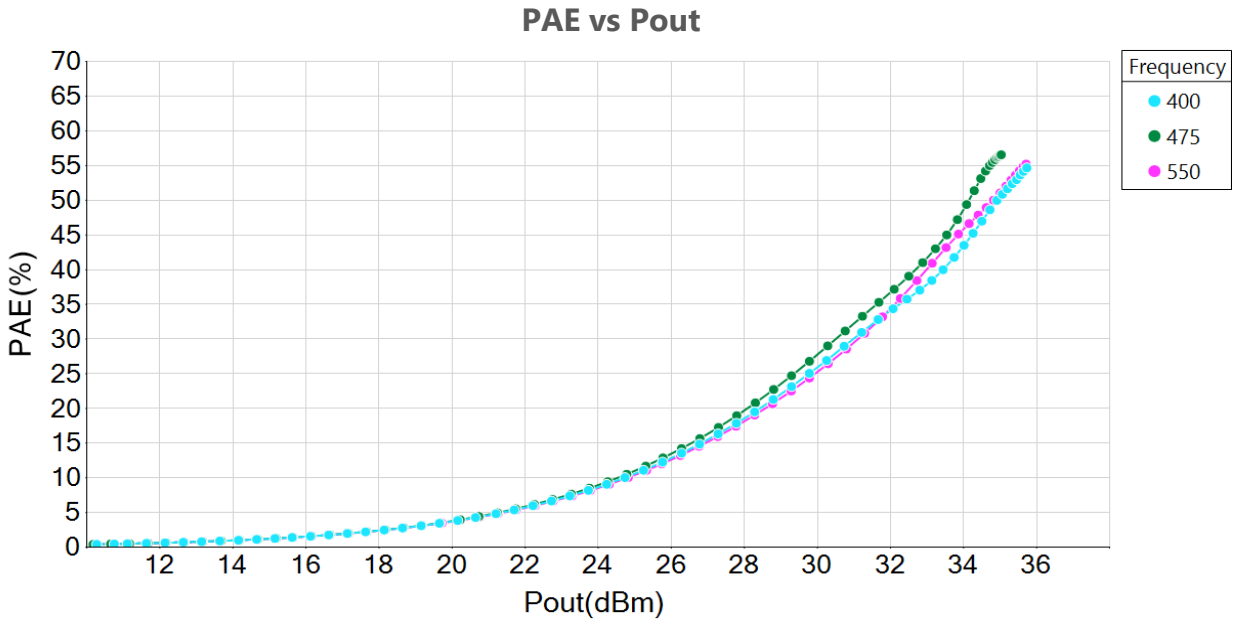
GRF5710 Typical Operating Curves: Mu Factor (400 to 550 MHz Tune)



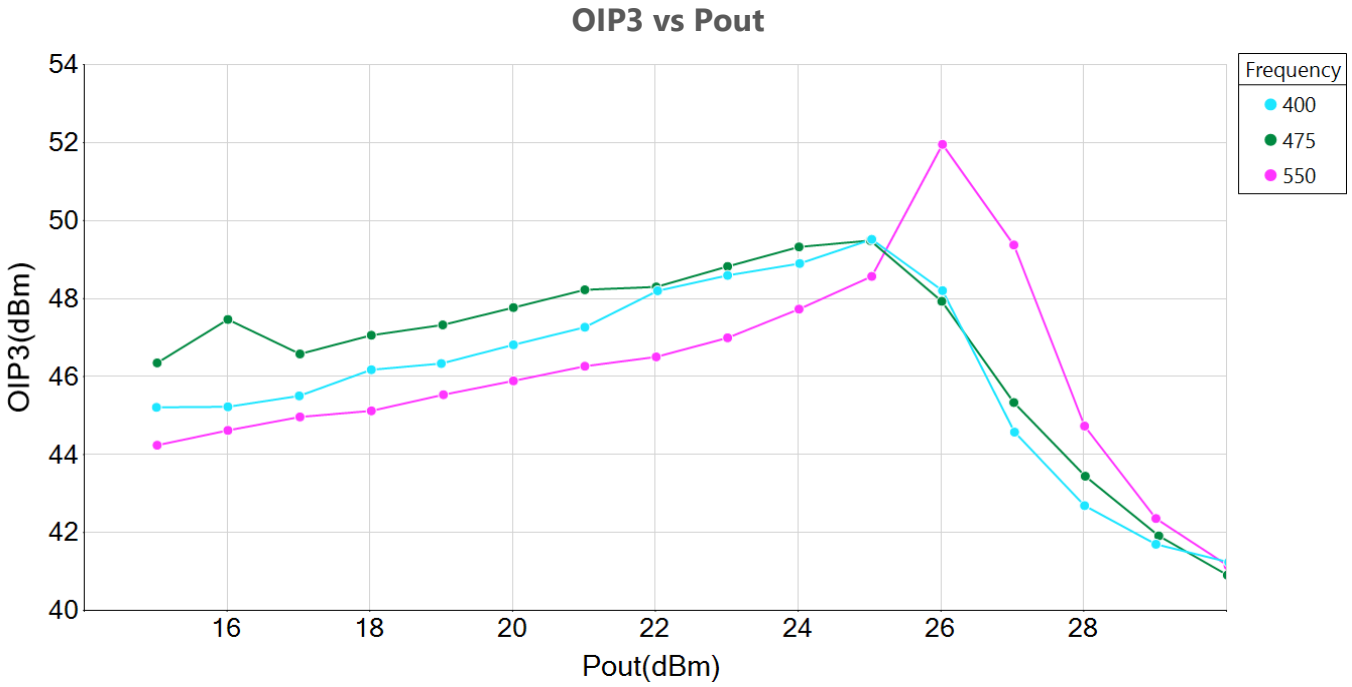
Note: Mu Factor ≥ 1.0 implies unconditional stability.

GRF5710 Typical Operating Curves: 400 to 550 MHz Tune





GRF5710 Typical Operating Curves: 400 to 550 MHz Tune

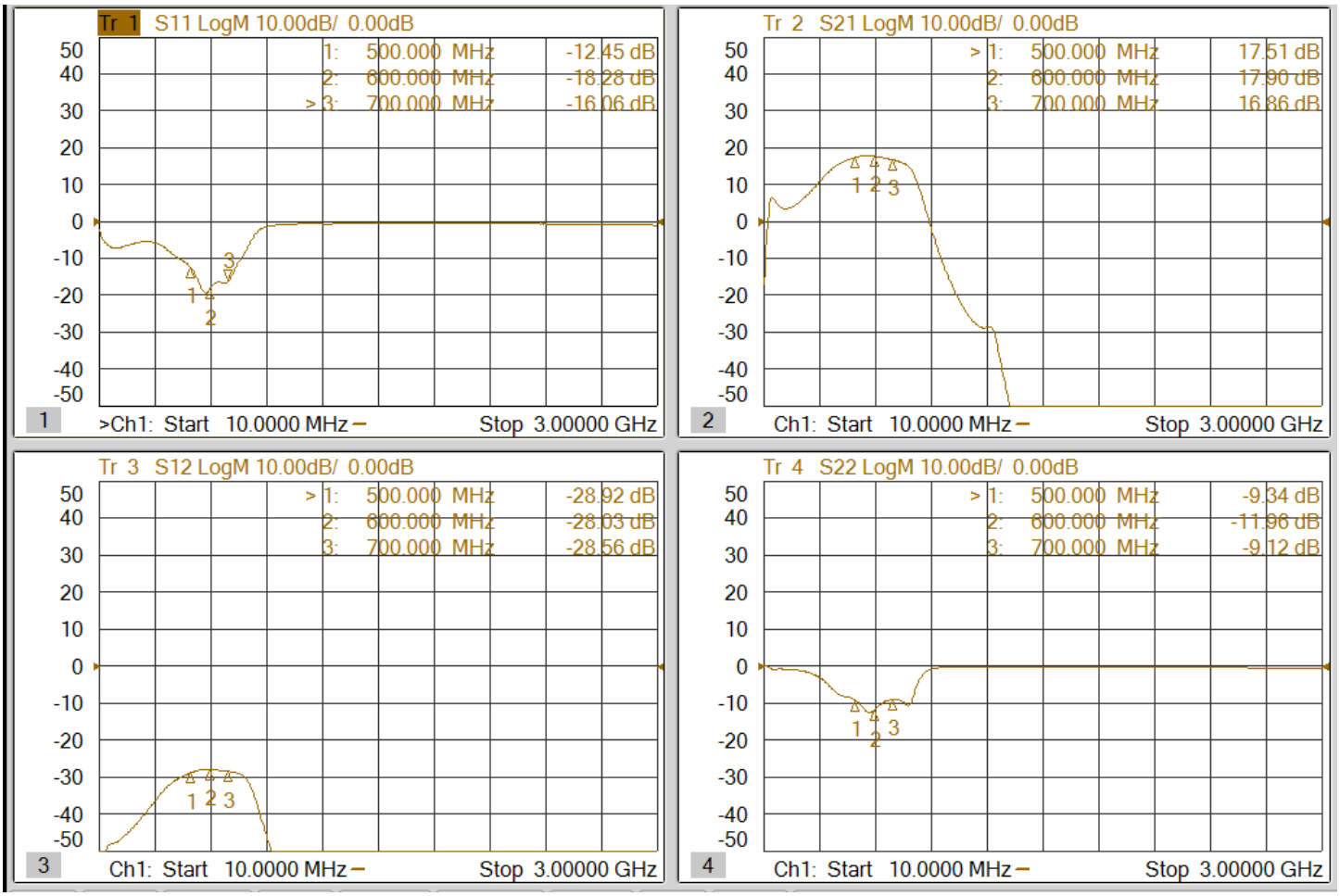


Typical Performance – RF: 500 to 700 MHz

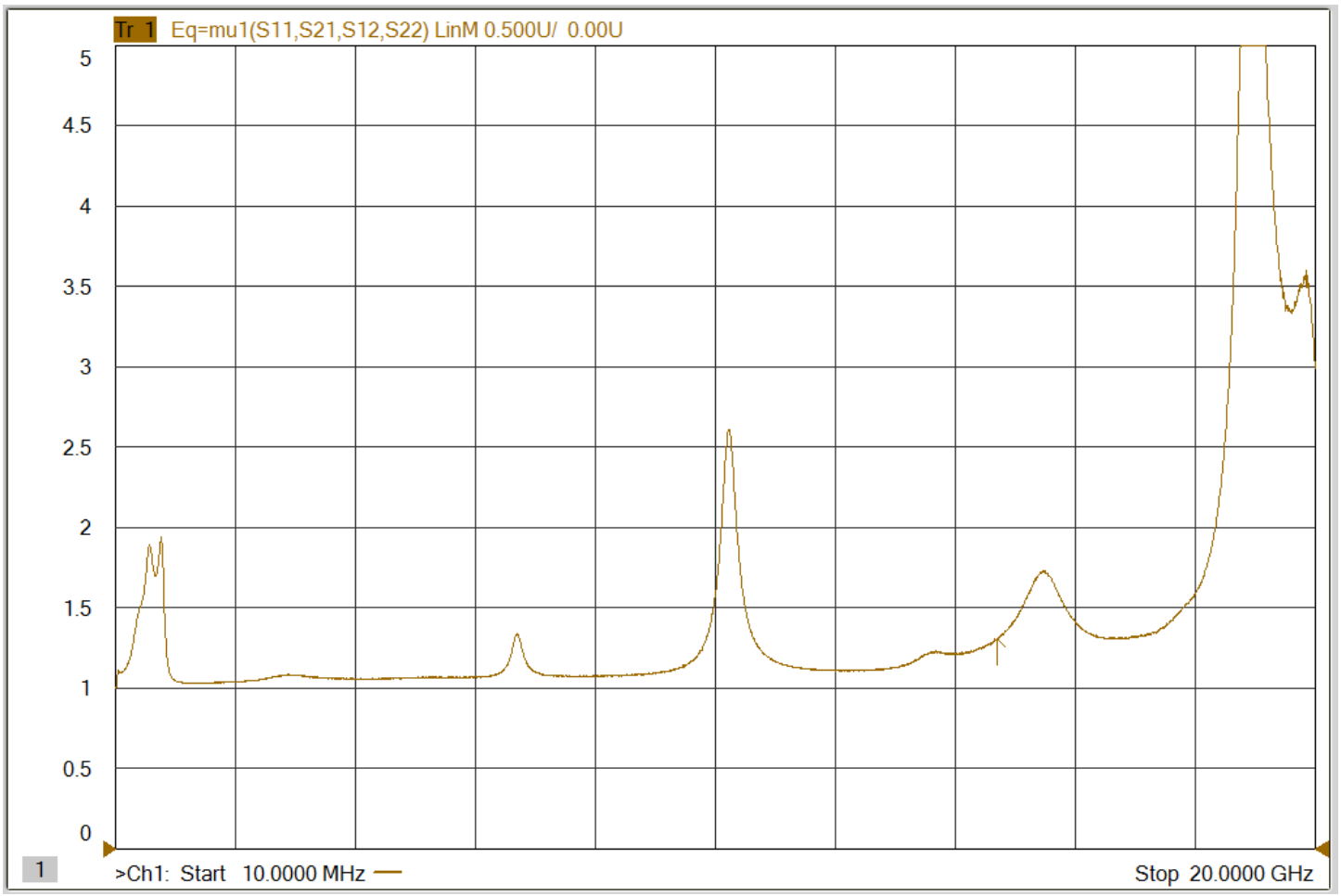
The following conditions apply unless noted otherwise: typical application schematic using the 500 to 700 MHz tuning set. $V_{CC}/V_{BIAS}/V_{REF}$ = 5 V, Icq = 500 mA, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C, Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		500 MHz	600 MHz	700 MHz		
Small Signal Gain	S21	17.8	18	17	dB	Pin = -20 dBm
Input Return Loss	S11	12.5	18.3	16.1	dB	Pin = -20 dBm
Output Return Loss	S22	9.3	12.0	9.1	dB	Pin = -20 dBm
Reverse Isolation	S12	28.9	28.0	28.6	dB	Pin = -20 dBm
Noise Figure	NF	6.0	5.8	6.1	dB	On standard evaluation board.
Output 1 dB Compression Power	OP1dB	34.6	34.4	35	dBm	
Output 3rd Order Intercept Point	OIP3	50.7	47.3	46.7	dBm	Pout = 24 dBm, Δf = 0.5 MHz

GRF5710 Typical Operating Curves: S-parameters (500 to 700 MHz Tune)



GRF5710 Typical Operating Curves: Mu Factor (500 to 700 MHz Tune)



Note: Mu Factor ≥ 1.0 implies unconditional stability.

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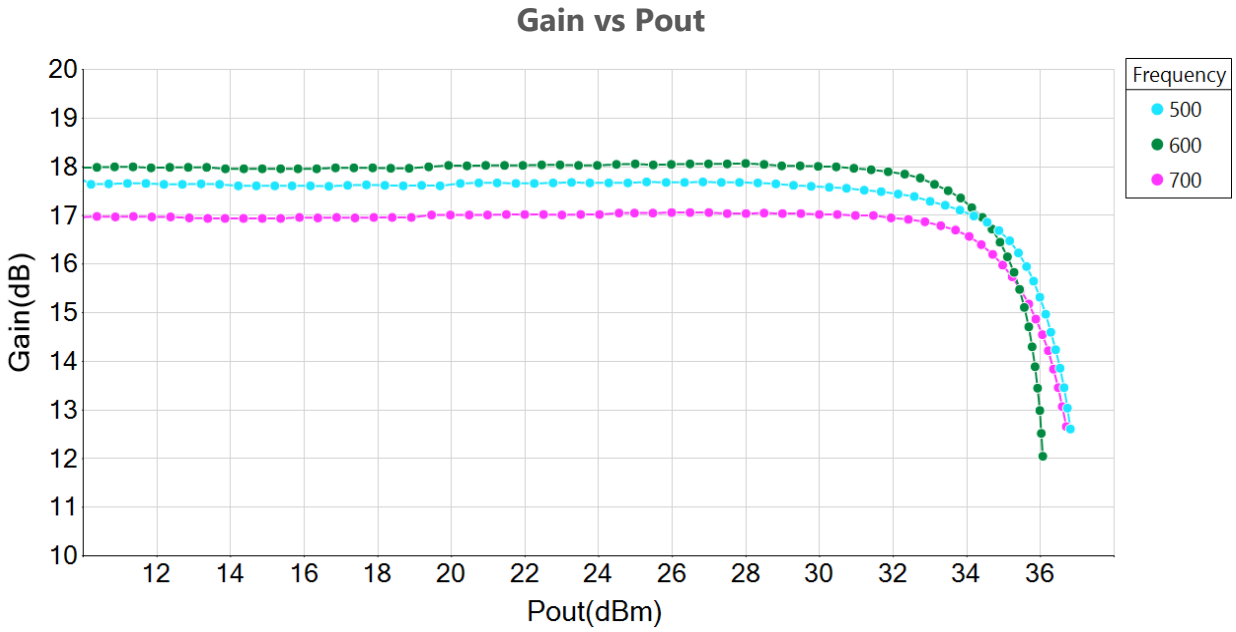
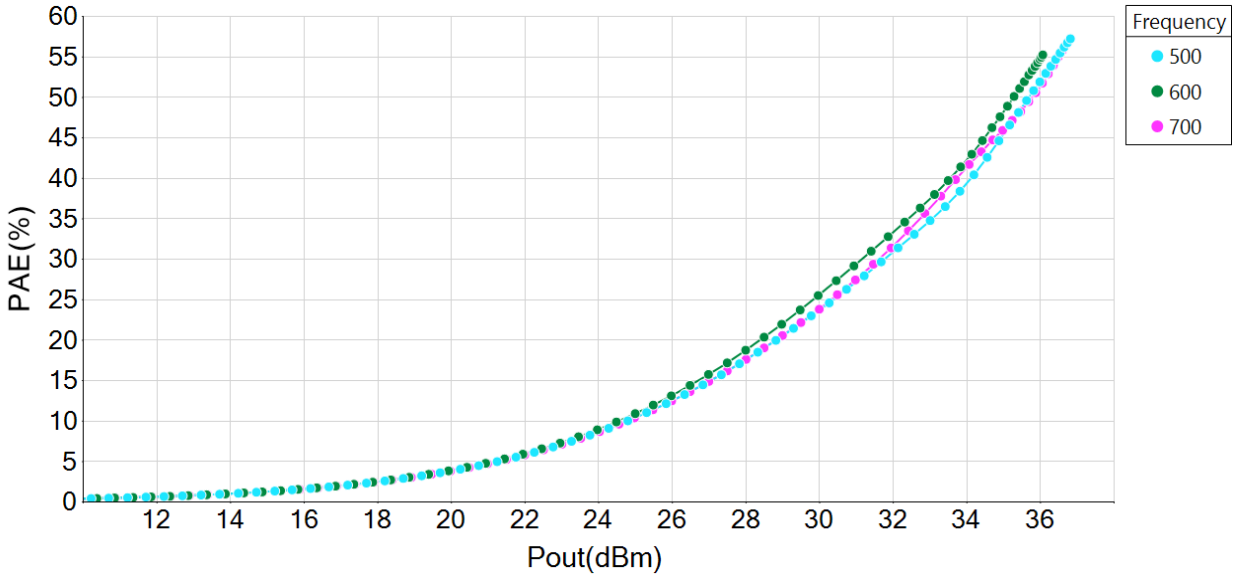
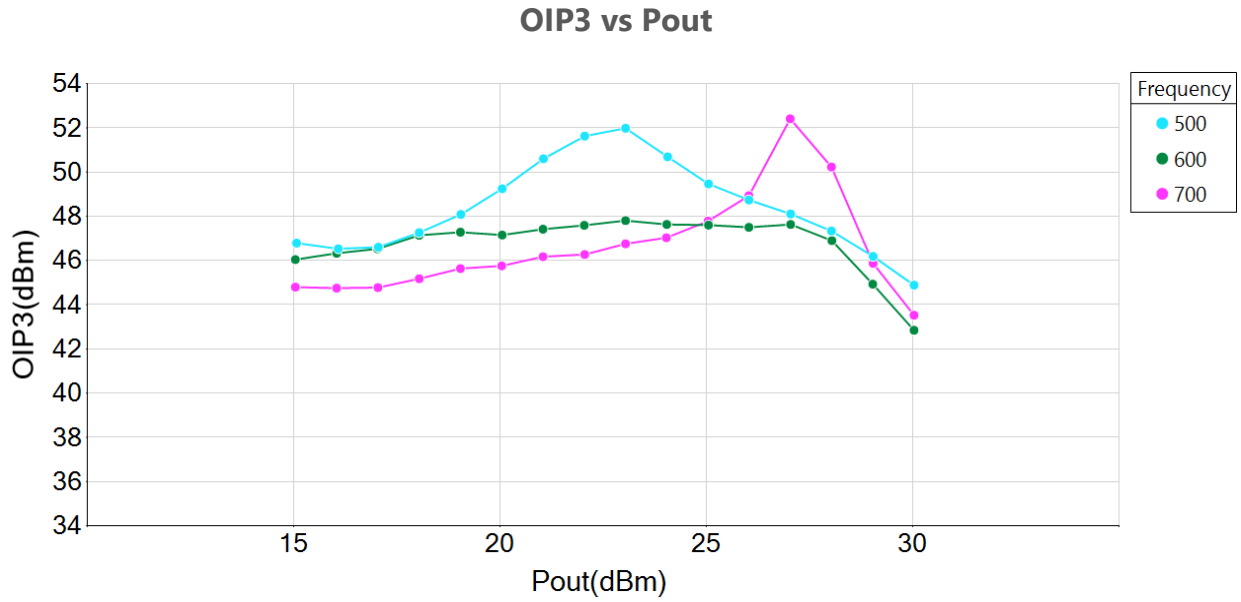
GRF5710 Typical Operating Curves: 500 to 700 MHz Tune





GRF5710 Typical Operating Curves: 500 to 700 MHz Tune



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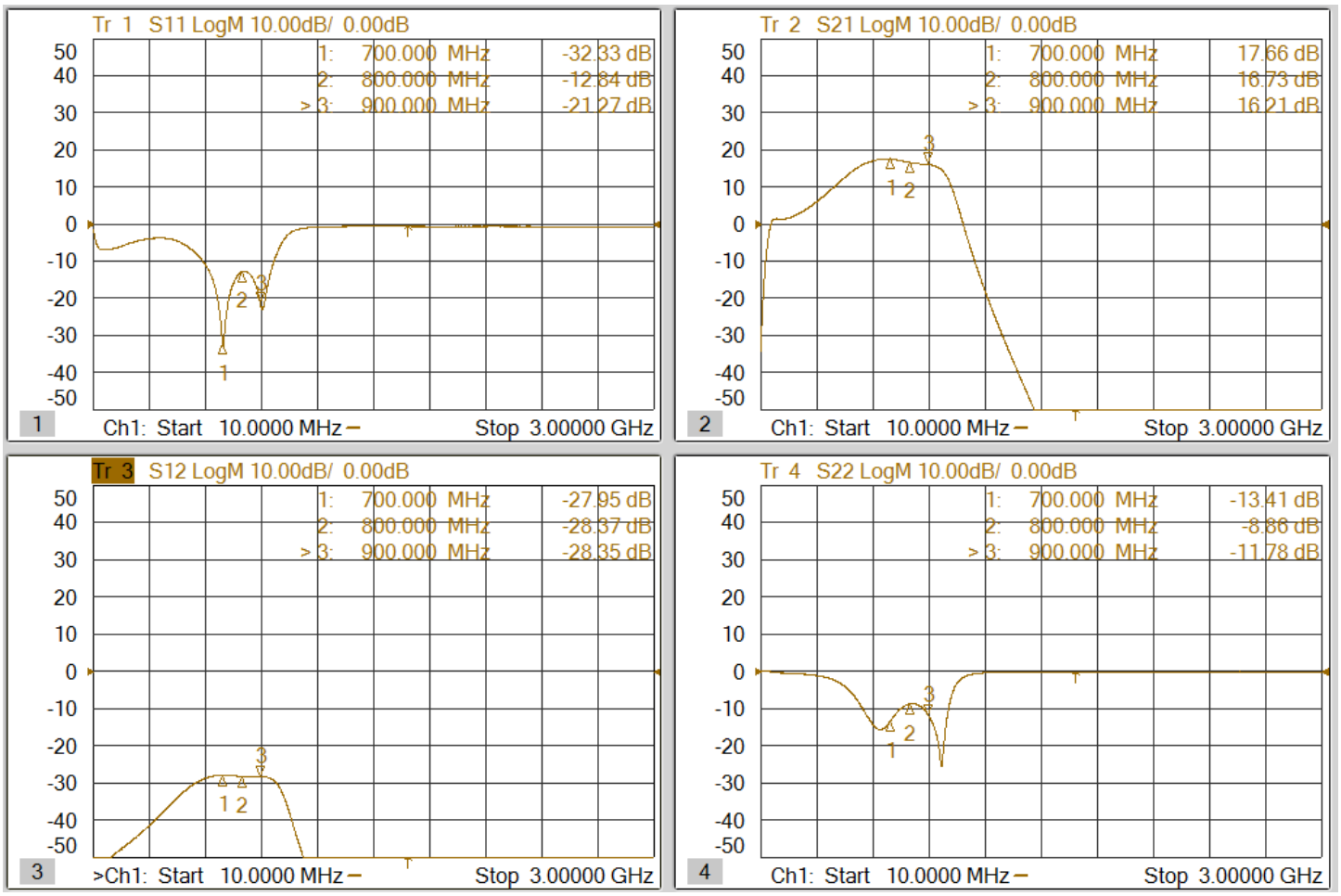
Typical Performance – RF: 700 to 900 MHz

The following conditions apply unless noted otherwise: typical application schematic using the 700 to 900 MHz tuning set. $V_{CC}/V_{BIAS}/V_{REF}$ = 5 V, Icq = 500 mA, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C, Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		700 MHz	800 MHz	900 MHz		
Small Signal Gain	S21	17.7	16.7	16.2	dB	Pin = -20 dBm
Input Return Loss	S11	-32.3	-12.8	-21.3	dB	Pin = -20 dBm
Output Return Loss	S22	-13.4	-8.9	-11.8	dB	Pin = -20 dBm
Reverse Isolation	S12	-28.0	-28.4	-28.4	dB	Pin = -20 dBm
Noise Figure	NF	5.6	5.7	6.2	dB	On standard evaluation board.
Output 1 dB Compression Power	OP1dB	33.4	33.2	34.0	dBm	
Output 3rd Order Intercept Point	OIP3	49.4	49.1	47.2	dBm	Pout = 24 dBm, Δf = 0.5 MHz

GRF5710 Typical Operating Curves: S-parameters (700 to 900 MHz Tune)



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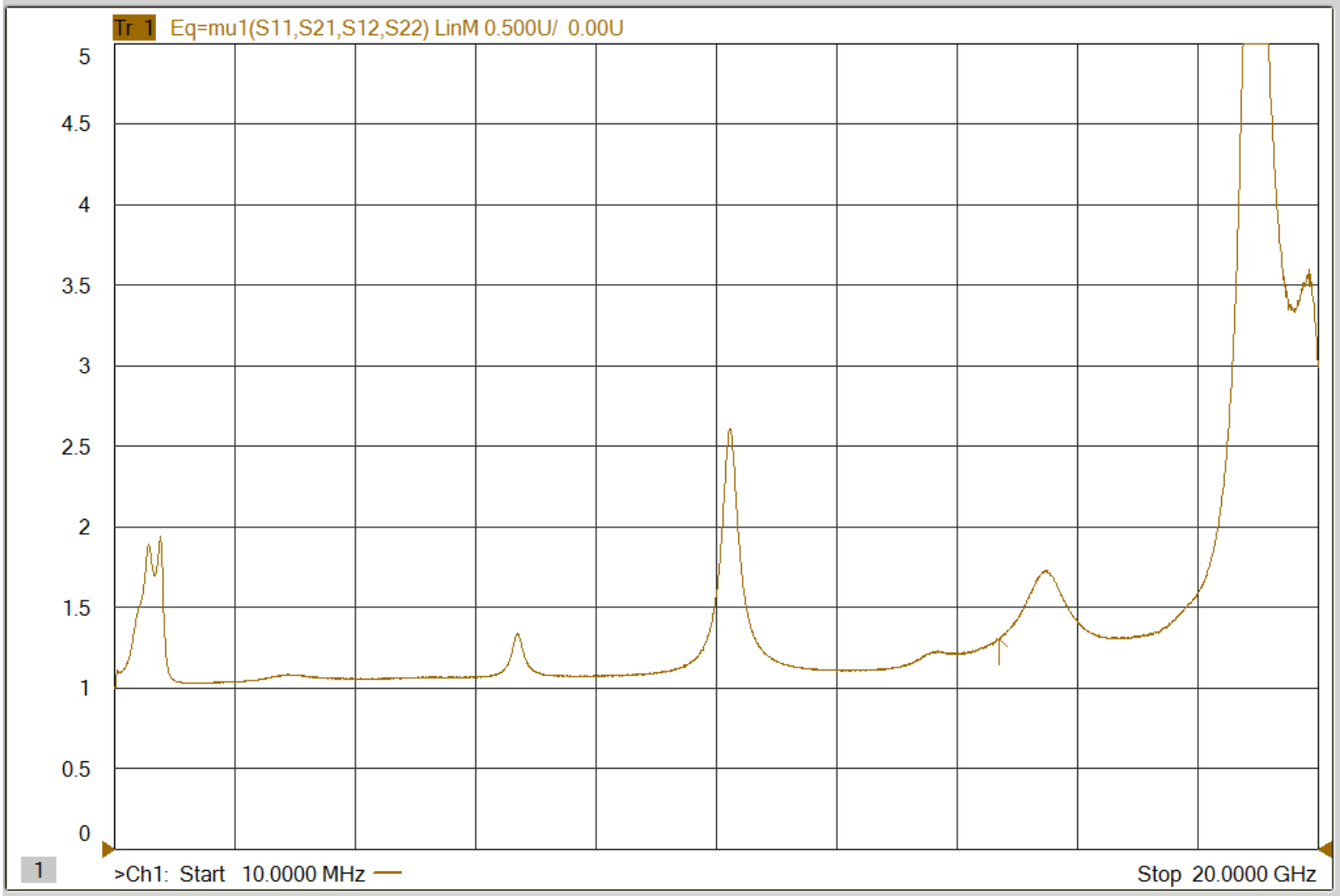
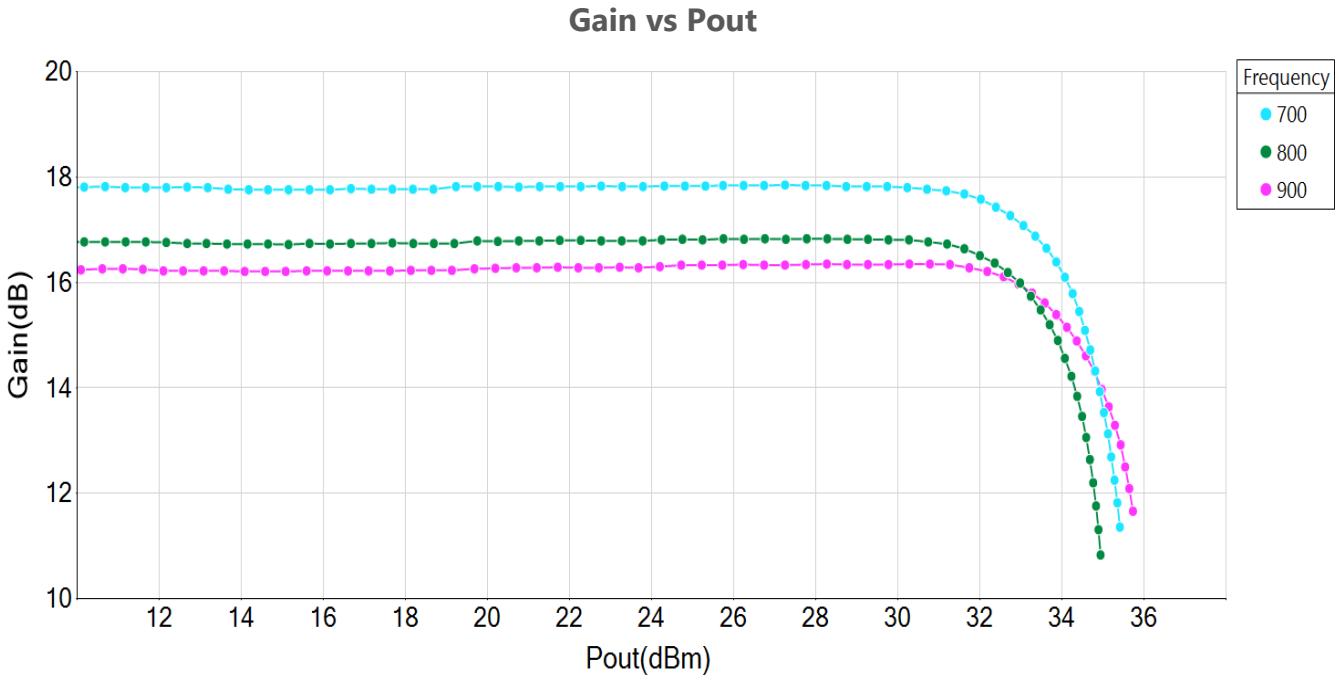
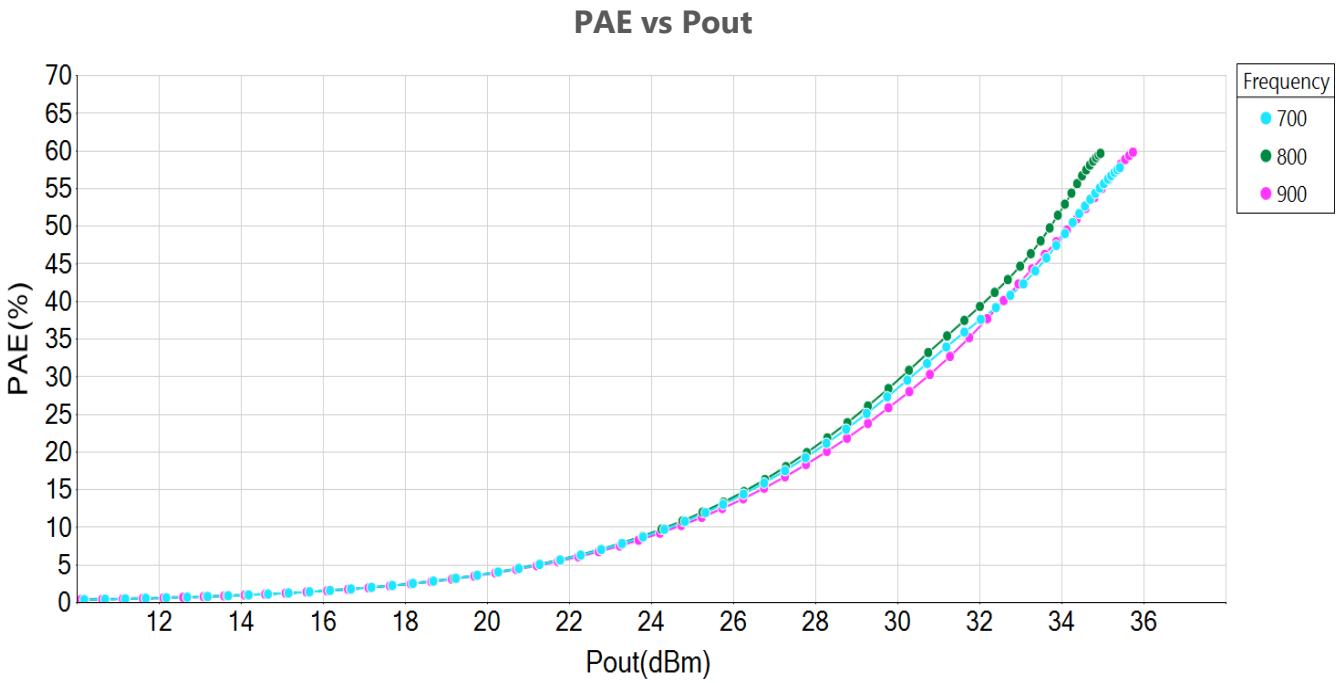
GRF5710 Typical Operating Curves: Mu Factor (700 to 900 MHz Tune)



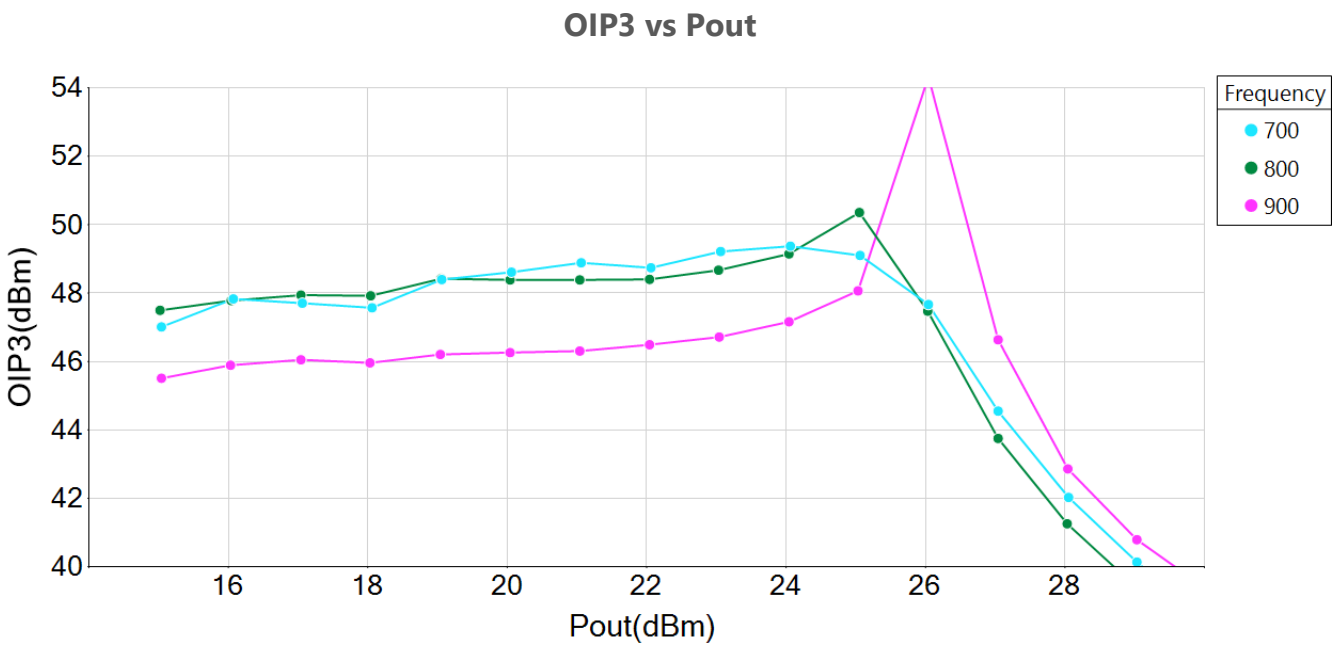
Note: Mu Factor ≥ 1.0 implies unconditional stability.

GRF5710 Typical Operating Curves: 700 to 900 MHz Tune





GRF5710 Typical Operating Curves: 700 to 900 MHz Tune

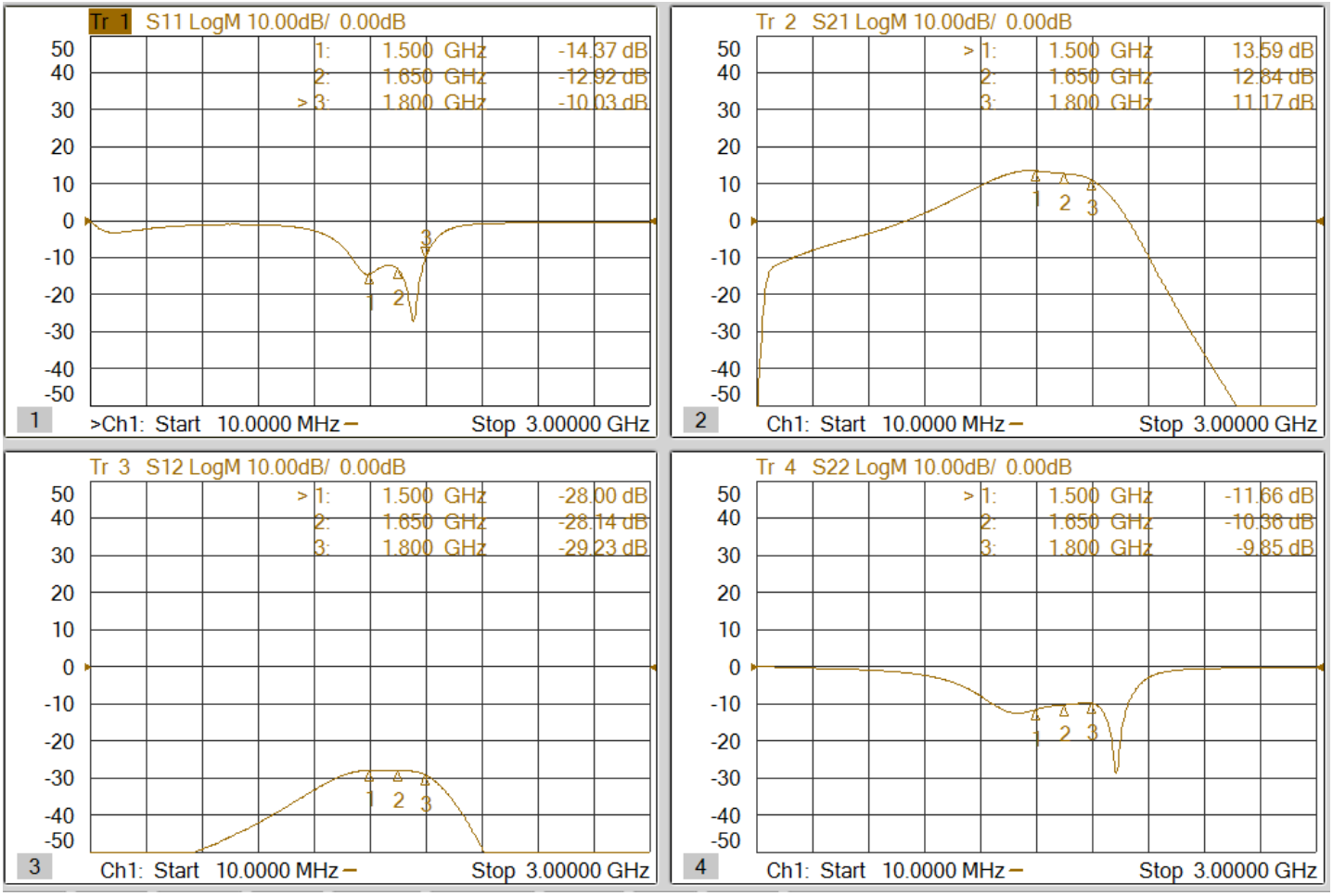


Typical Performance – RF: 1500 to 1800 MHz

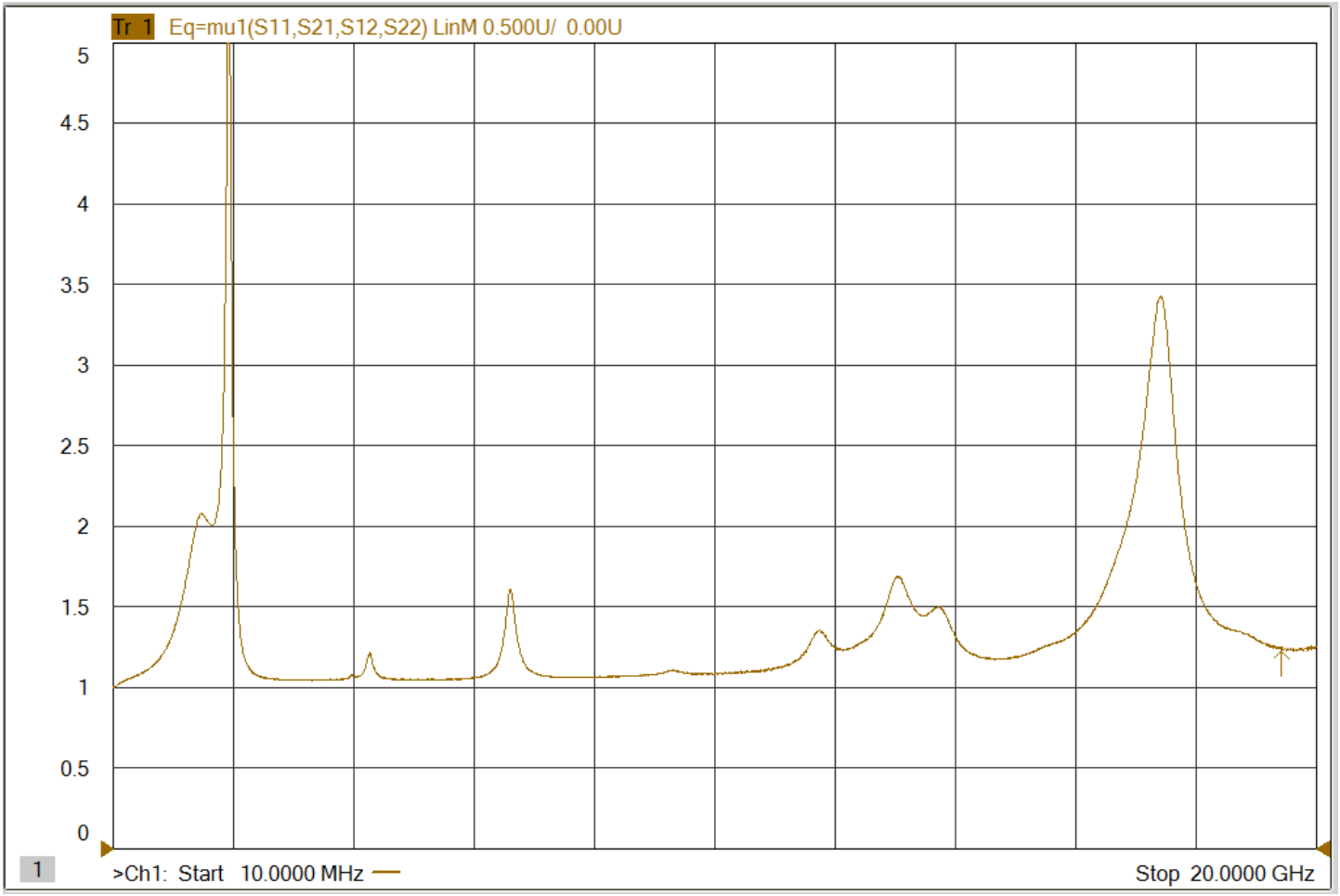
The following conditions apply unless noted otherwise: typical application schematic using the 1500 to 1800 MHz tuning set. $V_{CC}/V_{BIAS}/V_{REF}$ = 5 V, Icq = 500 mA, 50 Ω system impedance, $T_{PKG\ BASE}$ = 25 °C, Evaluation board losses are included within the specifications.

Parameter	Symbol	Specification			Unit	Condition
		1500 MHz	1650 MHz	1800 MHz		
Small Signal Gain	S21	13.9	13	11.4	dB	Pin = -20 dBm
Input Return Loss	S11	14.4	12.9	10.0	dB	Pin = -20 dBm
Output Return Loss	S22	11.7	10.4	9.9	dB	Pin = -20 dBm
Reverse Isolation	S12	28	28.1	29.2	dB	Pin = -20 dBm
Noise Figure	NF	5.5	5.5	6.9	dB	On standard evaluation board.
Output 1 dB Compression Power	OP1dB	33.4	33.3	33.8	dBm	
Output 3rd Order Intercept Point	OIP3	48.9	48.3	45.6	dBm	Pout = 24 dBm, Δf = 0.5 MHz

GRF5710 Typical Operating Curves: S-parameters (1500 to 1800 MHz Tune)



GRF5710 Typical Operating Curves: Mu Factor (1500 to 1800 MHz Tune)



Note: Mu Factor ≥ 1.0 implies unconditional stability.

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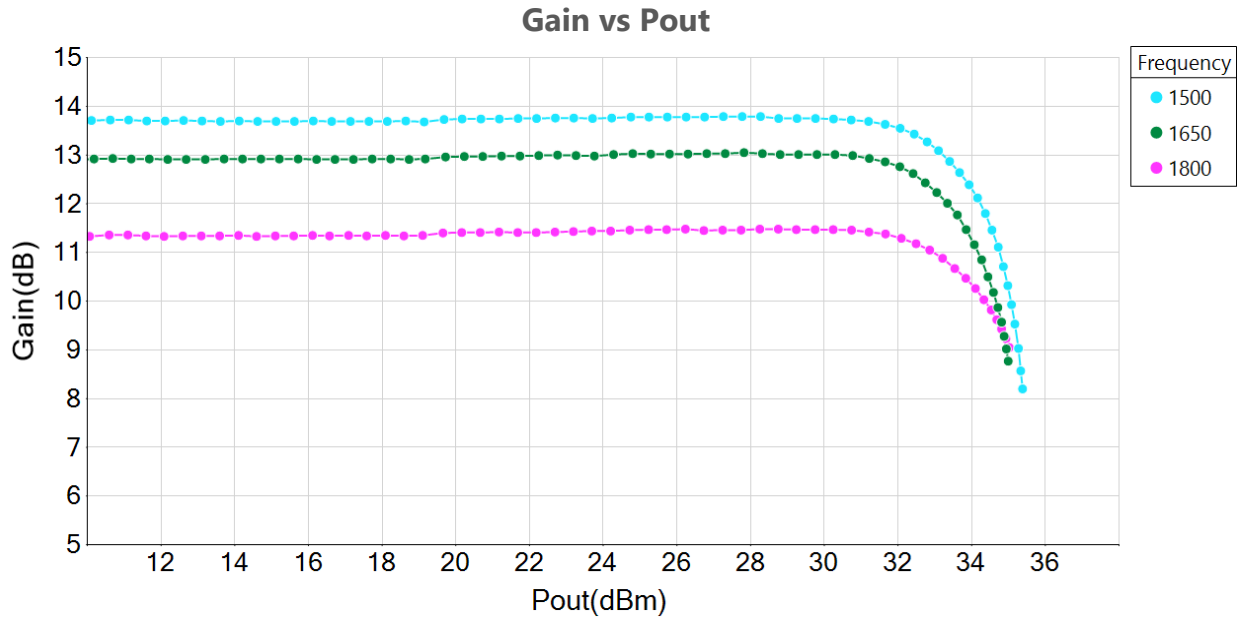
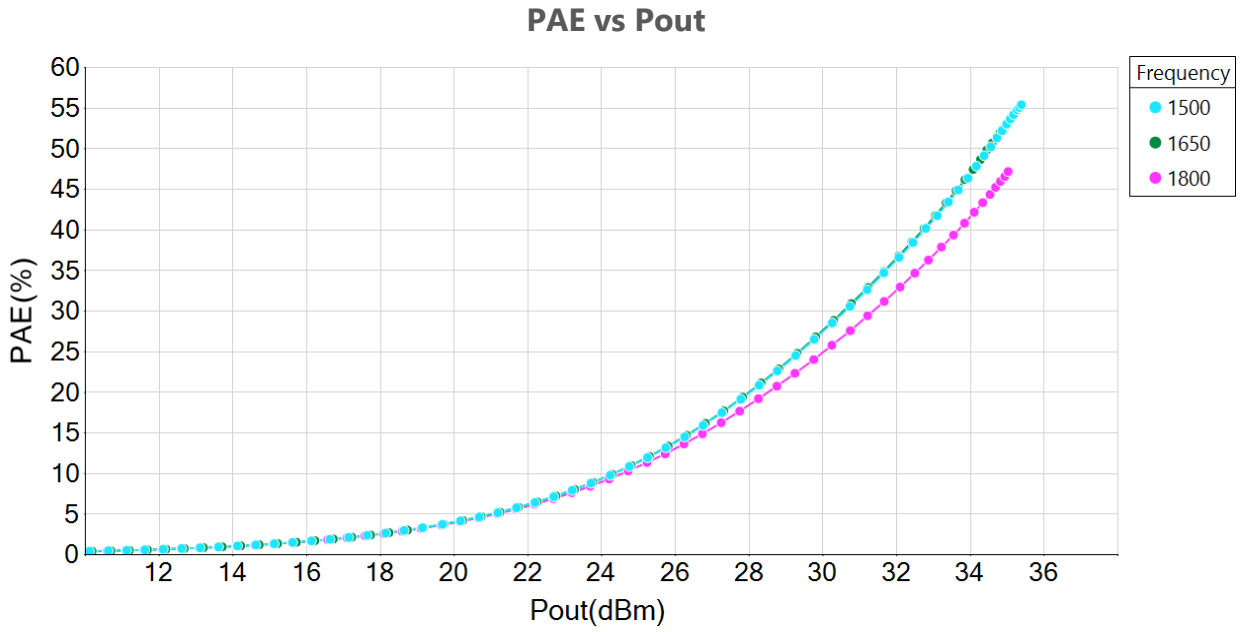
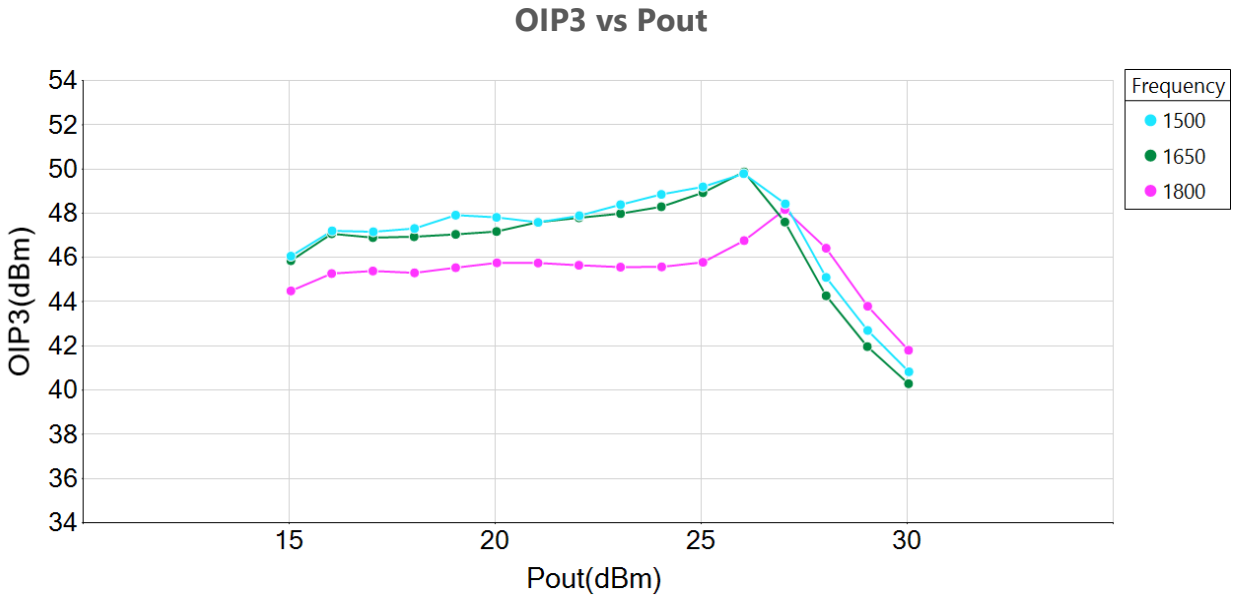
GRF5710 Typical Operating Curves: 1500 to 1800 MHz Tune





GRF5710 Typical Operating Curves: 1500 to 1800 MHz Tune



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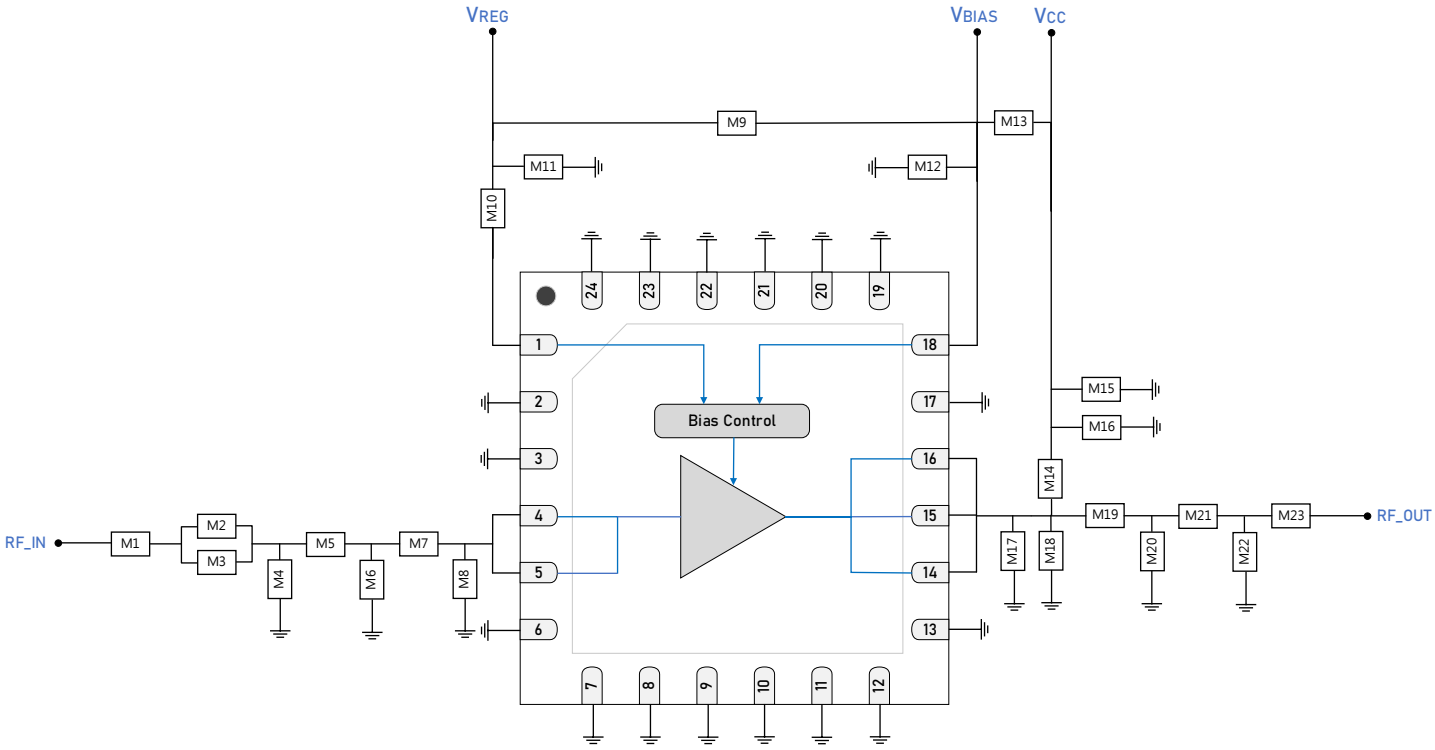
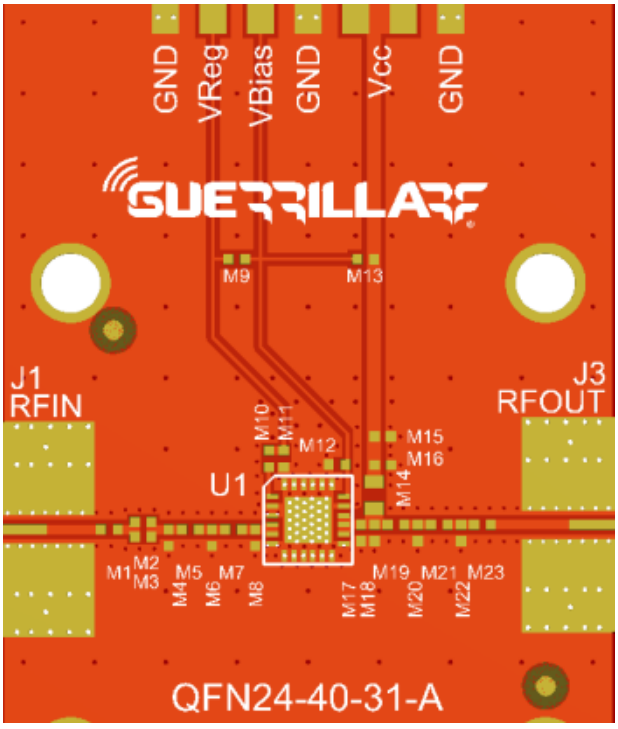
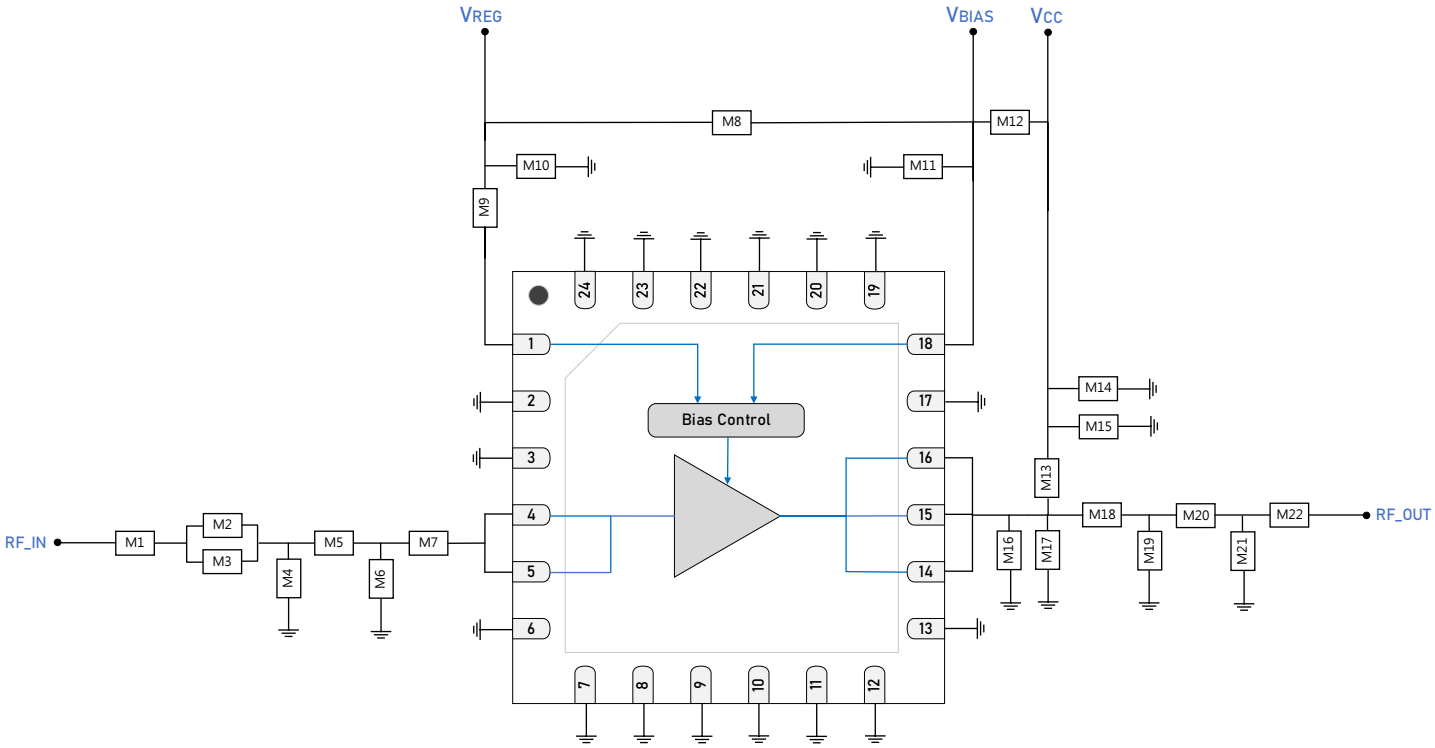


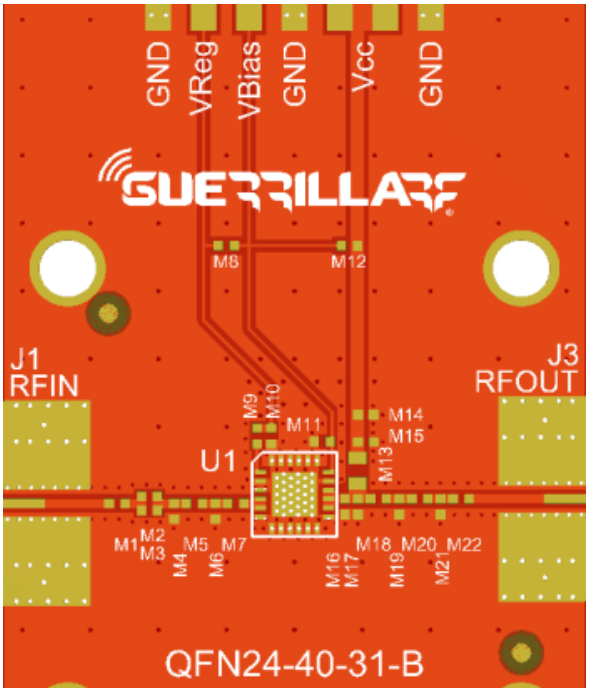
GRF5710 Standard Evaluation Board Schematic: 400 to 900 MHz Tune



GRF5710 Evaluation Board Assembly Diagram



GRF5710 Standard Evaluation Board Schematic: 1500 to 1800 MHz Tune



GRF5710 Evaluation Board Assembly Diagram

GRF5710 Evaluation Board Assembly Diagram Reference: 400 to 550 MHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1, M23	Capacitor	Murata	GRM	100 pF	0402	ok
M2	Resistor	Various	1%	49.9 Ω	0402	ok
M3	Capacitor	Murata	GJM	22 pF	0402	ok
M4	Capacitor	Murata	GJM	12 pF	0402	ok
M5	Inductor	Murata	LQG	6.8 nH	0402	ok
M6	Capacitor	Murata	GJM	47 pF	0402	ok
M7	Inductor	Murata	LQG	1.0 nH	0402	ok
M8	Capacitor	Murata	GJM	39 pF	0402	ok
M9, M13, M18	DNP	--	--	--	--	--
M10	Resistor	Various	1%	360 Ω	0402	ok
M11, M12, M16	Capacitor	Murata	GRM	0.1 µF	0402	ok
M14	Inductor	Murata	LQW	8.2 nH	0805	ok
M15	Capacitor	Murata	GRM	10 µF	0402	ok
M17	Capacitor	Murata	GJM	12 pF	0402	ok
M19	Inductor	Murata	LQG	1.5 nH	0402	ok
M20	Capacitor	Murata	GJM	39 pF	0402	ok
M21	Inductor	Coilcraft	0402 DC	7.8 nH	0402	ok
M22	Capacitor	Murata	GJM	12 pF	0402	ok
Evaluation Board	QFN24-40-31-A					

GRF5710 Evaluation Board Assembly Diagram Reference: 500 to 700 MHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1, M23	Capacitor	Murata	GRM	100 pF	0402	ok
M2	Resistor	Various	1%	49.9 Ω	0402	ok
M3	Capacitor	Murata	GJM	22 pF	0402	ok
M4	Capacitor	Murata	GJM	8.2 pF	0402	ok
M5	Inductor	Murata	LQG	5.1 nH	0402	ok
M6	Capacitor	Murata	GJM	33 pF	0402	ok
M7	Inductor	Murata	LQGWH	0.7 nH	0402	ok
M8	Capacitor	Murata	GJM	27 pF	0402	ok
M9, M13, M18	DNP	--	--	--	--	--
M10	Resistor	Various	1%	360 Ω	0402	ok
M11, M12, M16	Capacitor	Murata	GRM	0.1 µF	0402	ok
M14	Inductor	Murata	LQW	8.2 nH	0805	ok
M15	Capacitor	Murata	GRM	10 µF	0402	ok
M17	Capacitor	Murata	GJM	8.2 pF	0402	ok
M19	Inductor	Murata	LQGWH	0.8 nH	0402	ok
M20	Capacitor	Murata	GJM	33 pF	0402	ok
M21	Inductor	Coilcraft	0402 DC	5.2 nH	0402	ok
M22	Capacitor	Murata	GJM	10 pF	0402	ok
Evaluation Board	QFN24-40-31-A					

GRF5710 Evaluation Board Assembly Diagram Reference: 700 to 900 MHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1	Capacitor	Murata	GRM	100 pF	0402	ok
M2	Resistor	Various	1%	49.9 Ω	0402	ok
M3	Capacitor	Murata	GJM	22 pF	0402	ok
M4, M9, M13, M18	DNP	--	--	--	--	--
M5, M19	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M6	Capacitor	Murata	GJM	8.2 pF	0402	ok
M7	Inductor	Murata	LQG	3.3 nH	0402	ok
M8	Capacitor	Murata	GJM	33 pF	0402	ok
M10	Resistor	Various	1%	360 Ω	0402	ok
M11, M12, M16	Capacitor	Murata	GRM	0.1 µF	0402	ok
M14	Inductor	Murata	LQW	3.6 nH	0805	ok
M15	Capacitor	Murata	GRM	10 µF	0402	ok
M17	Capacitor	Murata	GJM	5.1 pF	0402	ok
M20	Capacitor	Murata	GJM	22 pF	0402	ok
M21	Inductor	Coilcraft	0402 DC	4.5 nH	0402	ok
M22	Capacitor	Murata	GJM	6.8 pF	0402	ok
M23	Capacitor	Murata	GRM	47 pF	0402	ok
Evaluation Board	QFN24-40-31-A					

GRF5710 Evaluation Board Assembly Diagram Reference: 1500 to 1800 MHz Tune

Component	Type	Manufacturer	Family	Value	Package Size	Substitution
M1, M22	Resistor (jumper)	Various	5%	0 Ω	0402	ok
M2	Resistor	Various	1%	49.9 Ω	0402	ok
M3	Capacitor	Murata	GJM	22 pF	0402	ok
M4	Capacitor	Murata	GJM	4.3 pF	0402	ok
M5	Inductor	Murata	LQG	1.5 nH	0402	ok
M6	Capacitor	Murata	GJM	12 pF	0402	ok
M7	Capacitor	Murata	GJM	10 pF	0402	ok
M8, M12, M21	DNP	--	--	--	--	--
M9	Resistor	Various	1%	360 Ω	0402	ok
M10, M11, M15	Capacitor	Murata	GRM	0.1 µF	0402	ok
M13	Inductor	Murata	LQW	3.2 nH	0805	ok
M14	Capacitor	Murata	GRM	10 µF	0402	ok
M16	Capacitor	Murata	GJM	6.8 pF	0402	ok
M17	Capacitor	Murata	GJM	4.3 pF	0402	ok
M18	Inductor	Coilcraft	0402 DC	1.8 nH	0402	ok
M19	Capacitor	Murata	GJM	3.3 pF	0402	ok
M20	Capacitor	Murata	GJM	22 pF	0402	ok
Evaluation Board	QFN24-40-31-B					

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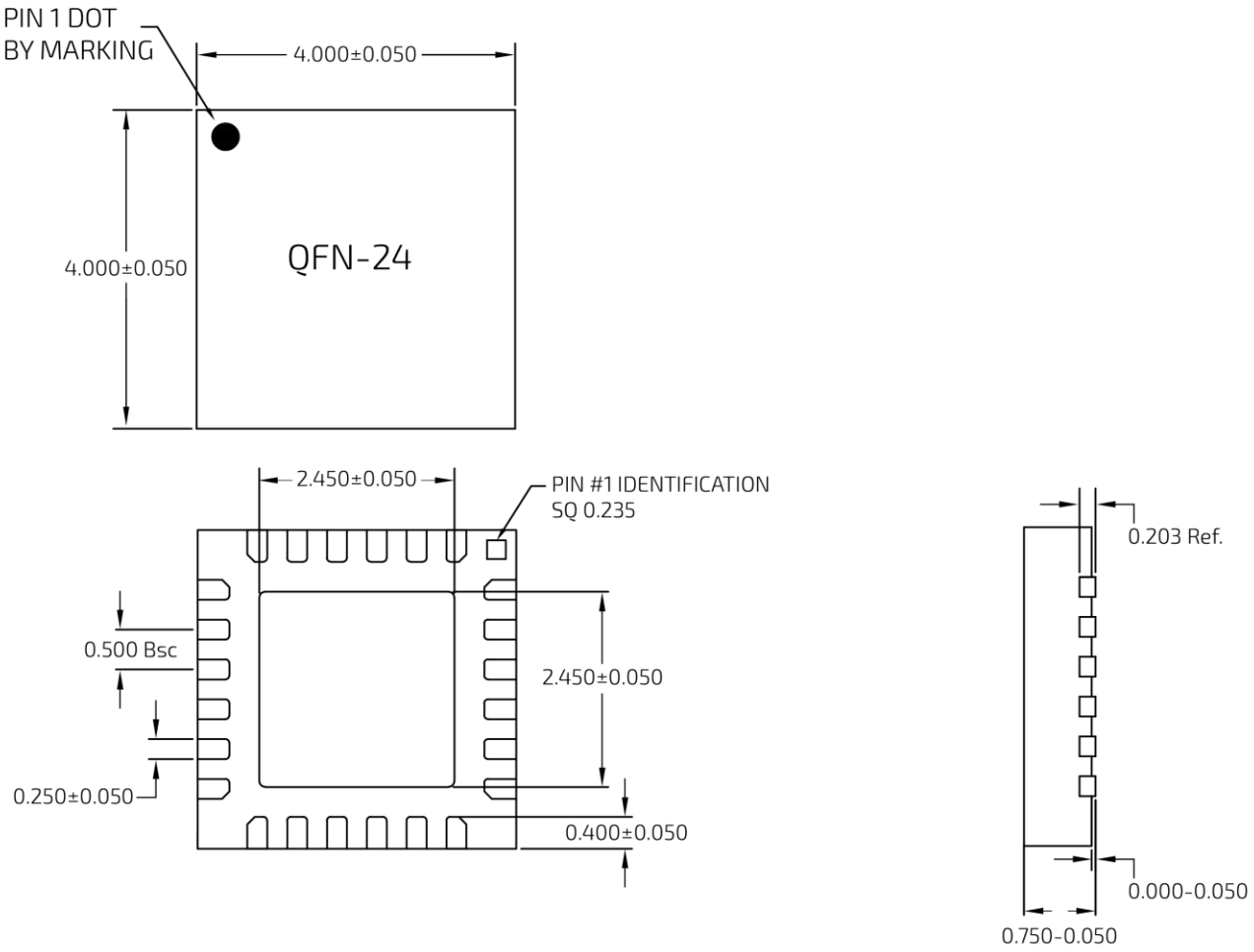
Package Outline Drawing



4 x 4 mm QFN-24 Package Dimensions

Package Marking Diagram

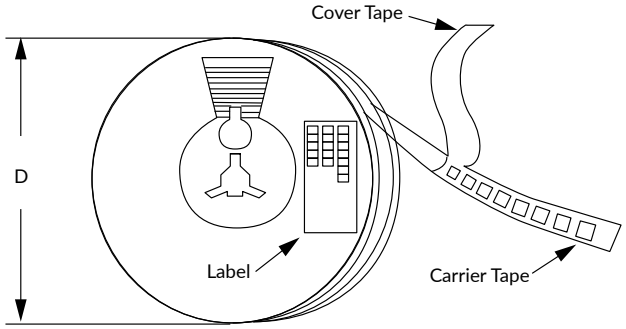
- Line 1: "YY" = YEAR. "WW" = WORK WEEK the device was assembled.
- Line 2: "GRF" = Guerrilla RF.
- Line 3: "XXXX" = Device PART NUMBER.

Tape and Reel Information

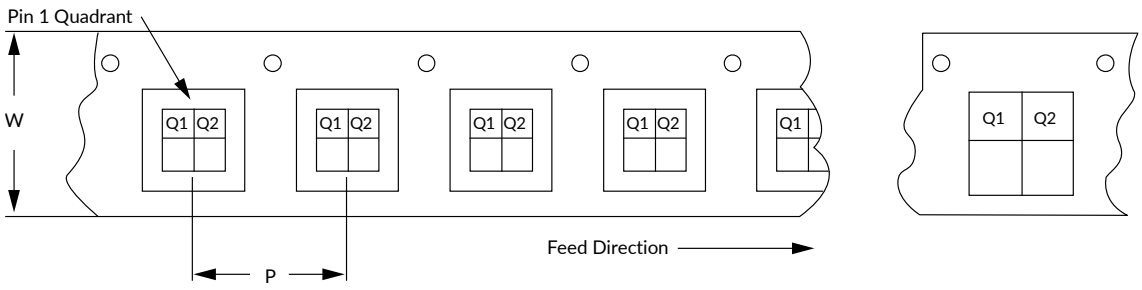
Guerrilla RF's tape and reel specification complies with Electronic Industries Alliance (EIA) standards for "Embossed Carrier Tape of Surface Mount Components for Automatic Handling" (reference EIA-481). See the following page for the Tape and Reel Specification and Device Package Information table, which includes units per reel.

Devices are loaded with pins down into the carrier pocket with protective cover tape and reeled onto a plastic reel. Each reel is packaged in a cardboard box. There are product labels on the reel, the protective ESD bag and the outside surface of the box.

For the Tape and Reel Reference Table, please refer to: *https://www.guerrilla-rf.com/prodFiles/Manufacturing/MN001.pdf*



Tape and Reel Packaging with Reel Diameter Noted (D)



Carrier Tape Width (W), Pitch (P), Feed Direction and Pin 1 Quadrant Information

Revision History

Revision Date	Description of Change
June 24, 2025	Preliminary Data Sheet.

Datasheet Classifications

Data Sheet 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 limited evaluation board measurements taken within the Guerrilla RF Applications Lab. All parametric values are subject to change pending the collection of additional data.
Release Ø	All data based on measurements taken with *production-released* material. TYP values are based on a combination of ATE and bench-level measurements, with MIN/MAX limits defined using *modelled estimates* that account for part-to-part variations and expected process spreads. Although unlikely, future refinements to the TYP/MIN/MAX values may be in order as multiple lots are processed through the factory.
Release A-Z	All data based on measurements taken with production-released material *derived from multiple lots which have been fabricated over an extended period of time.* MIN/MAX limits may be refined over previous releases as more statistically significant data is collected to account for process spreads.