RF2475

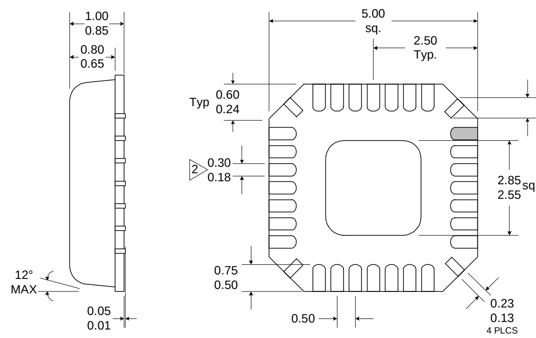
DUAL-BAND LOW NOISE AMPLIFIER/MIXER WITH FREQUENCY DOUBLER

Typical Applications

- TDMA Handsets

Product Description

The RF2475 includes two downconverting mixers and associated LNAs. It is designed for IS136 handset applications in the cellular 800MHz and PCS 1900MHz bands. Each LNA has a gain bypass mode, which is controlled by the gain select pin. The device internally ties the two mixer outputs together, providing interface to a single IF SAW filter. A frequency doubler is provided to supply the LO signal to the PCS mixer and feeds the PCS transmit LO output buffer. A cellular LO output buffer is also included. The device is fabricated using Gallium Arsenide HBT technology and is packaged in a 28-pin, 5mmx5mm leadless package.

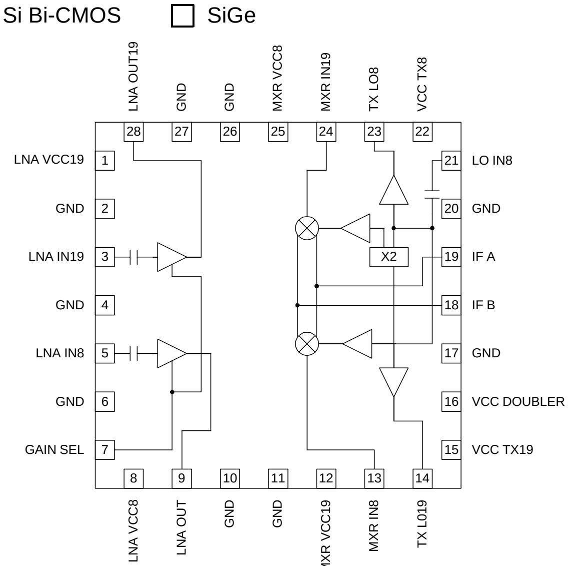


NOTES:
1 Shaded Pin is Lead 1.
2 Dimension applies to plated terminal: to be measured between 0.02 mm and 0.25 mm from terminal end.
3 Pin 1 identifier must exist on top surface of package by identification mark or feature on the package body. Exact shape and size is optional.
4 Package Warpage: 0.05 mm max.
5 Die Thickness Allowable: 0.305 mm max.

Optimum Technology Matching® Applied

- ☐ Si BJT
- ☑ GaAs HBT
- ☐ GaAs MESFET
- ☐ Si Bi-CMOS
- ☐ SiGe

Package Style: LCC, 28-Pin, 5x5



Functional Block Diagram

Features

- Complete Dual-Band Receiver Front-End
- Stepped LNA Gain Control
- Integrated LO Frequency Doubler
- Integrated LO Output Buffers
- Meets IS136 Specifications

Ordering Information

RF2475	Dual-Band Low Noise Amplifier/Mixer with Frequency Doubler
RF2475 PCBA	Fully Assembled Evaluation Board

RF Micro Devices, Inc.
7628 Thorndike Road
Greensboro, NC 27409, USA
Tel (336) 664 1233
Fax (336) 664 0454
http://www.rfmd.com

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.5 to +5.0	V_{DC}
Input LO and RF Levels	+6	dBm
Operating Ambient Temperature	-30 to +85	°C
Storage Temperature	-40 to +150	°C

Caution! ESD sensitive device.

RF Micro Devices believes the furnished information is correct and accurate at the time of this printing. However, RF Micro Devices reserves the right to make changes to its products without notice. RF Micro Devices does not assume responsibility for the use of the described product(s).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Cellular Receive Path					
Operational Limits					
RF Frequency	869		894	MHz	
LO Frequency	950		1045	MHz	
IF Frequency	100		150	MHz	
LNA Input Level			+10	dBm	
LO Input Level	-10	-7	-4	dBm	
Supply Voltage	2.7	2.8	3.3	V	
Cellular Cascaded Electrical Specifications					T_{AMB}=25°C, V_{CC}=2.8V, f_{RF}=881MHz, f_{LO}=1016MHz, f_{IF}=135MHz, LO Level=-7dBm, Image Filter I.L.=3dB
Gain	23	25	27	dB	High Gain, Gain Select=High
		8		dB	Low Gain, Gain Select=Low
Gain Step	14	17		dB	
Gain Variations versus Temperature			±1.5	dB	-30°C to +85°C
Noise Figure		2.2	2.6	dB	High Gain, Gain Select=High
		15	20	dB	Low Gain, Gain Select=Low
Input Third Order Intercept[1]	-10	-9		dBm	High Gain, Gain Select=High
	-2.0	-0.5		dBm	Low Gain, Gain Select=Low
Return Loss	10			dB	LNA Input - External Match
	10			dB	LNA Output - External Match
	10			dB	Mixer RF Input - External Match
	10			dB	Mixer LO Input - External Match
Isolation	60			dB	LO IN to LNA IN, Gain Select=High[2]
	60			dB	LO IN to LNA IN, Gain Select=Low
		60		dB	Image Rejection[3]
		50		dB	LO IN to IF OUT
		50		dB	Mixer RF IN to IF OUT
		35		dB	Mixer RF IN to TX LO OUT
IF Output Impedance		>10		kΩ	Mixer "ON"
Supply Current		20	25	mA	Not including TX LO buffer
TX LO Buffer					
LO Output Buffer	-7	-4		dBm	LO Input Level=-7dBm
Harmonic Output	-22	-25		dBc	LO Input Level=-7dBm
Isolation - LO OUT to LO IN	25			dB	TX LO Buffer ON
Supply Current		7.5	9.0	mA	
Logic					
Input Low			0.5	V	V_{CC}=2.7V to 2.9V
Input High	2.0			V	V_{CC}=2.7V to 2.9V
Input Current		TBD		µA	
Input Impedance		TBD		kΩ	

NOTES:
1 LNA input IP3 response to out of band frequencies (824Hz to 849MHz) should be -6dBm in high gain mode.
2 LO IN to LNA IN isolation specification with the 900MHz TX LO buffer on.
3 Image rejection measured with f_{RF}=869MHz, P_{RF}=-105dBm, f_{LO}=1004MHz; P_{IMAGE}=-85dBm, f_{IMAGE}=1139MHz

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Cellular Receive Path, Cont'd					
Cellular Block Level Electrical Specifications					
Low Noise Amplifier					
Frequency Range	869		894	MHz	
Gain		20		dB	High Gain, Gain Select=High
		3	6	dB	Low Gain, Gain Select=Low
Gain Step	14	17		dB	
Gain Variations versus Temperature			±1.0	dB	-30°C to +85°C
Noise Figure		1.4	1.6	dB	High Gain, Gain Select=High
				dB	Low Gain, Gain Select=Low
Input Third Order Intercept	-3	0		dBm	High Gain, Gain Select=High
	-3	0		dBm	Low Gain, Gain Select=Low
Terminating Impedance		50		Ω	External Match
Supply Current		6	8	mA	High Gain, Gain Select=High
		6	8	mA	Low Gain, Gain Select=Low
Logic Input Low			0.5	V	V_{CC}=2.7V to 2.9V
Logic Input High	2.0			V	V_{CC}=2.7V to 2.9V
Mixer and LO Buffer					
Frequency Range, Mixer Input	869		894	MHz	
Frequency Range, IF Output	85		150	MHz	
Frequency Range, LO Input	950		1045	MHz	
Conversion Gain	7	8	9	dB	
Noise Figure (SSB)		11	12	dB	
Input Third Order Intercept	7	8		dBm	
Terminating Impedance, Mixer In, LO In, LO Out		50		Ω	External Match
Terminating Impedance, Mixer In, LO In, LO Out Return Loss		10		Ω	External Match
Terminating Impedance, IF Out		>10		kΩ	Mixer "ON"
Mixer Supply Current		14	19	mA	
LO Input Level	-10	-7	-4	dBm	
LO Buffer Supply Current		7.5	9.0	mA	
LO Output Level	-7	-4		dBm	
PCS Receive Path					
Operational Limits					
RF Frequency	1930		1990	MHz	
Frequency Range, LO Input to Doubler	1015	1039	1063	MHz	LO input to device at LO IN8.
Frequency Range, Doubler Output	2030	2078	2126	MHz	Internal output of LO doubler driving the mixer and TX LO buffer.
IF Frequency	100		150	MHz	
LNA Input Level			+10	dBm	
LO Input Level	-10	-7	-4	dBm	
Supply Voltage	2.7	2.8	3.3	V	

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS Receive Path, Cont'd					
PCS Cascaded Electrical Specifications					T_{AMB}=25°C, V_{CC}=2.8V, f_{RF}=1960MHz, f_{LO}=2095MHz, f_{IF}=135MHz, LO Level=-7dBm, Image Filter I.L.=3dB
Gain	24	26	28	dB	High Gain, Gain Select=High
		6		dB	Low Gain, Gain Select=Low
Gain Step	17	20		dB	
Gain Variations versus Temperature			$\pm$1.5	dB	-30°C to +85°C
Noise Figure		2.8	3.3	dB	High Gain, Gain Select=High
		15	20	dB	Low Gain, Gain Select=Low
Input Third Order Intercept	-12	-10		dBm	High Gain, Gain Select=High
	-2	-0.5		dBm	Low Gain, Gain Select=Low
Return Loss	10			dB	LNA Input - External Match
	10			dB	LNA Output - External Match
	10			dB	Mixer RF Input - External Match
	10			dB	Mixer LO Input - External Match
Isolation	40			dB	LO IN to LNA IN, Gain Select=High[4]
	40			dB	LO IN to LNA IN, Gain Select=Low
	35	37		dB	Image Rejection[5]
		>53		dB	LO IN to IF OUT
		>40		dB	Mixer RF IN to IF OUT
		35		dB	Mixer RF IN to TX LO OUT
Half IF Spur[6]		-68		dBc	
IF Output Impedance		>10		kΩ	Mixer "ON"
Supply Current		28	33	mA	Including the LO doubler, but not the TX LO buffer
TX LO Buffer					
LO Doubler Output Buffer	-5	-3		dBm	LO Input Level=-7dBm
Harmonic Output	-22	-25		dBc	LO Input Level=-7dBm
Doubler Harmonic Output	-45	-50		dBc	Fundamental Suppression
Isolation - LO OUT to LO IN	35			dB	TX LO Buffer ON
Supply Current		7.5	9.0	mA	Including the LO doubler and the TX LO buffer
Logic					
Input Low			0.5	V	V_{CC}=2.7V to 2.9V
Input High	2.0			V	V_{CC}=2.7V to 2.9V
Input Current		TBD		µA	
Input Impedance		TBD		kΩ	

NOTES:

4 LO IN to LNA IN isolation specification with the 1900MHz TX LO buffer on.

5 Image rejection measured with f_{RF}=1930MHz, P_{RF}=-105dBm, f_{LO}=2065MHz; P_{IMAGE}=-85dBm, f_{IMAGE}=2220MHz. Image interferer should be suppressed 11dB below desired signal at the IF output.

6 2LO$\pm$2RF Half IF Spur. (1/2 IF spur relative to $P_{1/2RF}$) f_{RF}=1930MHz, P_{RF}=-105dBm, f_{LO}=2065MHz; $F_{1/2IF}$=1997.5MHz, $P_{1/2IF}$=-48dBm.
1/2 IF interferer should be suppressed 11dB below desired signal at the IF output.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
PCS Receive Path, Cont'd					
PCS Block Level Electrical Specifications					
Low Noise Amplifier					
Frequency Range	1930		1990	MHz	
Gain		22		dB	High Gain, Gain Select=High
		2		dB	Low Gain, Gain Select=Low
Gain Step	16	20		dB	
Gain Variations versus Temperature			±1.0	dB	-30°C to +85°C
Noise Figure		1.7	1.9	dB	High Gain, Gain Select=High
				dB	Low Gain, Gain Select=Low
Input Third Order Intercept	-7	-6		dBm	High Gain, Gain Select=High
	-2	0		dBm	Low Gain, Gain Select=Low
Terminating Impedance		50		Ω	
Supply Current		8	9	mA	High Gain, Gain Select=High
		8	9	mA	Low Gain, Gain Select=Low
Logic Input Low			0.5	V	V_{CC}=2.7V to 2.9V
Logic Input High	2.0			V	V_{CC}=2.7V to 2.9V
Mixer and LO Buffer					
Frequency Range, Mixer Input	1930		1990	MHz	
Frequency Range, IF Output	100		150	MHz	
Frequency Range, LO Input to Doubler	1015	1039	1063	MHz	LO input to device at LO IN8.
Frequency Range, Doubler Output	2030	2078	2126	MHz	Internal output of LO doubler driving the mixer and TX LO buffer.
Conversion Gain	7	8	9	dB	
Noise Figure (SSB)		13	4	dB	
Input Second Order Intercept		35		dBm	
Input Third Order Intercept	7	8		dBm	
Terminating Impedance, Mixer In, LO In, LO Out		50		Ω	External Match
Terminating Impedance, Mixer In, LO In, LO Out Return Loss		10		Ω	External Match
Terminating Impedance, IF Out		>10		kΩ	Mixer "ON"
Mixer Supply Current		23	28	mA	Including the LO doubler, but not the TX LO buffer
LO Input Level	-10	-7	-4	dBm	
LO Buffer Supply Current		7.5	8.0	mA	Including the LO doubler and the TX LO buffer
LO Output Level	-5	-2		dBm	

Pin	Function	Description	Interface Schematic
1	LNA VCC19	PCS LNA supply voltage. Local bypass capacitor required.	
2	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
3	LNA IN19	PCS LNA input. AC-coupled. Requires external 50Ω matching components.	
4	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
5	LNA IN8	Cellular LNA input. AC-coupled. Requires external 50Ω matching components.	
6	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
7	GAIN SEL	Gain select control input. Logic high=high gain, logic low=low gain.	
8	LNA VCC8	Cellular LNA RF supply voltage. Local bypass capacitor required.	
9	LNA OUT	Cellular LNA output. AC-coupled. Requires matching to 50Ω.	
10	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
11	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
12	MXR VCC19	PCS mixer and RX LO doubler enable supply voltage. Local bypass capacitor required.	
13	MXR IN8	Cellular RF mixer input. AC-coupled. Requires matching to 50Ω.	
14	TX LO19	PCS Transmit LO buffer output. Requires matching to 50Ω.	
15	VCC TX19	PCS TX LO buffer and TX LO doubler enable supply voltage. Local bypass capacitor required.	
16	VCC DOUBLER	Doubler output supply voltage for PCS RX and PCS TX modes. See Note 1.	
17	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
18	IF B	Mixer IF B output. Open collector output, requires external matching components and DC connection to VCC.	
19	IF A	Mixer IF A output. Open collector output, requires external matching components and DC connection to VCC.	
20	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
21	LO IN8	Mixer LO input. AC-coupled. Requires matching to 50Ω.	
22	VCC TX8	Cellular TX LO buffer supply voltage. Local bypass capacitor required.	
23	TX LO8	Cellular TX LO buffer output. AC-coupled. Requires matching to 50Ω.	
24	MXR IN19	PCS RF mixer input. AC-coupled. Requires matching to 50Ω.	
25	MXR VCC8	Cellular mixer supply voltage. Local bypass capacitor required.	
26	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
27	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
28	LNA OUT19	PCS LNA output. AC-coupled. Requires matching to 50Ω.	
Pkg Base	GND	Ground connection. The backside of the package should be soldered to a top side ground pad which is connected to the ground plane with multiple vias. The pad should have a short thermal path to the ground plane.	

NOTE:

The LO doubler is enabled by either MXR VCC19 (PCS RX mode) or TX LO19 (PCS TX mode). VCC DOUBLER is the DC current return path for the output of the doubler. This should be connected to the PLL VCC or a supply that is on in both the TX and RX modes of the 1900MHz band of operation. In the Cellular mode, the doubler is powered down to save current, even when VCC DOUBLER is energized. Therefore, the VCC DOUBLER pin can be connected to a supply that is on in all modes, while minimizing the current consumption of the device.

Truth Table of Pin-by-Pin Biasing

Pin #	1	28	8	9	12	14	15	16	18	19	22	23	25
Pin Name	LNA VCC19	LNA OUT19	LNA VCC8	LNA OUT8	MXR VCC19	TX LO19	VCC TX19	DOUBLER VCC	IF B	IF A	VCC TX8	TX LO8	MXR VCC8
Biased by VCC Supply	RX19 VCC	RX19 VCC	RX8 VCC	RX8 VCC	RX19 VCC	TX19 VCC	TX19 VCC	PLL VCC	IF VCC	IF VCC	TX8 VCC	TX8 VCC	RX8 VCC
Mode													
RX-800	L	L	H	H	L	L	L	H	H	H	L	L	H
RX-1900	H	H	L	L	H	L	L	H	H	H	L	L	L
TX-800	L	L	L	L	L	L	L	H	L	L	H	H	L
TX-1900	L	L	L	L	L	H	H	H	L	L	L	L	L

L = Supply Off
H = Supply On

Power Control Modes

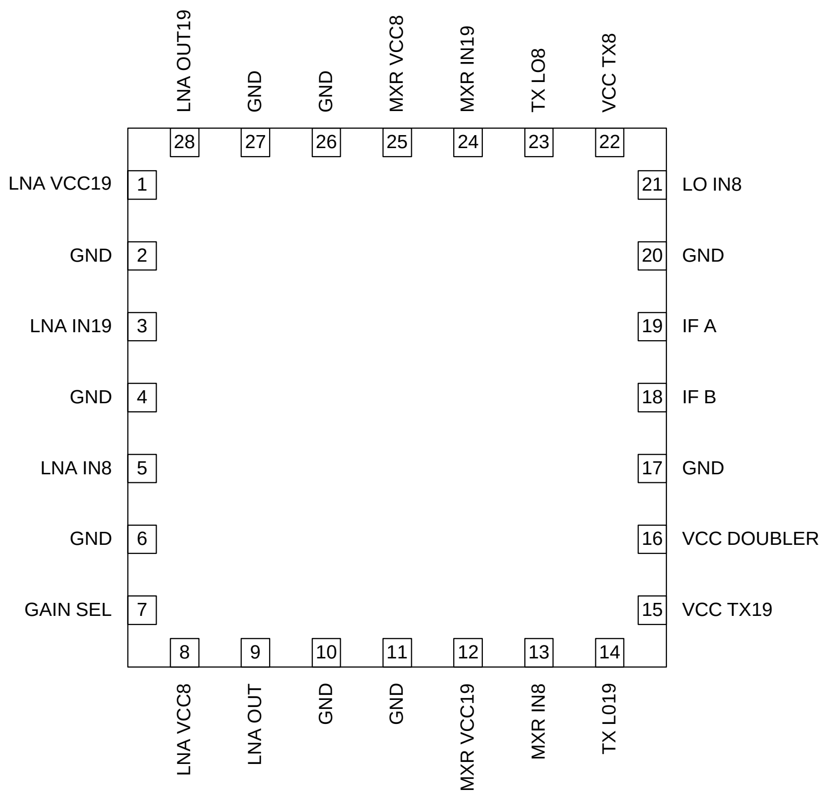
Mode	Pin Name	Pin #	Controls the Following Circuit Functions
RX19	LNA VCC19	1	1900MHz LNA Bias
	MXR VCC19	12	Mixer RF Amplifier
			Mixer LO Driver
			RX LO Doubler
	Doubler VCC	16	DC Return for the LO Doubler
	IF B	18	DC Return for Mixer
	IF A	19	DC Return for Mixer
RX8	LNA VCC8	8	800MHz LNA Bias
	MXR VCC8	25	Mixer RF Amplifier
			Mixer LO Driver
	IF B	18	DC Return for Mixer
	IF A	19	DC Return for Mixer
TX8	VCC TX8	22	800MHz TX LO Buffer
TX19	VCC TX19	15	1900MHz TX LO Buffer
			TX LO Doubler
	Doubler VCC	16	DC Return for the LO Doubler

NOTES:
There are separate RX/TX LO doublers with a common output.
The DC return path for both the TX and RX doublers is via the PLL VCC which is on in all TX and RX modes.
This allows sharing of the LC load at the doubler output, which saves a significant amount of die area.

8

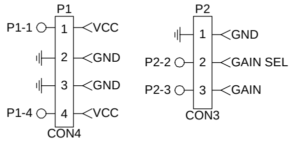
FRONT-ENDS

Pin Out

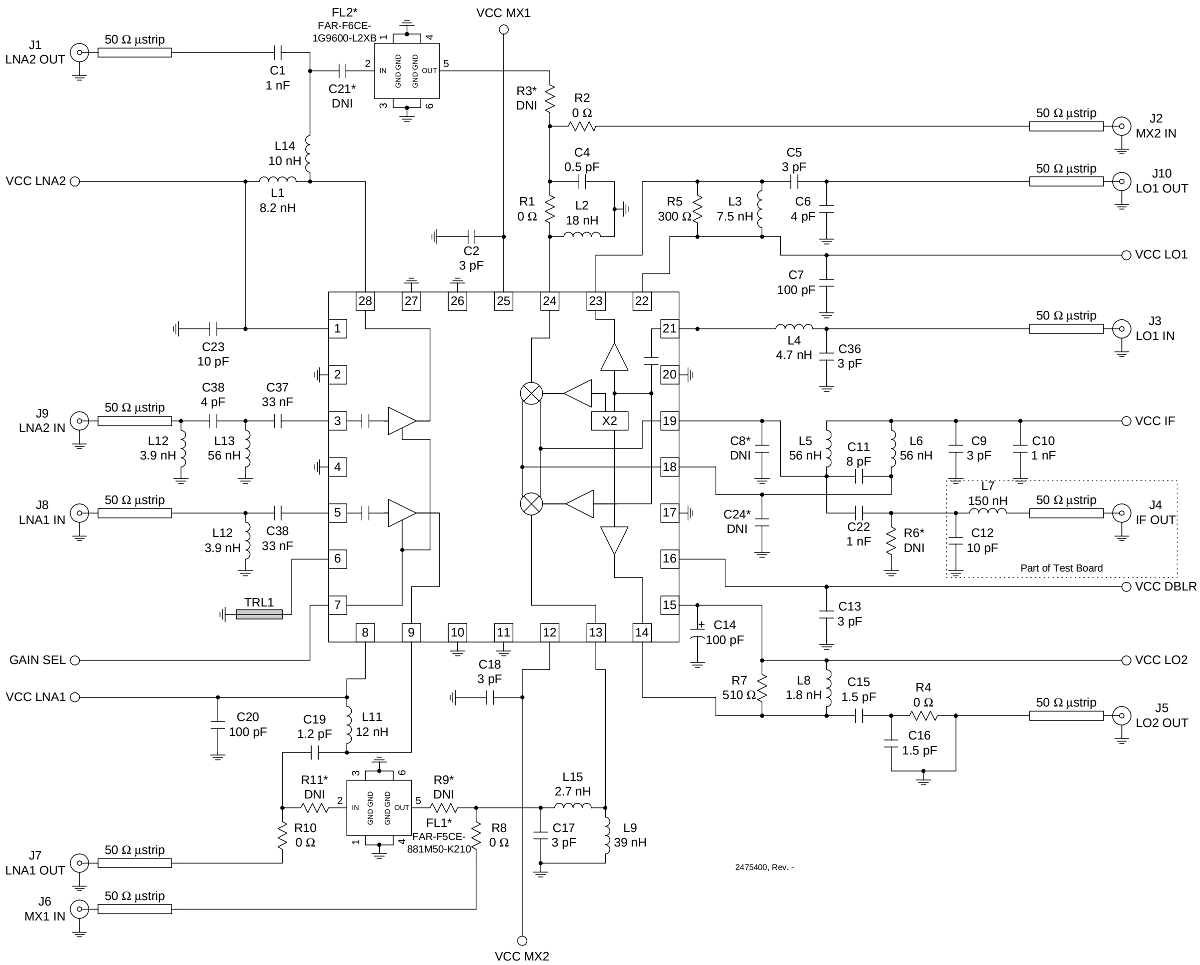

LNA OUT19
GND
GND
MXR VCC8
MXR IN19
TX LO8
VCC TX8
28
27
26
25
24
23
22
LNA VCC19
1
GND
2
LNA IN19
3
GND
4
LNA IN8
5
GND
6
GAIN SEL
7
21
LO IN8
20
GND
19
IF A
18
IF B
17
GND
16
VCC DOUBLER
15
VCC TX19
8
9
10
11
12
13
14
LNA VCC8
LNA OUT
GND
GND
MXR VCC19
MXR IN8
TX L019

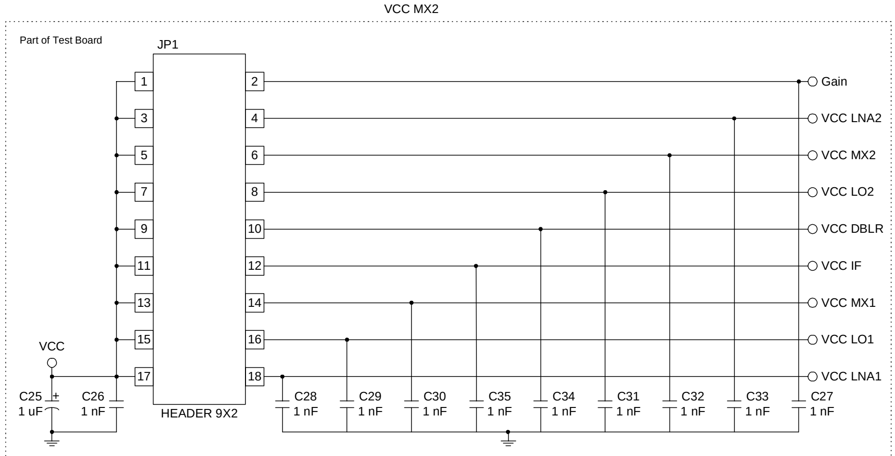
Evaluation Board Schematic

(Download Bill of Materials from www.rfmd.com.)



NOTES:
1. For best image rejection, provide a common ground under the device connecting pins 10, 11, 26, and 27.
2. There is a single gain select pin for both frequency bands.
3. The image reject SAW filters are assumed to have a 3 dB insertion loss and 40 dB of image rejection.
4. Parts with "*" should not be populated on the evaluation board.

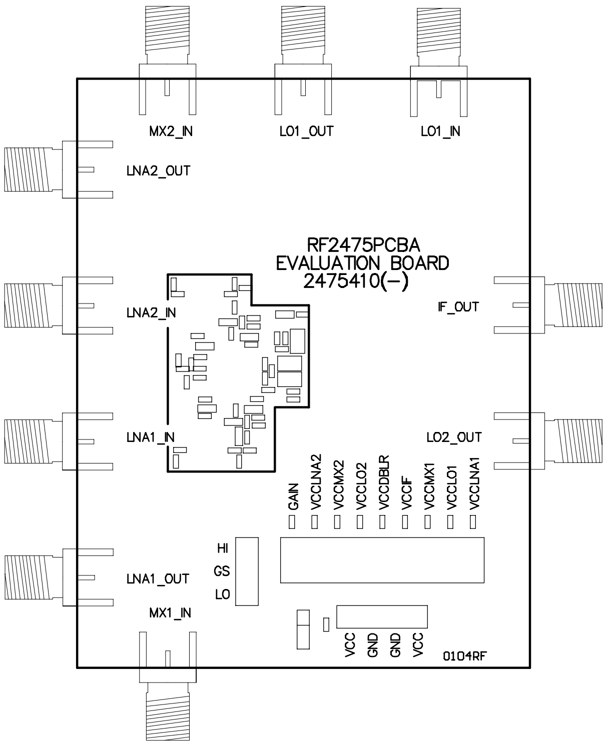




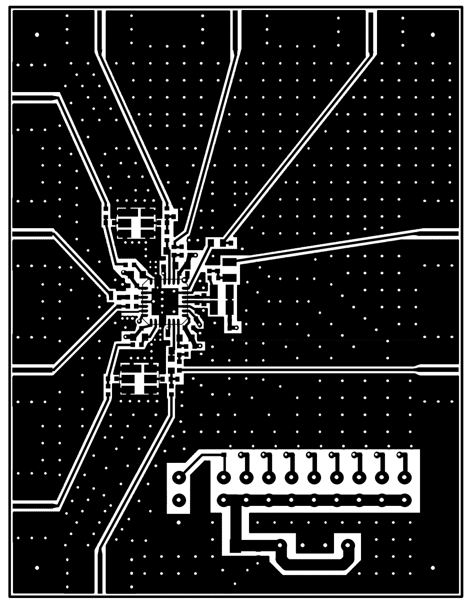
Evaluation Board Layout
Board Size 2.6” x 2.0”

Board Thickness 0.058”, Board Material FR-4, Multi-Layer

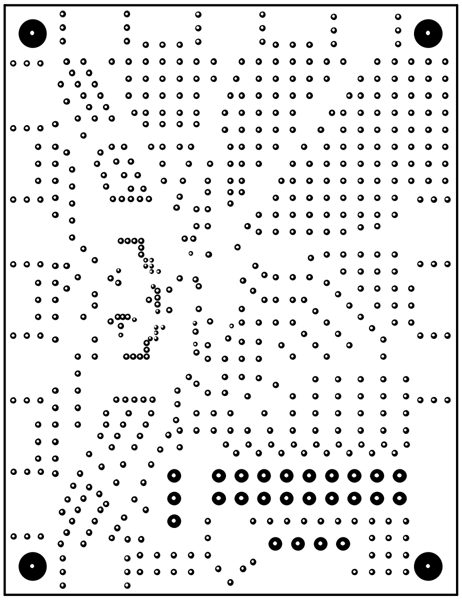
Assembly



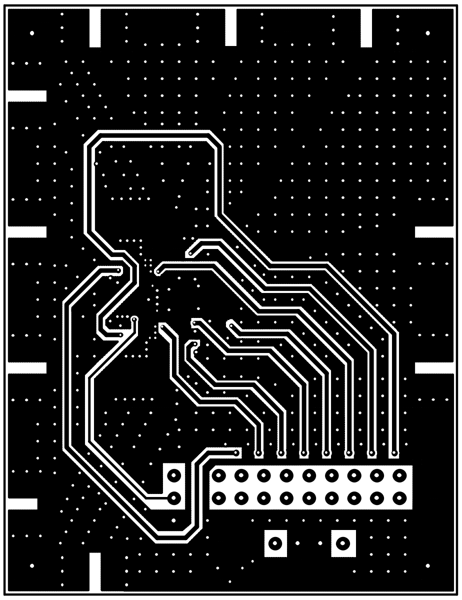
Top



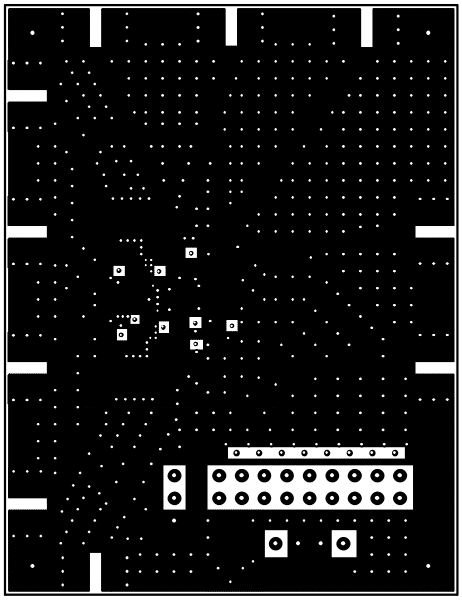
Inner 1



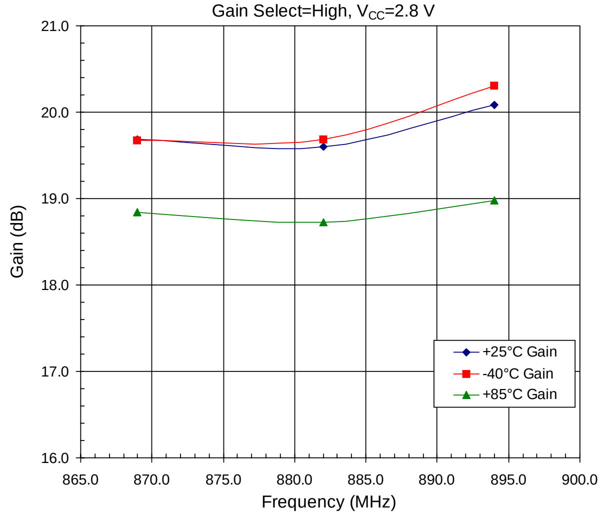
Inner 2



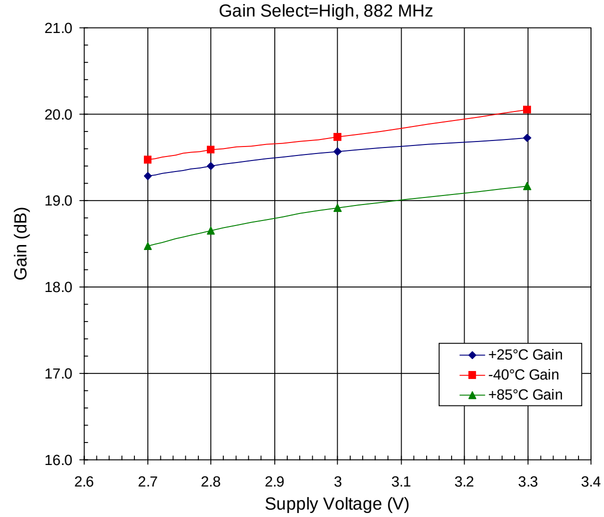
Back



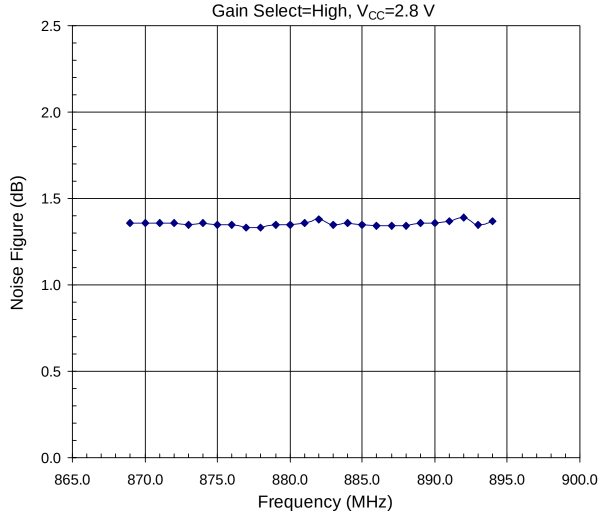
LNA1 Gain versus Frequency
Gain Select=High, V_{CC}=2.8 V



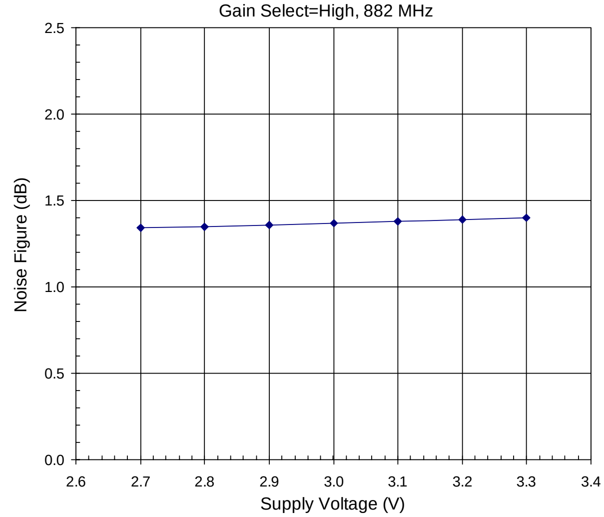
LNA1 Gain versus Supply Voltage
Gain Select=High, 882 MHz



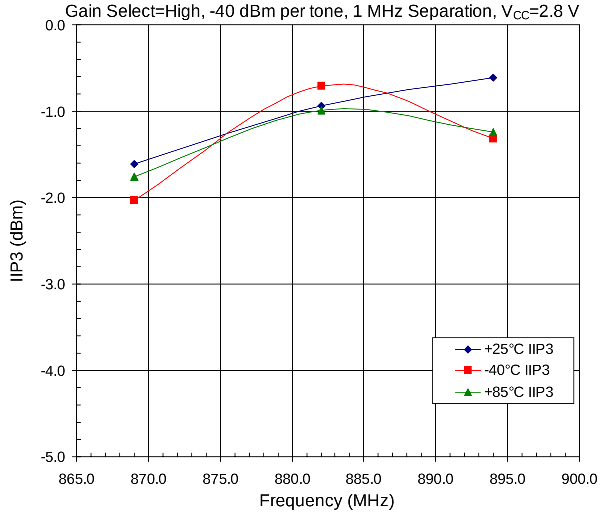
LNA1 Noise Figure versus Frequency
Gain Select=High, V_{CC}=2.8 V



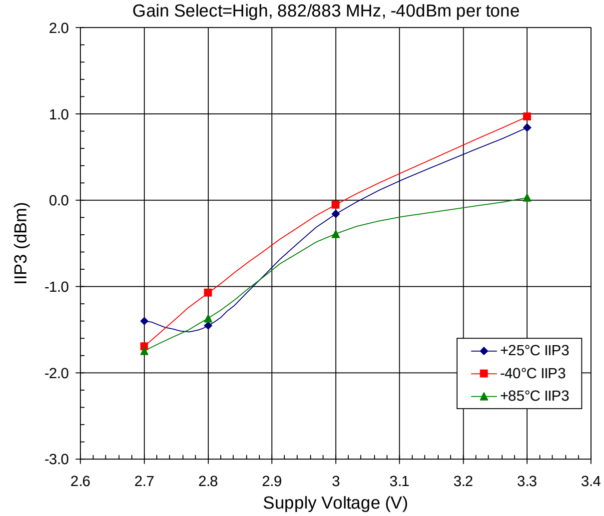
LNA1 Noise Figure versus Supply Voltage
Gain Select=High, 882 MHz



LNA1 Input IP3 versus Frequency
Gain Select=High, -40 dBm per tone, 1 MHz Separation, V_{CC}=2.8 V

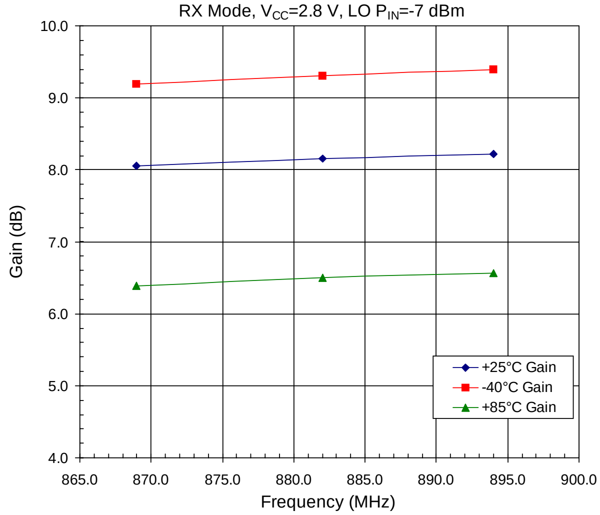


LNA1 Input IP3 versus Supply Voltage
Gain Select=High, 882/883 MHz, -40dBm per tone



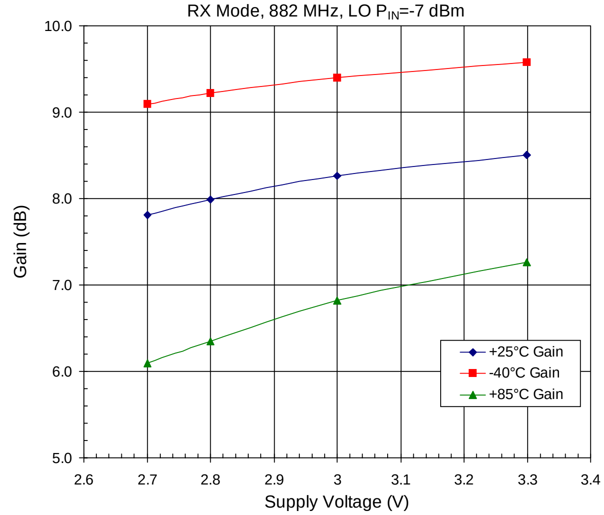
Mixer1 Gain versus Frequency

RX Mode, V_{CC}=2.8 V, LO P_{IN}=-7 dBm



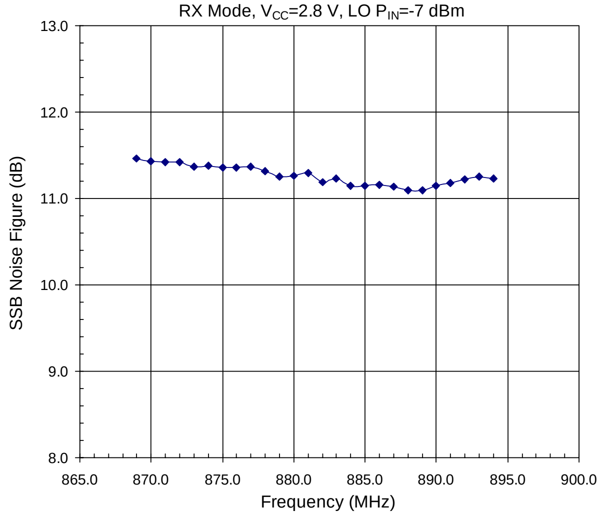
Mixer1 Gain versus Supply Voltage

RX Mode, 882 MHz, LO P_{IN}=-7 dBm



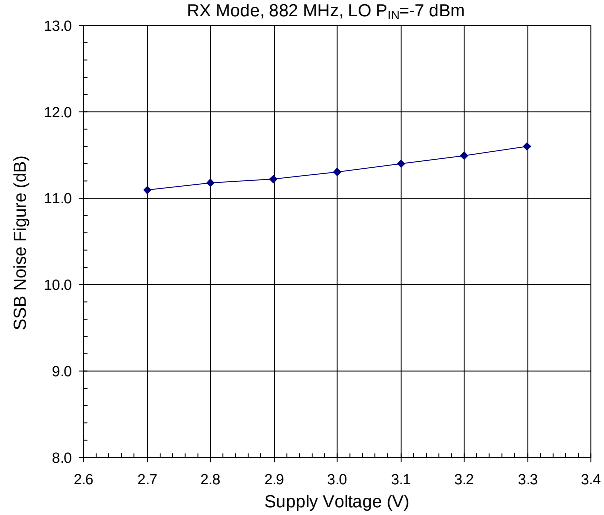
Mixer1 SSB Noise Figure versus Frequency

RX Mode, V_{CC}=2.8 V, LO P_{IN}=-7 dBm



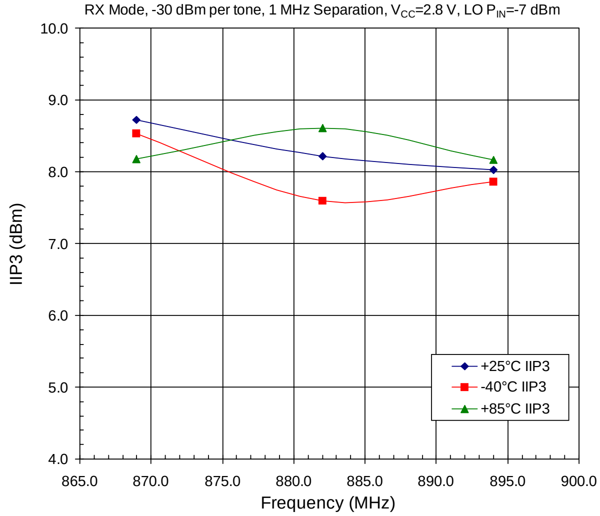
Mixer1 SSB Noise Figure versus Supply Voltage

RX Mode, 882 MHz, LO P_{IN}=-7 dBm



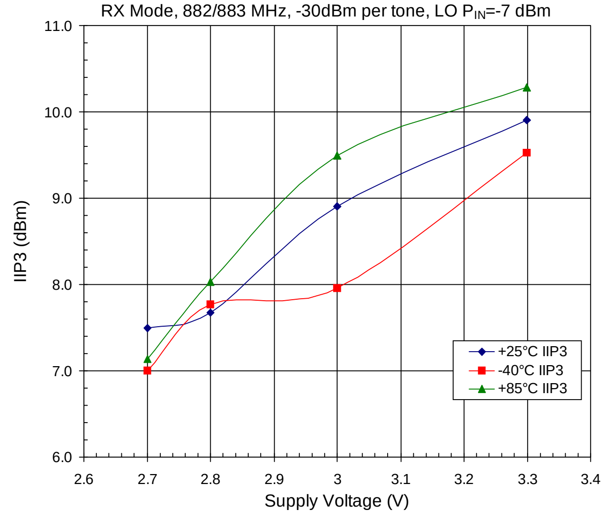
Mixer1 Input IP3 versus Frequency

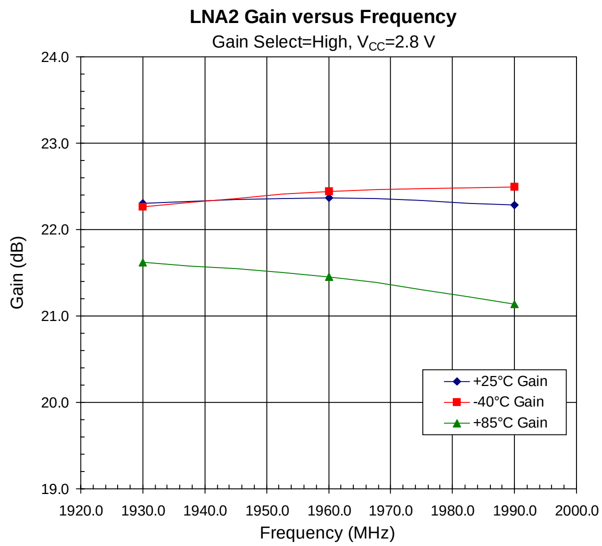
RX Mode, -30 dBm per tone, 1 MHz Separation, V_{CC}=2.8 V, LO P_{IN}=-7 dBm

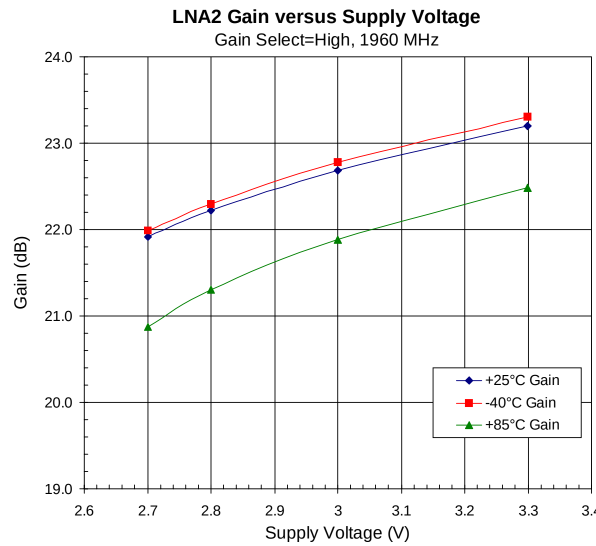


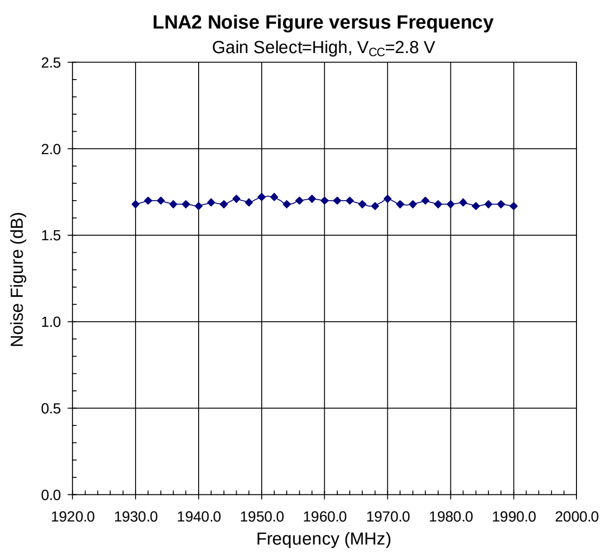
Mixer1 Input IP3 versus Supply Voltage

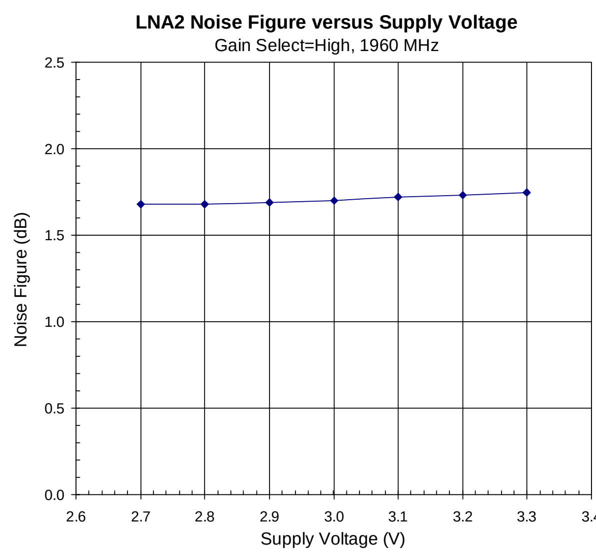
RX Mode, 882/883 MHz, -30dBm per tone, LO P_{IN}=-7 dBm

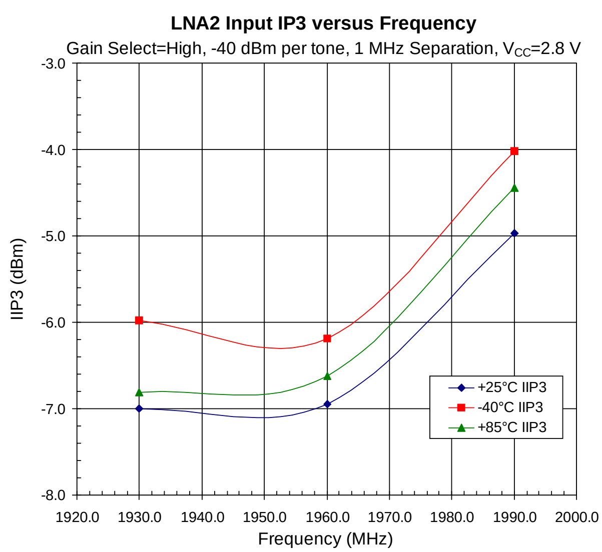


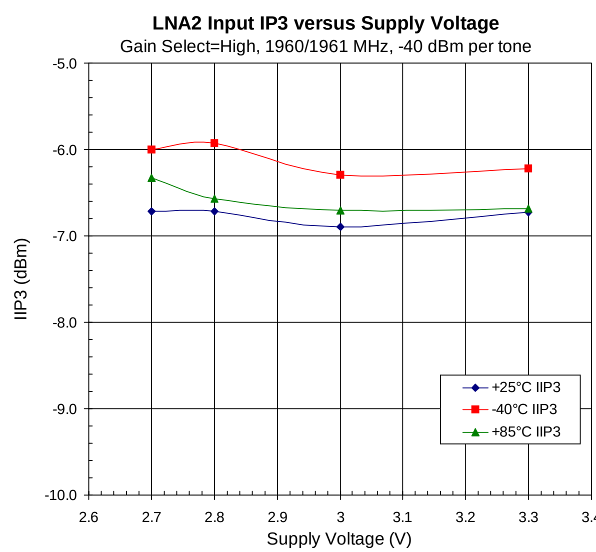

LNA2 Gain versus Frequency
Gain Select=High, V_CC=2.8 V
Gain (dB)
Frequency (MHz)
+25°C Gain
-40°C Gain
+85°C Gain


LNA2 Gain versus Supply Voltage
Gain Select=High, 1960 MHz
Gain (dB)
Supply Voltage (V)
+25°C Gain
-40°C Gain
+85°C Gain


LNA2 Noise Figure versus Frequency
Gain Select=High, V_CC=2.8 V
Noise Figure (dB)
Frequency (MHz)

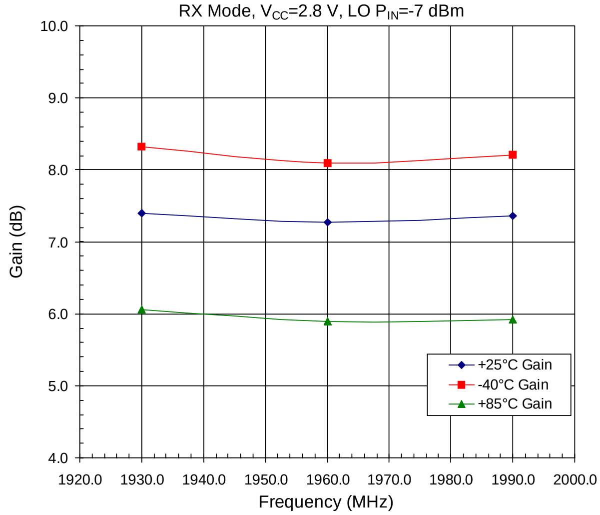

LNA2 Noise Figure versus Supply Voltage
Gain Select=High, 1960 MHz
Noise Figure (dB)
Supply Voltage (V)


LNA2 Input IP3 versus Frequency
Gain Select=High, -40 dBm per tone, 1 MHz Separation, V_CC=2.8 V
IIP3 (dBm)
Frequency (MHz)
+25°C IIP3
-40°C IIP3
+85°C IIP3


LNA2 Input IP3 versus Supply Voltage
Gain Select=High, 1960/1961 MHz, -40 dBm per tone
IIP3 (dBm)
Supply Voltage (V)
+25°C IIP3
-40°C IIP3
+85°C IIP3

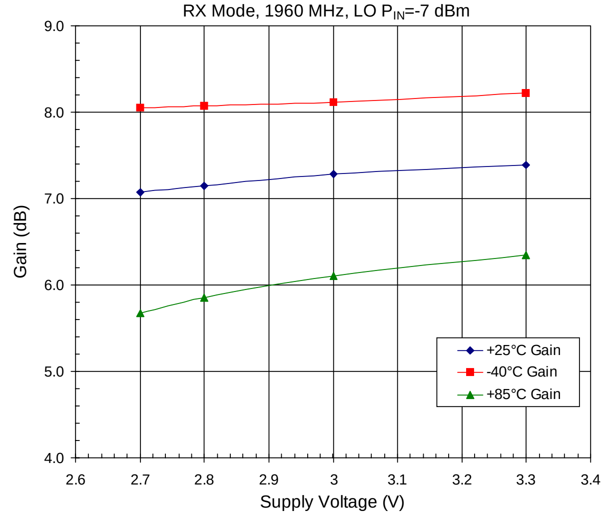
Mixer2 Gain versus Frequency

RX Mode, V_{CC}=2.8 V, LO P_{IN}=-7 dBm



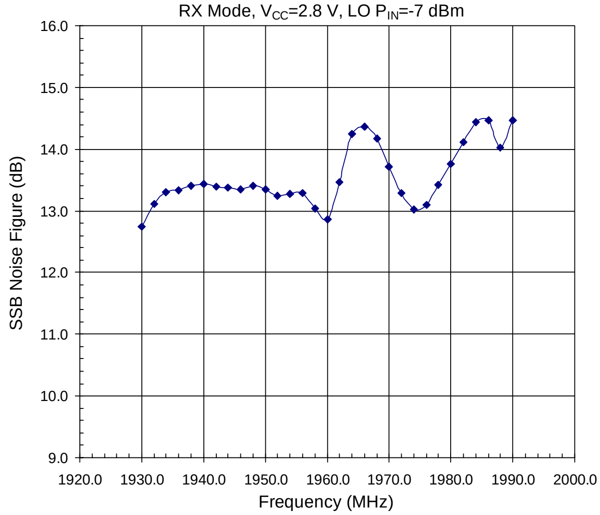
Mixer2 Gain versus Supply Voltage

RX Mode, 1960 MHz, LO P_{IN}=-7 dBm



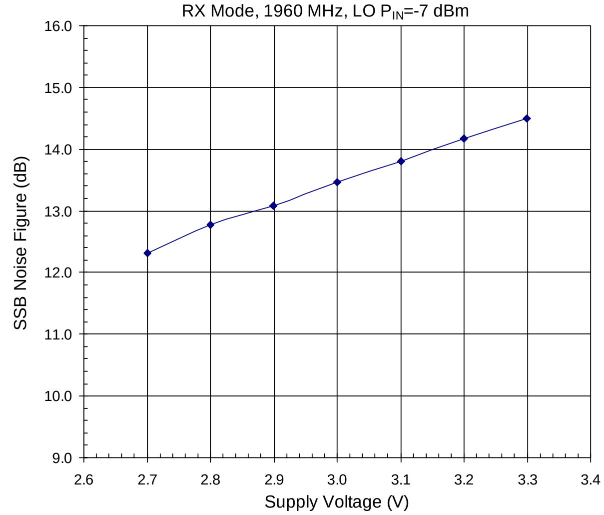
Mixer2 SSB Noise Figure versus Frequency

RX Mode, V_{CC}=2.8 V, LO P_{IN}=-7 dBm



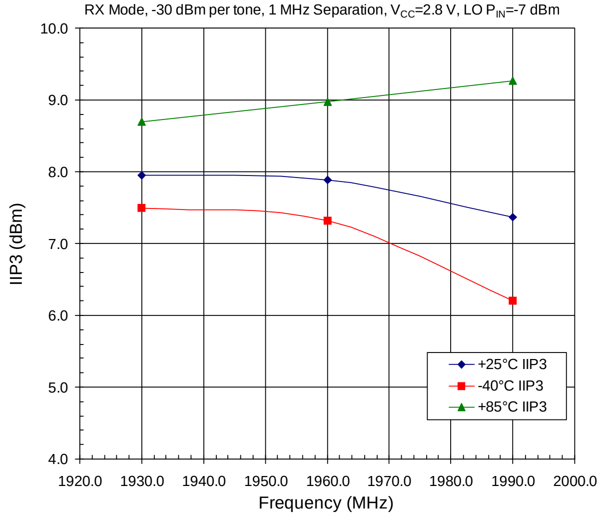
Mixer2 SSB Noise Figure versus Supply Voltage

RX Mode, 1960 MHz, LO P_{IN}=-7 dBm



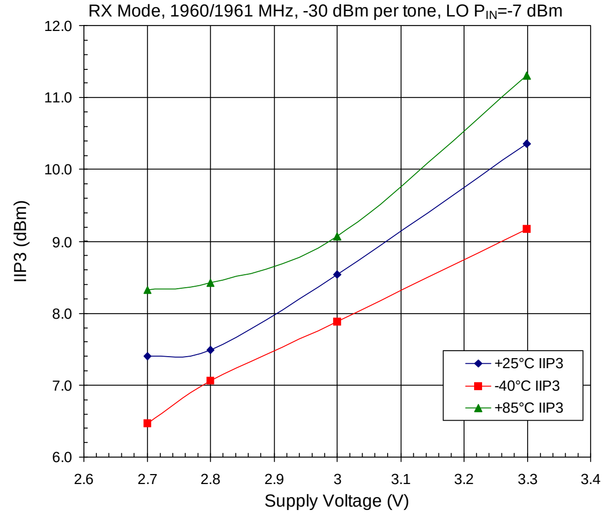
Mixer2 Input IP3 versus Frequency

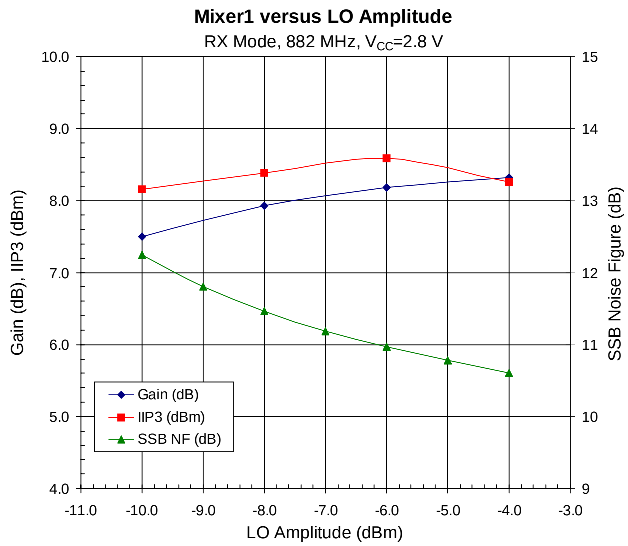
RX Mode, -30 dBm per tone, 1 MHz Separation, V_{CC}=2.8 V, LO P_{IN}=-7 dBm

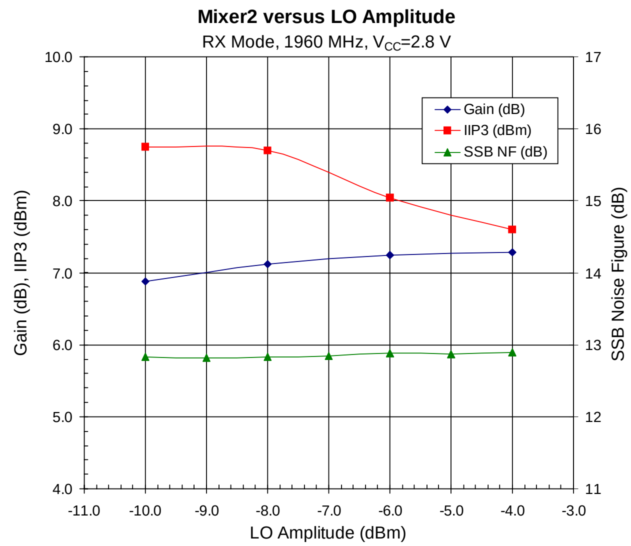


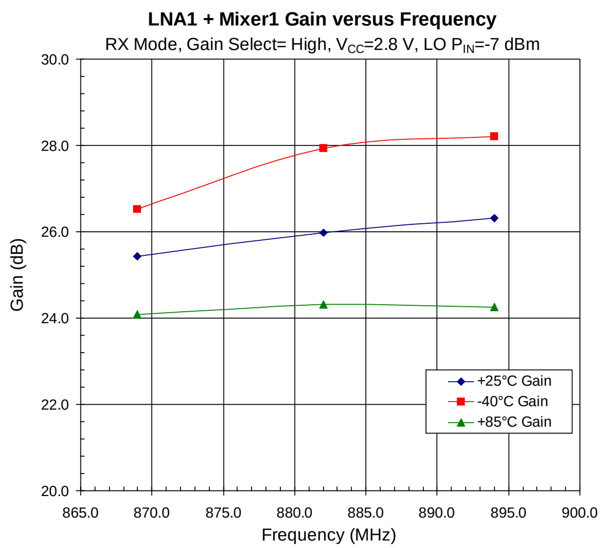
Mixer2 Input IP3 versus Supply Voltage

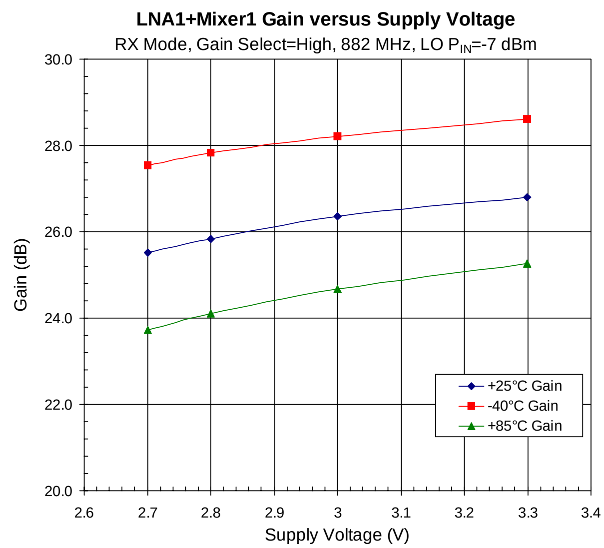
RX Mode, 1960/1961 MHz, -30 dBm per tone, LO P_{IN}=-7 dBm

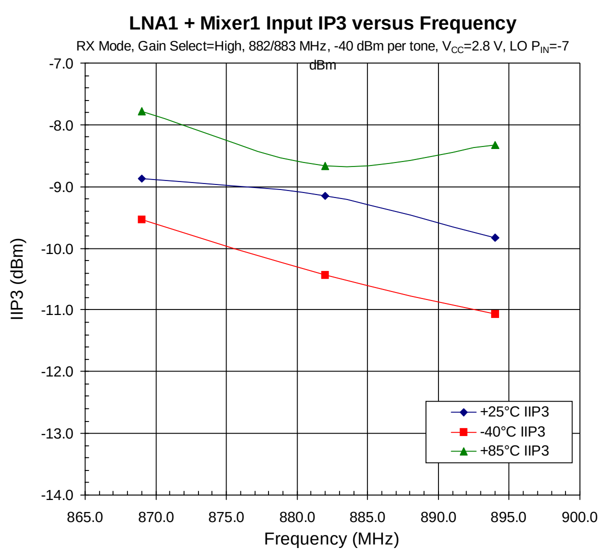


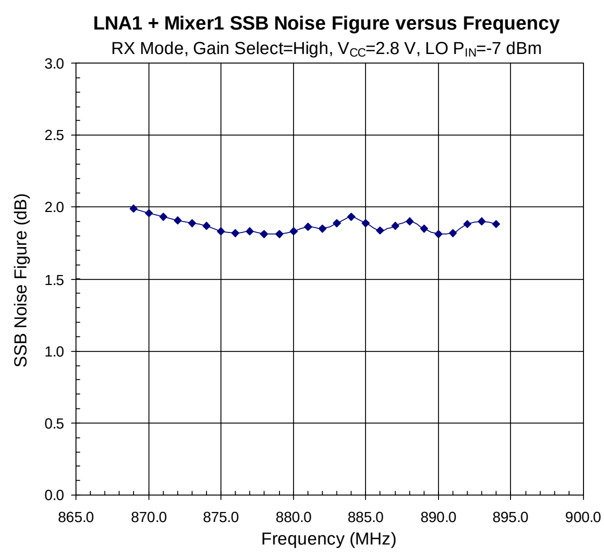

Mixer1 versus LO Amplitude
RX Mode, 882 MHz, VCC=2.8 V
Gain (dB), IIP3 (dBm)
SSB Noise Figure (dB)
LO Amplitude (dBm)
Gain (dB)
IIP3 (dBm)
SSB NF (dB)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
15
14
13
12
11
10
9
-11.0
-10.0
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0

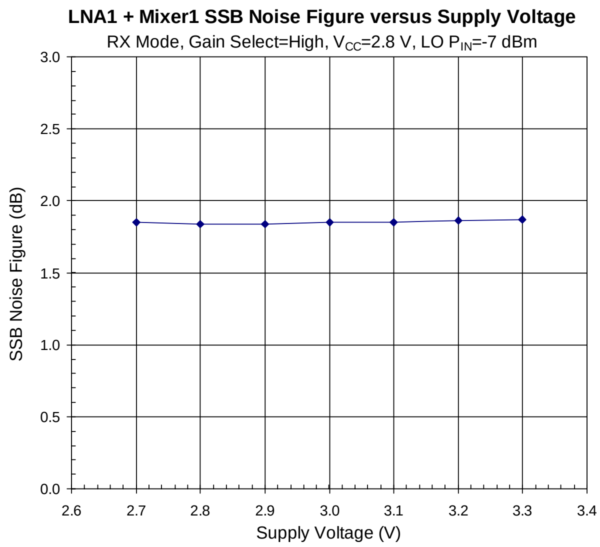

Mixer2 versus LO Amplitude
RX Mode, 1960 MHz, VCC=2.8 V
Gain (dB), IIP3 (dBm)
SSB Noise Figure (dB)
LO Amplitude (dBm)
Gain (dB)
IIP3 (dBm)
SSB NF (dB)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
17
16
15
14
13
12
11
-11.0
-10.0
-9.0
-8.0
-7.0
-6.0
-5.0
-4.0
-3.0

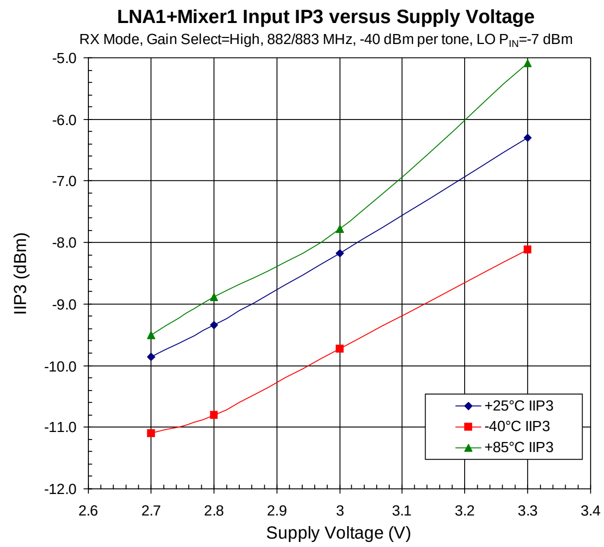

LNA1 + Mixer1 Gain versus Frequency
RX Mode, Gain Select= High, VCC=2.8 V, LO PIN=-7 dBm
Gain (dB)
Frequency (MHz)
+25°C Gain
-40°C Gain
+85°C Gain
30.0
28.0
26.0
24.0
22.0
20.0
865.0
870.0
875.0
880.0
885.0
890.0
895.0
900.0

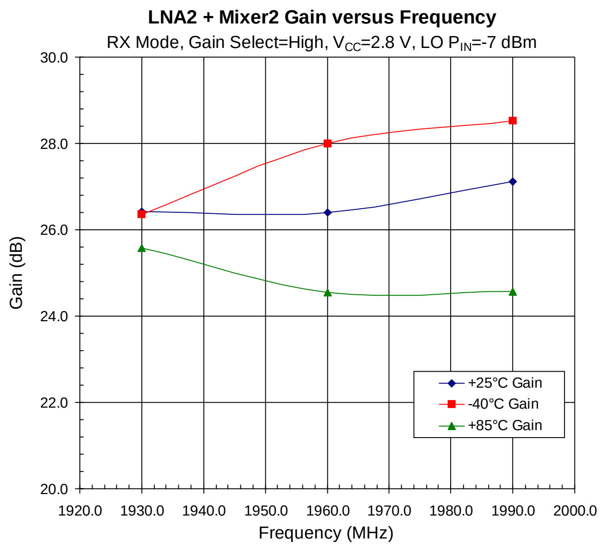

LNA1+Mixer1 Gain versus Supply Voltage
RX Mode, Gain Select=High, 882 MHz, LO PIN=-7 dBm
Gain (dB)
Supply Voltage (V)
+25°C Gain
-40°C Gain
+85°C Gain
30.0
28.0
26.0
24.0
22.0
20.0
2.6
2.7
2.8
2.9
3
3.1
3.2
3.3
3.4

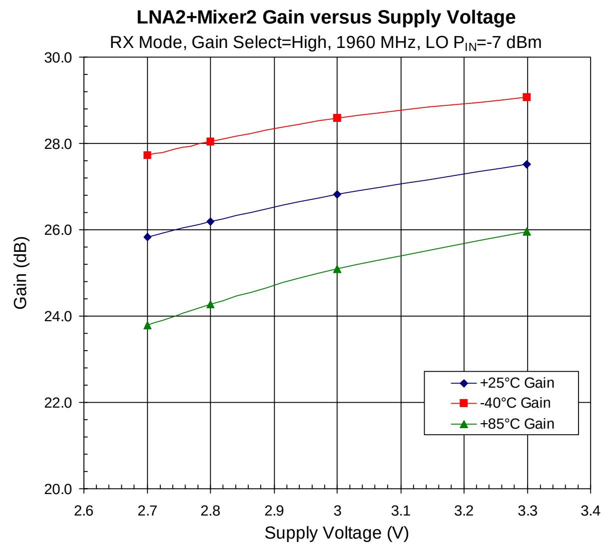

LNA1 + Mixer1 Input IP3 versus Frequency
RX Mode, Gain Select=High, 882/883 MHz, -40 dBm per tone, VCC=2.8 V, LO PIN=-7 dBm
IIP3 (dBm)
Frequency (MHz)
+25°C IIP3
-40°C IIP3
+85°C IIP3
-7.0
-8.0
-9.0
-10.0
-11.0
-12.0
-13.0
-14.0
865.0
870.0
875.0
880.0
885.0
890.0
895.0
900.0

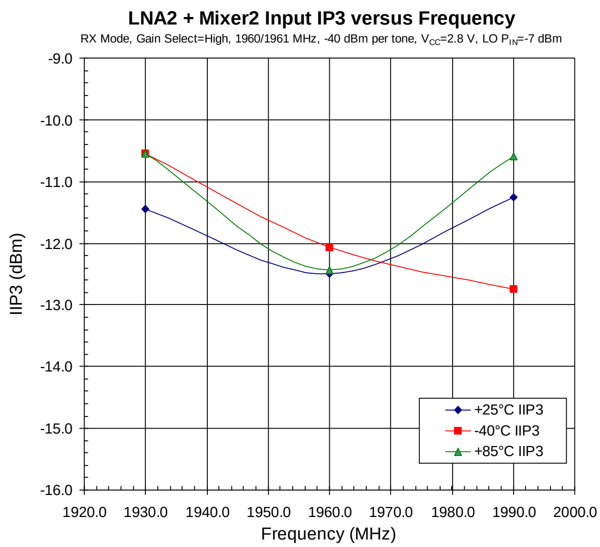

LNA1 + Mixer1 SSB Noise Figure versus Frequency
RX Mode, Gain Select=High, VCC=2.8 V, LO PIN=-7 dBm
SSB Noise Figure (dB)
Frequency (MHz)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
865.0
870.0
875.0
880.0
885.0
890.0
895.0
900.0

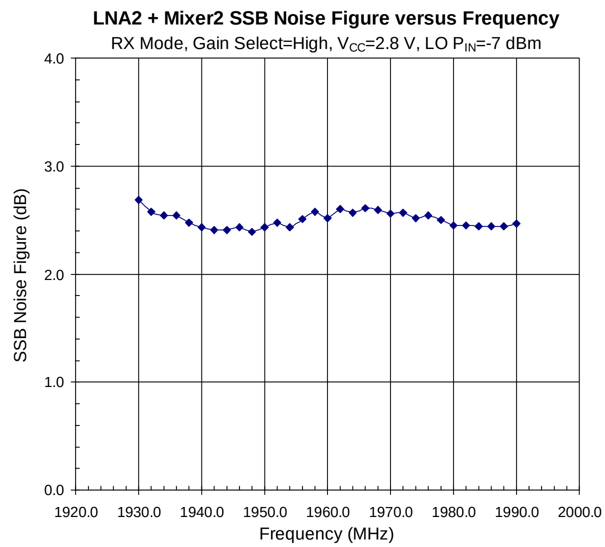

LNA1 + Mixer1 SSB Noise Figure versus Supply Voltage
RX Mode, Gain Select=High, VCC=2.8 V, LO PIN=-7 dBm
SSB Noise Figure (dB)
Supply Voltage (V)

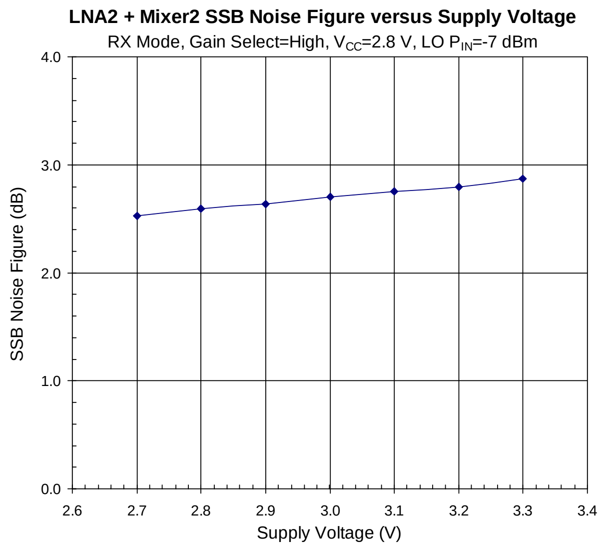

LNA1+Mixer1 Input IP3 versus Supply Voltage
RX Mode, Gain Select=High, 882/883 MHz, -40 dBm per tone, LO PIN=-7 dBm
IIP3 (dBm)
Supply Voltage (V)
+25°C IIP3
-40°C IIP3
+85°C IIP3

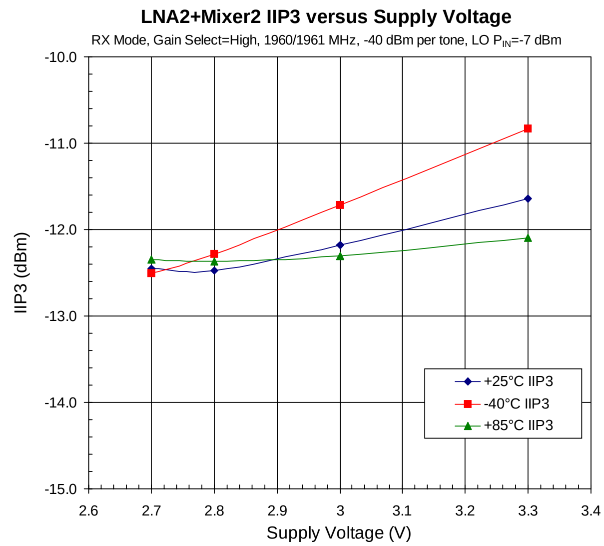

LNA2 + Mixer2 Gain versus Frequency
RX Mode, Gain Select=High, VCC=2.8 V, LO PIN=-7 dBm
Gain (dB)
Frequency (MHz)
+25°C Gain
-40°C Gain
+85°C Gain

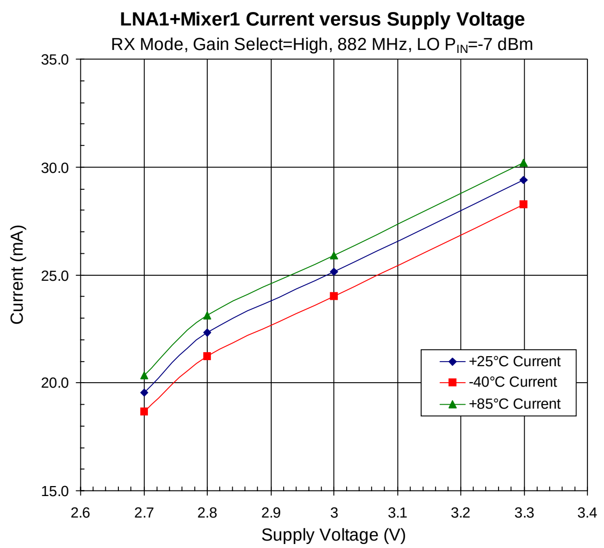

LNA2+Mixer2 Gain versus Supply Voltage
RX Mode, Gain Select=High, 1960 MHz, LO PIN=-7 dBm
Gain (dB)
Supply Voltage (V)
+25°C Gain
-40°C Gain
+85°C Gain

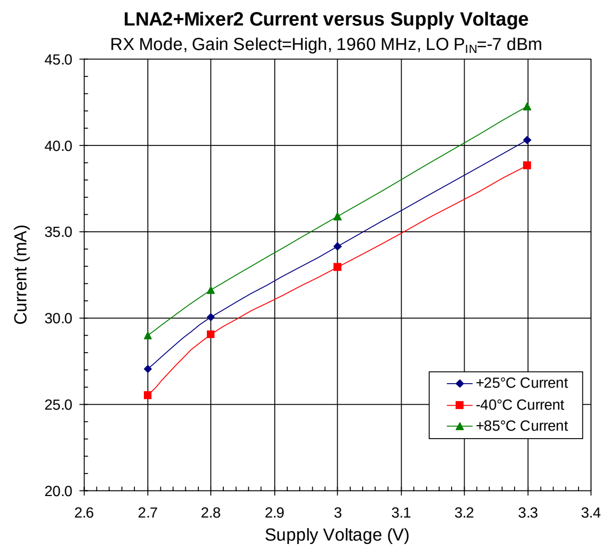

LNA2 + Mixer2 Input IP3 versus Frequency
RX Mode, Gain Select=High, 1960/1961 MHz, -40 dBm per tone, VCC=2.8 V, LO PIN=-7 dBm
IIP3 (dBm)
Frequency (MHz)
+25°C IIP3
-40°C IIP3
+85°C IIP3

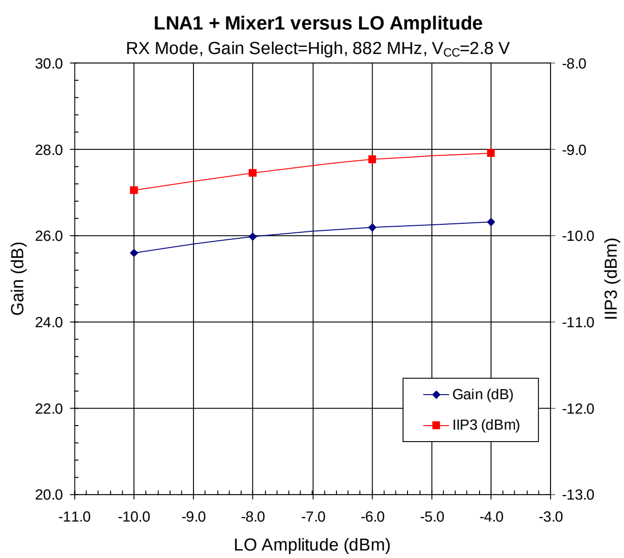

LNA2 + Mixer2 SSB Noise Figure versus Frequency
RX Mode, Gain Select=High, VCC=2.8 V, LO PIN=-7 dBm
SSB Noise Figure (dB)
Frequency (MHz)

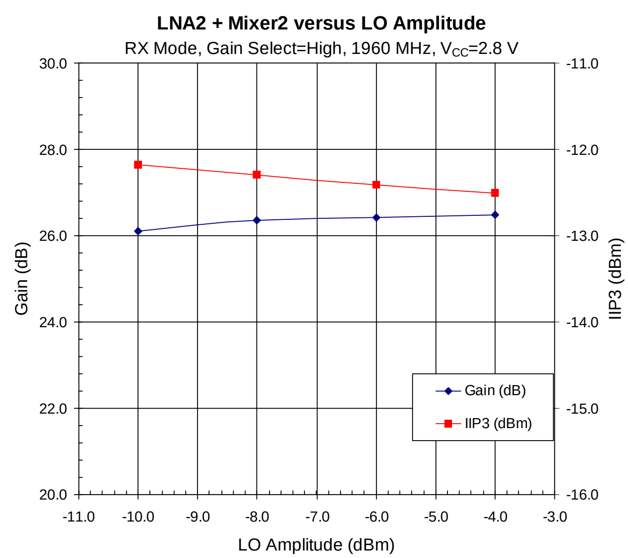

LNA2 + Mixer2 SSB Noise Figure versus Supply Voltage
RX Mode, Gain Select=High, VCC=2.8 V, LO PIN=-7 dBm
SSB Noise Figure (dB)
Supply Voltage (V)

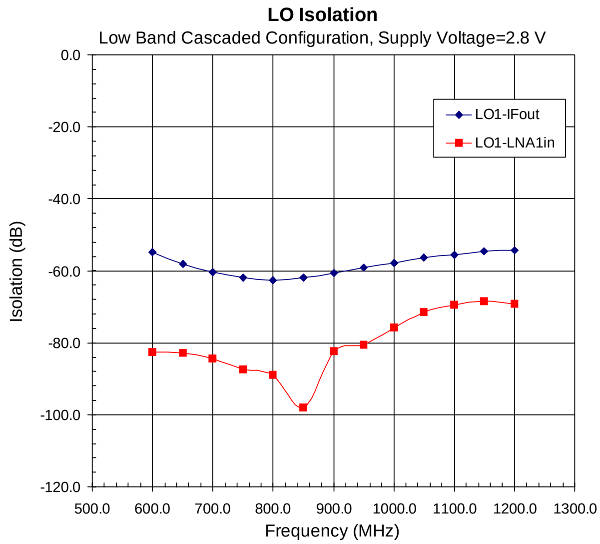

LNA2+Mixer2 IIP3 versus Supply Voltage
RX Mode, Gain Select=High, 1960/1961 MHz, -40 dBm per tone, LO PIN=-7 dBm
IIP3 (dBm)
Supply Voltage (V)
+25°C IIP3
-40°C IIP3
+85°C IIP3

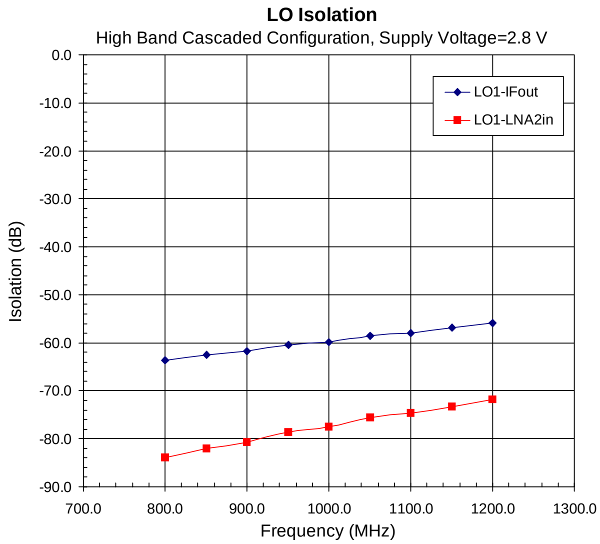

LNA1+Mixer1 Current versus Supply Voltage
RX Mode, Gain Select=High, 882 MHz, LO PIN=-7 dBm
Current (mA)
Supply Voltage (V)
+25°C Current
-40°C Current
+85°C Current

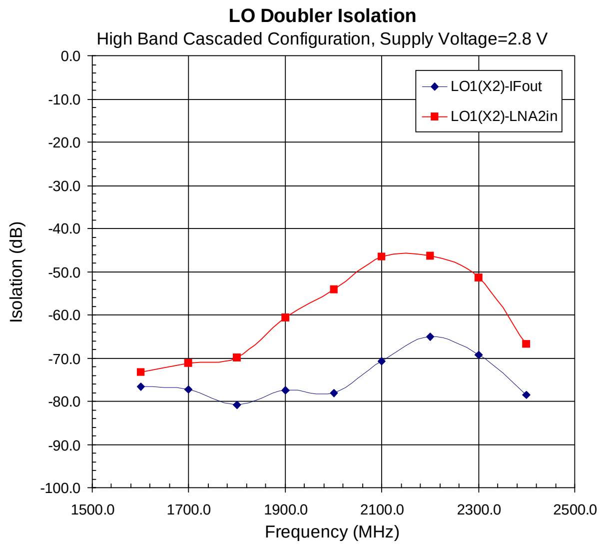

LNA2+Mixer2 Current versus Supply Voltage
RX Mode, Gain Select=High, 1960 MHz, LO PIN=-7 dBm
Current (mA)
Supply Voltage (V)
+25°C Current
-40°C Current
+85°C Current


LNA1 + Mixer1 versus LO Amplitude
RX Mode, Gain Select=High, 882 MHz, VCC=2.8 V
Gain (dB)
IIP3 (dBm)
LO Amplitude (dBm)
Gain (dB)
IIP3 (dBm)


LNA2 + Mixer2 versus LO Amplitude
RX Mode, Gain Select=High, 1960 MHz, VCC=2.8 V
Gain (dB)
IIP3 (dBm)
LO Amplitude (dBm)
Gain (dB)
IIP3 (dBm)


LO Isolation
Low Band Cascaded Configuration, Supply Voltage=2.8 V
Isolation (dB)
Frequency (MHz)
LO1-IFout
LO1-LNA1in
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
500.0
600.0
700.0
800.0
900.0
1000.0
1100.0
1200.0
1300.0


LO Isolation
High Band Cascaded Configuration, Supply Voltage=2.8 V
Isolation (dB)
Frequency (MHz)
LO1-IFout
LO1-LNA2in
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
700.0
800.0
900.0
1000.0
1100.0
1200.0
1300.0


LO Doubler Isolation
High Band Cascaded Configuration, Supply Voltage=2.8 V
Isolation (dB)
Frequency (MHz)
LO1(X2)-IFout
LO1(X2)-LNA2in
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
1500.0
1700.0
1900.0
2100.0
2300.0
2500.0