DATA SHEET

SA1921

Satellite and cellular dual-band RF front-end

Product specification
Supersedes data of 1998 Sep 11
IC17 Data Handbook

1999 Mar 02

Philips
Semiconductors

PHILIPS

Satellite and cellular dual-band RF front-end SA1921

DESCRIPTION

The SA1921 is an integrated dual-band RF front-end that operates at both cellular (AMPS, DAMPS, and GSM) and satellite (1515–1600 MHz) frequencies, and is designed in a 13 GHz f_T BiCMOS process—QUBiC1. The low-band is a combined low-noise amplifier (LNA) and mixer. The LNA has a 1.7 dB noise figure at 943 MHz with 18.3 dB of gain and an IIP3 of –5 dBm. The wide-dynamic range mixer has a 11 dB noise figure at 943 MHz with 7.2 dB of gain and an IIP3 of +5 dBm.

The high-band contains a receiver front-end, and a high frequency transmit mixer intended for closed loop transmitters. One advantage of the high-band architecture is an image-rejection mixer with over 30 dB of image rejection; thus, eliminating external filter cost while saving board space. The system noise figure is 3.9 dB at 1550 MHz with a power gain of 22.2 dB and an IIP3 of –11.5 dB.

FEATURES

- Low current consumption
- Outstanding low- and high-band noise figure
- Excellent gain stability versus temperature and supply
- Image reject high-band mixer with over 30 dB of rejection
- Increased low-band LNA gain compression during analog transmission
- LO input and output buffers
- On chip logic for network selection and power down
- Very small outline package

APPLICATIONS

- 800 to 1000 MHz analog and digital receivers
- 1515 to 1600 MHz digital receivers
- Portable radios
- Digital mobile communications equipment

PIN CONFIGURATION

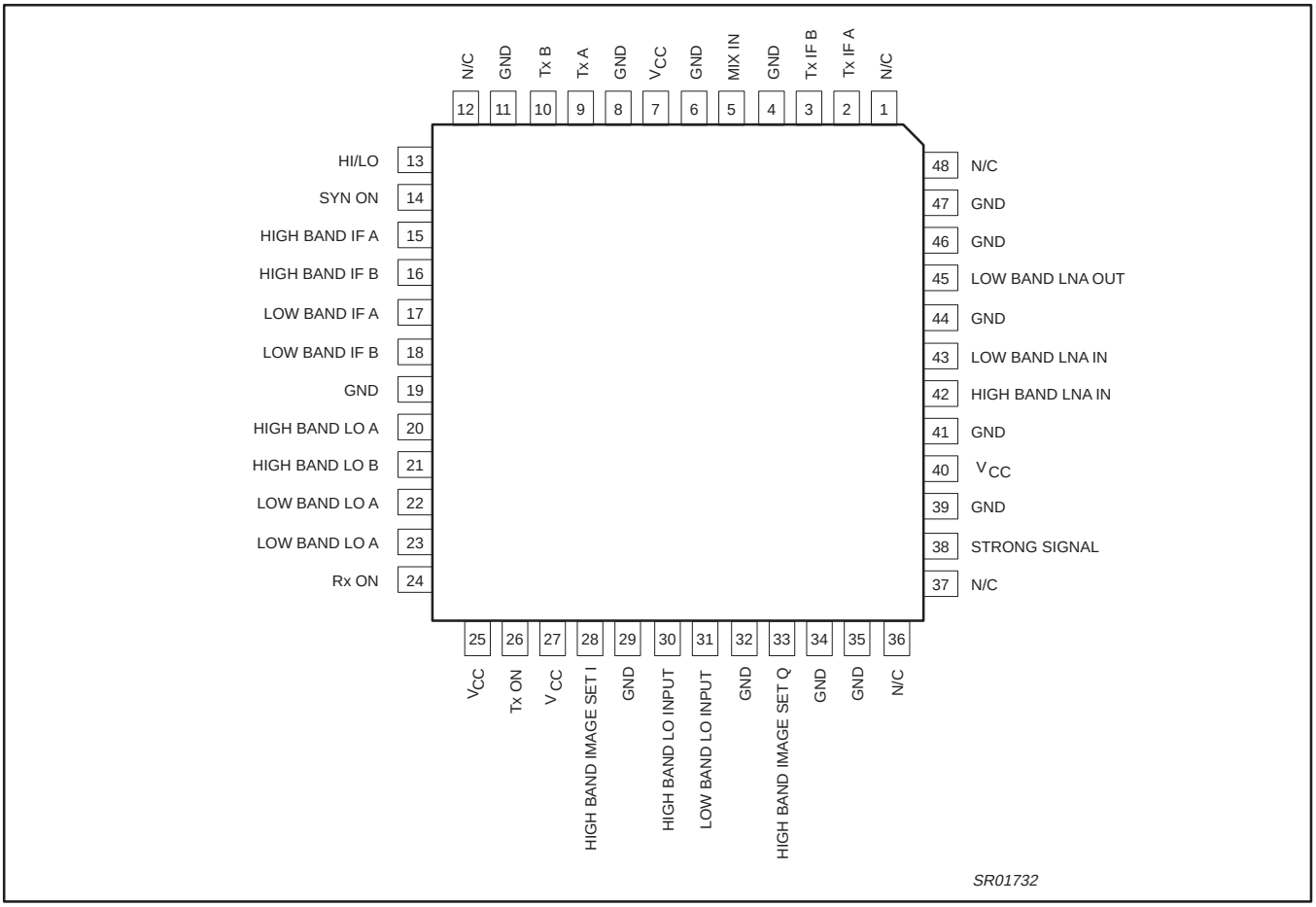


Figure 1. Pin Configuration

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
SA1921	LQFP48	Plastic low profile quad flat package; 48 leads; body 7x7x1.4 mm	SOT313-2

PIN DESCRIPTIONS

PIN NO.	PIN NAME	DESCRIPTION
1	N/C	No Connection
2	Tx IF A	Transmit IF A
3	Tx IF B	Transmit IF B
4	GND	Ground
5	MIX IN	Low Band Mixer Input
6	GND	Ground
7	V_{CC}	V_{CC}
8	GND	Ground
9	Tx A	Transmit Signal A
10	Tx B	Transmit Signal B
11	GND	Ground
12	N/C	No Connection
13	HI/LO	High Band/Low Band Control
14	SYN ON	LO Buffer Power Control
15	HIGH BAND IF A	High Band IF A
16	HIGH BAND IF B	High Band IF B
17	LOW BAND IF A	Low Band IF A
18	LOW BAND IF B	Low Band IF B
19	GND	Ground
20	HIGH BAND LO A	High Band LO Output
21	HIGH BAND LO B	High Band LO Output
22	LOW BAND LO A	Low Band LO Output
23	LOW BAND LO B	Low Band LO Output
24	Rx ON	LNA/Mixer Power Control
25	V_{CC}	V_{CC}
26	Tx ON	Tx Mixer/Driver Power
27	V_{CC}	V_{CC}
28	HIGH BAND IMAGE SET I	High Band Image Set I
29	GND	Ground
30	HIGH BAND LO INPUT	High Band LO Connection
31	LOW BAND LO INPUT	Low Band LO Connection
32	GND	Ground
33	HIGH BAND IMAGE SET Q	High Band Image Set Q
34	GND	Ground
35	GND	Ground
36	N/C	No Connection
37	N/C	No Connection
38	STRONG SIGNAL	Strong Signal Detection
39	GND	Ground
40	V_{CC}	V_{CC}
41	GND	Ground
42	HIGH BAND LNA IN	High Band LNA Input
43	LOW BAND LNA IN	Low Band LNA Input
44	GND	Ground
45	LOW BAND LNA OUT	Low Band LNA Output
46	GND	Ground
47	GND	Ground
48	N/C	No Connection

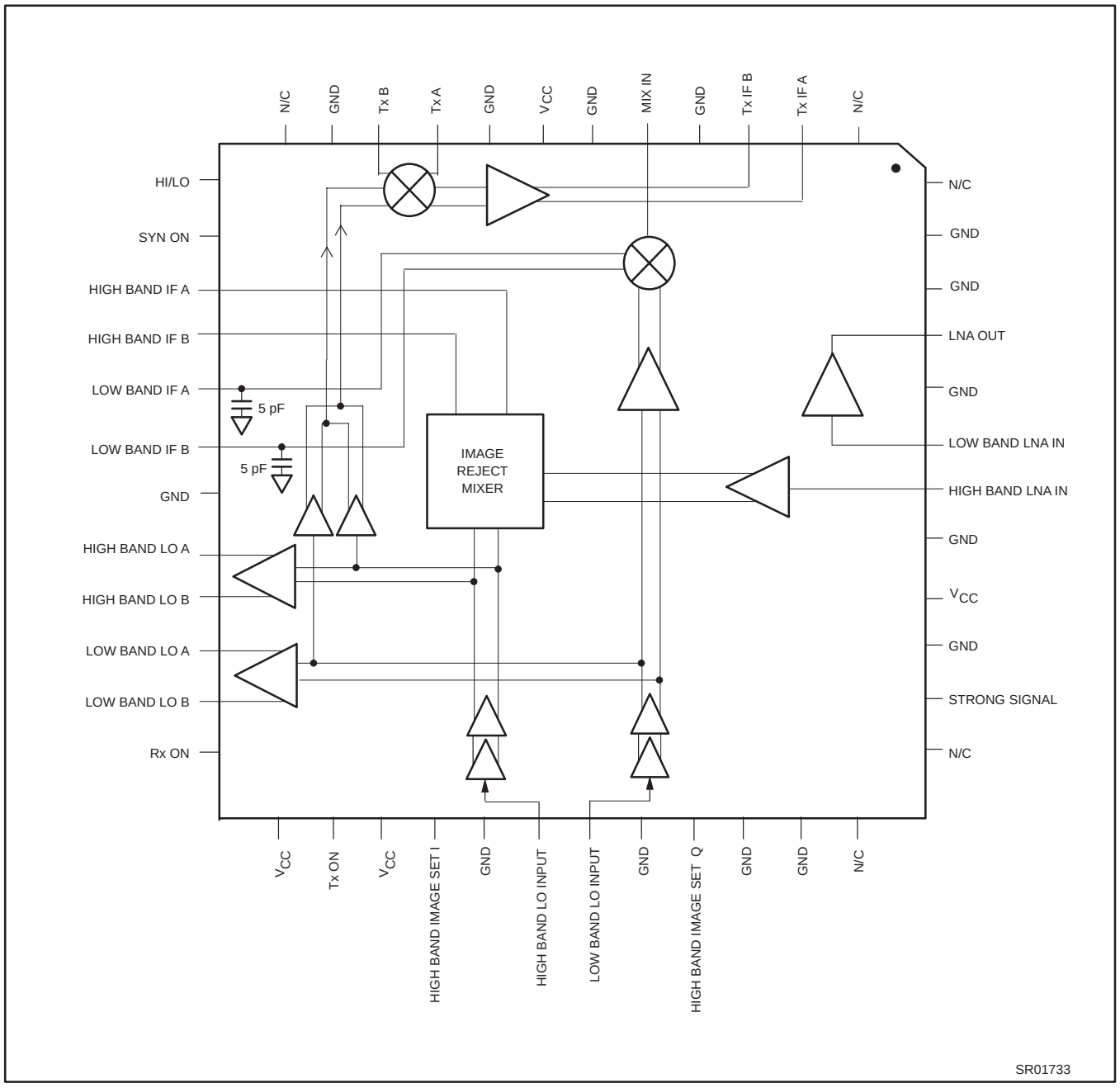


Figure 2. Block Diagram

Table 1. POWER DOWN CONTROL

		LO BUFFER		LNA		MIXER		T_X MIXER DRIVER	
Control State (Hi/Lo, Syn On, Rx On, Tx On, Strong Signal)		High Band	Low Band	High Band	Low Band	High Band	Low Band	High Band	Low Band
x000x	Sleep	Off	Off	Off	Off	Off	Off	Off	Off
01000	Low-Band LO Buffer on	Off	On	Off	Off	Off	Off	Off	Off
01100	Low-Band Receive Normal	Off	On	Off	On	Off	On	Off	Off
01101	Low-Band receive Strong Signal	Off	On	Off	Off	Off	On	Off	Off
01110	Low-Band Transmit (Analog only)	Off	On	Off	On High Bias	Off	On	Off	On
01010	N/A	Off	On	Off	Off	Off	Off	Off	On
11000	High-Band LO Buffer On	On	Off	Off	Off	Off	Off	Off	Off
11100	High-Band Receive Normal	On	Off	On	Off	On	Off	Off	Off
11101	High-Band Receive Strong Signal	On	Off	Off	Off	On	Off	Off	Off
11010	N/A	On	Off	Off	Off	Off	Off	On	Off

NOTE:
1. “0” is low logic state; “1” is high logic state.

OPERATION

The low-band contains both an LNA and mixer that is designed to operate in the 800 to 1000 MHz frequency range. The high-band contains an LNA and image-rejection mixer that is designed to operate in the 1515 to 1600 MHz frequency range with over 30 dB of rejection over an intermediate frequency (IF) range from 150 to 185 MHz.

Image rejection is achieved in the internal architecture by two RF mixers in quadrature and two all-pass filters in the I and Q IF channels that phase shift the IF by 45° and 135°, respectively. The two phase shifted IFs are recombined and buffered to produce the IF output signal.

The LO section consists of an internal phase shifter to provide quadrature LO signals to the receive mixers. The filters outputs are buffered before being fed to the receive mixers. The transmit mixer section consists of a low-noise amplifier, and a down-convert mixer. In the transmit mode, an internal LO buffer is used to drive the transmit IF down-convert mixer.

Low-Band Receive Section

The circuit contains a LNA followed by a wide-band mixer. In a typical application circuit, the LNA output uses an external pull-up inductor to V_{CC} and is AC coupled. The mixer IF outputs are differential. A typical application will load the output buffer with an inductor across the IF outputs, a pull-up inductor to V_{CC} and an AC coupled capacitor to the matching network.

Low-Band Receive Section (Analog Transmit Mode)

The bias current of the low-band LNA will increase during analog transmission, which increases its gain compression point and makes the receiver less sensitive to PA leakage power for an AMPS application.

High-Band Receive Section

The circuit contains an LNA followed by two high dynamic range mixers. These are Gilbert cell mixers; the internal architecture is fully differential. The LO is shifted in phase by 45° and 135° and mixes the amplified RF signal to create I and Q channels. The two I and Q channels are buffered, phase shifted by 45° and 135°, respectively, amplified and recombined internally to realize the image rejection.

The IF output is differential and of the open-collector type. A typical application will load the output buffer with an inductor across the IF outputs, a pull-up inductor to V_{CC} and an AC coupled capacitor to the matching network.

Control Logic Section

Pins HI/LO, SYN ON, Rx On, Tx On, Strong Signal, control the logic functions. The HI/LO mode selects between low-band and high-band operation. The SYN ON mode enables the LO buffers independent of the other circuitry. When SYN ON is high, all internal buffers in the LO path of the circuit are turned on, thus minimizing LO pulling when the remainder of the receive or transmit chain is powered-up.

The Rx ON mode enables the LO buffers when the device is in the low-band receive normal, receive strong signal and transmit modes; the Rx ON mode enables the LO buffers, also, when the device is in the high-band receive normal, and receive strong signal modes.

The Tx ON mode enables the transmit mixer. The strong signal mode, when disabled, allows the low- and high-band LNAs to function normally; and when the strong signal mode is enabled, it turns-off the low- and high-band LNAs. This is needed when the input signal is large and needs to be attenuated.

Local Oscillator (LO) Section

The LO input directly drives the two internal all-pass networks to provide quadrature LO to the receive mixers. A synthesizer-on (SYN ON) mode is used to power-up all LO input buffers, thus minimizing the pulling effect on the external VCO when entering receive or transmit mode.

Transmit Mixer Section

The transmit mixer is used for down-conversion to the transmit IF. Its inputs are coupled to the transmit RF which is down-converted to a modulated transmit IF frequency, and phase-locked with the baseband modulation.

The IF outputs are HIGH impedance (open-collector type). A typical application will load the output buffer with an inductor across the IF outputs, a pull-up inductor to V_{CC} and AC coupled capacitors to the matching network.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETERS	VALUE	UNIT
V_{CC}	Input supply voltage at pins: 7, 25, 27, 40	4.75	V
P_D	Power dissipation	150	mW
P_{IN}	Input power at all ports	+20	dBm
T_{srg}	Storage temperature range	–65 to +125	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETERS	RATING	UNIT
V_{CC}	DC Supply voltage	3.6 to 3.9	V
T_O	Operating temperature range (pin temp)	–40 to +85	°C

DC ELECTRICAL CHARACTERISTICS

Unless otherwise specified, all Input/Output ports are single-ended.

DC PARAMETERS

V_{CC} = +3.75 V, T_A = +25°C unless otherwise noted

SYMBOL	PARAMETERS	CONDITION	MIN.	TYP.	MAX.	UNIT
I_{CC}	Current Consumption: Sleep Mode	X000X		1.0	25	μA
I_{CC}	Low Band Receive Normal	01100	9.8	12.2	14.7	mA
I_{CC}	Low Band Receive Strong	01101		9.0		mA
I_{CC}	Low Band Transmit (Analog)	01111		18.0		mA
I_{CC}	Low Band Transmit (GSM)	01010		16.5		mA
I_{CC}	High Band Receive Normal	11100	32.0	40.0	48.0	mA
I_{CC}	High Band Receive Strong	11101		36.0		mA
I_{CC}	High Band Transmit (GSM)	11010		19.4		mA
	Logic Low Input		0		0.5	V
	Logic High Input		1.9		4.0	V

AC ELECTRICAL CHARACTERISTICS

Low-Band, Dual Mode of Operation

V_{CC} = +3.75 V, $Freq_{RF}$ = 943 MHz, $Freq_{LO}$ = 1106 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

PARAMETERS	Min	–3σ	TYP	+3σ	Max	UNITS	NOTES
System							
RF Input Frequency Range	869		943		960	MHz	
IF Frequency			163			MHz	
LO Frequency	1032		1106		1123	MHz	
Cascaded Power Gain; includes 3dB filter loss		21.4	22.5	23.6		dB	
Power Gain Reduction (Strong Signal Mode—LNA Off)		30	36	42		dB	
Cascaded Noise Figure; includes 3dB filter loss			2.6			dB	
LNA							
LNA Gain		17.6	18.3	19		dB	
LNA IIP3 (60 kHz spacing)		–6.0	–5.0	–4.0		dBm	
LNA IIP3 (200 kHz spacing)			–3.0			dBm	
LNA Noise Figure		1.6	1.7	1.8		dB	
LNA 1 dB RF Input Compression Point			–21.0			dBm	
Mixer							
Mixer Gain		6.9	7.2	7.5		dB	
Mixer IIP3 (60 kHz spacing)		4.0	5.0	6.0		dBm	
Mixer Noise Figure		10.4	11.0	11.6		dB	
Mixer 1 dB RF Input Compression Point			–13.0			dBm	
Other							
Input Impedance, RF Port			50			Ω	
Return Loss at LNA Inputs and Output					–10	dB	1
Return Loss at Mixer Input and Outputs					–10	dB	1
LO leakage at RF Port			–42			dBm	
LO Input Power		–5	–3	–1		dBm	
Turn ON/OFF Time			100			μsec	

Low-Band LO Buffer

V_{CC} = +3.75 V, $Freq_{LO}$ = 1106 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

PARAMETERS	Min	–3σ	TYP.	+3σ	Max	UNITS	NOTES
LO Frequency	1032		1106		1123	MHz	
Differential Output Power			–7			dBm	
Differential Output Impedance			100			Ω	
Harmonic Content			–20			dBc	
Input Power		–5	–3	–1		dBm	
Input Impedance			50			Ω	1
Turn On/Off Time			10			μsec	

NOTE:
1. External matching network is required.

AC ELECTRICAL CHARACTERISTICS

High-Band, Single Mode of Operation
LNA and Image Reject Mixer

V_{CC} = +3.75 V, $Freq_{RF}$ = 1550 MHz, $Freq_{LO}$ = 1713 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

PARAMETERS	MIN	–3σ	TYP.	+3σ	MAX	UNITS	NOTES
RF Input Frequency Range	1515				1600	MHz	
IF Frequency	150		163		185	MHz	
LO Frequency	1665				1785	MHz	
Power Gain		21.5	22.2	22.9		dB	
Power Gain Reduction (Strong Signal Mode—LNA Off)		34	47	60		dB	
Noise Figure		3.7	3.9	4.1		dB	
Input Impedance, RF Port			50			Ω	
Return Loss at Inputs					–10	dB	1
LO leakage at RF Port			–48			dBm	
1 dB RF Input Compression Point			–24			dBm	
IP3 (3^{RD} Order Intermodulation Product) Referred to the RF Input Port		–14	–11.5	–9		dBm	
(2 x LO) – (2 x RF) Spur Performance –50 dBm IN Referred to RF Input Port Measure at LO = 1688 MHz and RF = 1606 MHz			–62			dBc	
(3 x LO) – (3 x RF) Spur Performance. –50 dBm IN Referred to RF Input Port. Measure at LO = 1688 MHz and RF = 1634 MHz.			–102			dBc	
Image rejection, $f_{RX}+2f_{IF}$ Referred to the RF Input Port		31.5	34	36.5		dB	
LO Input Power		–5	–3	–1		dBm	
Turn ON/OFF Time			10			μsec	

High-Band LO Buffer

V_{CC} = +3.75 V, $Freq_{LO}$ = 1713 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

PARAMETERS	MIN	–3σ	TYP.	+3σ	MAX	UNITS	NOTES
LO Frequency Range	1665				1785	MHz	
Differential Output Power			–9			dBm	
Differential Output Impedance			100			Ω	
Harmonic Content			–20			dBc	
Input Power		–5	–3	–1		dBm	
Input Impedance			50			Ω	1
Turn On/Off Time			10			μsec	

NOTE:
1. External matching network is required.

Transmit Mixer

V_{CC} = +3.75 V, $Freq_{RF}$ = 1550 MHz, $Freq_{LO}$ = 1713 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

PARAMETERS	MIN	–3σ	TYP.	+3σ	MAX	UNITS	NOTES
T_X Mixer Input Frequency	824				1661	MHz	
T_X RF Input Impedance, Balanced			200			Ω	
T_X Mixer Output Frequency	70		163		200	MHz	
T_X IF Load Impedance			1000			Ω	
Maximum T_X IF Load Capacitance					2	pF	
Conversion Power Gain		17	18	19		dB	1
1 dB Input Compression Point			–17			dBm	
IIP2			20			dBm	
IIP3		–9	–7	–5		dBm	
Noise Figure (double sideband)			8.5			dB	
Reverse Isolation T_{XIN}–LO_{IN}		40				dB	
Isolation LO_{IN}–T_{XIN}		40				dB	

NOTES:
1. Input and output ports matched to 50 Ω.

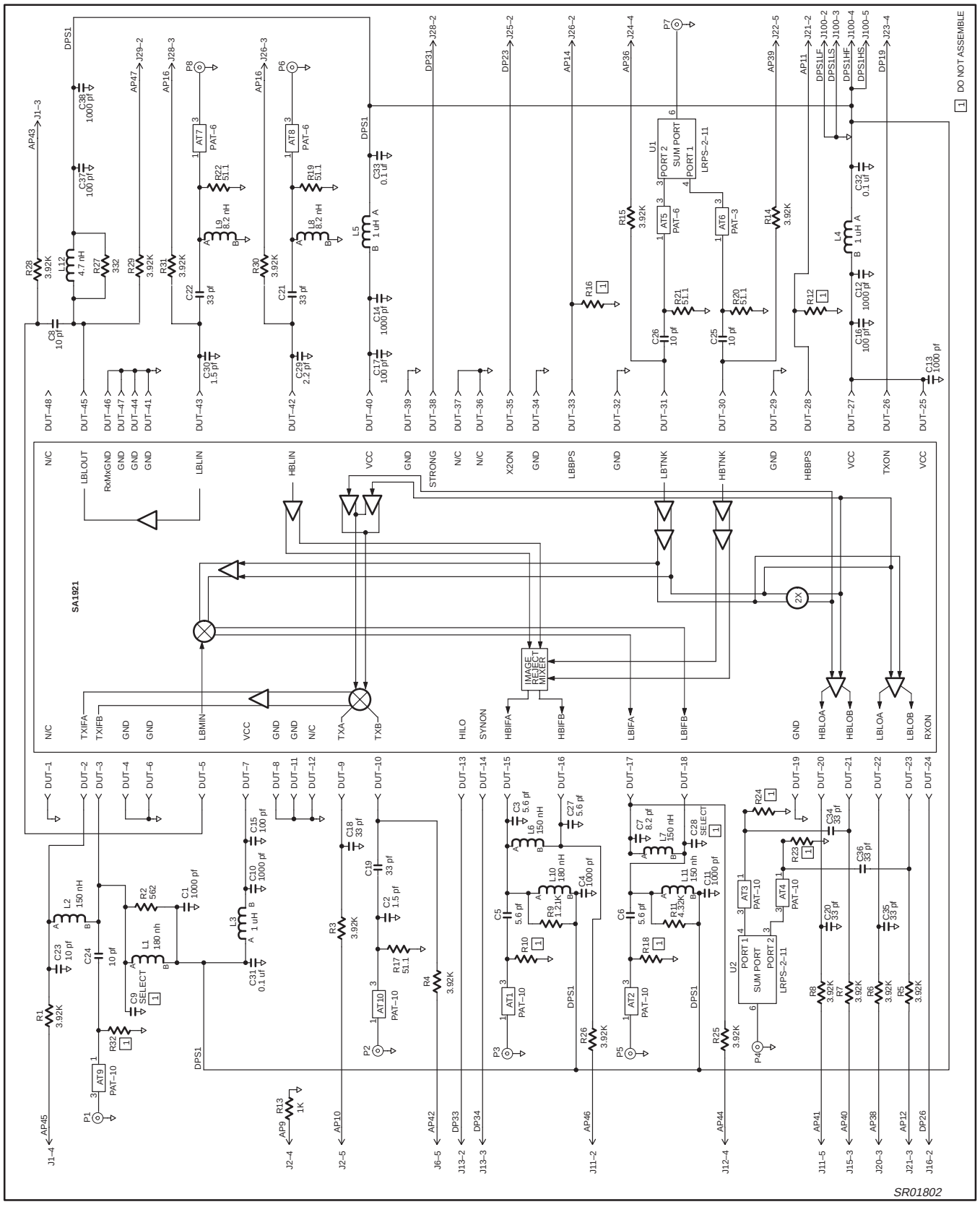


Figure 3. SA1921 Dual-Band Test Circuit

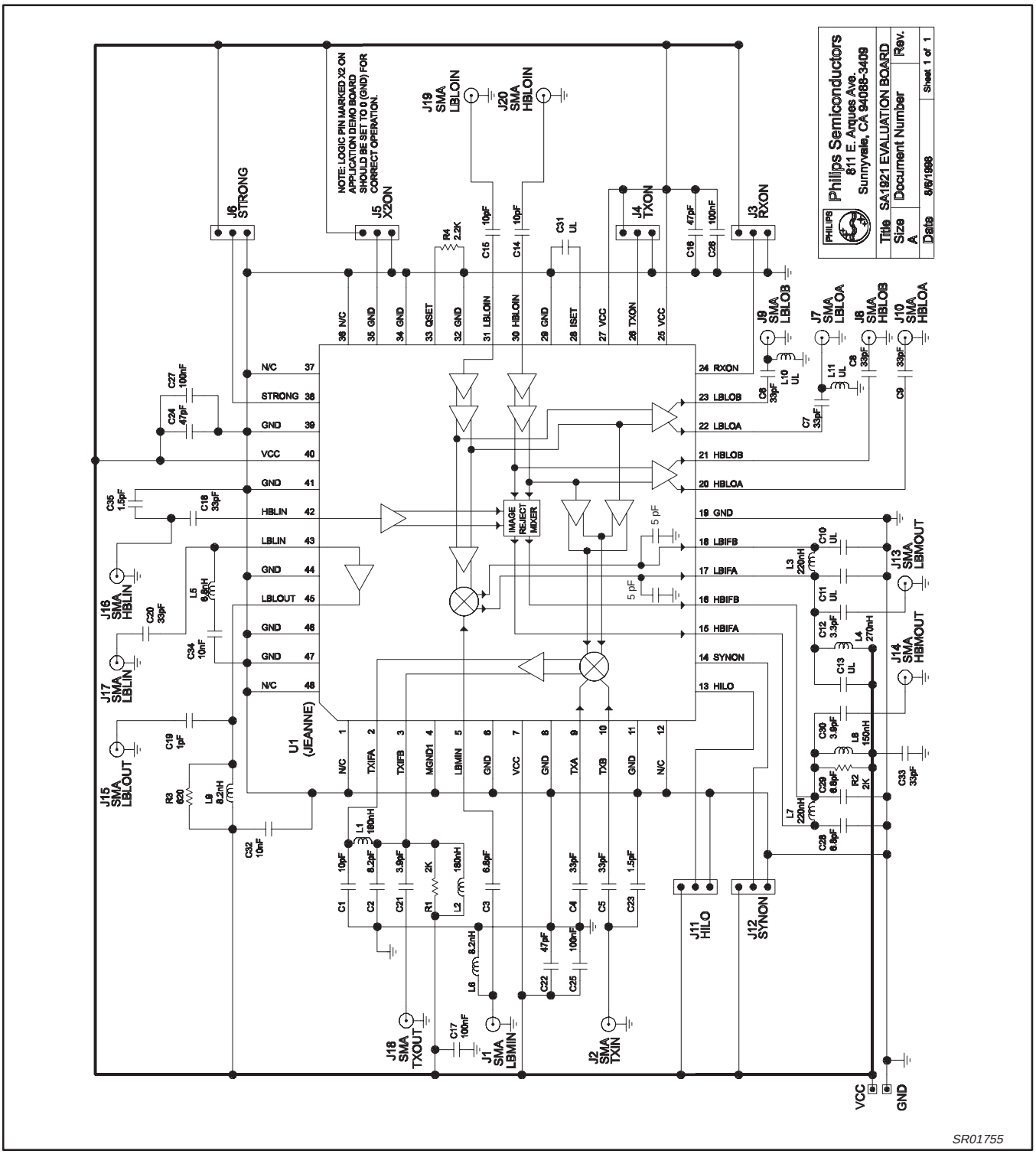


Figure 4. SA1921 Dual-Band Application Circuit

NOTE:
GSM and Satellite frequencies

PERFORMANCE CHARACTERISTICS

V_{CC} = +3.75 V, $Freq_{RF}$ = 1550 MHz, $Freq_{LO}$ = 1713 MHz, P_{LOin} = –3 dBm, T_A = +25°C; unless otherwise stated.

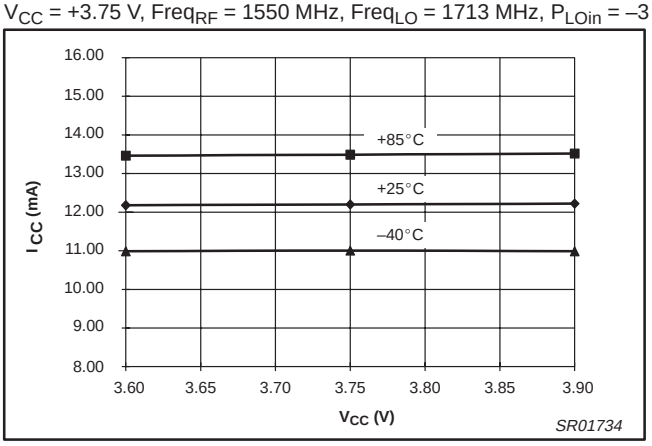


Figure 5. Low Band Receive Normal I_{CC}

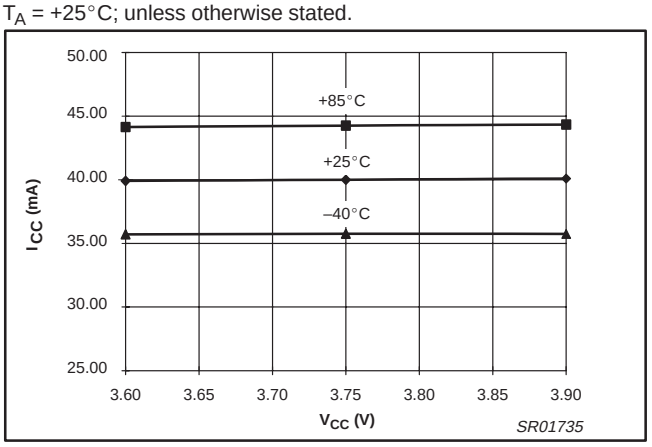


Figure 6. High Band Receive Normal I_{CC}

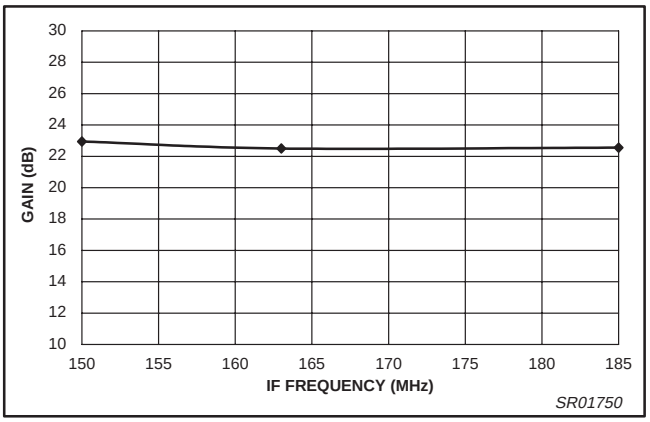


Figure 7. High Band Gain vs. IF Frequency

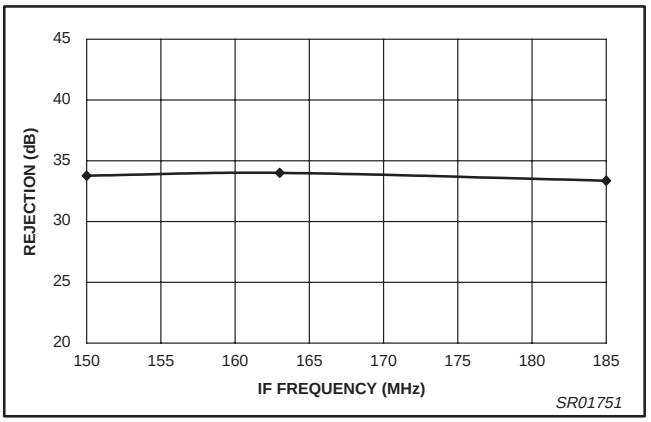


Figure 8. High Band Image Rejection vs. IF Frequency

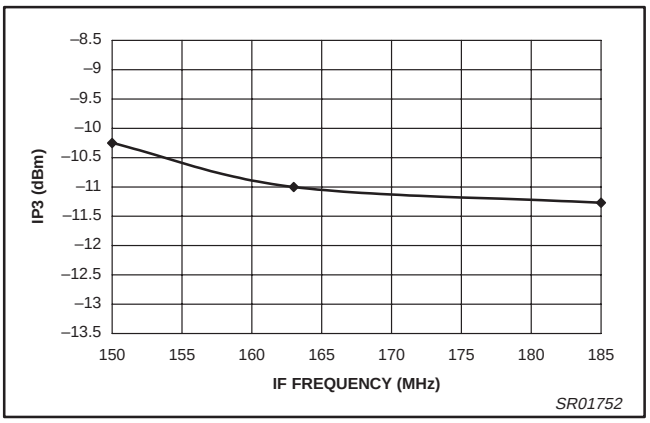


Figure 9. High Band IP3 vs. IF Frequency

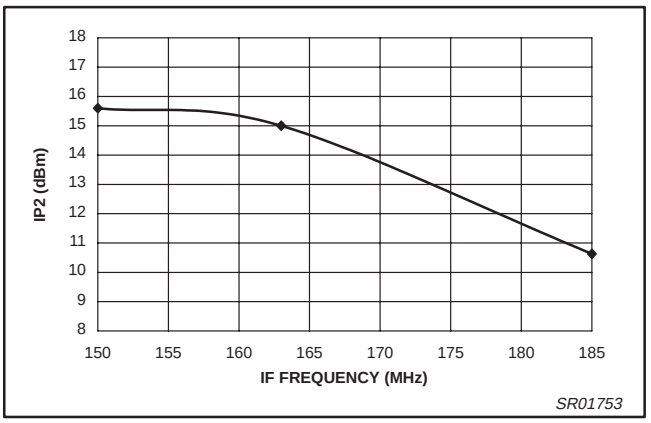


Figure 10. High Band IP2 vs. IF Frequency

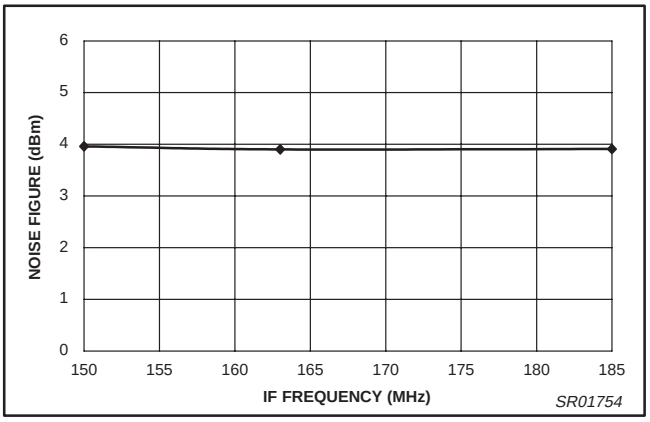


Figure 11. High Band NF vs. IF Frequency

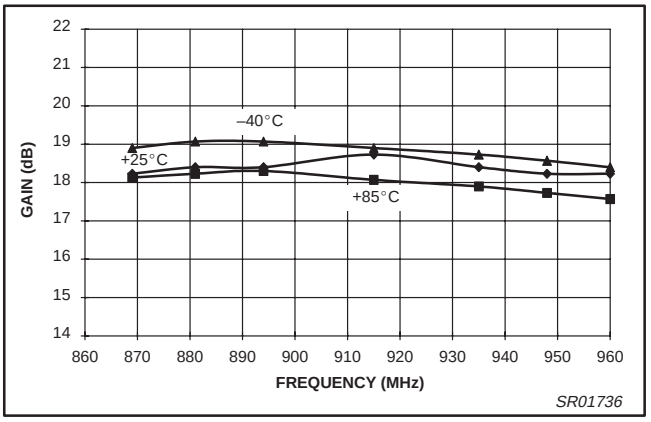


Figure 12. LB LNA Gain vs. Frequency

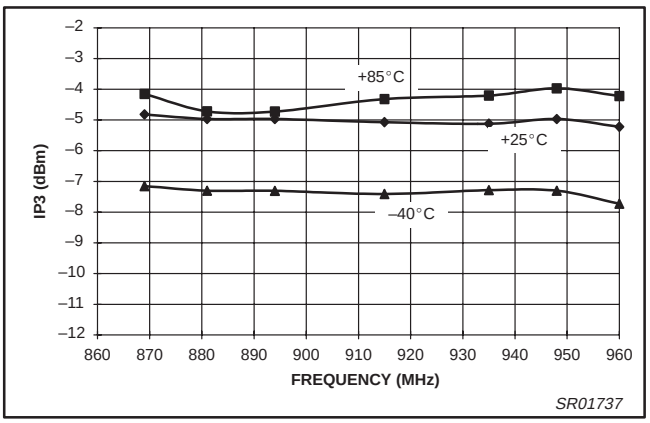


Figure 13. LB LNA IP3 vs. Frequency

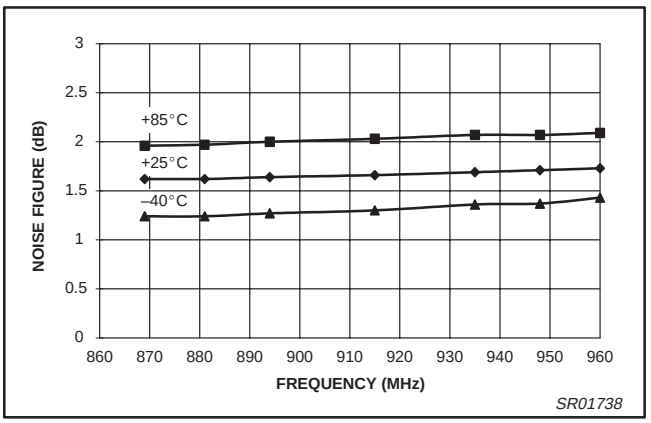


Figure 14. LB LNA Noise Figure vs. Frequency

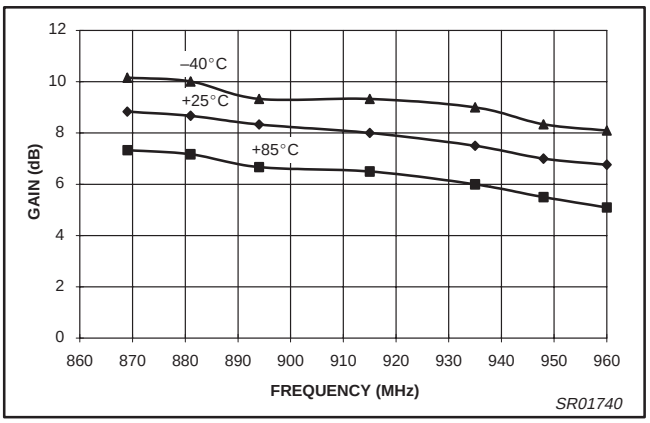


Figure 15. LB Mixer Gain vs. Frequency

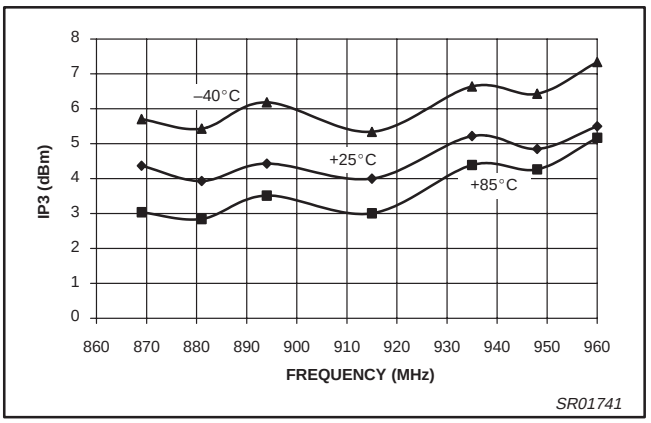


Figure 16. LB Mixer IP3 vs. Frequency

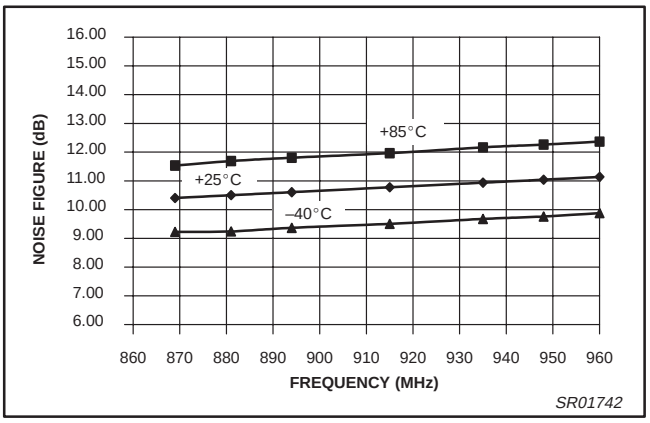


Figure 17. LB Mixer Noise Figure vs. Frequency

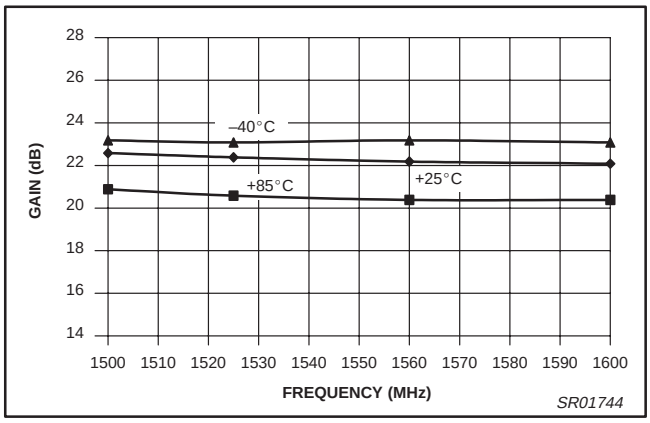


Figure 18. HB Gain vs. Frequency

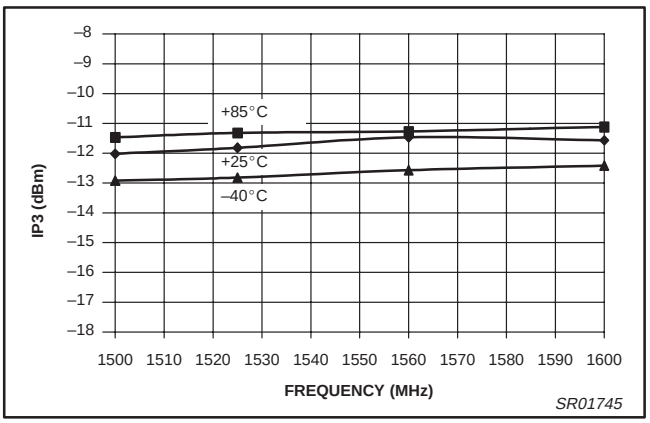


Figure 19. HB IP3 vs. Frequency

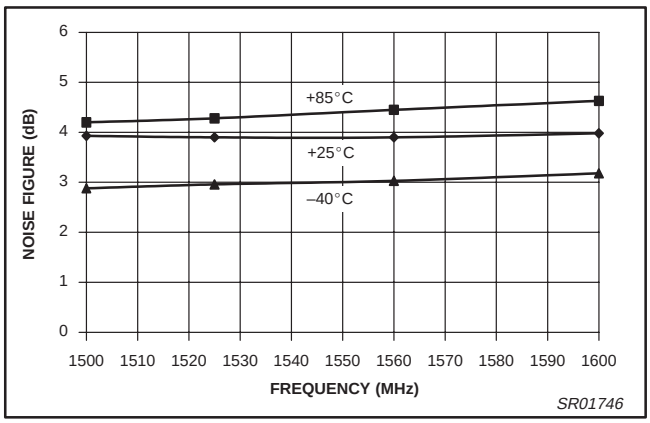


Figure 20. HB Noise Figure vs. Frequency

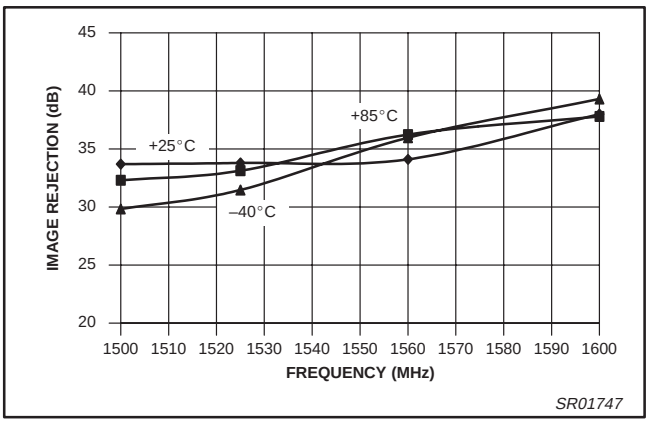


Figure 21. HB Image Rejection vs. Frequency

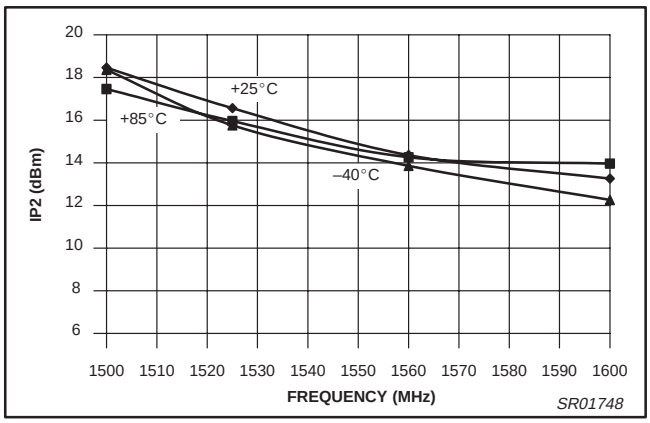


Figure 22. HB IP2 vs. Frequency

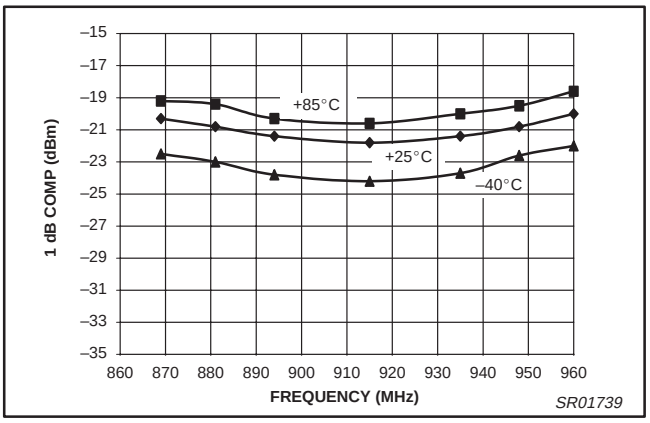


Figure 23. LB LNA 1 dB Compression vs. Frequency

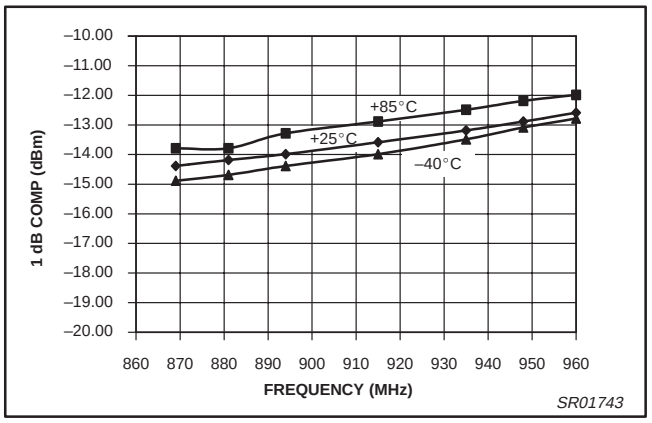


Figure 24. LB Mixer 1 dB Compression vs. Frequency

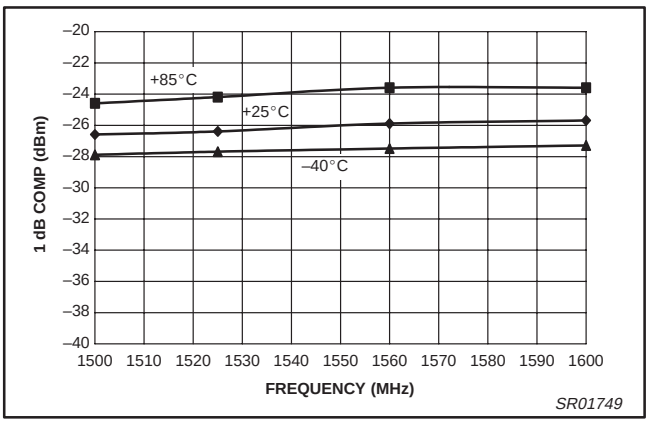


Figure 25. HB 1 dB Compression vs. Frequency

S-PARAMETERS

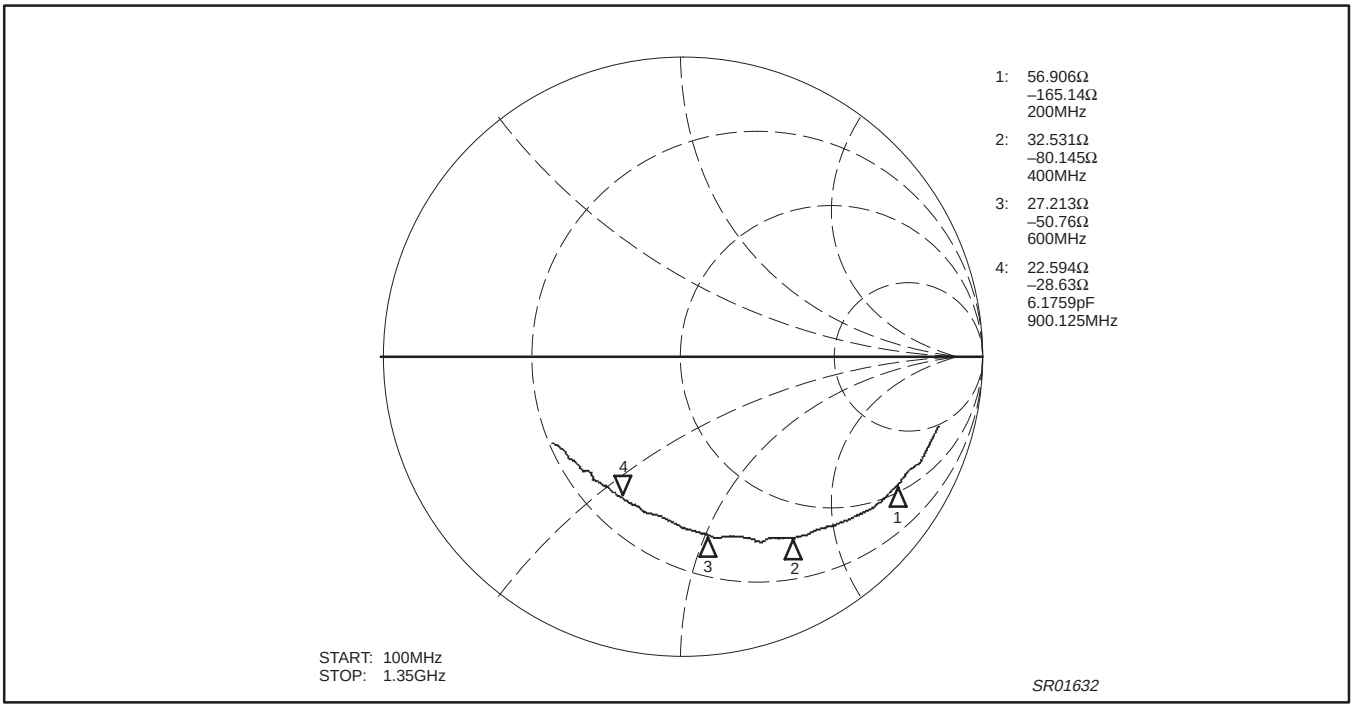


Figure 26. Typical S_{11} of the Low Band LNA at 3.75 V for the Low Band Receive Normal Mode

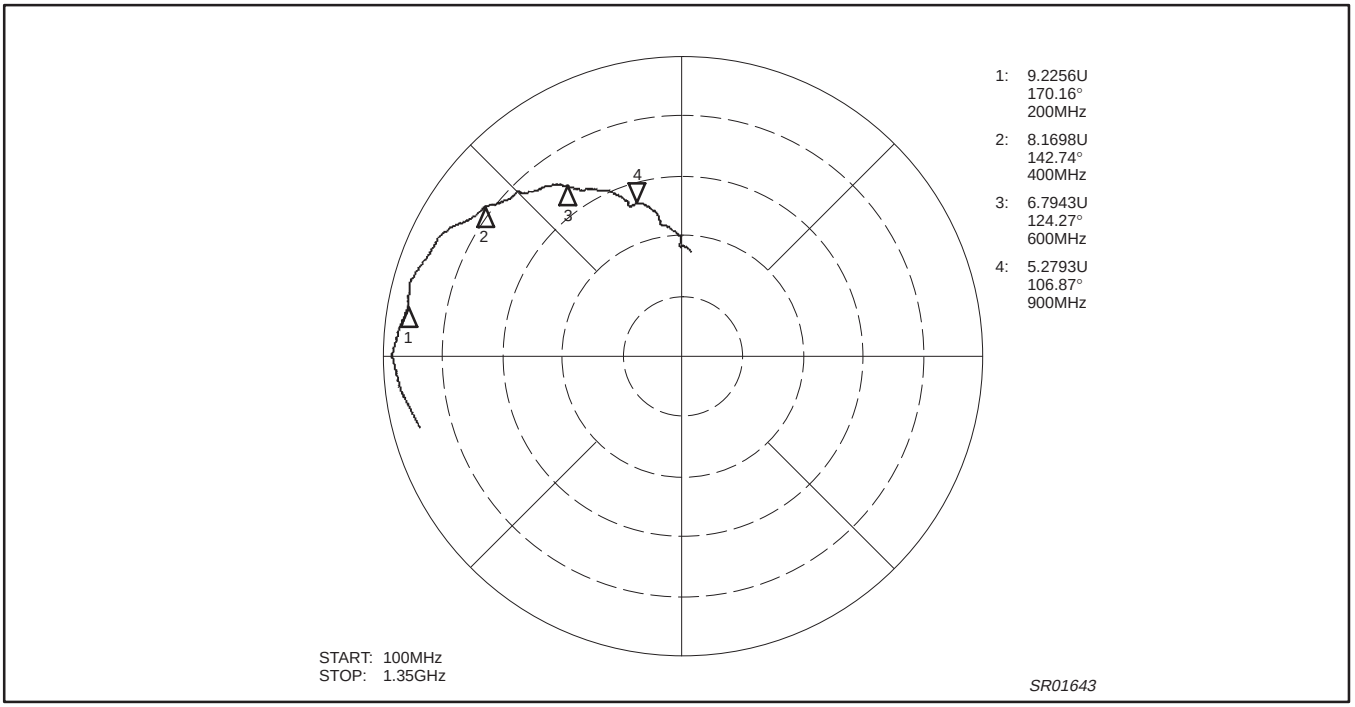


Figure 27. Typical S_{21} of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

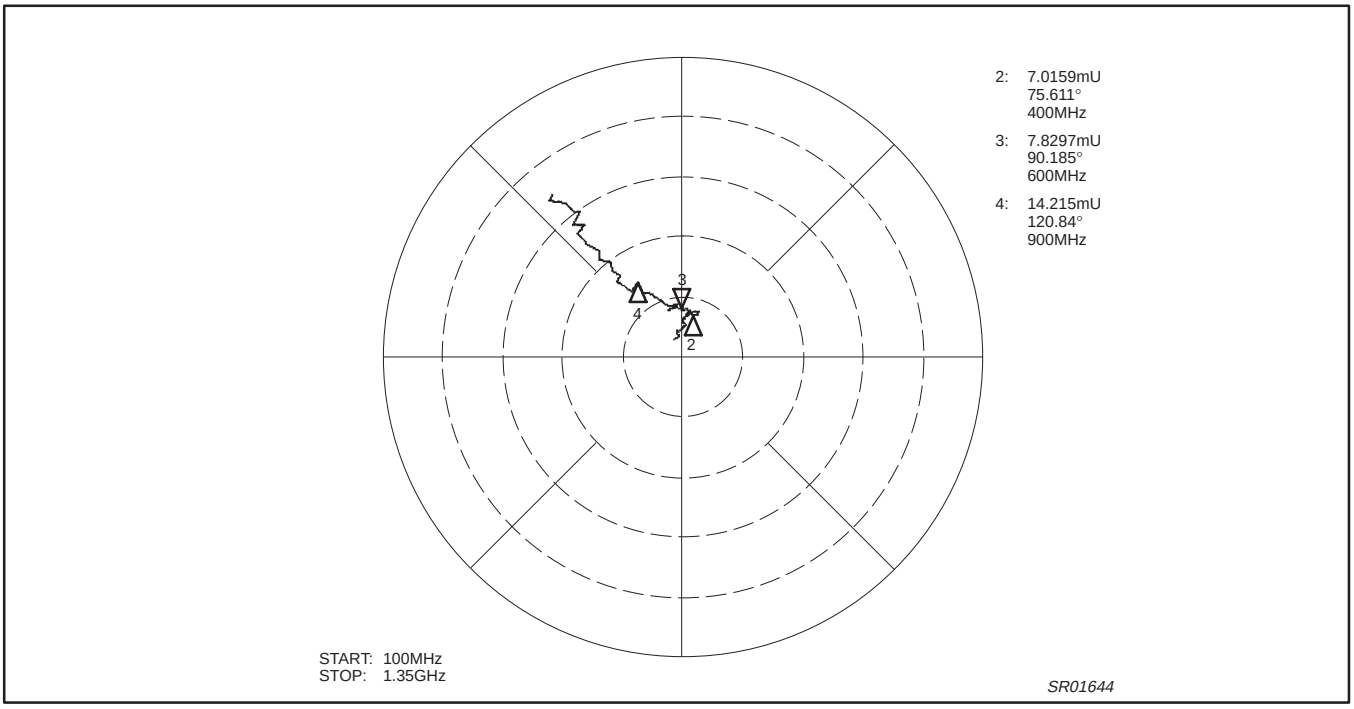


Figure 28. Typical S_{12} of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

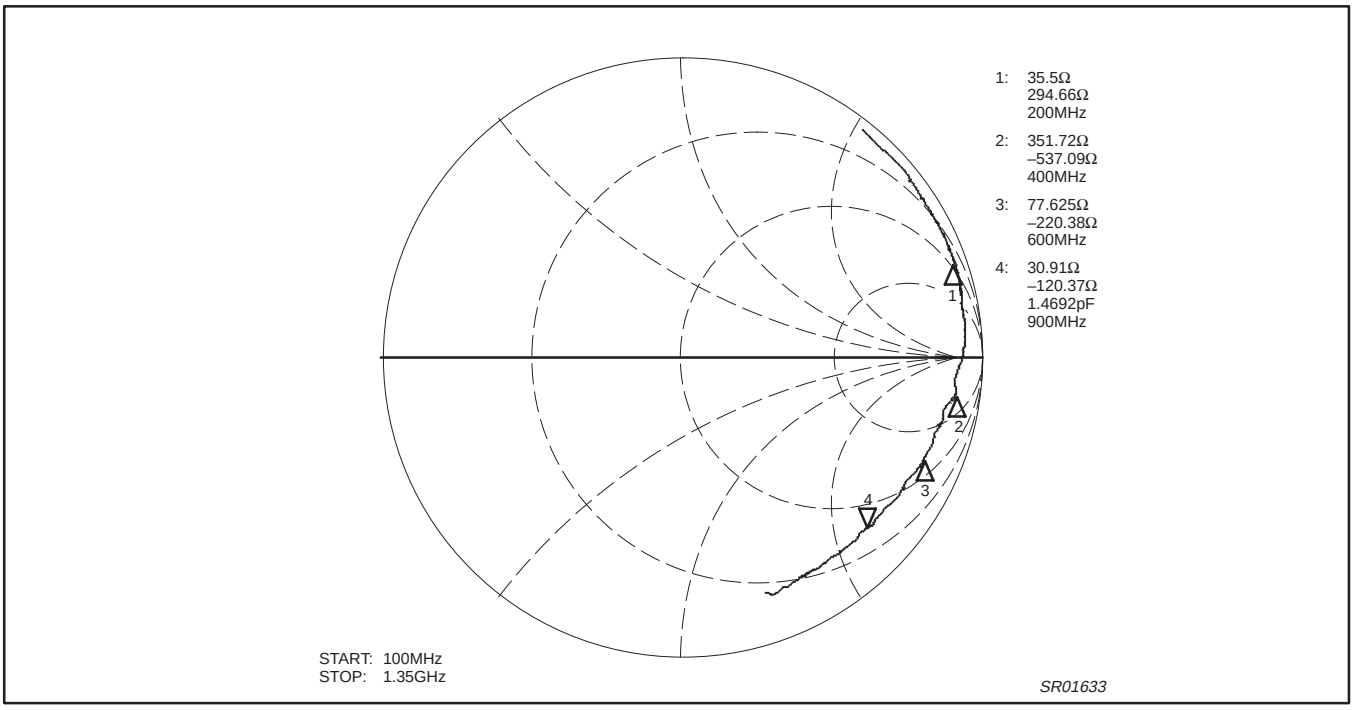


Figure 29. Typical S_{22} of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

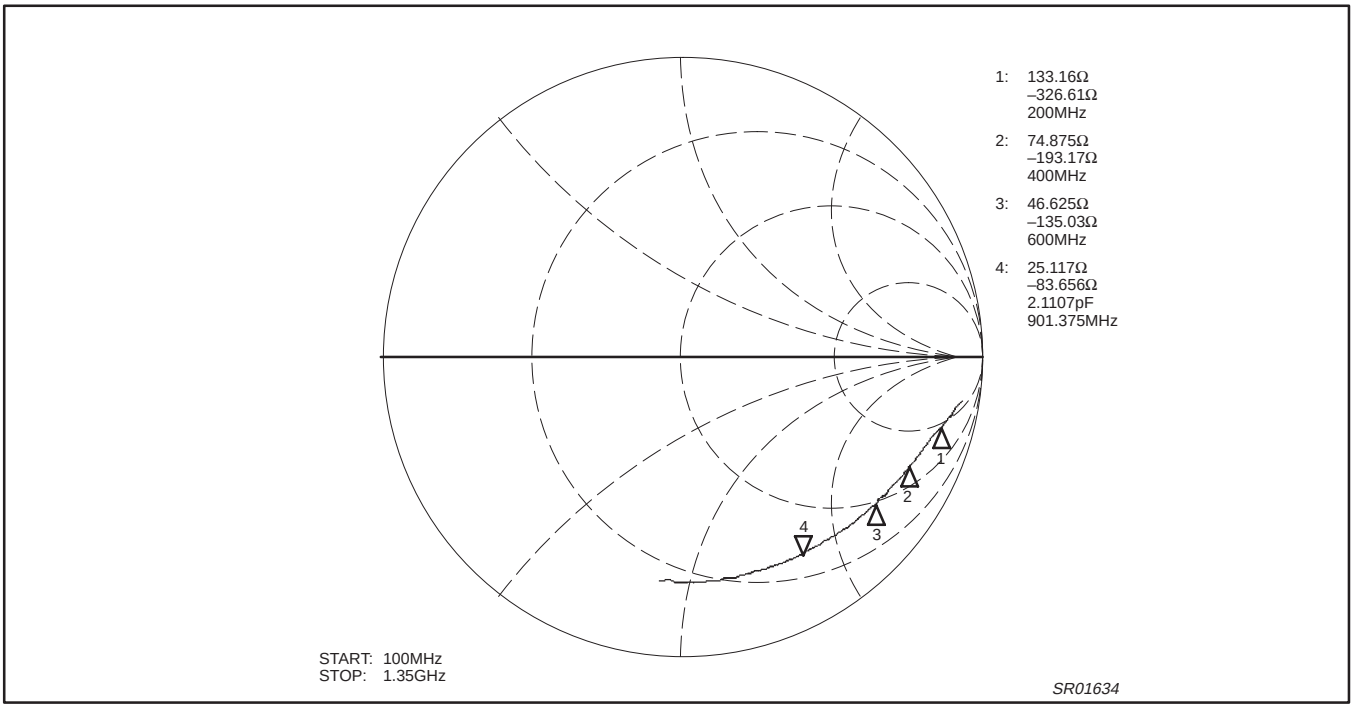


Figure 30. Typical S_{11} of Low Band LNA @ 3.75V for Receive Strong Signal Mode

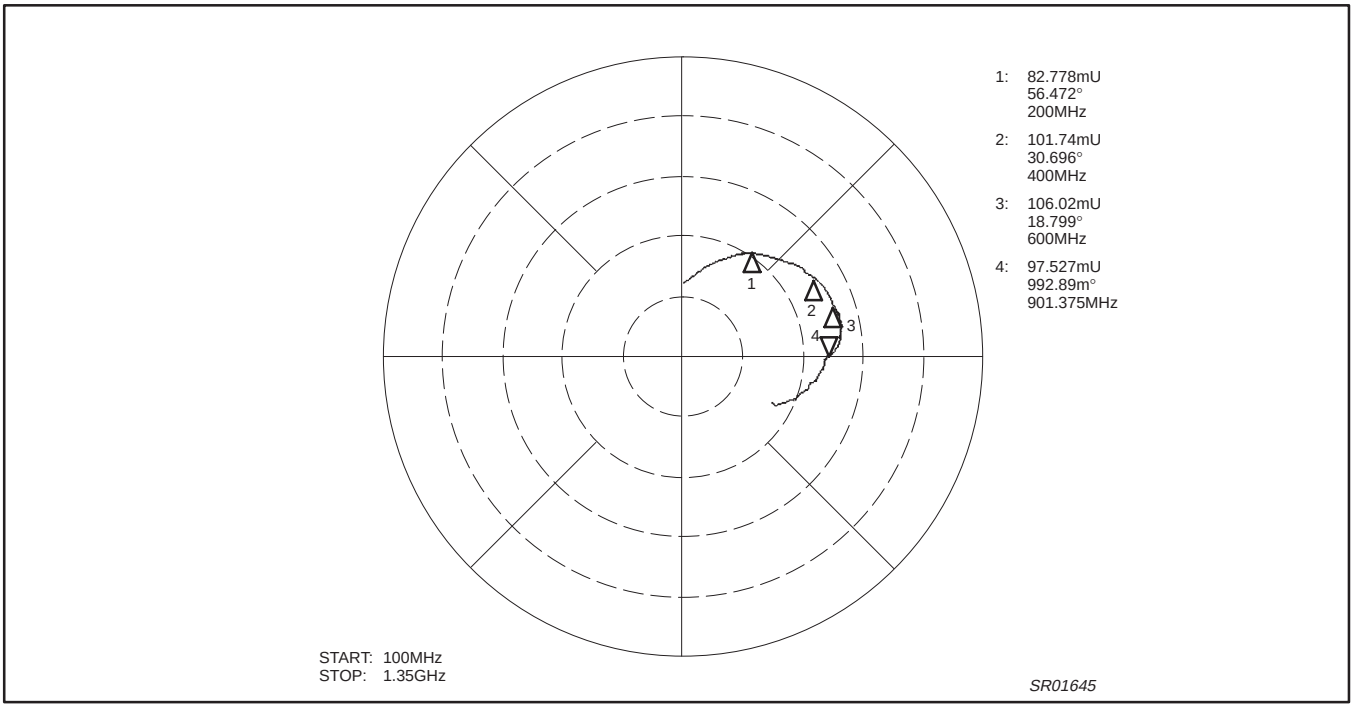


Figure 31. Typical S_{21} of the Low Band LNA @ 3.75V for Receive Strong Signal Mode

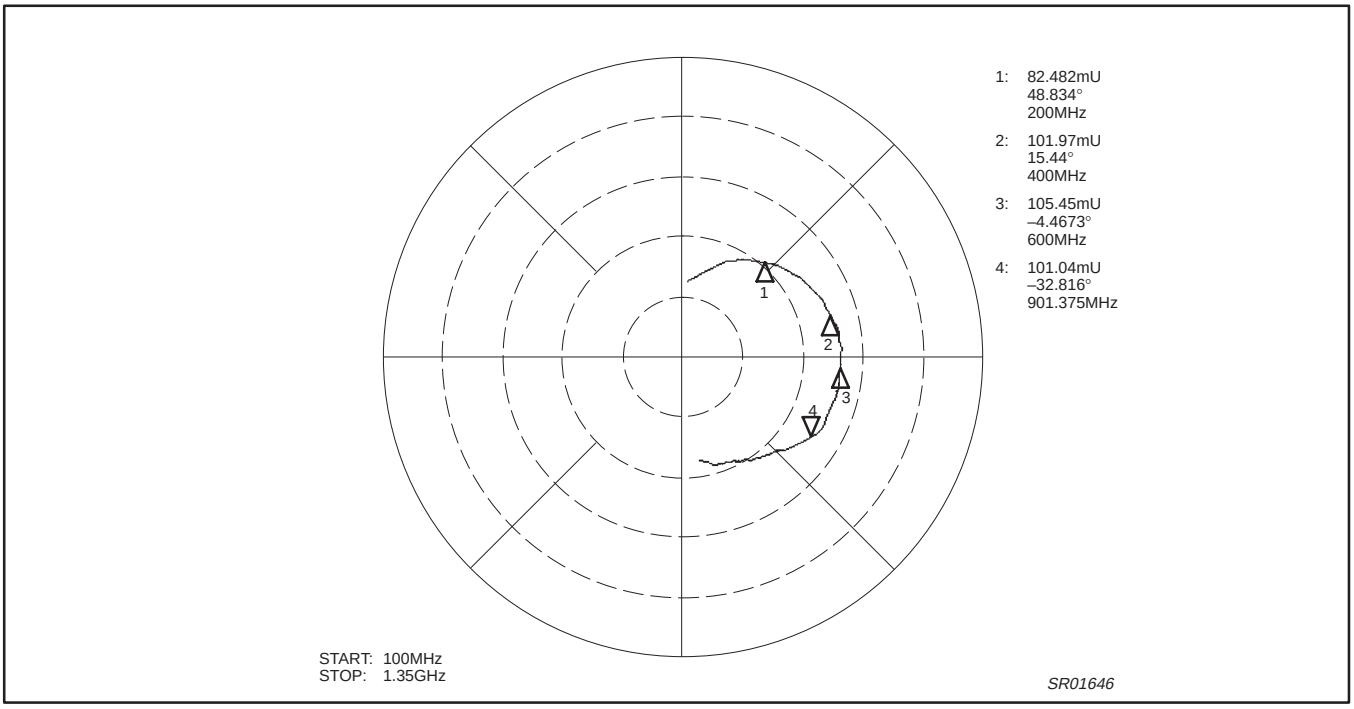


Figure 32. Typical S_{12} for the Low Band LNA @ 3.75V for the Receive Strong Signal Mode

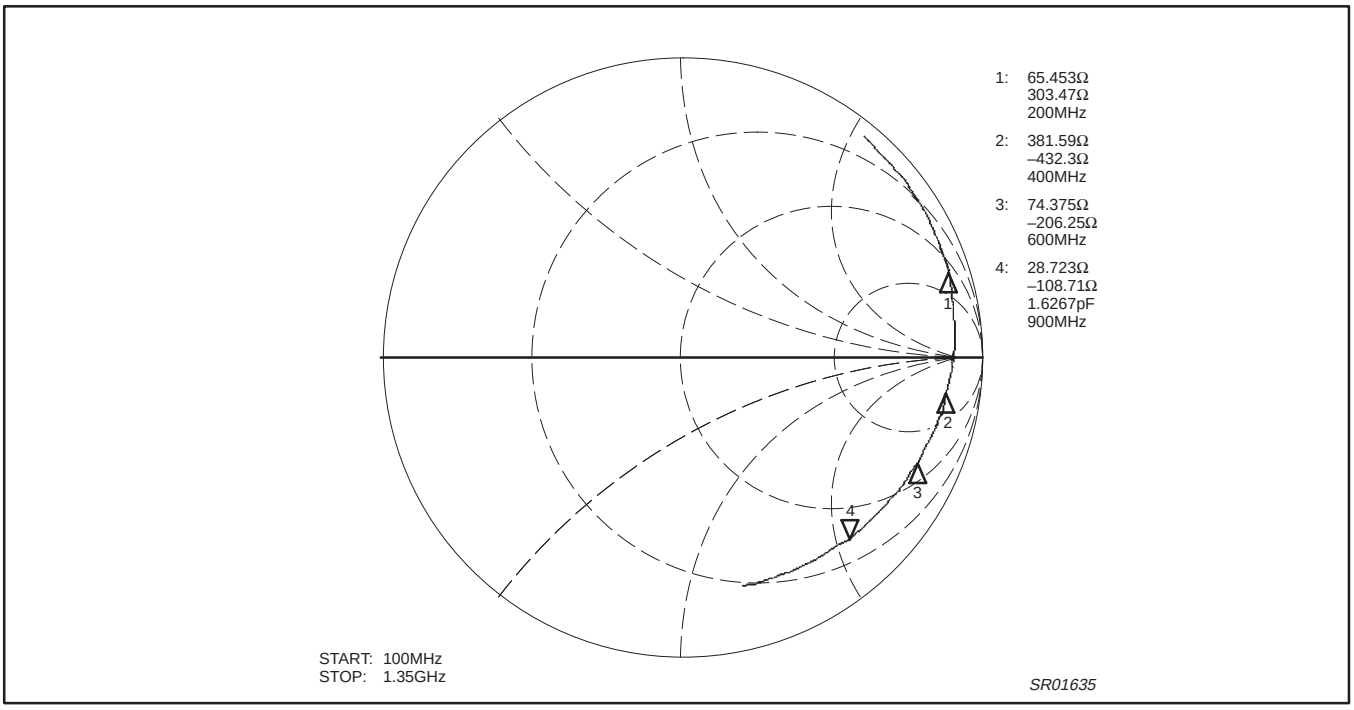


Figure 33. Typical S_{22} for the Low Band LNA @ 3.75V for the Strong Receive Signal Mode

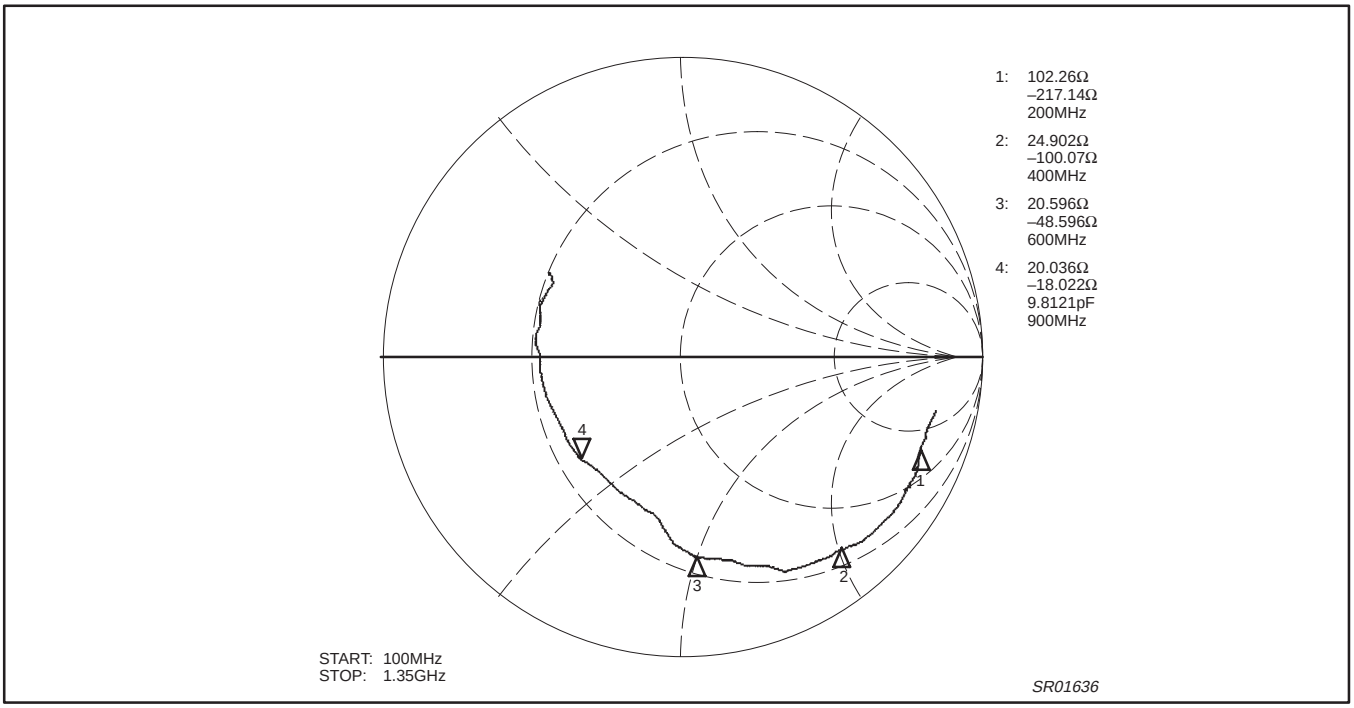


Figure 34. Typical S_{11} for the Low Band Mixer @ 3.75V for the Receive Normal Mode

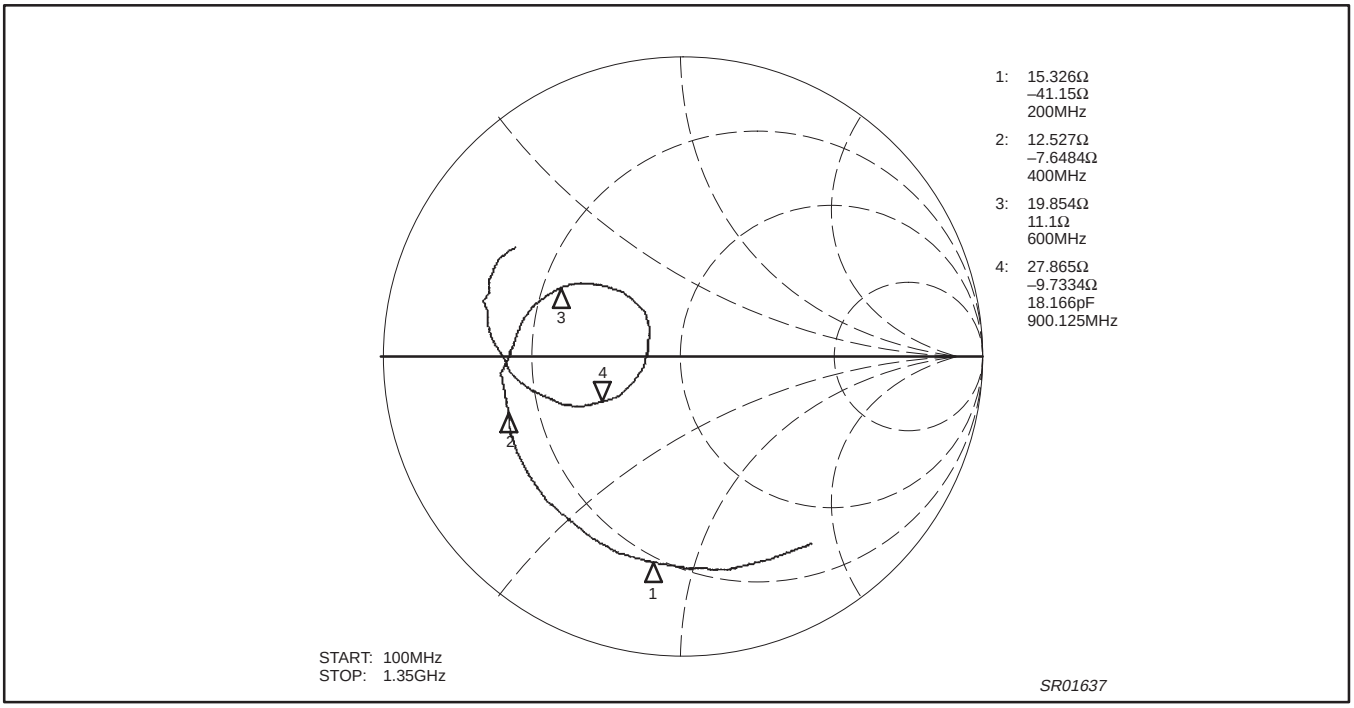


Figure 35. Typical S_{11} for the Low Band LO @ 3.75V for the Low Band Receive Normal Mode

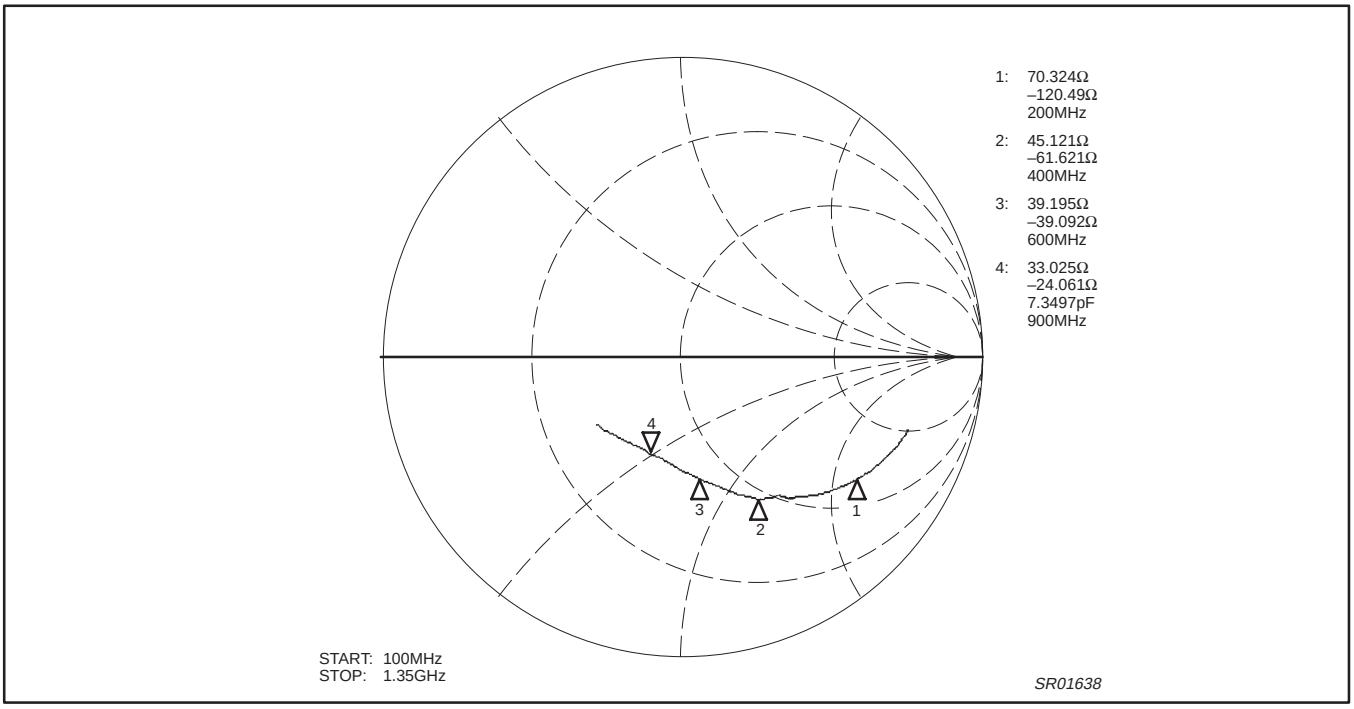


Figure 36. Typical S_{11} for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

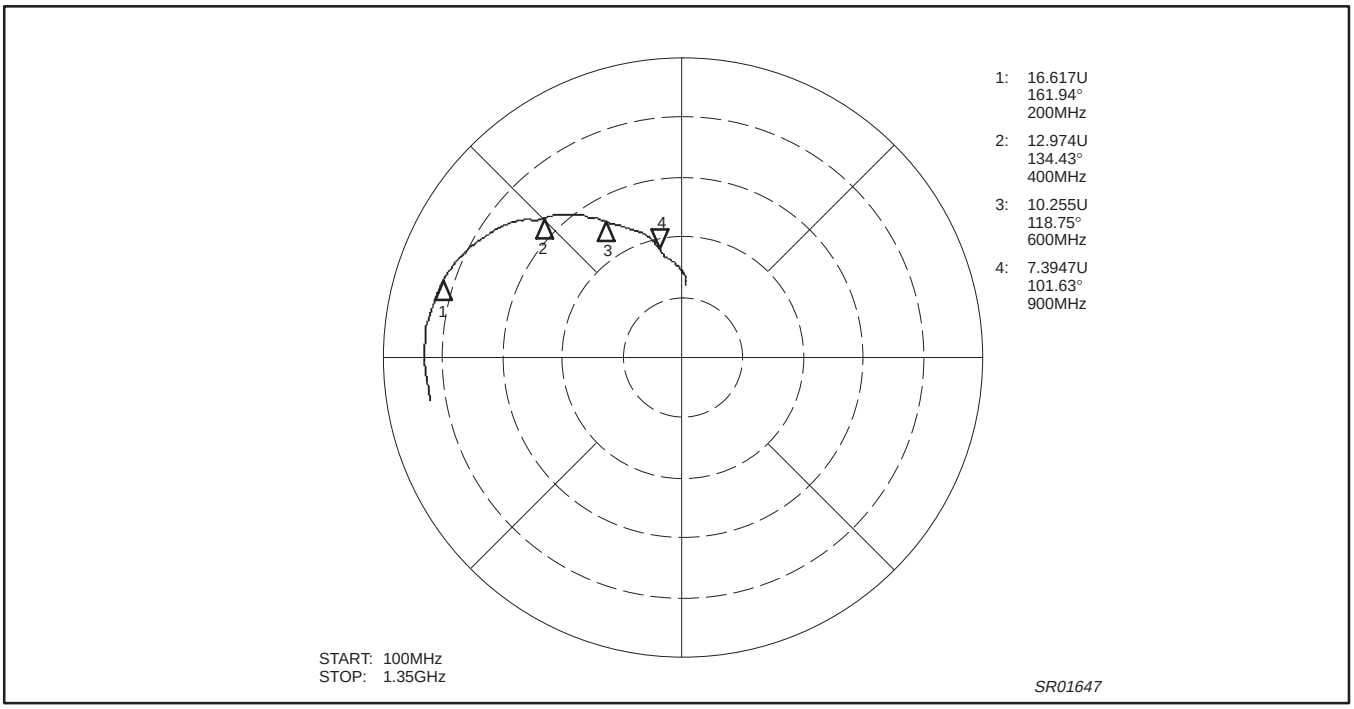


Figure 37. Typical S_{21} of the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

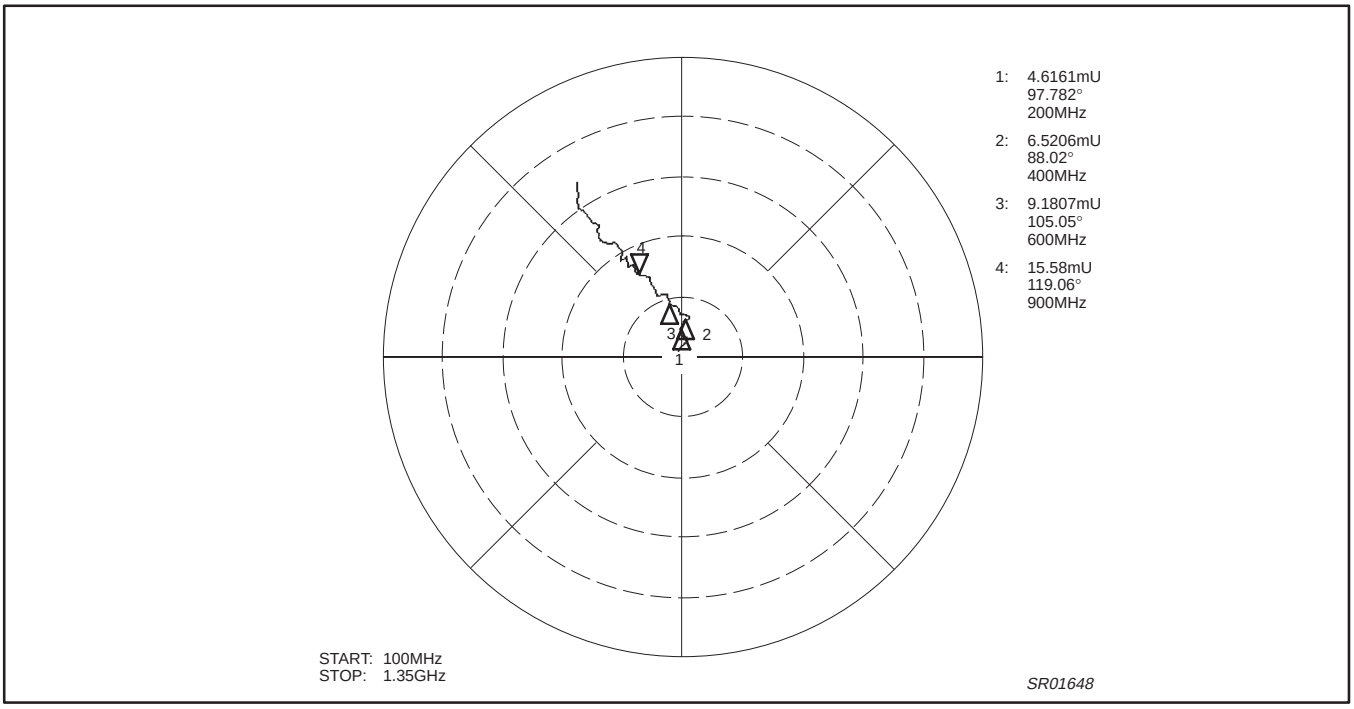


Figure 38. Typical S_{12} for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

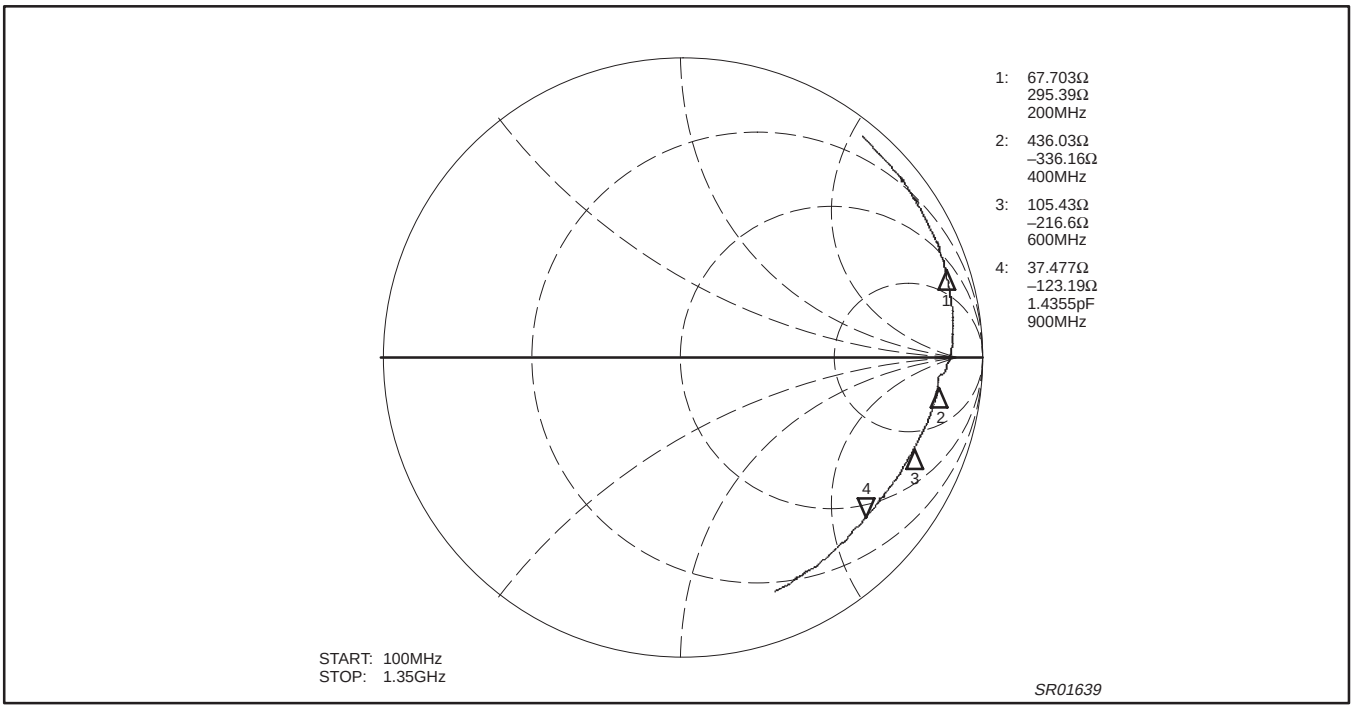


Figure 39. Typical S_{22} for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

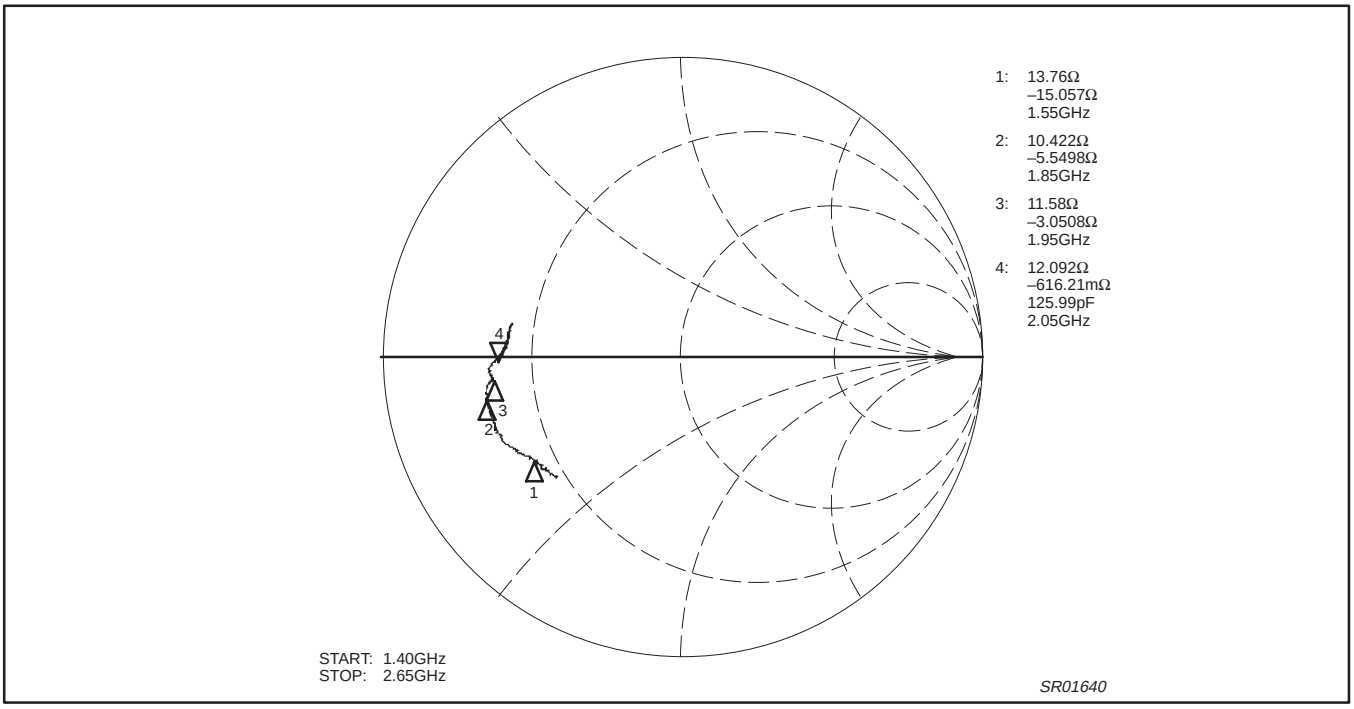


Figure 40. Typical S_{11} for the High Band LNA @ 3.75V for the High Band Receive Normal Mode

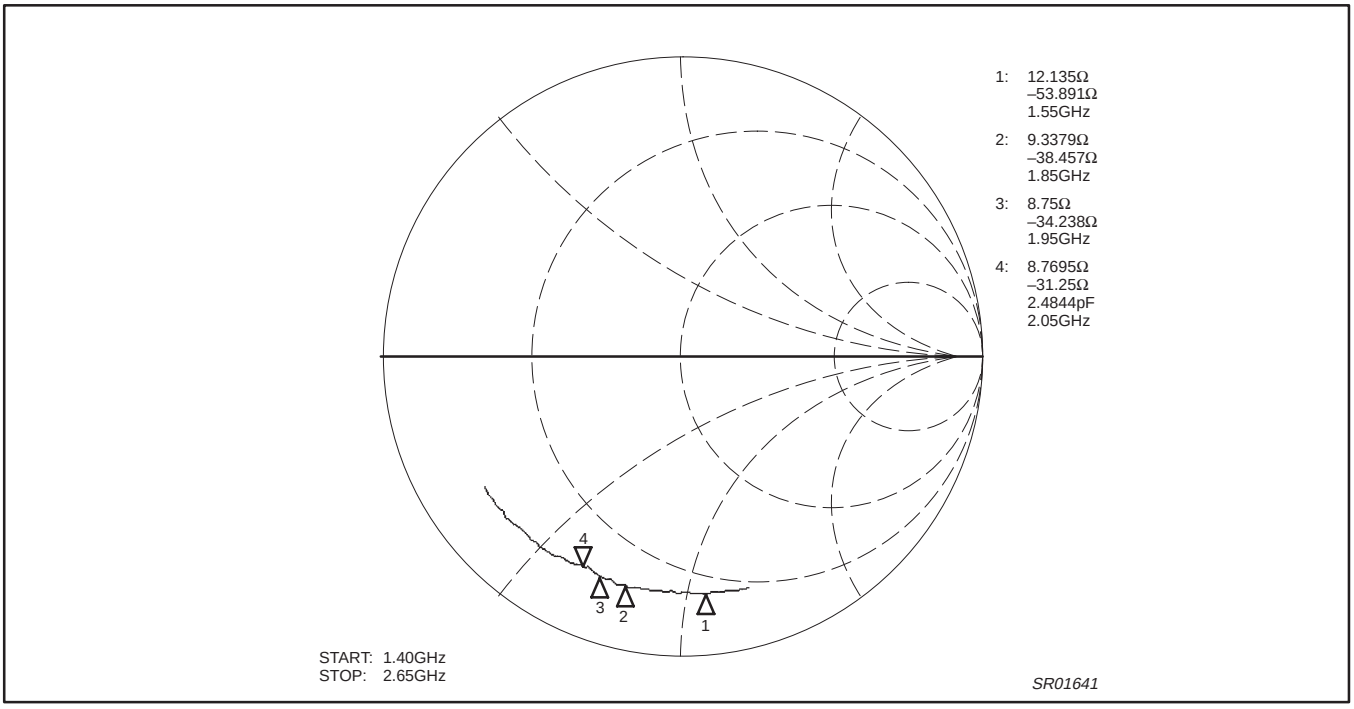


Figure 41. Typical S_{11} for the High Band LNA @ 3.75V for the High Band Receive Strong Signal Mode

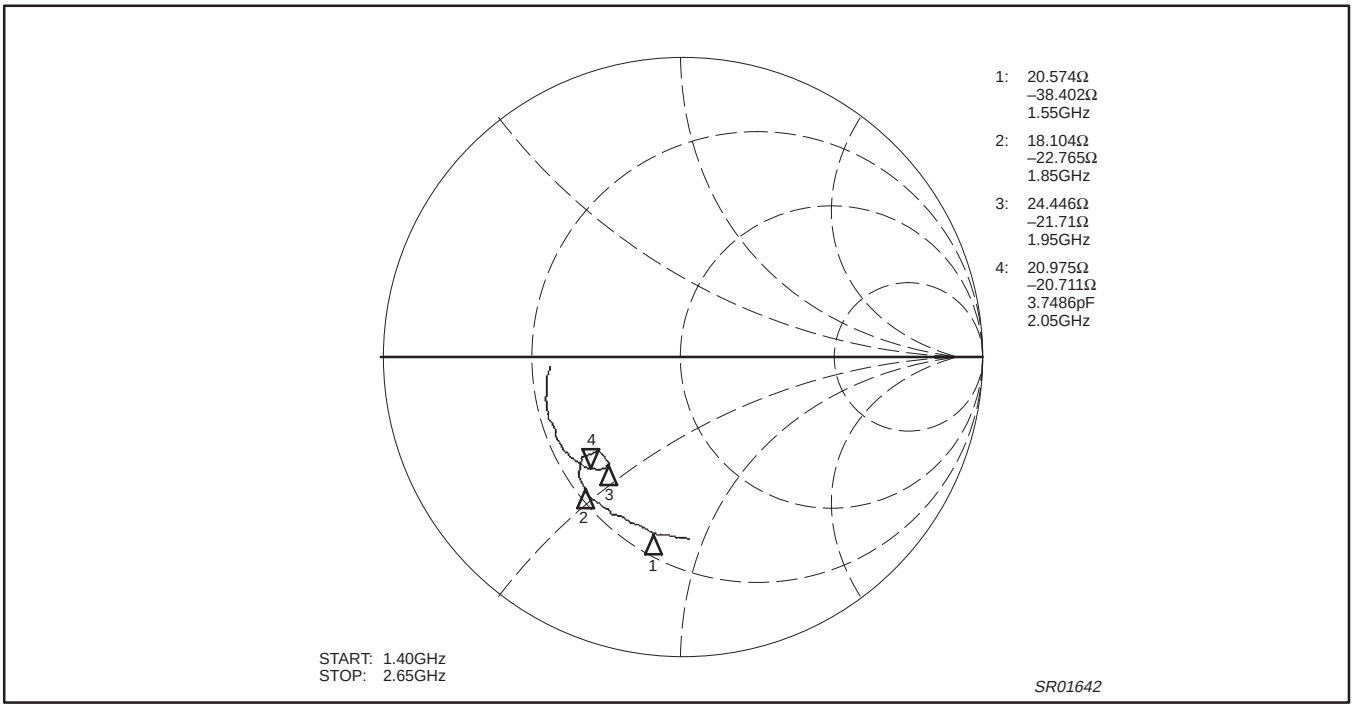


Figure 42. Typical S_{11} of the High Band LO @ 3.75V for the High Band Receive Normal Mode

Table 2. Typical S-Parameters of Low Band LNA at V_{CC} = +3.75V, LB Receive Normal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)	|S21| (U)	<S21 (DEG)	|S12| (U)	<S12 (DEG)	|S22| (U)	<S22 (DEG)
100	0.89	–15.49	8.70	–165.43	0.0027	108.66	0.97	51.38
150	0.87	–22.76	8.71	–179.74	0.0038	93.41	0.96	31.54
200	0.85	–29.87	8.53	170.16	0.0049	92.10	0.96	19.54
250	0.82	–37.01	8.33	161.71	0.0065	86.08	0.95	11.08
300	0.79	–43.99	8.12	154.61	0.0071	82.95	0.94	4.19
350	0.75	–50.47	7.75	148.41	0.0078	69.24	0.93	–1.56
400	0.73	–56.72	7.49	144.24	0.0072	71.73	0.91	–5.69
450	0.70	–63.14	7.24	139.14	0.0078	76.99	0.91	–10.06
500	0.67	–69.13	6.97	134.34	0.0071	82.72	0.90	–13.94
550	0.63	–75.14	6.71	130.13	0.0078	84.15	0.89	–17.69
600	0.61	–81.15	6.45	126.62	0.0074	87.69	0.88	–21.14
650	0.59	–86.84	6.23	122.98	0.0079	91.07	0.88	–24.77
700	0.57	–92.30	6.03	119.16	0.0085	103.71	0.87	–28.09
750	0.55	–97.73	5.80	115.55	0.0098	103.73	0.87	–31.38
800	0.54	–102.99	5.56	111.56	0.0107	113.57	0.86	–34.82
850	0.53	–108.21	5.24	107.93	0.0121	115.45	0.86	–38.18
900	0.52	–113.27	4.97	105.40	0.0134	124.98	0.86	–41.51
950	0.51	–118.12	4.75	104.08	0.0155	127.67	0.86	–44.72
1000	0.51	–122.43	4.62	102.52	0.0175	128.87	0.86	–47.96
1050	0.51	–126.73	4.52	99.54	0.0193	128.89	0.86	–51.12
1100	0.50	–130.83	4.34	96.33	0.0217	129.85	0.86	–54.20
1150	0.51	–134.58	4.13	93.78	0.0238	128.74	0.86	–57.23
1200	0.51	–138.20	3.94	91.13	0.0269	131.20	0.86	–60.03
1250	0.51	–141.69	3.72	88.49	0.0297	130.22	0.87	–62.72
1300	0.51	–145.12	3.46	86.84	0.032	128.07	0.87	–65.57
1350	0.52	–148.25	3.25	86.69	0.033	127.73	0.87	–68.10

Table 3. Typical S-Parameters of Low Band LNA at V_{CC} = +3.75V, LB Strong Signal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)	|S21| (U)	<S21 (DEG)	|S12| (U)	<S12 (DEG)	|S22| (U)	<S22 (DEG)
100	0.94	–8.77	0.05	88.15	0.049	84.08	0.96	50.15
150	0.92	–12.15	0.07	68.32	0.069	63.51	0.95	30.01
200	0.90	–15.01	0.08	55.23	0.082	47.79	0.93	17.79
250	0.88	–17.75	0.09	46.14	0.090	37.04	0.92	9.22
300	0.87	–20.37	0.09	39.25	0.094	28.09	0.91	2.68
350	0.85	–23.15	0.10	33.96	0.099	21.40	0.90	–2.68
400	0.85	–25.85	0.10	29.86	0.100	14.70	0.89	–7.56
450	0.84	–28.73	0.10	26.35	0.102	9.32	0.88	–12.06
500	0.83	–31.65	0.10	23.06	0.103	4.37	0.88	–16.23
550	0.82	–34.56	0.10	20.07	0.103	–0.41	0.87	–20.35
600	0.81	–38.02	0.10	17.87	0.103	–5.17	0.86	–24.23
650	0.80	–41.41	0.10	15.28	0.104	–9.07	0.85	–28.29
700	0.80	–44.70	0.10	12.27	0.104	–13.29	0.85	–32.11
750	0.79	–48.40	0.10	9.05	0.103	–18.00	0.84	–35.85
800	0.78	–52.30	0.10	5.24	0.103	–23.07	0.83	–39.74
850	0.78	–56.58	0.10	2.20	0.102	–28.68	0.83	–43.59
900	0.77	–60.63	0.09	–0.26	0.099	–33.94	0.82	–47.19
950	0.77	–64.88	0.09	–2.21	0.094	–39.65	0.82	–50.95
1000	0.76	–69.05	0.09	–4.19	0.090	–44.01	0.81	–54.29
1050	0.76	–73.21	0.09	–7.58	0.086	–47.95	0.81	–57.67
1100	0.76	–77.26	0.09	–11.56	0.084	–52.34	0.81	–60.86
1150	0.76	–81.34	0.08	–16.05	0.080	–58.43	0.80	–64.05
1200	0.76	–85.37	0.08	–19.50	0.076	–62.90	0.80	–66.96
1250	0.76	–89.33	0.07	–23.71	0.074	–68.35	0.80	–69.89
1300	0.76	–93.28	0.07	–27.20	0.072	–75.17	0.79	–72.64
1350	0.75	–97.37	0.06	–31.20	0.068	–82.58	0.79	–75.21

Table 4. Typical S-Parameters of Low Band LNA at V_{CC} = +3.75V, LB Transmit On (Analog) Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)	|S21| (U)	<S21 (DEG)	|S12| (U)	<S12 (DEG)	|S22| (U)	<S22 (DEG)
100	0.80	–18.49	16.98	–170.30	0.003	121.40	0.95	50.55
150	0.76	–27.25	17.07	173.61	0.004	100.49	0.94	30.44
200	0.72	–35.34	16.62	161.95	0.005	87.01	0.93	18.29
250	0.67	–43.14	15.82	152.47	0.005	88.74	0.92	9.80
300	0.62	–50.04	14.89	144.65	0.007	80.87	0.91	2.68
350	0.57	–55.41	13.73	138.33	0.007	64.95	0.89	–2.99
400	0.55	–61.58	12.97	134.43	0.007	90.16	0.87	–6.38
450	0.51	–67.13	12.27	129.49	0.007	90.97	0.86	–10.66
500	0.47	–72.08	11.53	125.20	0.008	89.19	0.85	–14.35
550	0.44	–76.94	10.83	121.58	0.009	96.23	0.84	–17.92
600	0.42	–81.92	10.24	118.69	0.009	98.83	0.84	–21.27
650	0.40	–86.62	9.78	115.74	0.009	102.03	0.83	–24.85
700	0.38	–91.05	9.32	112.66	0.010	107.95	0.83	–28.04
750	0.37	–95.76	8.89	109.66	0.012	108.58	0.83	–31.27
800	0.36	–100.37	8.46	106.44	0.012	114.73	0.82	–34.68
850	0.35	–105.06	7.92	103.48	0.014	115.62	0.82	–38.05
900	0.34	–109.12	7.39	101.58	0.015	116.40	0.82	–41.29
950	0.34	–113.76	7.02	100.76	0.017	116.04	0.82	–44.70
1000	0.34	–117.50	6.81	99.95	0.019	122.13	0.82	–47.58
1050	0.34	–121.31	6.64	97.57	0.021	122.61	0.83	–50.73
1100	0.34	–124.67	6.36	94.92	0.023	121.36	0.83	–53.76
1150	0.35	–127.76	6.09	92.79	0.025	123.58	0.83	–56.81
1200	0.35	–130.93	5.80	90.59	0.026	125.25	0.83	–59.62
1250	0.36	–133.78	5.48	88.25	0.030	123.53	0.84	–62.32
1300	0.36	–136.90998	5.10	87.00	0.03	122.37	0.84	–65.27
1350	0.37	–140.02216	4.82	87.05	0.03	122.64	0.85	–68.06

Table 5. Typical S-Parameters of Low Band Mixer Input at V_{CC} = +3.75V, LB Receive Normal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)
100	0.85	–13.10
150	0.84	–17.65
200	0.85	–23.74
250	0.85	–29.63
300	0.85	–37.49
350	0.85	–45.23
400	0.85	–54.50
450	0.80	–64.14
500	0.75	–73.90
550	0.70	–82.34
600	0.67	–91.47
650	0.57	–100.54
700	0.53	–106.44
750	0.51	–114.37
800	0.49	–123.87
850	0.48	–132.17
900	0.49	–141.42
950	0.47	–150.07
1000	0.47	–160.64
1050	0.47	–169.49
1100	0.47	–179.79
1150	0.48	171.14
1200	0.48	162.01
1250	0.49	154.08
1300	0.50	144.55
1350	0.51	136.11

Table 6. Typical S-Parameters of Low Band LO Input at V_{CC} = +3.75V, LB Receive Normal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)
100	0.76	–55.83
150	0.73	–78.35
200	0.70	–98.64
250	0.68	–116.73
300	0.66	–133.17
350	0.64	–147.82
400	0.61	–161.51
450	0.59	–173.68
500	0.55	173.99
550	0.51	162.15
600	0.46	150.30
650	0.38	140.69
700	0.29	132.76
750	0.18	131.71
800	0.10	171.44
850	0.18	–150.19
900	0.31	–149.41
950	0.42	–157.78
1000	0.50	–166.73
1050	0.57	–175.14
1100	0.61	177.49
1150	0.64	170.74
1200	0.66	164.22
1250	0.68	157.61
1300	0.68	150.89
1350	0.65	144.80

Table 7. Typical S-Parameters of HB LNA Input at V_{CC} = +3.75V, HB Receive Normal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)
1400	0.58	–135.43
1450	0.59	–138.48
1500	0.59	–141.42
1550	0.60	–144.44
1600	0.62	–146.93
1650	0.63	–149.85
1700	0.65	–154.08
1750	0.66	–158.38
1800	0.66	–162.67
1850	0.66	–167.09
1900	0.65	–170.72
1950	0.63	–172.76
2000	0.64	–175.38
2050	0.61	–178.44
2100	0.60	–179.38
2150	0.59	179.32
2200	0.58	178.44
2250	0.58	177.61
2300	0.57	176.29
2350	0.57	175.39
2400	0.57	174.35
2450	0.56	173.01
2500	0.57	172.12
2550	0.57	170.91
2600	0.56	169.89
2650	0.56	168.41

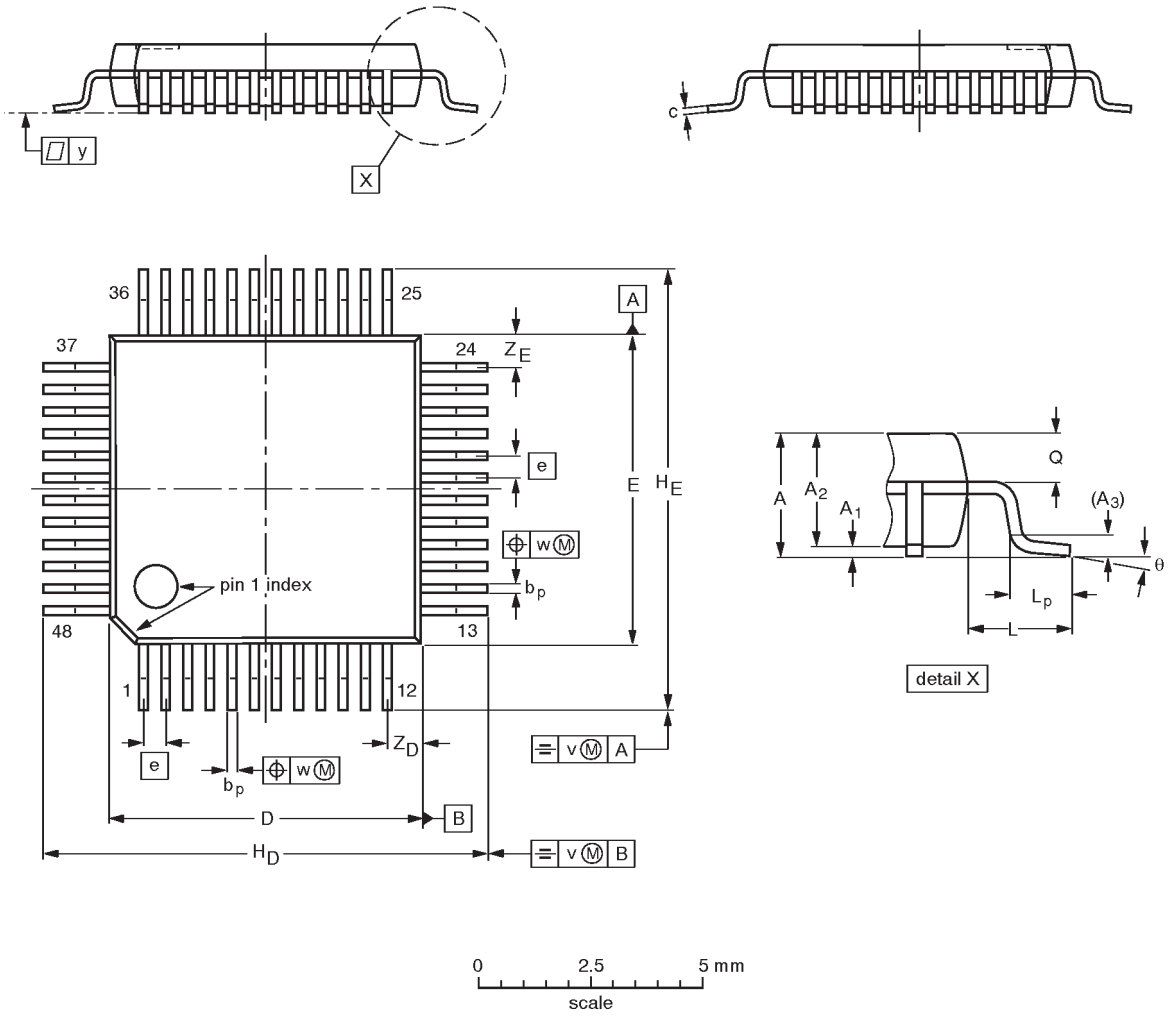
Table 8. Typical S-Parameters of HB LNA Input at V_{CC} = +3.75V, HB Strong Signal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)
1400	0.81	–73.99
1450	0.81	–77.23
1500	0.81	–80.62
1550	0.80	–84.00
1600	0.80	–87.02
1650	0.80	–90.35
1700	0.79	–93.54
1750	0.79	–96.48
1800	0.79	–100.32
1850	0.79	–103.54
1900	0.79	–107.23
1950	0.79	–110.05
2000	0.77	–113.75
2050	0.78	–114.79
2100	0.79	–117.61
2150	0.79	–120.50
2200	0.80	–122.65
2250	0.79	–125.91
2300	0.80	–128.17
2350	0.79	–130.64
2400	0.79	–133.19
2450	0.79	–135.66
2500	0.79	–138.22
2550	0.79	–140.56
2600	0.79	–143.22
2650	0.79	–145.47

Table 9. Typical S-Parameters of HB LO Input at V_{CC} = +3.75V, HB Receive Normal Mode

FREQ (MHz)	|S11| (U)	<S11 (DEG)
1400	0.62	–87.50
1450	0.61	–90.87
1500	0.60	–94.44
1550	0.60	–98.86
1600	0.59	–102.10
1650	0.59	–106.34
1700	0.58	–110.67
1750	0.57	–114.48
1800	0.57	–119.86
1850	0.55	–126.14
1900	0.48	–134.66
1950	0.43	–123.95
2000	0.47	–126.26
2050	0.48	–128.33
2100	0.50	–131.34
2150	0.50	–135.52
2200	0.50	–138.76
2250	0.50	–142.68
2300	0.50	–146.60
2350	0.49	–150.21
2400	0.49	–154.30
2450	0.48	–157.62
2500	0.47	–161.79
2550	0.46	–166.32
2600	0.45	–170.41
2650	0.43	–174.86

LQFP48: plastic low profile quad flat package; 48 leads; body 7 x 7 x 1.4 mm **SOT313-2**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	Q	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.60	0.20 0.05	1.45 1.35	0.25	0.27 0.17	0.18 0.12	7.1 6.9	7.1 6.9	0.5	9.15 8.85	9.15 8.85	1.0	0.75 0.45	0.69 0.59	0.2	0.12	0.1	0.95 0.55	0.95 0.55	7° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT313-2						~~93-06-15~~ 94-12-19

NOTES

Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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