

# DATA SHEET

**SA1920**

Dual-band RF front-end

Product specification  
Supersedes data of 1998 Apr 07  
IC17 Data Handbook

1999 Mar 02

# Dual-band RF front-end

# SA1920

## DESCRIPTION

The SA1920 is an integrated dual-band RF front-end that operates at both cellular (AMPS, GSM and TDMA) and PCS/DCS (TDMA and GSM) 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 881 MHz with 17.5 dB of gain and an IIP3 of -5 dBm. The wide-dynamic range mixer has a 10 dB noise figure at 881 MHz with 9.5 dB of gain and an IIP3 of +5 dBm.

The high-band contains a receiver front-end, doubler 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 4.2 dB at 1960 MHz with a power gain of 23.5 dB and an IIP3 of -12.5 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
- Frequency doubler
- On chip logic for network selection and power down
- Very small outline package

## APPLICATIONS

- 800 to 1000 MHz analog and digital receivers
- 1800 to 2000 MHz digital receivers
- Portable radios
- Digital mobile communications equipment

## PIN CONFIGURATION

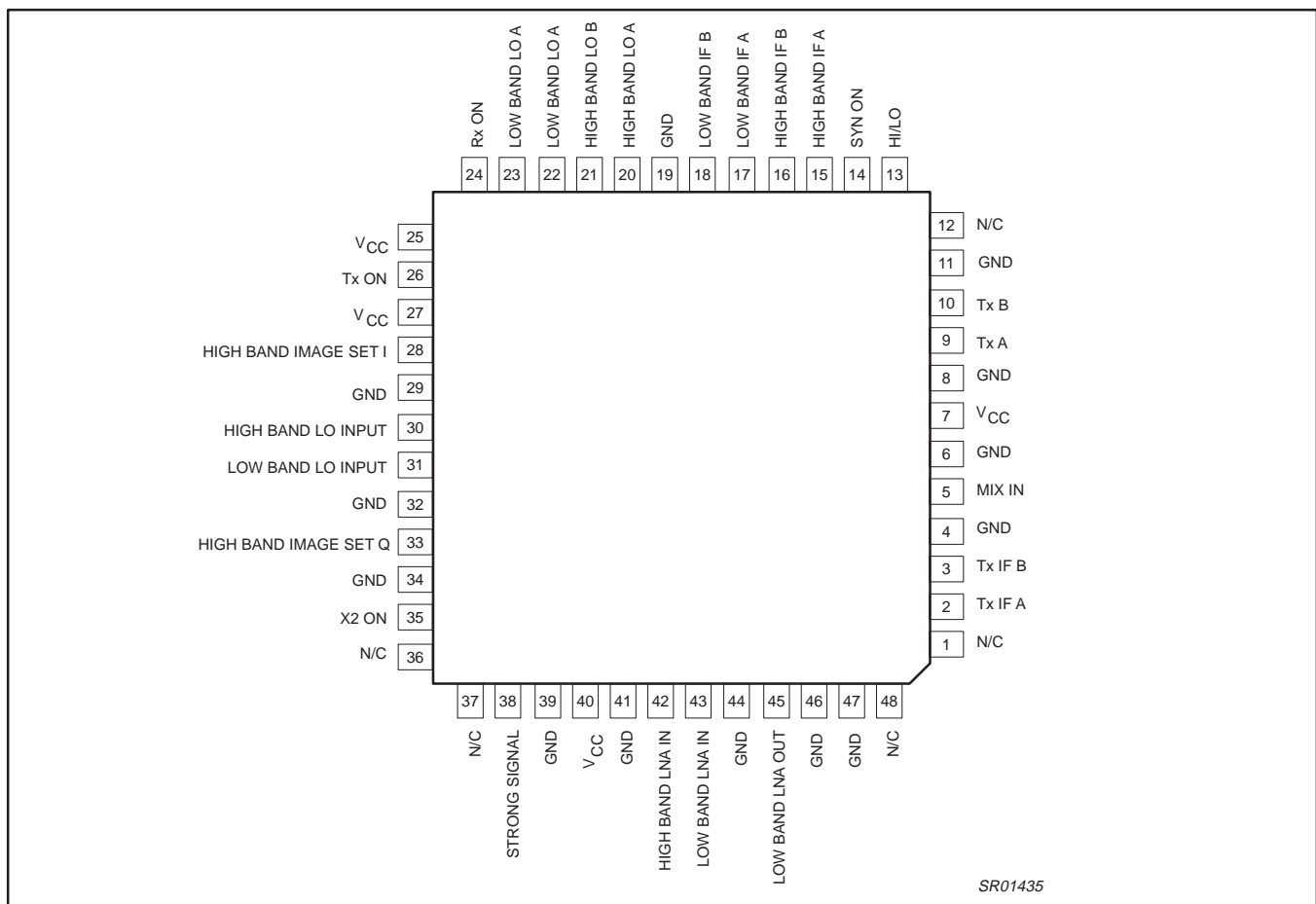


Figure 1. Pin Configuration

## ORDERING INFORMATION

| TYPE NUMBER | PACKAGE |  |          |
|-------------|---------|--|----------|
|             | NAME    | DESCRIPTION  | VERSION  |
| SA1920      | LQFP48  | Plastic low profile quad flat package; 48 leads; body 7x7x1.4 mm | SOT313-2 |

## Dual-band RF front-end

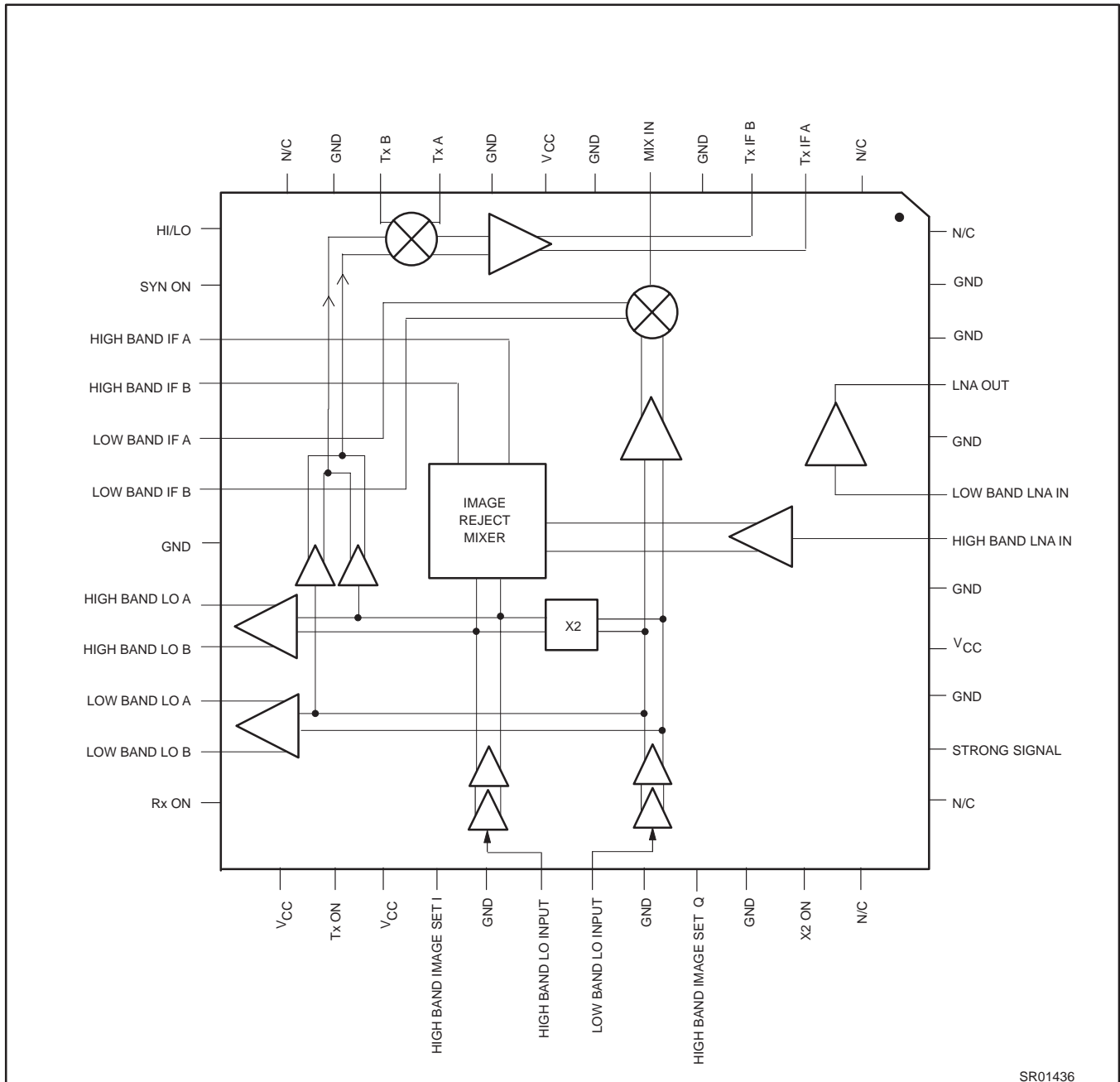
SA1920

## 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 <sub>CC</sub>       | V <sub>CC</sub>             |
| 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 <sub>CC</sub>       | V <sub>CC</sub>             |
| 26      | Tx ON                 | Tx Mixer/Driver Power       |
| 27      | V <sub>CC</sub>       | V <sub>CC</sub>             |
| 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      | X2 ON                 | Freq. Doubler Power Control |
| 36      | N/C                   | No Connection               |
| 37      | N/C                   | No Connection               |
| 38      | STRONG SIGNAL         | Strong Signal Detection     |
| 39      | GND                   | Ground                      |
| 40      | V <sub>CC</sub>       | V <sub>CC</sub>             |
| 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               |

# Dual-band RF front-end

# SA1920



SR01436

Figure 2. Block Diagram

## Dual-band RF front-end

SA1920

**Table 1. POWER DOWN CONTROL**

For Applications Not Using a Frequency Doubler, each state is defined as follows:

| Control State<br>(Hi/Lo, Syn On, Rx On, Tx On, Strong Signal, X2 ON) |                                 | DOUBLER | LO BUFFER |          | LNA       |                 | MIXER     |          | T <sub>X</sub> MIXER DRIVER |          |
|--|---------------------------------|---------|-----------|----------|-----------|-----------------|-----------|----------|-----------------------------|----------|
|  |                                 |         | High Band | Low Band | High Band | Low Band        | High Band | Low Band | High Band                   | Low Band |
| x000xx   | Sleep                           | Off     | Off       | Off      | Off       | Off             | Off       | Off      | Off                         | Off      |
| 010000   | Low-Band LO Buffer on           | Off     | Off       | On       | Off       | Off             | Off       | Off      | Off                         | Off      |
| 011000   | Low-Band Receive Normal         | Off     | Off       | On       | Off       | On              | Off       | On       | Off                         | Off      |
| 011010   | Low-Band receive Strong Signal  | Off     | Off       | On       | Off       | Off             | Off       | On       | Off                         | Off      |
| 011100   | Low-Band Transmit (Analog only) | Off     | Off       | On       | Off       | On<br>High Bias | Off       | On       | Off                         | On       |
| 010100   | N/A                             | Off     | Off       | On       | Off       | Off             | Off       | Off      | Off                         | On       |
| 110000   | High-Band LO Buffer On          | Off     | On        | Off      | Off       | Off             | Off       | Off      | Off                         | Off      |
| 111000   | High-Band Receive Normal        | Off     | On        | Off      | On        | Off             | On        | Off      | Off                         | Off      |
| 111010   | High-Band Receive Strong Signal | Off     | On        | Off      | Off       | Off             | On        | Off      | Off                         | Off      |
| 110100   | N/A                             | Off     | On        | Off      | Off       | Off             | Off       | Off      | On                          | Off      |

For Applications Using a Frequency Doubler, each state is defined as follows:

| Control State<br>(Hi/Lo, Syn On, Rx On, Tx On, Strong Signal, X2 ON) |                                 | DOUBLER | LO BUFFER |          | LNA       |                 | MIXER     |          | T <sub>X</sub> MIXER DRIVER |          |
|--|---------------------------------|---------|-----------|----------|-----------|-----------------|-----------|----------|-----------------------------|----------|
|  |                                 |         | High Band | Low Band | High Band | Low Band        | High Band | Low Band | High Band                   | Low Band |
| x000xx   | Sleep                           | Off     | Off       | Off      | Off       | Off             | Off       | Off      | Off                         | Off      |
| 010000   | Transmit (Low and High Band)    | Off     | Off       | On       | Off       | Off             | Off       | Off      | Off                         | Off      |
| 011000   | Low-Band Receive Normal         | Off     | Off       | On       | Off       | On              | Off       | On       | Off                         | Off      |
| 011010   | Low-Band Receive Strong Signal  | Off     | Off       | On       | Off       | Off             | Off       | On       | Off                         | Off      |
| 011110   | Low-Band Transmit (Analog only) | Off     | Off       | On       | Off       | On<br>High Bias | Off       | On       | Off                         | Off      |
| 010100   | Low-Band Transmit (GSM)         | Off     | Off       | On       | Off       | Off             | Off       | Off      | Off                         | On       |
| 010001   | Transmit (Low and High Band)    | On      | Off       | On       | Off       | Off             | Off       | Off      | Off                         | Off      |
| 011001   | Low-Band Receive Normal         | On      | Off       | On       | Off       | On              | Off       | On       | Off                         | Off      |
| 011011   | Low-Band Receive Strong Signal  | On      | Off       | On       | Off       | Off             | Off       | On       | Off                         | Off      |
| 011111   | Low-Band Transmit(Analog only)  | On      | Off       | On       | Off       | On<br>High Bias | Off       | On       | Off                         | Off      |
| 111001   | High-Band Receive Normal        | On      | On        | On       | On        | Off             | On        | Off      | Off                         | Off      |
| 111011   | High-Band Receive Strong Signal | On      | On        | On       | Off       | Off             | On        | Off      | Off                         | Off      |
| 110101   | High-Band Transmit (GSM)        | On      | On        | On       | Off       | Off             | Off       | Off      | On                          | Off      |

**NOTE:**

"0" is low logic state; "1" is high logic state.

## Dual-band RF front-end

SA1920

### 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 1800 to 2000 MHz frequency range with over 30 dB of rejection over an intermediate frequency (IF) range from 100 to 125 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 all-pass type phase shifter to provide quadrature LO signals to the receive mixers. The all-pass 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, X2 (doubler) On, 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.

The doubler (X2) on mode enables the doubler. When the doubler is on, the input signal from the LO buffers is doubled in frequency. The signal can be used to drive the image-rejection mixer and the output LO high-band ports. When the doubler mode is on, all other control logic (see table 1) functions the same.

### 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.

## Dual-band RF front-end

SA1920

**ABSOLUTE MAXIMUM RATINGS**

| QUANTITY                                    | SYMBOL    | VALUE       | UNIT |
|---|-----------|-------------|------|
| Input supply voltage at pins: 7, 25, 27, 40 | $V_{CC}$  | 4.75        | V    |
| Power dissipation                           | $P_D$     | 150         | mW   |
| Input power at all ports                    | $P_{IN}$  | +20         | dBm  |
| Operating temperature range (pin temp)      | $T_O$     | -40 to+85   | °C   |
| Storage temperature range                   | $T_{srg}$ | -65 to +125 | °C   |

**DC ELECTRICAL CHARACTERISTICS**

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

**DC PARAMETERS**

$V_{CC} = +3.75$  V,  $T_A = -40$  to  $+85$ °C unless otherwise noted

| QUANTITY                        | CONDITION | SYMBOL   | MIN. | TYP. | MAX. | UNIT |
|---------------------------------|-----------|----------|------|------|------|------|
| DC Supply voltage               |           | $V_{CC}$ | 3.6  | 3.75 | 3.9  | V    |
| Current Consumption: Sleep Mode | X000XX    | $I_{CC}$ |      | 1    | 100  | μA   |
| Low Band Receive Normal         | 011000    | $I_{CC}$ | 10.1 | 12.5 | 15.2 | mA   |
| Low Band Receive Strong         | 011010    | $I_{CC}$ |      | 8.8  |      | mA   |
| Low Band Transmit (Analog)      | 011110    | $I_{CC}$ |      | 18.0 |      | mA   |
| Low Band Transmit (GSM)         | 010100    | $I_{CC}$ |      | 16.0 |      | mA   |
| High Band Receive Normal        | 111000    | $I_{CC}$ | 35.0 | 42.0 | 53.0 | mA   |
| High Band Receive Strong        | 111010    | $I_{CC}$ |      | 38.0 |      | mA   |
| High Band Transmit (GSM)        | 110100    | $I_{CC}$ |      | 21.5 |      | mA   |
| Frequency Doubler               |           |          |      | 8.8  |      | mA   |
| Logic Low Input                 |           |          | 0    |      | 0.5  | V    |
| Logic High Input                |           |          | 1.9  |      | 4.0  | V    |

## Dual-band RF front-end

SA1920

**AC ELECTRICAL CHARACTERISTICS****Low-Band, Dual Mode of Operation** $V_{CC} = +3.75$  V,  $F_{req_{RF}} = 881$  MHz,  $F_{req_{LO}} = 991.52$  MHz,  $P_{in} = -3$  dBm,  $T_A = +25^\circ\text{C}$ ; unless otherwise stated

| PARAMETERS  | Min  | $-3\sigma$ | TYP    | $+3\sigma$ | Max  | UNITS           | NOTES |
|---|------|------------|--------|------------|------|-----------------|-------|
| <b>System</b>                                     |      |            |        |            |      |                 |       |
| RF Input Frequency Range                          | 869  |            | 881    |            | 960  | MHz             |       |
| IF Frequency                                      |      |            | 110.52 |            |      | MHz             |       |
| LO Frequency                                      |      |            | 991.52 |            |      | MHz             |       |
| Cascaded Power Gain; includes 3dB filter loss     | 22.5 |            | 24     |            | 25.5 | dB              |       |
| Power Gain Reduction (Strong Signal Mode—LNA Off) | 29   |            | 35     |            | 41   | dB              |       |
| Cascaded Noise Figure; includes 3dB filter loss   |      |            | 2.6    |            |      | dB              |       |
| <b>LNA</b>  |      |            |        |            |      |                 |       |
| LNA Gain  |      | 17         | 17.5   | 18         |      | dB              |       |
| LNA IIP3  |      | -6         | -5     | -4         |      | dBm             |       |
| LNA Noise Figure                                  |      | 1.6        | 1.7    | 1.8        |      | dB              |       |
| <b>Mixer</b>                                      |      |            |        |            |      |                 |       |
| Mixer Gain  |      | 9          | 9.5    | 10         |      | dB              |       |
| Mixer IIP3  |      | 4          | 5      | 6          |      | dBm             |       |
| Mixer Noise Figure                                |      | 9          | 10     | 11         |      | dB              |       |
| <b>Other</b>                                      |      |            |        |            |      |                 |       |
| Input Impedance, RF Port                          |      |            | 50     |            |      | $\Omega$        |       |
| 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    |            |      | $\mu\text{sec}$ |       |

**Low-Band LO Buffer**

| PARAMETERS                    | Min | $-3\sigma$ | TYP.   | $+3\sigma$ | Max | UNITS           | NOTES |
|-------------------------------|-----|------------|--------|------------|-----|-----------------|-------|
| LO Frequency                  |     |            | 991.52 |            |     | MHz             |       |
| Differential Output Power     |     |            | -7     |            |     | dBm             |       |
| Differential Output Impedance |     |            | 100    |            |     | $\Omega$        |       |
| Harmonic Content              |     |            | -20    |            |     | dBc             |       |
| Input Power                   | -5  |            | -3     |            | -1  | dBm             |       |
| Input Impedance               |     |            | 50     |            |     | $\Omega$        | 1     |
| Turn On/Off Time              |     |            | 30     |            |     | $\mu\text{sec}$ |       |



## Dual-band RF front-end

SA1920

## AC ELECTRICAL CHARACTERISTICS

High-Band, Single Mode of Operation  
LNA and Image Reject Mixer $V_{CC} = +3.75$  V,  $F_{req_{RF}} = 1960$  MHz,  $F_{req_{LO}} = 2070.52$  MHz,  $P_{in} = -3$  dBm,  $T_A = +25^\circ$  C; unless otherwise stated

| PARAMETERS  | MIN  | $-3\sigma$ | TYP.   | $+3\sigma$ | MAX  | UNITS     | NOTES |
|---|------|------------|--------|------------|------|-----------|-------|
| RF Input Frequency Range  | 1805 |            |        |            | 1990 | MHz       |       |
| IF Frequency  | 100  |            | 110.52 |            | 125  | MHz       |       |
| LO Frequency  | 1905 |            |        |            | 2115 | MHz       |       |
| Power Gain  | 21   |            | 23.5   |            | 25   | dB        |       |
| Power Gain Reduction (Strong Signal Mode—LNA Off)   | 40   |            | 47     |            | 54   | dB        |       |
| Noise Figure  |      | 4.0        | 4.2    | 4.4        |      | dB        |       |
| Input Impedance, RF Port  |      |            | 50     |            |      | $\Omega$  |       |
| Return Loss at Inputs   |      |            |        |            | -10  | dB        | 1     |
| LO leakage at RF Port   |      |            | -48    |            |      | dBm       |       |
| 1 dB RF Input Compression Point   |      |            | -24    |            |      | dBm       |       |
| IP3 (3 <sup>RD</sup> Order Intermodulation Product)<br>Referred to the RF Input Port  |      | -15        | -12.5  | -10        |      | dBm       |       |
| (2 x LO) – (2 x RF) Spur Performance<br>-50 dBm IN Referred to RF Input Port<br>Measure at LO = 2040 MHz and RF = 1985 MHz    |      |            | -65    |            |      | dBc       |       |
| (3 x LO) – (3 x RF) Spur Performance.<br>-50 dBm IN Referred to RF Input Port.<br>Measure at LO = 2040 MHz and RF = 2003 MHz. |      |            | -62.5  |            |      | dBc       |       |
| Image rejection, $f_{RX}+2f_{IF}$ or $f_{RX}-2f_{IF}$<br>Referred to the RF Input Port  | 30   |            | 35     |            |      | dB        |       |
| LO Input Power  | -5   |            | -3     |            | -1   | dBm       |       |
| Turn ON/OFF Time  |      |            | 30     |            |      | $\mu$ sec |       |

## High-Band LO Buffer

| PARAMETERS                    | MIN  | $-3\sigma$ | TYP. | $+3\sigma$ | MAX  | UNITS     | NOTES |
|-------------------------------|------|------------|------|------------|------|-----------|-------|
| LO Frequency Range            | 1905 |            |      |            | 2115 | MHz       |       |
| Differential Output Power     |      |            | -9   |            |      | dBm       |       |
| Differential Output Impedance |      |            | 100  |            |      | $\Omega$  |       |
| Harmonic Content              |      |            |      |            | -20  | dBc       |       |
| Input Power                   | -5   |            | -3   |            | -1   | dBm       |       |
| Input Impedance               |      |            | 50   |            |      | $\Omega$  | 1     |
| Turn On/Off Time              |      |            | 30   |            |      | $\mu$ sec |       |

## Dual-band RF front-end

SA1920

## Frequency Doubler

| PARAMETERS                                   | MIN  | -3 $\sigma$ | TYP. | +3 $\sigma$ | MAX  | UNITS     | NOTES |
|--|------|-------------|------|-------------|------|-----------|-------|
| Output Frequency Range                       | 1905 |             |      |             | 2115 | MHz       |       |
| Output Power                                 |      |             | -9   |             |      | dBm       |       |
| Differential Output Impedance                |      |             | 100  |             |      | $\Omega$  |       |
| Harmonic Content (3F, 4F, etc.)              |      |             | -20  |             |      | dBc       |       |
| Subharmonic Content ( $F_i$ )                |      |             | -20  |             |      | dBc       |       |
| Non-Harmonic Content                         |      |             | 80   |             |      | dBc       |       |
| Turn On/Off Time                             |      |             | 30   |             |      | $\mu$ sec |       |
| Phase Noise Degradation, $\Delta f = 30$ kHz |      |             | 6    |             |      | dB        |       |

## Transmit Mixer

| PARAMETERS   | MIN | -3 $\sigma$ | TYP. | +3 $\sigma$ | MAX  | UNITS    | NOTES |
|--|-----|-------------|------|-------------|------|----------|-------|
| T <sub>X</sub> Mixer Input Frequency                 | 824 |             |      |             | 1910 | MHz      |       |
| T <sub>X</sub> RF Input Impedance, Balanced          |     |             | 200  |             |      | $\Omega$ |       |
| T <sub>X</sub> Mixer Output Frequency                | 70  |             |      |             | 200  | MHz      |       |
| T <sub>X</sub> IF Load Impedance                     |     |             | 1000 |             |      | $\Omega$ |       |
| Maximum T <sub>X</sub> IF Load Capacitance           |     |             |      |             | 2    | pF       |       |
| Conversion Power Gain                                |     | 15          | 16   | 17          |      | dB       | 2     |
| 1 dB Input Compression Point                         |     |             | -17  |             |      | dBm      |       |
| IIP2   |     |             | 20   |             |      | dBm      |       |
| IIP3   |     | -9          | -7   | -5          |      | dBm      |       |
| Noise Figure (double sideband)                       |     |             | 7.5  |             |      | dB       |       |
| Reverse Isolation T <sub>XIN</sub> -L <sub>OIN</sub> | 40  |             |      |             |      | dB       |       |
| Isolation L <sub>OIN</sub> -T <sub>XIN</sub>         | 40  |             |      |             |      | dB       |       |

## NOTES:

- External matching network is required.
- From 200 $\Omega$  input to a 1k $\Omega$  output.

# Dual-band RF front-end

# SA1920

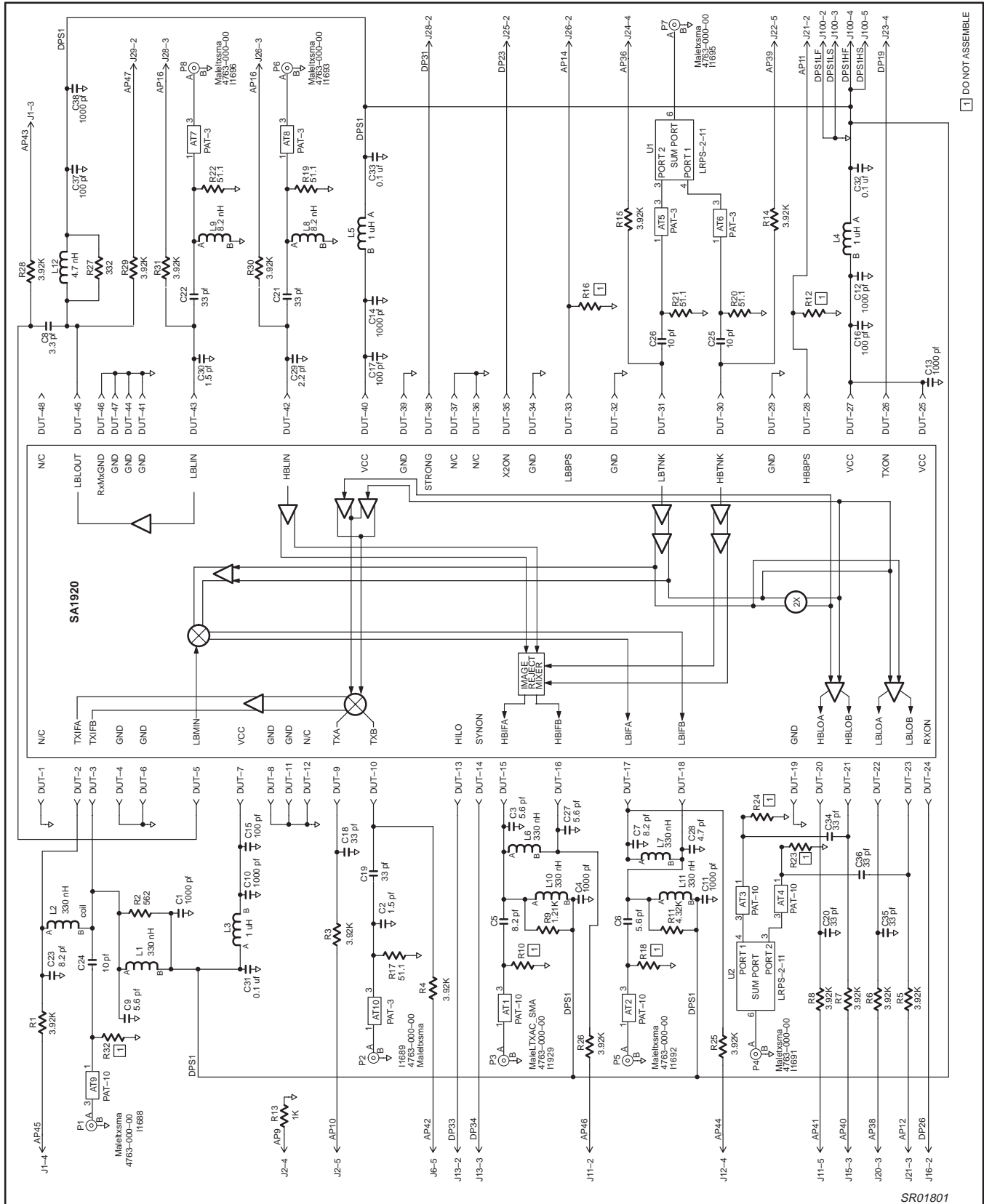


Figure 3. SA1920 Dual-Band Test Circuit

Dual-band RF front-end

SA1920

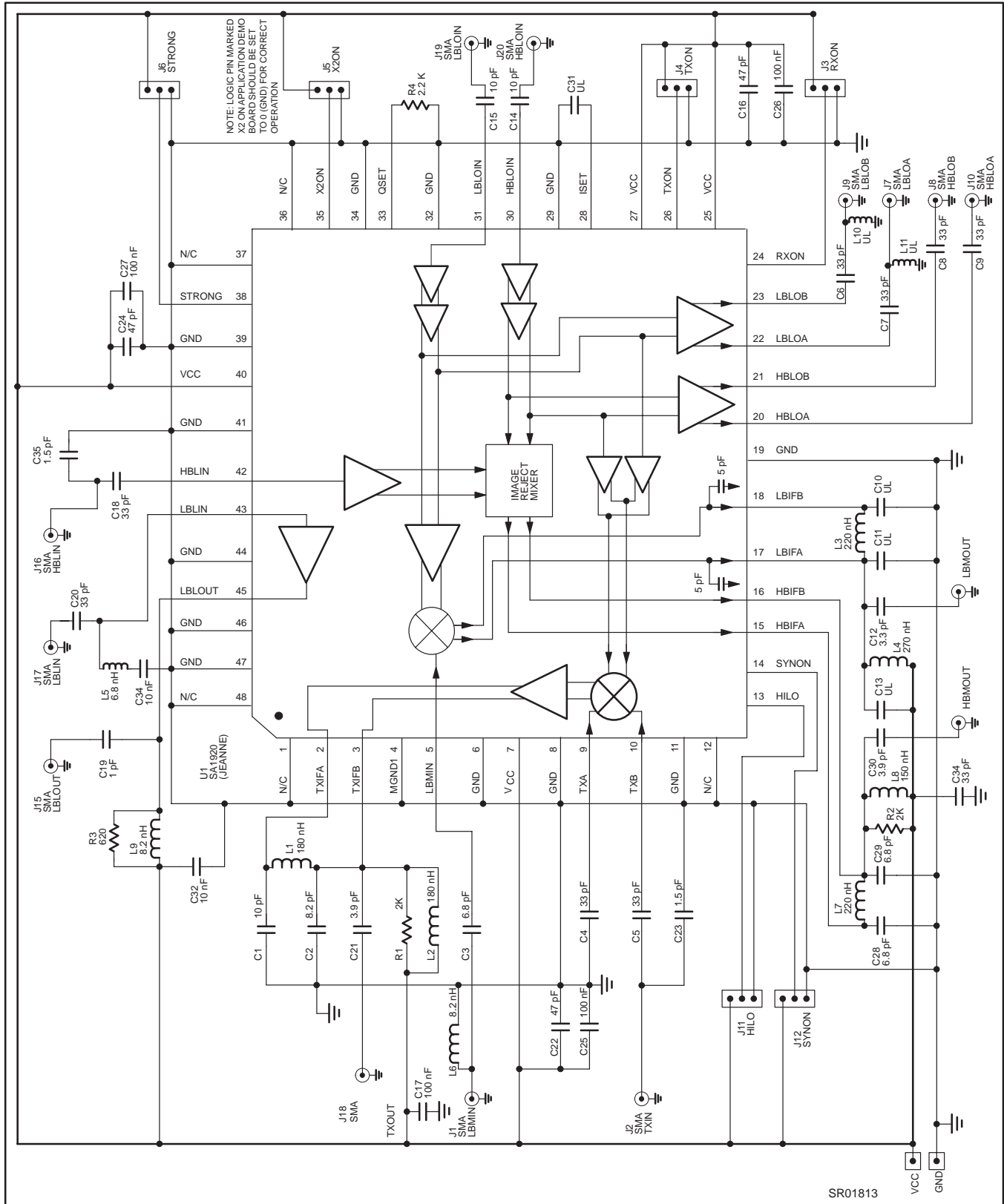


Figure 4. SA1920 Dual-Band Application Circuit

# Dual-band RF front-end

# SA1920

## PERFORMANCE CHARACTERISTICS

$V_{CC} = +3.75$  V,  $Freq_{RF} = 1960$  MHz,  $Freq_{LO} = 2070.52$  MHz,  $P_{in} = -5$  dBm,  $T_A = +25^\circ\text{C}$ ; unless otherwise stated

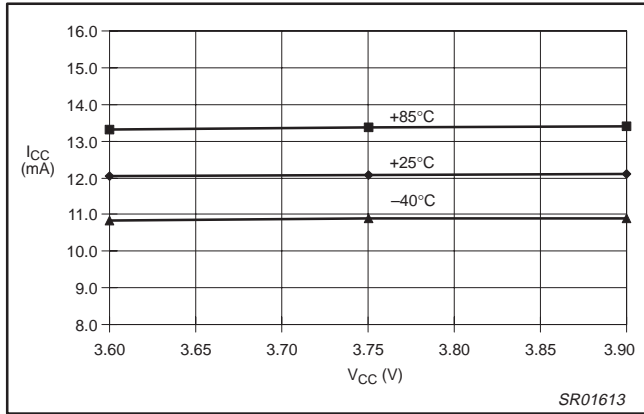


Figure 5. Low Band Receive Normal ICC

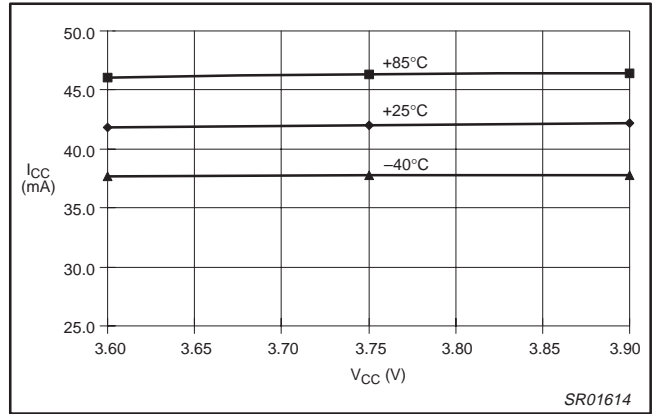


Figure 6. High Band Receive Normal ICC

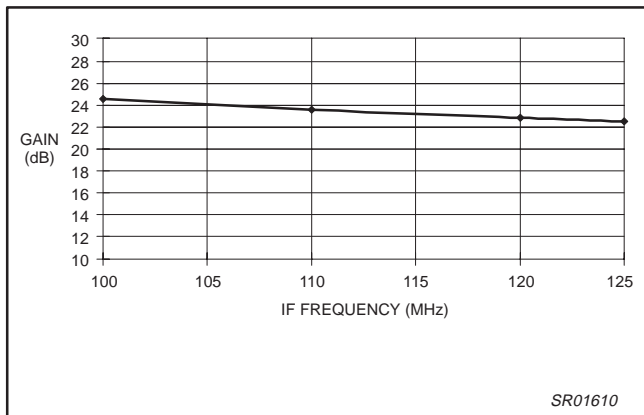


Figure 7. High Band Gain vs. IF Frequency

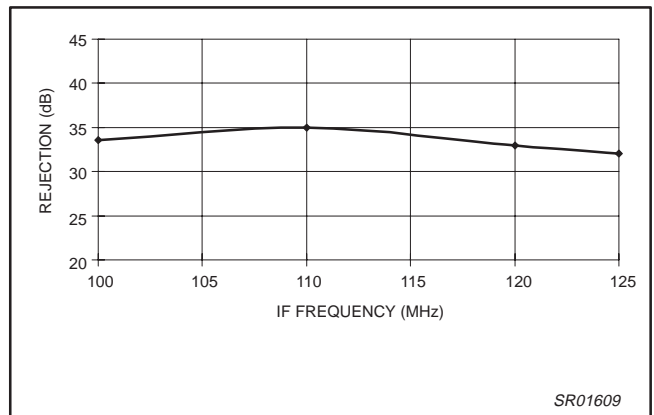


Figure 8. High Band Image Rejection vs. IF Frequency

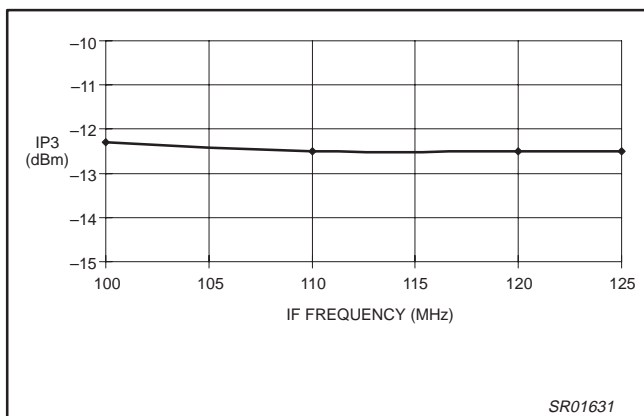


Figure 9. High Band IP3 vs. IF Frequency

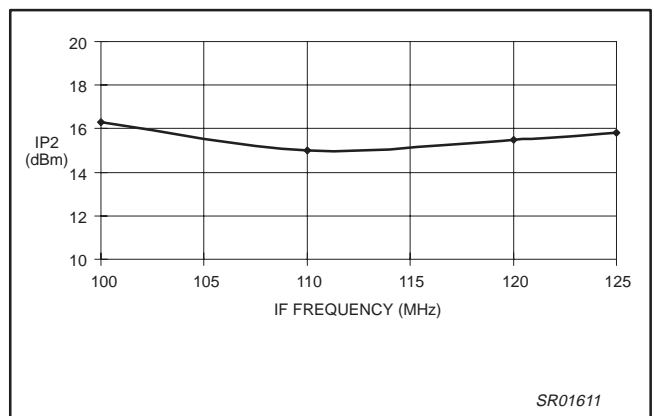


Figure 10. High Band IP2 vs. IF Frequency

# Dual-band RF front-end

# SA1920

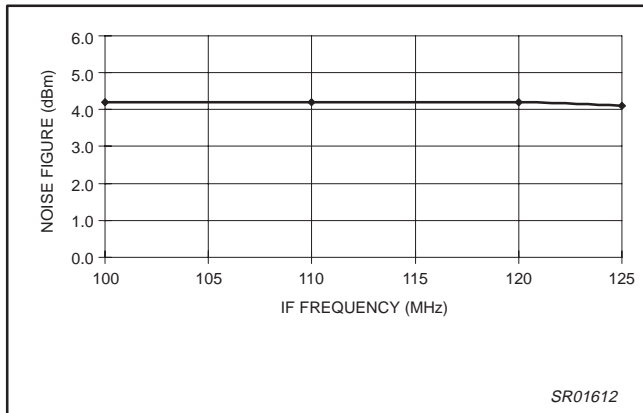


Figure 11. High Band NF vs. IF Frequency

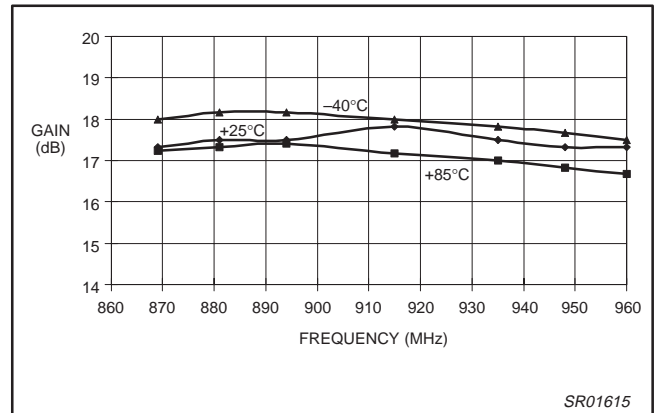


Figure 12. LB LNA Gain vs. Frequency

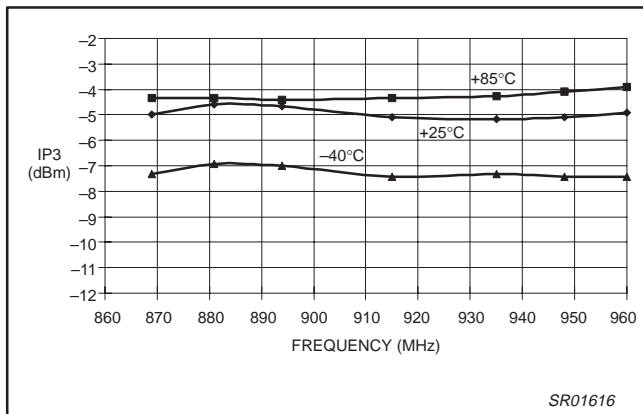


Figure 13. LB LNA IP3 vs. Frequency

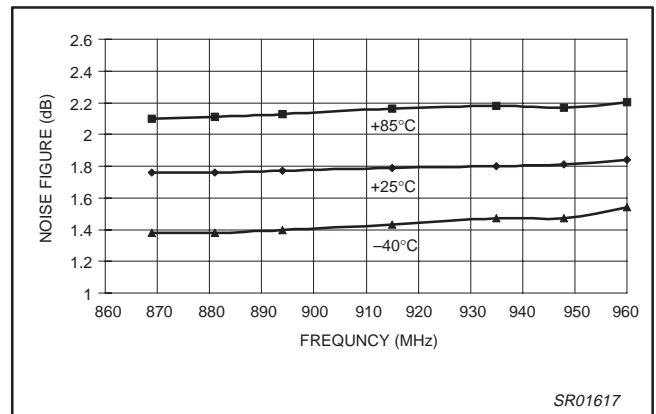


Figure 14. LB LNA Noise Figure vs. Frequency

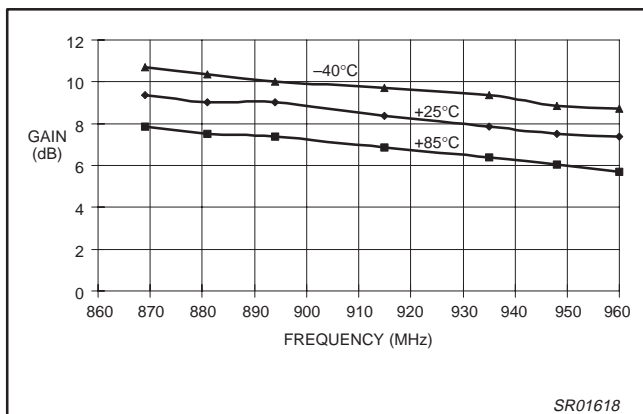


Figure 15. LB Mixer Gain vs. Frequency

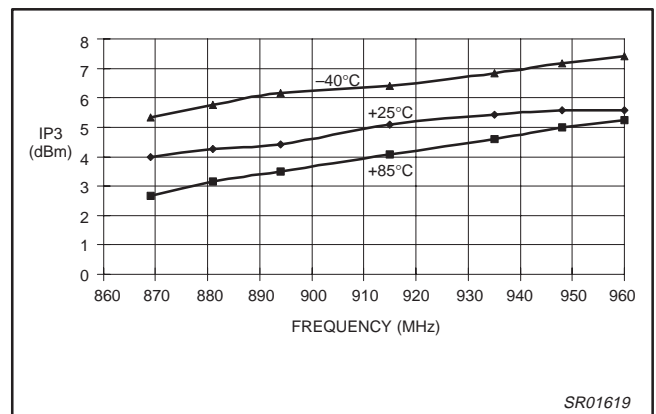


Figure 16. LB Mixer IP3 vs. Frequency

Dual-band RF front-end

SA1920

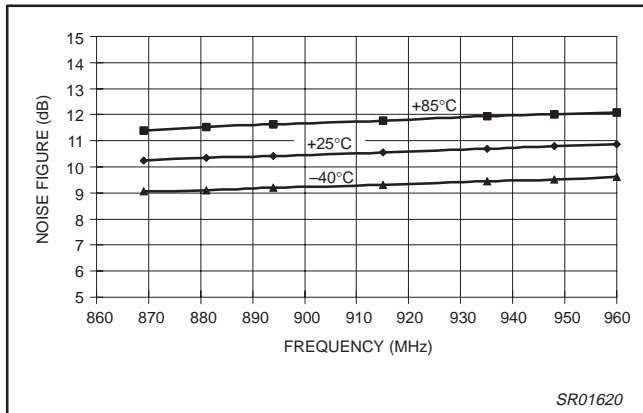


Figure 17. LB Mixer Noise Figure vs. Frequency

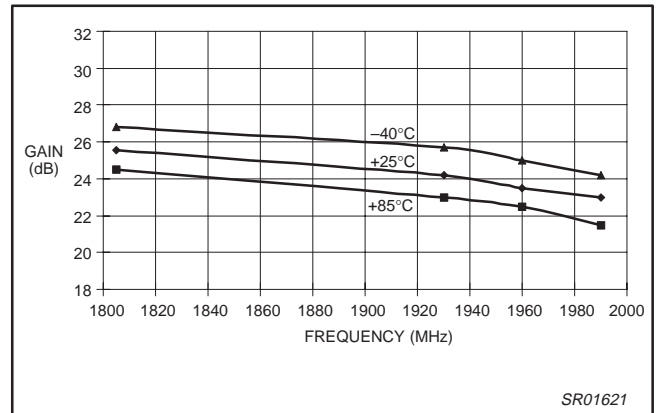


Figure 18. HB Gain vs. Frequency

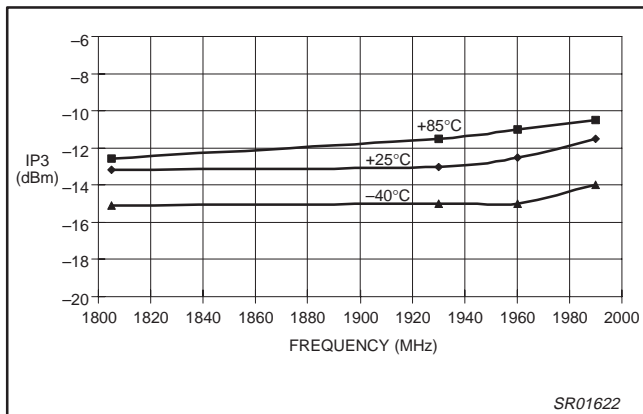


Figure 19. HB IP3 vs. Frequency

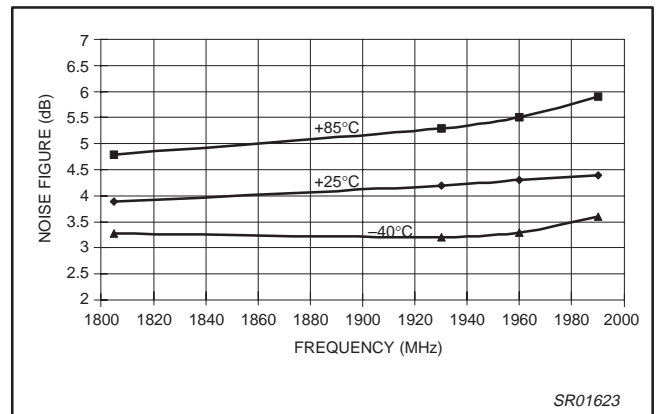


Figure 20. HB Noise Figure vs. Frequency

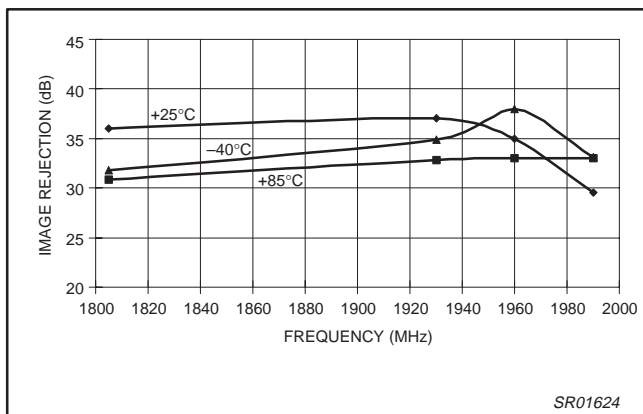


Figure 21. HB Image Rejection vs. Frequency

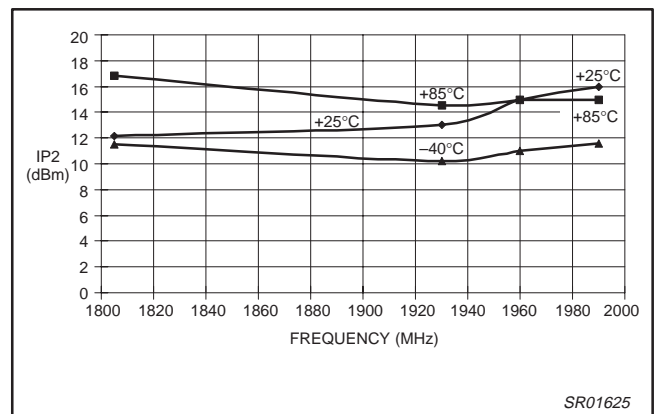


Figure 22. HB IP2 vs. Frequency

Dual-band RF front-end

SA1920

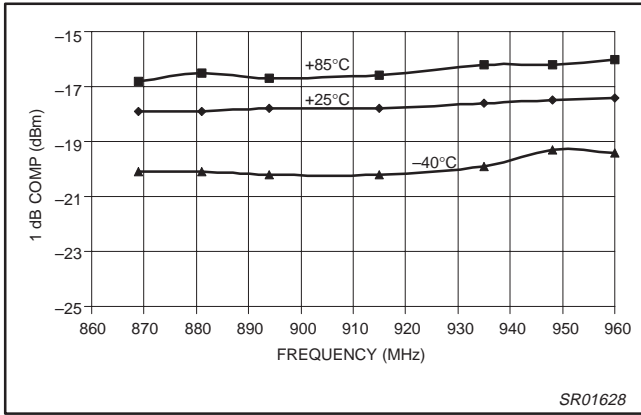


Figure 23. LB LNA 1 dB Compression vs. Frequency

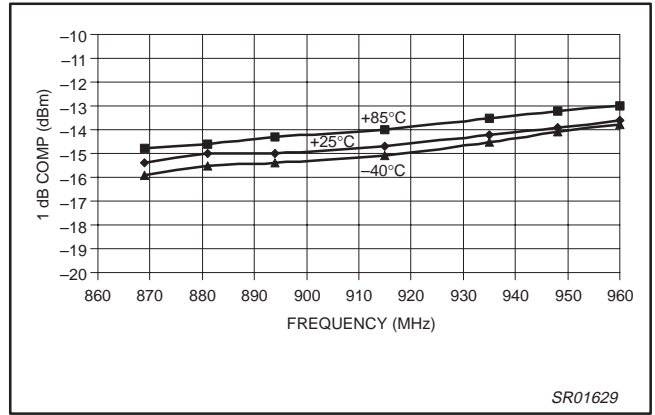


Figure 24. LB Mixer 1 dB Compression vs. Frequency

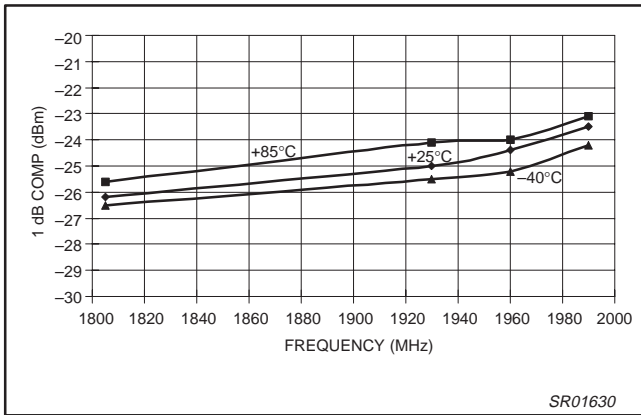


Figure 25. HB 1 dB Compression vs. Frequency



Dual-band RF front-end

SA1920

S-PARAMETERS

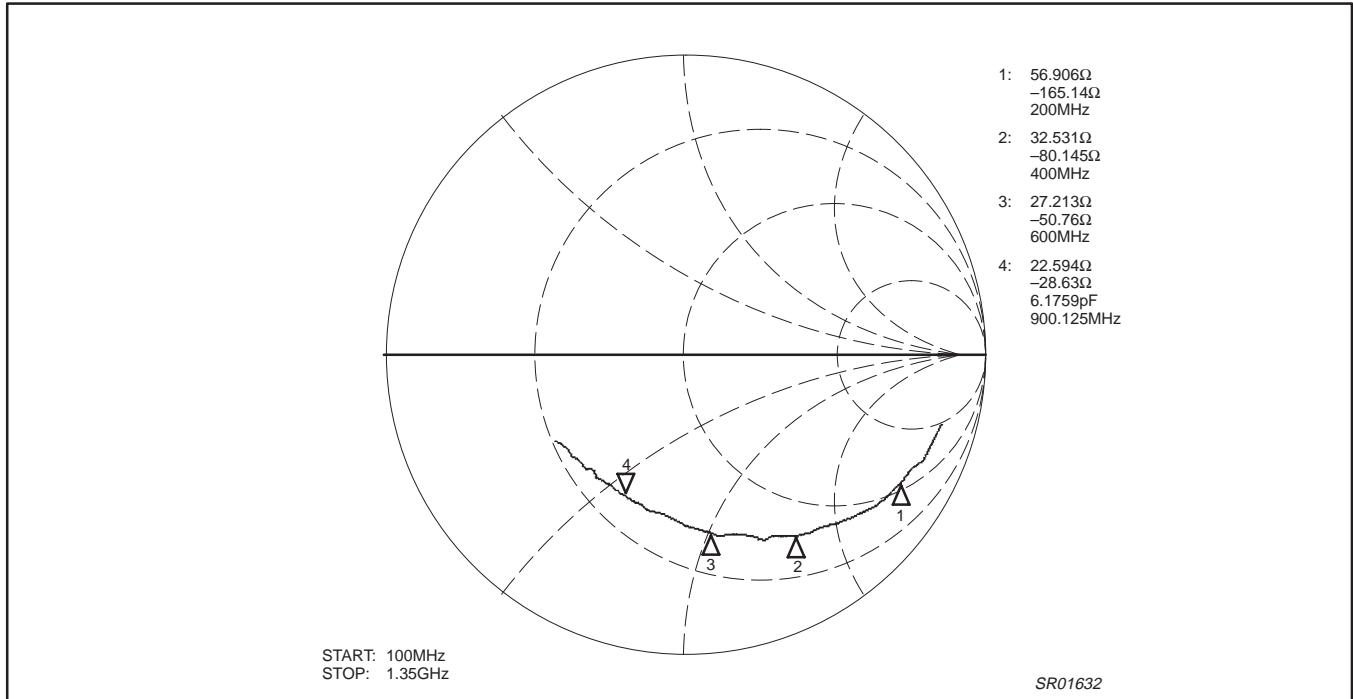


Figure 26. Typical  $S_{11}$  of the Low Band LNA at 3.75 V for the Low Band Receive Normal Mode

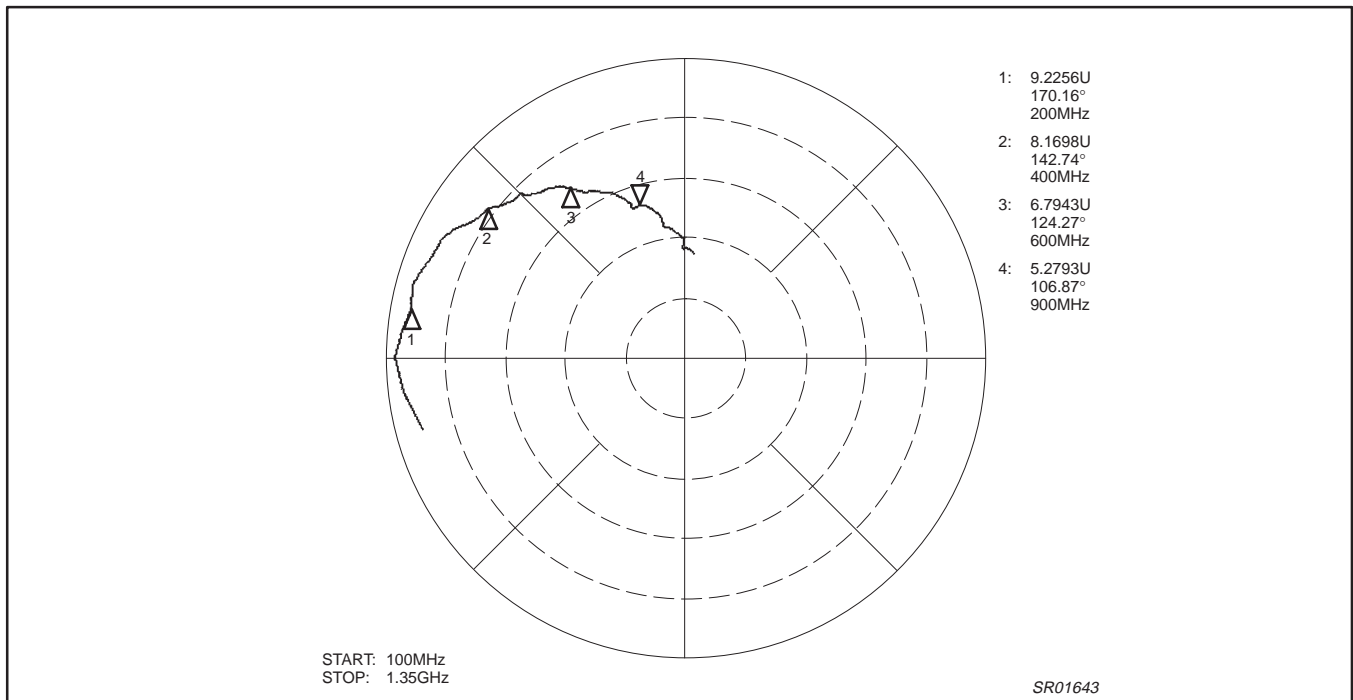


Figure 27. Typical  $S_{21}$  of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

Dual-band RF front-end

SA1920

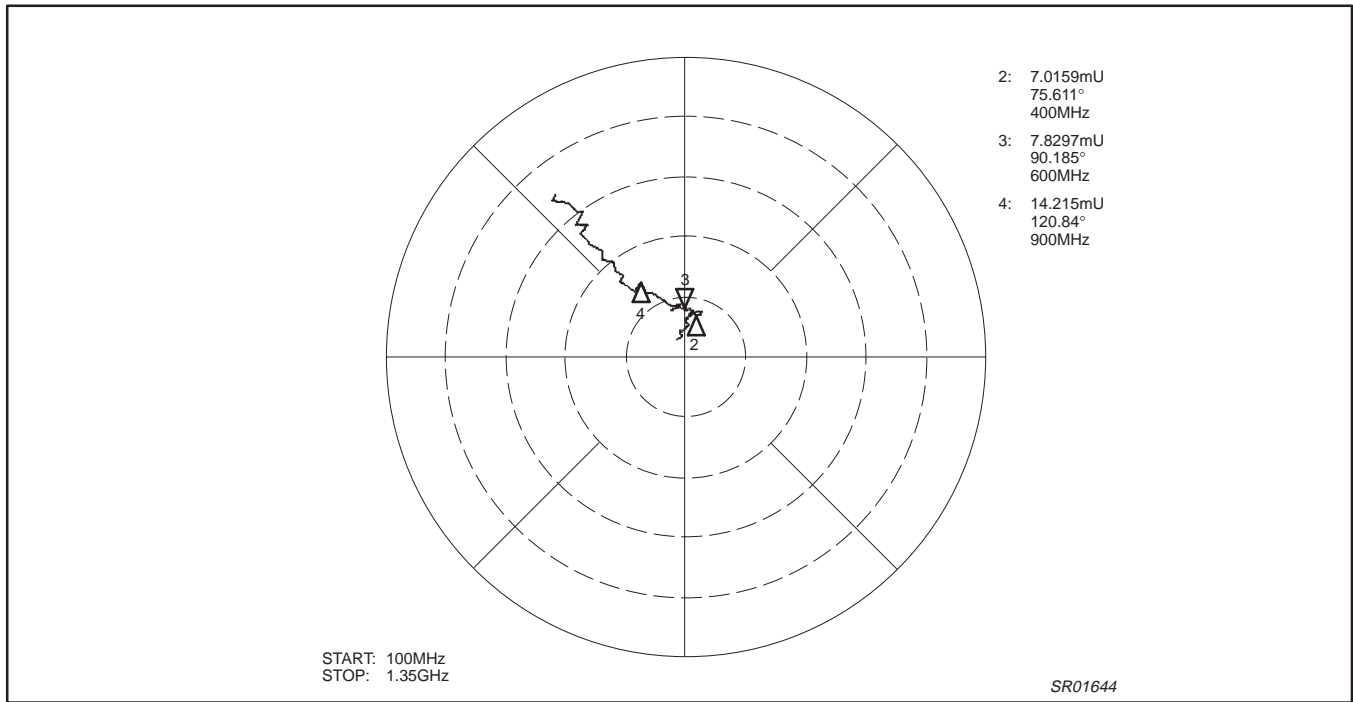


Figure 28. Typical  $S_{12}$  of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

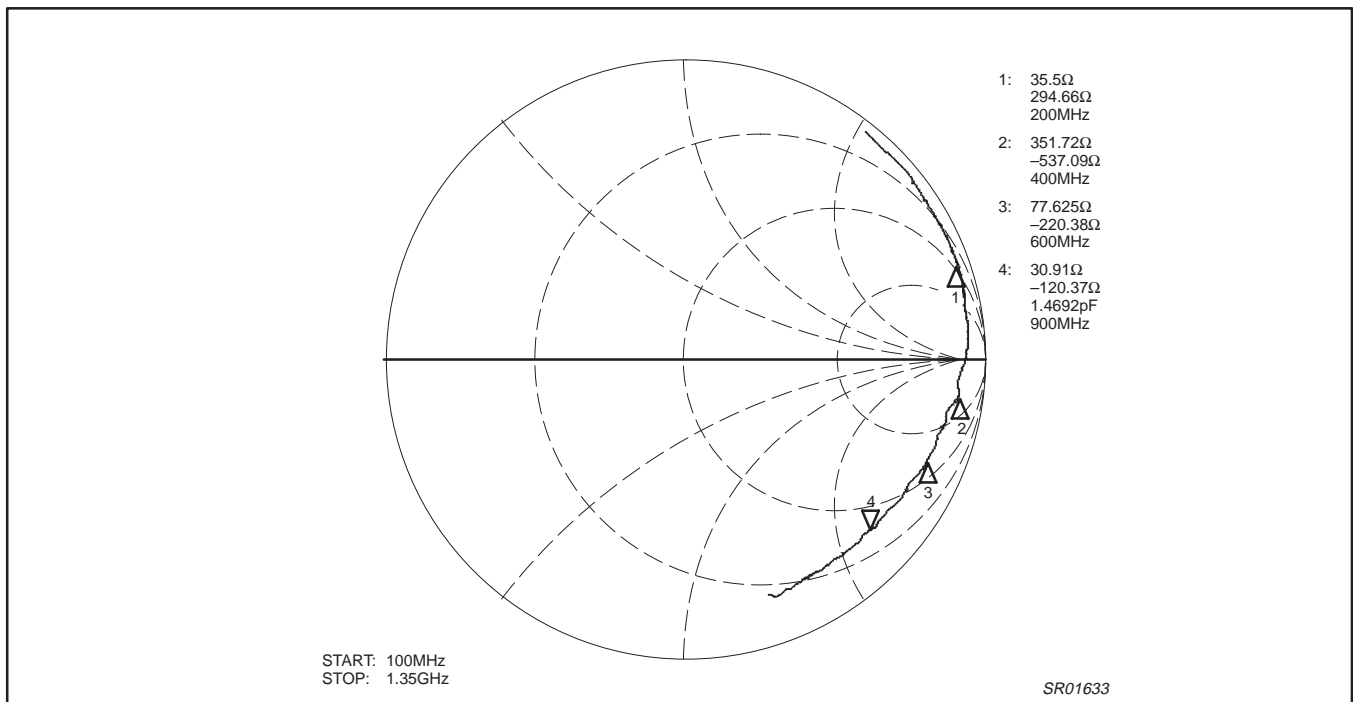


Figure 29. Typical  $S_{22}$  of the Low Band LNA @ 3.75V for the Low Band Receive Normal Mode

Dual-band RF front-end

SA1920

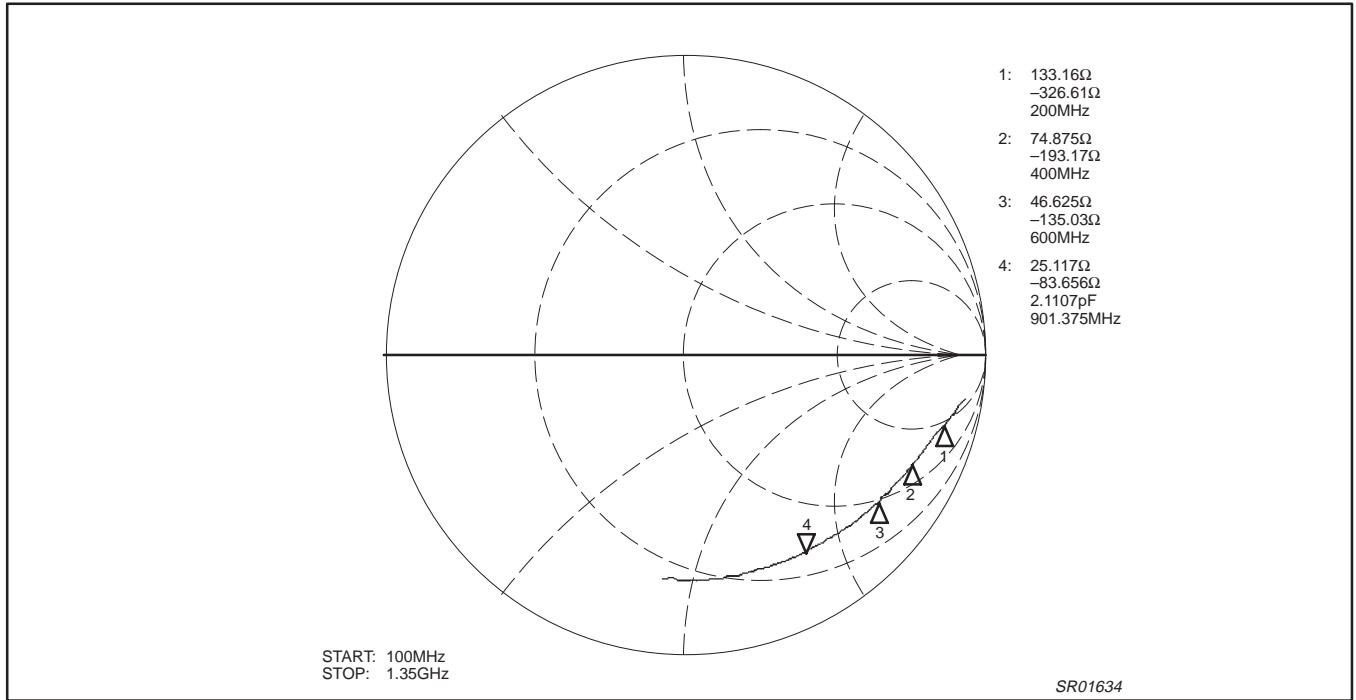


Figure 30. Typical  $S_{11}$  of Low Band LNA @ 3.75V for Receive Strong Signal Mode

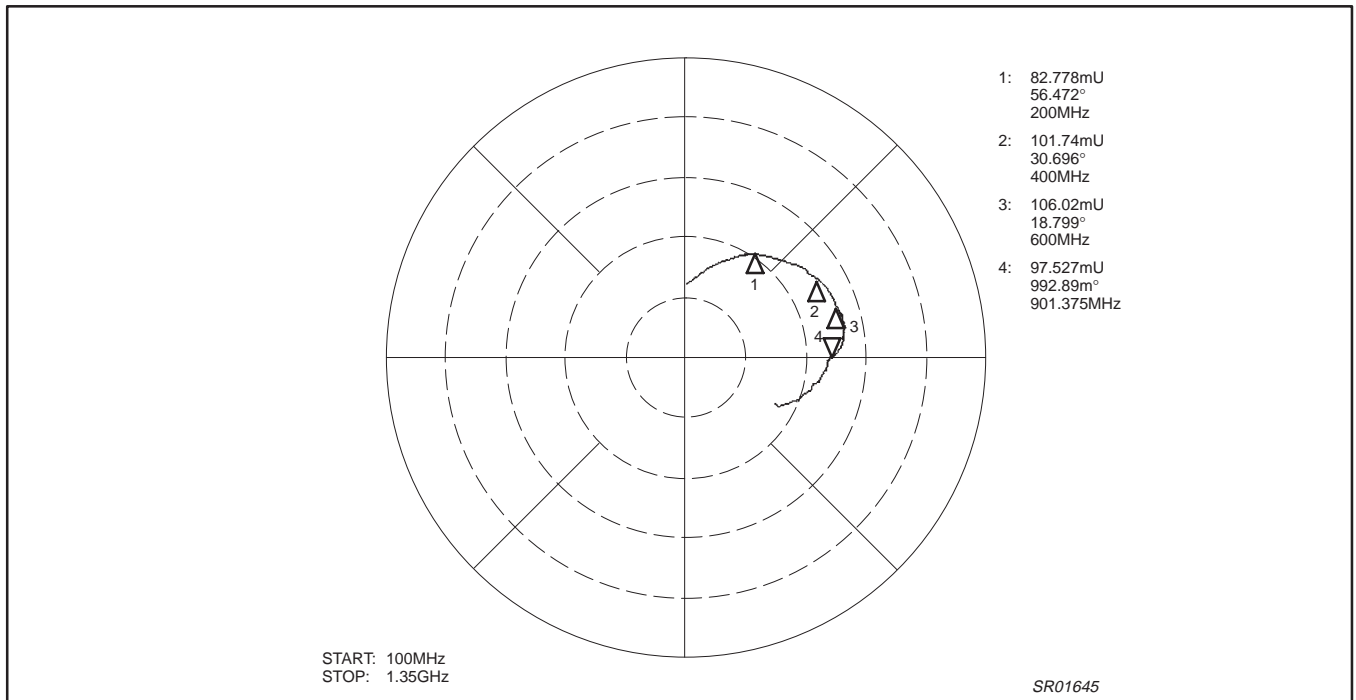


Figure 31. Typical  $S_{21}$  of the Low Band LNA @ 3.75V for Receive Strong Signal Mode

Dual-band RF front-end

SA1920

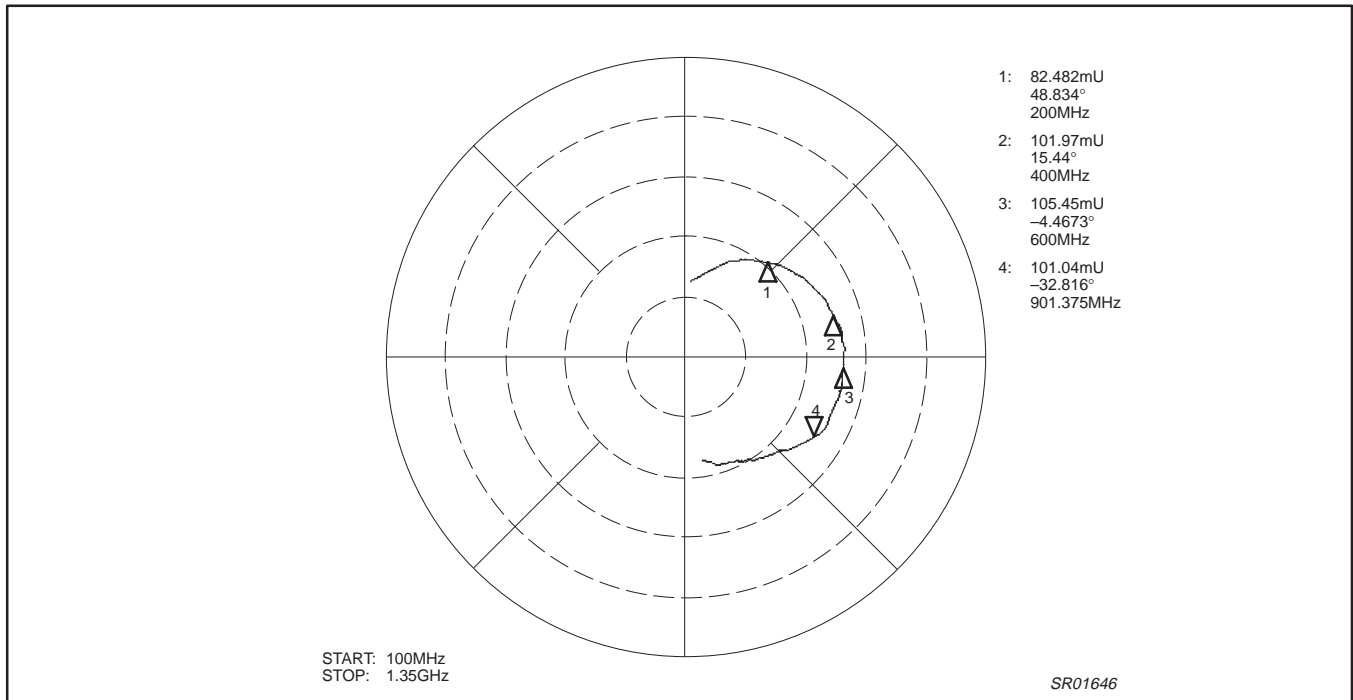


Figure 32. Typical  $S_{12}$  for the Low Band LNA @ 3.75V for the Receive Strong Signal Mode

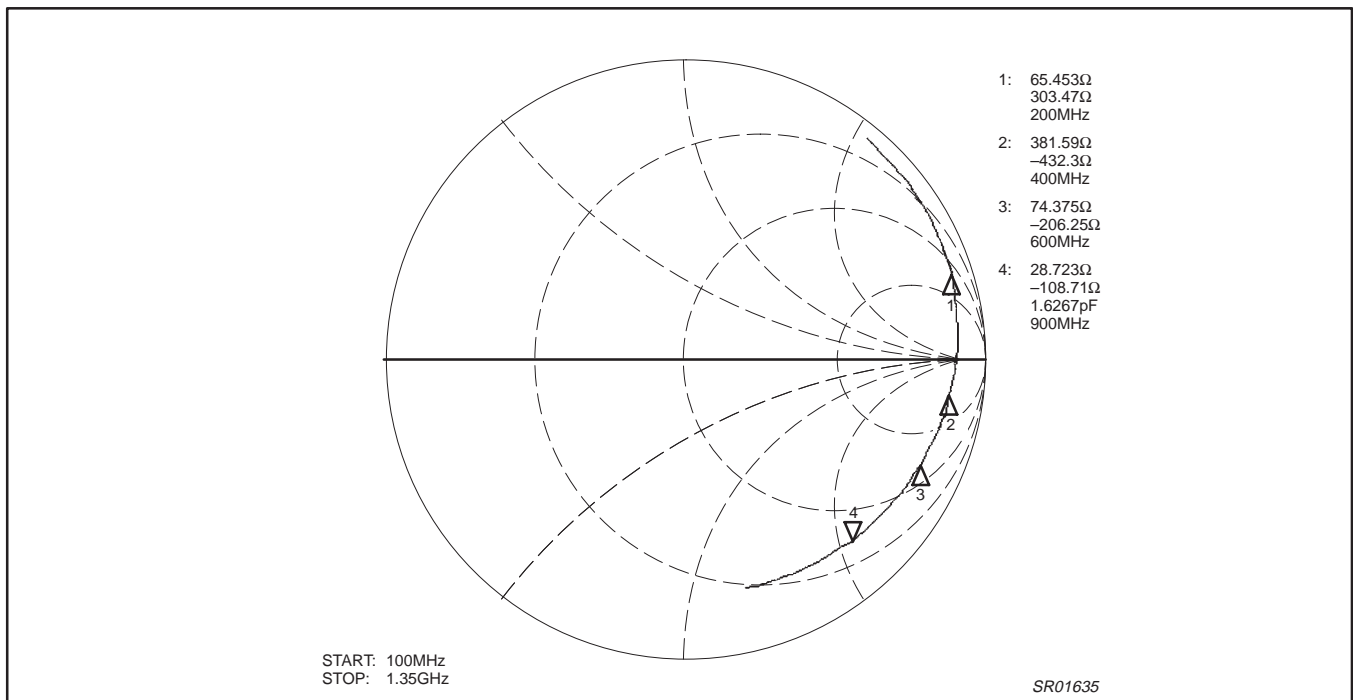


Figure 33. Typical  $S_{22}$  for the Low Band LNA @ 3.75V for the Strong Receive Signal Mode

Dual-band RF front-end

SA1920

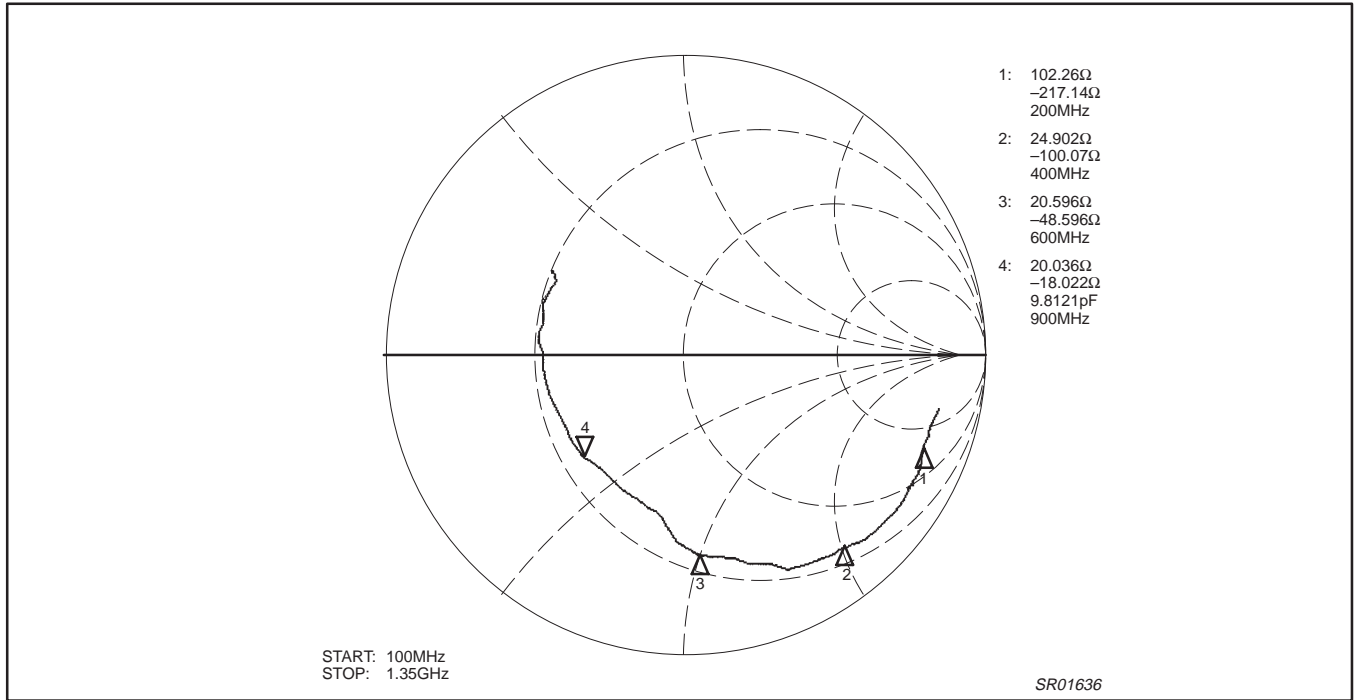


Figure 34. Typical  $S_{11}$  for the Low Band Mixer @ 3.75V for the Receive Normal Mode

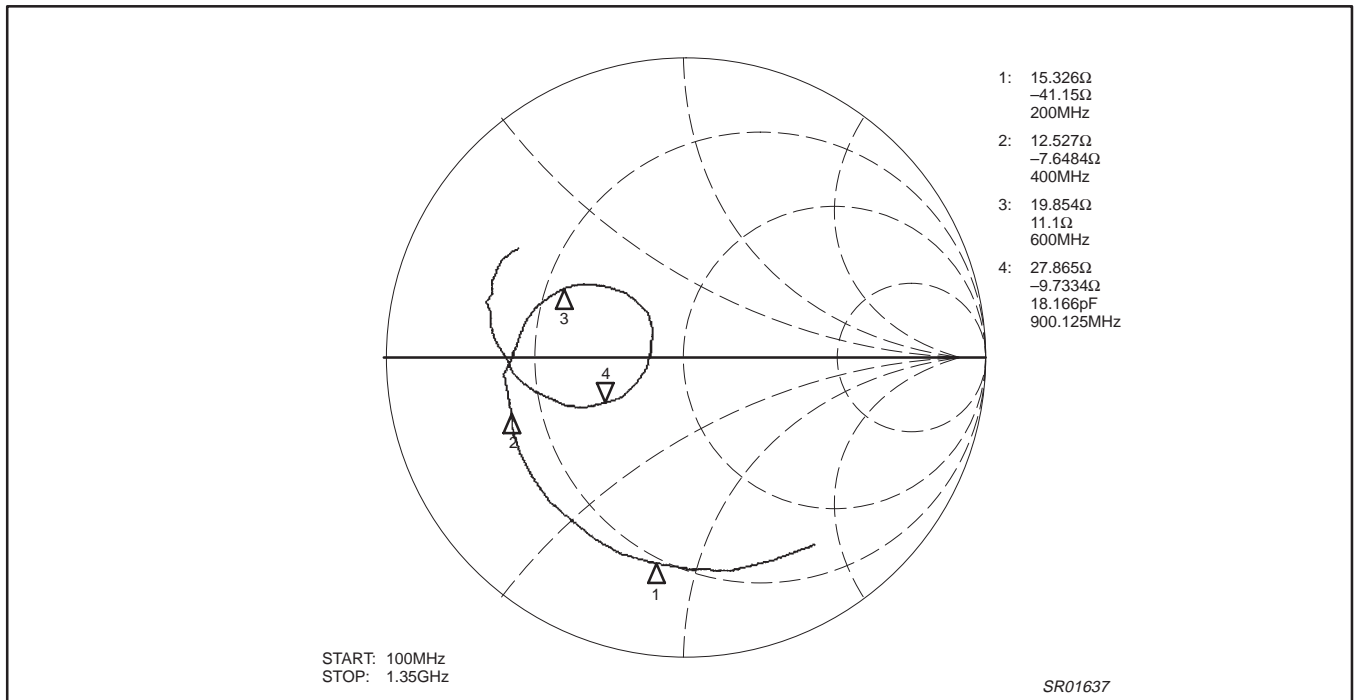


Figure 35. Typical  $S_{11}$  for the Low Band LO @ 3.75V for the Low Band Receive Normal Mode

Dual-band RF front-end

SA1920

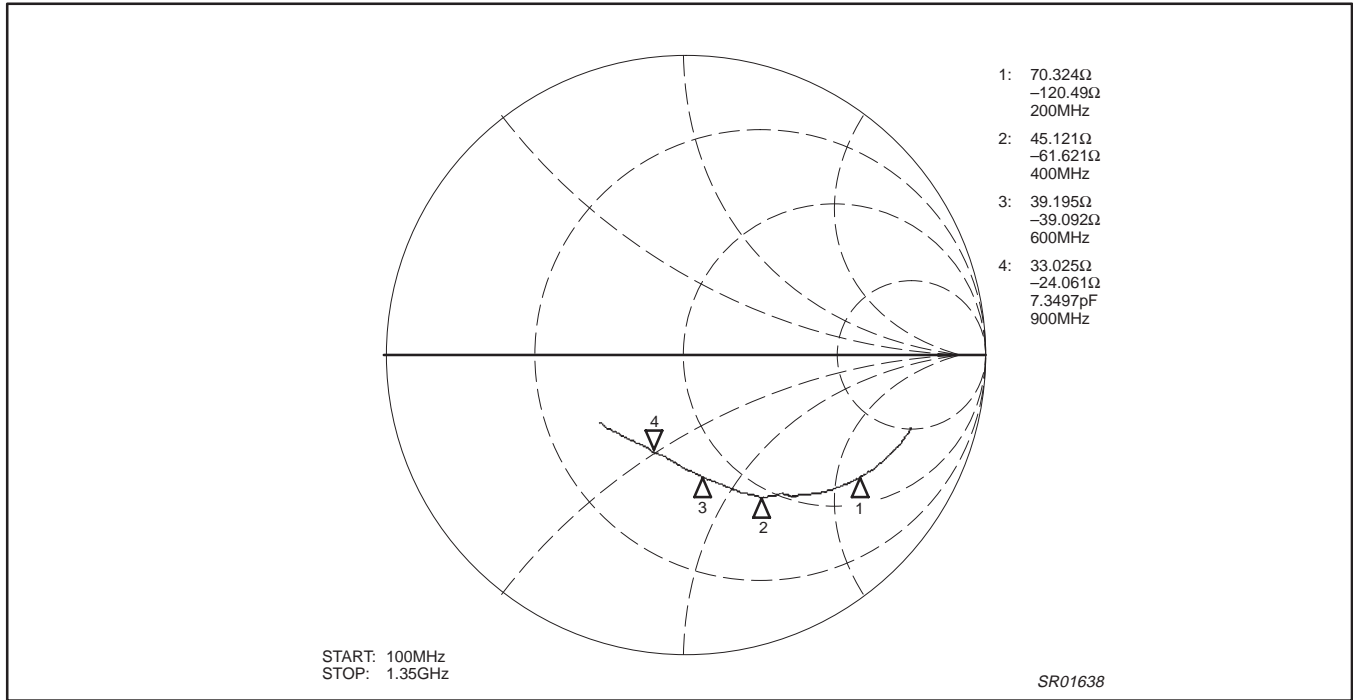


Figure 36. Typical  $S_{11}$  for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

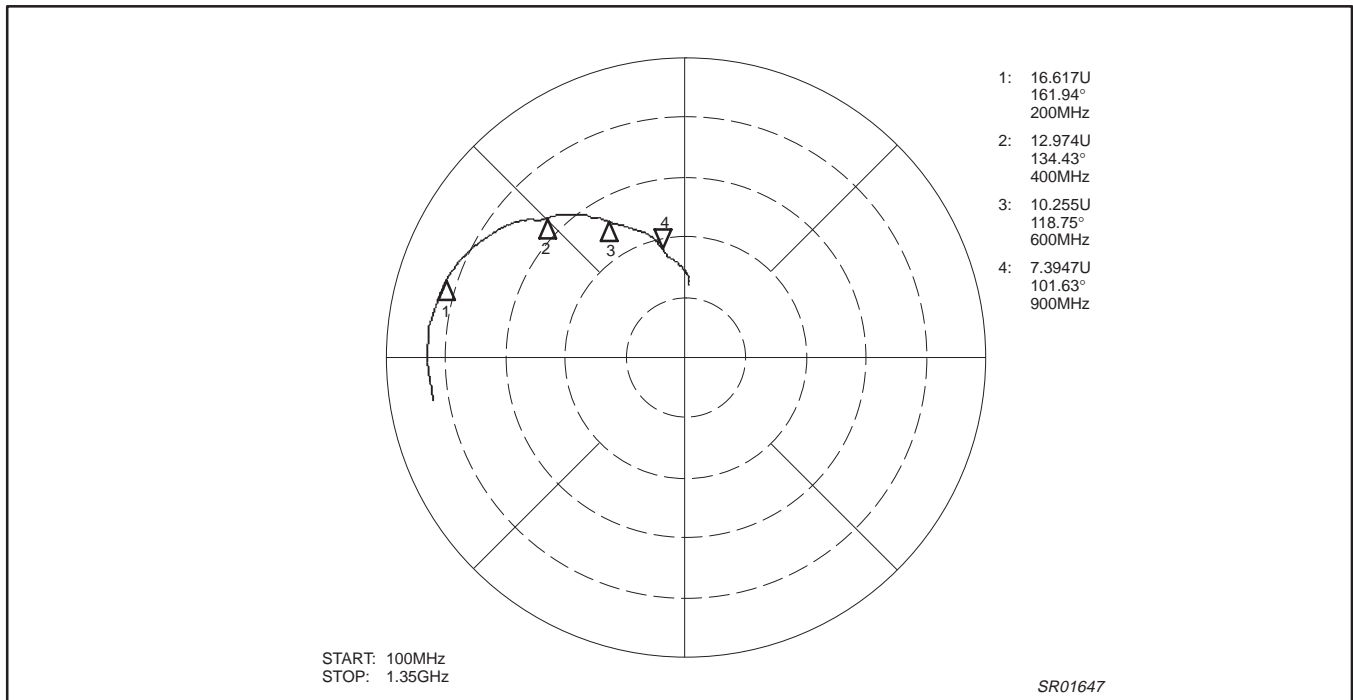


Figure 37. Typical  $S_{21}$  of the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

Dual-band RF front-end

SA1920

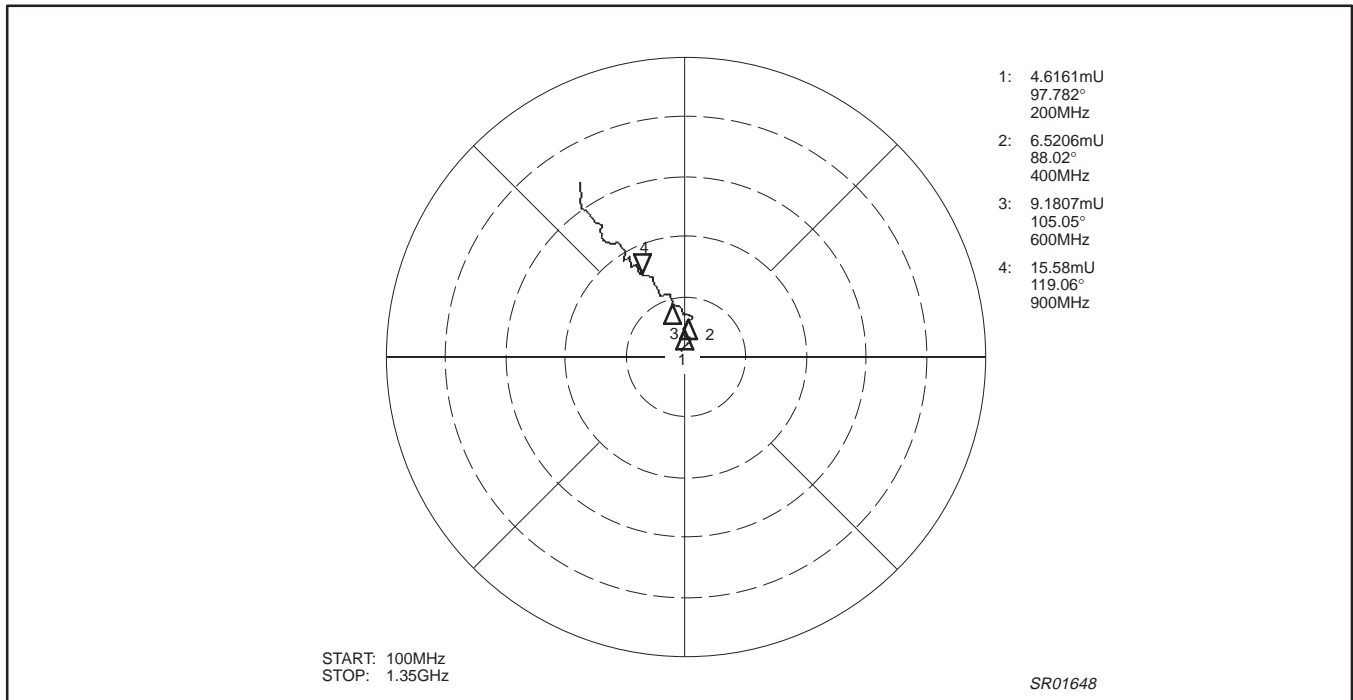


Figure 38. Typical  $S_{12}$  for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

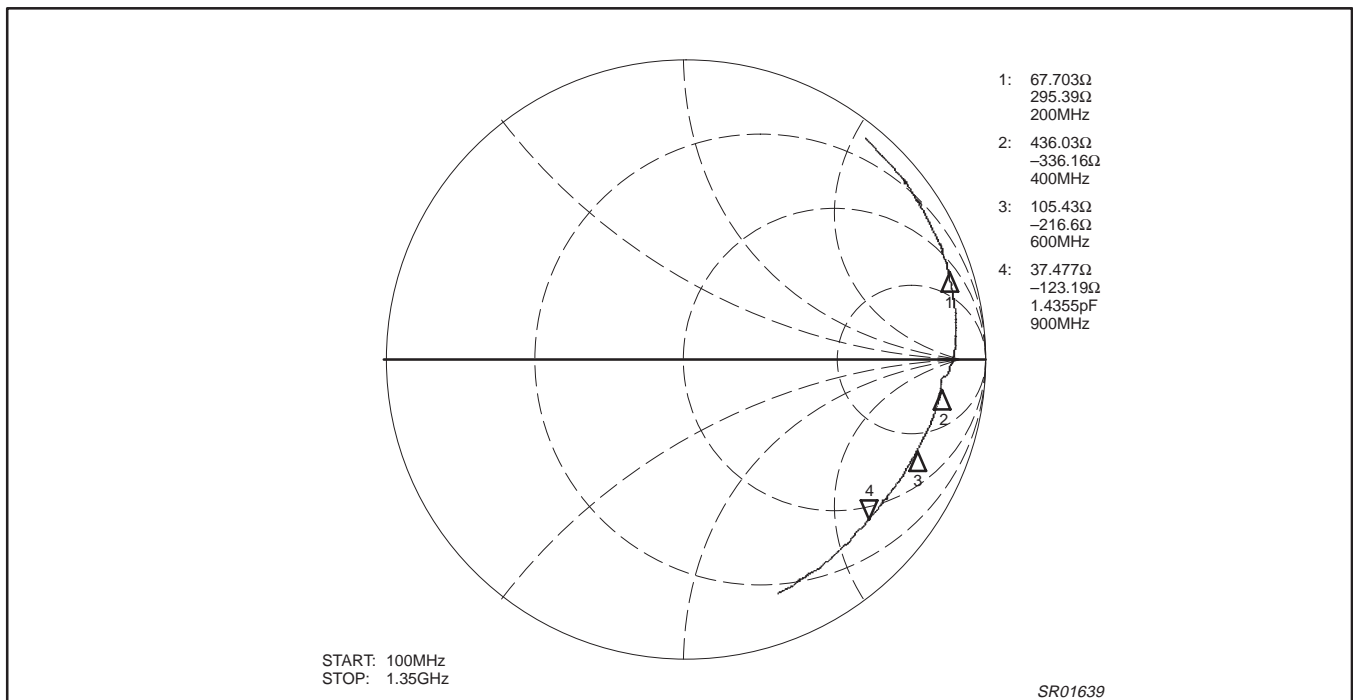


Figure 39. Typical  $S_{22}$  for the Low Band LNA @ 3.75V for the Low Band Transmit (Analog) Mode

Dual-band RF front-end

SA1920

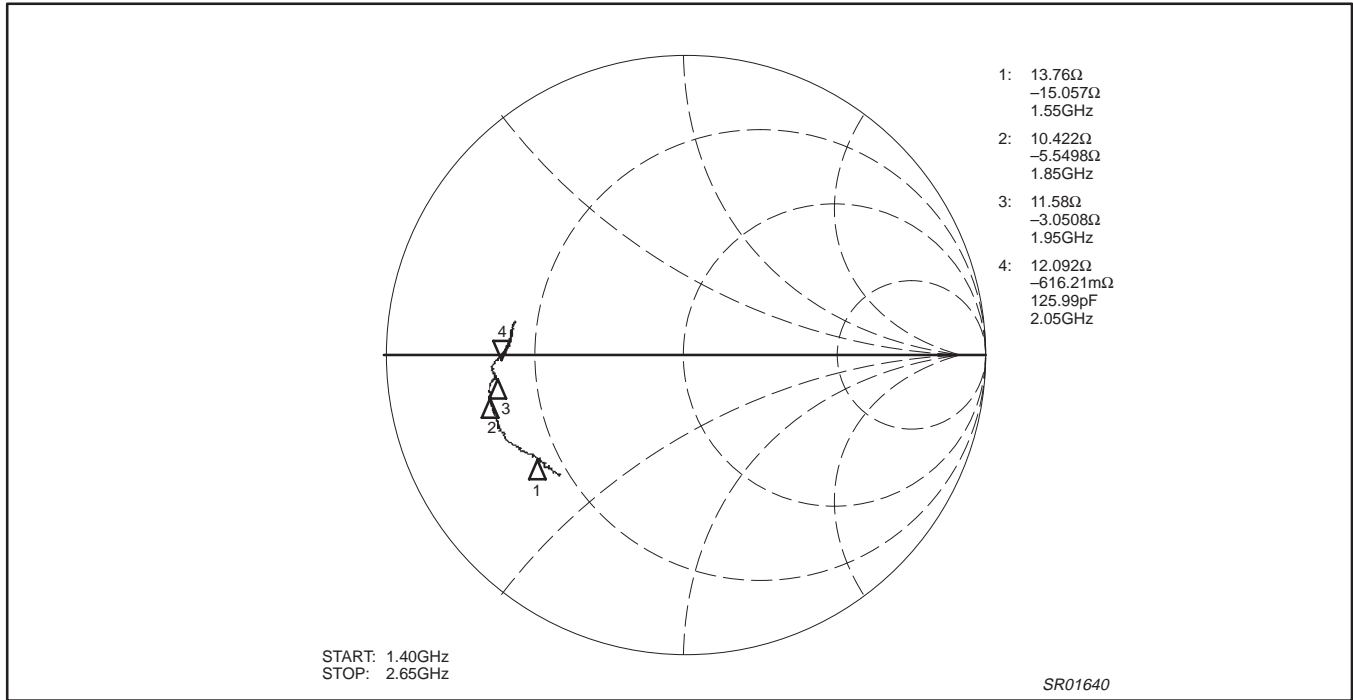


Figure 40. Typical  $S_{11}$  for the High Band LNA @ 3.75V for the High Band Receive Normal Mode

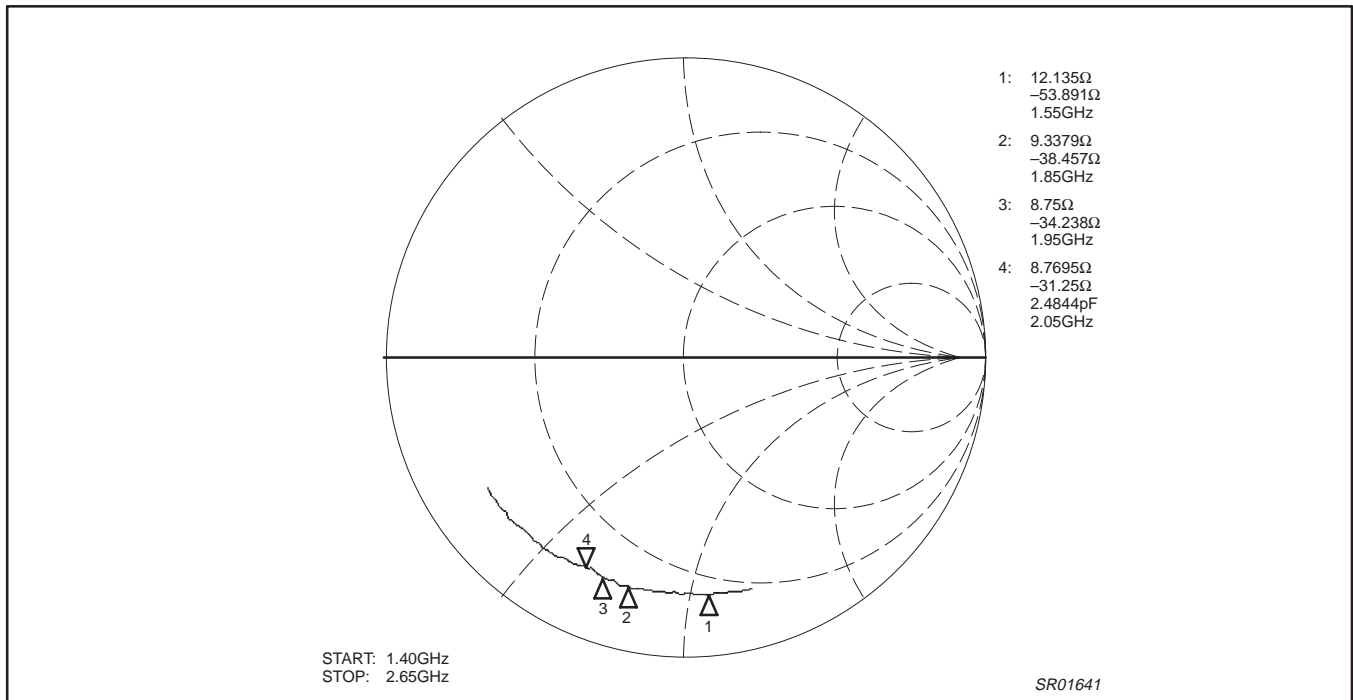


Figure 41. Typical  $S_{11}$  for the High Band LNA @ 3.75V for the High Band Receive Strong Signal Mode



Dual-band RF front-end

SA1920

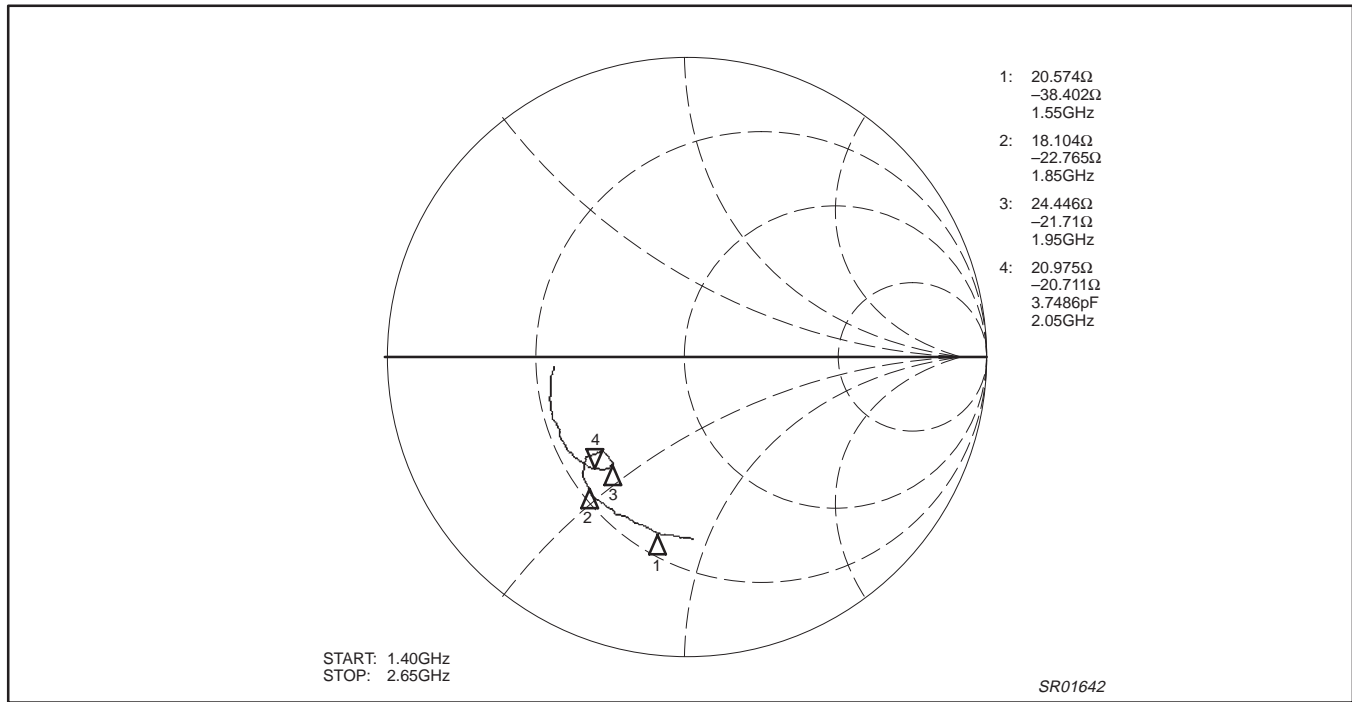


Figure 42. Typical  $S_{11}$  of the High Band LO @ 3.75V for the High Band Receive Normal Mode

## Dual-band RF front-end

## SA1920

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     |

## Dual-band RF front-end

## SA1920

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     |

## Dual-band RF front-end

## SA1920

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     |

## Dual-band RF front-end

SA1920

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     |

## Dual-band RF front-end

SA1920

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     |

## Dual-band RF front-end

## SA1920

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     |

## Dual-band RF front-end

## SA1920

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    |



## Dual-band RF front-end

## SA1920

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

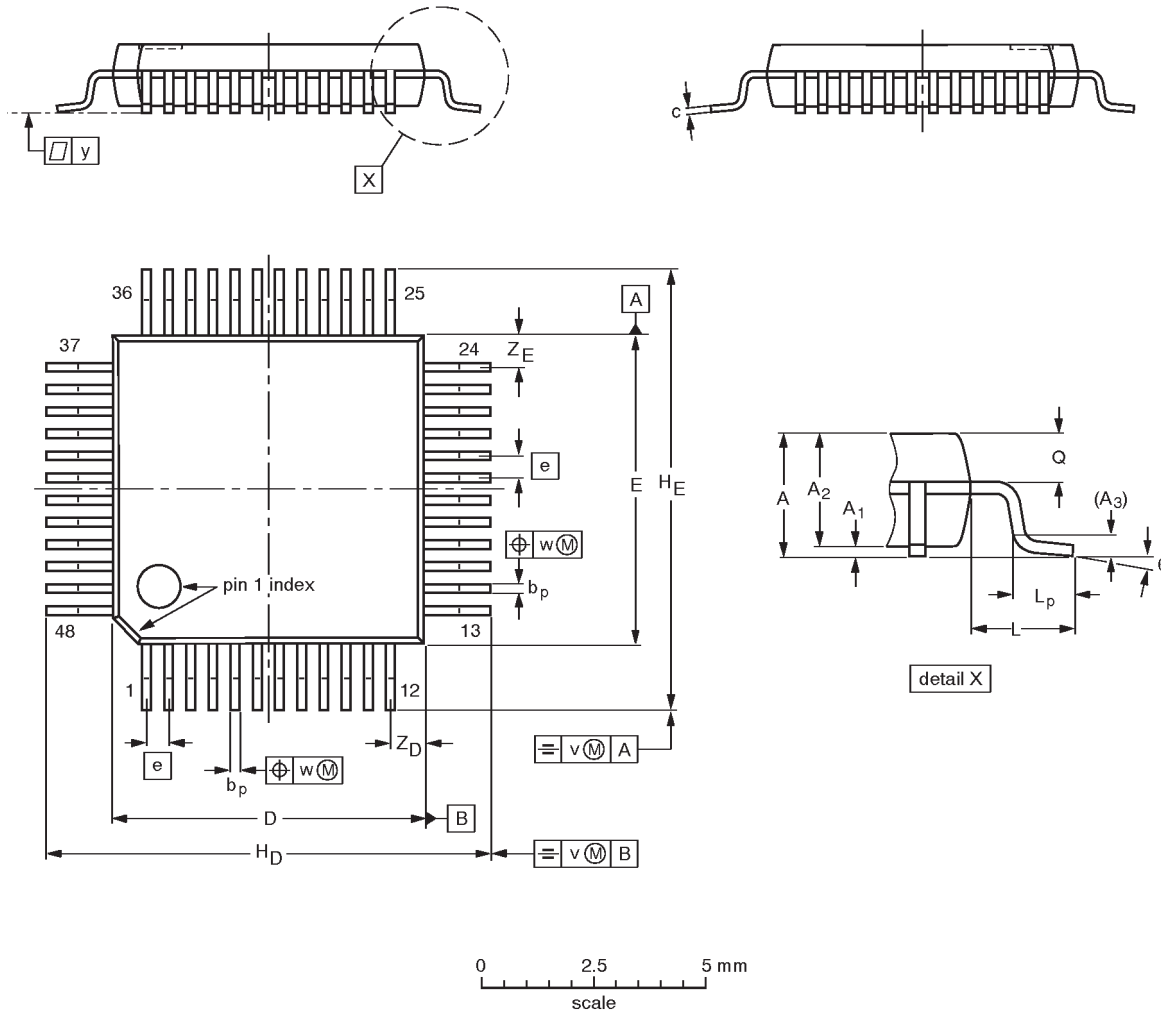
| FREQ (MHz) | S11  (U) | <S11 (DEG) |
|------------|----------|------------|
| 1400       | 0.62     | -87.50     |
| 1450       | 0.61     | -90.87     |
| 1500       | 0.60     | -94.44     |
| 1550       | 0.60     | -98.86     |
| 1600       | 0.59     | -102.10    |
| 1650       | 0.59     | -106.34    |
| 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    |

Dual-band RF front-end

SA1920

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 <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e   | H <sub>D</sub> | H <sub>E</sub> | L   | L <sub>p</sub> | Q            | v   | w    | y   | Z <sub>D</sub> <sup>(1)</sup> | Z <sub>E</sub> <sup>(1)</sup> | θ        |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|-----|----------------|----------------|-----|----------------|--------------|-----|------|-----|-------------------------------|-------------------------------|----------|
| mm   | 1.60   | 0.20<br>0.05   | 1.45<br>1.35   | 0.25           | 0.27<br>0.17   | 0.18<br>0.12 | 7.1<br>6.9       | 7.1<br>6.9       | 0.5 | 9.15<br>8.85   | 9.15<br>8.85   | 1.0 | 0.75<br>0.45   | 0.69<br>0.59 | 0.2 | 0.12 | 0.1 | 0.95<br>0.55                  | 0.95<br>0.55                  | 7°<br>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-<br>94-12-19 |

---

Dual-band RF front-end

SA1920

---

**NOTES**

## Dual-band RF front-end

SA1920

## 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.  |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification     | Production     | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.   |

[1] Please consult the most recently issued datasheet before initiating or completing a design.

## Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

## Disclaimers

**Life support** — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors  
811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

© Copyright Philips Electronics North America Corporation 1999  
All rights reserved. Printed in U.S.A.

Date of release: 03-99

Document order number:

9397 750 05354

*Let's make things better.*

SUNSTAR 商斯达实业集团是集研发、生产、工程、销售、代理经销、技术咨询、信息服务等为一体的高科技企业，是专业高科技电子产品生产厂家，是具有 10 多年历史的专业电子元器件供应商，是中国最早和最大的仓储式连锁规模经营大型综合电子零部件代理分销商之一，是一家专业代理和分销世界各大品牌 IC 芯片和电子元器件的连锁经营综合性国际公司，专业经营进口、国产名厂名牌电子元件，型号、种类齐全。在香港、北京、深圳、上海、西安、成都等全国主要电子市场设有直属分公司和产品展示展销窗口门市部专卖店及代理分销商，已在全国范围内建成强大统一的供货和代理分销网络。我们专业代理经销、开发生产电子元器件、集成电路、传感器、微波光电元器件、工控机/DOC/DOM 电子盘、专用电路、单片机开发、MCU/DSP/ARM/FPGA 软件硬件、二极管、三极管、模块等，是您可靠的一站式现货配套供应商、方案提供商、部件功能模块开发配套商。商斯达实业公司拥有庞大的资料库，有数位毕业于著名高校——有中国电子工业摇篮之称的西安电子科技大学（西军电）并长期从事国防尖端科技研究的高级工程师为您精挑细选、量身订做各种高科技电子元器件，并解决各种技术问题。

微波光电部专业代理经销高频、微波、光纤、光电元器件、组件、部件、模块、整机；电磁兼容元器件、材料、设备；微波 CAD、EDA 软件、开发测试仿真工具；微波、光纤仪器仪表。欢迎国外高科技微波、光纤厂商将优秀产品介绍到中国、共同开拓市场。长期大量现货专业批发高频、微波、卫星、光纤、电视、CATV 器件：晶振、VCO、连接器、PIN 开关、变容二极管、开关二极管、低噪晶体管、功率电阻及电容、放大器、功率管、MMIC、混频器、耦合器、功分器、振荡器、合成器、衰减器、滤波器、隔离器、环行器、移相器、调制解调器；光电子元件和组件：红外发射管、红外接收管、光电开关、光敏管、发光二极管和发光二极管组件、半导体激光二极管和激光器组件、光电探测器和光接收组件、光发射接收模块、光纤激光器和光放大器、光调制器、光开关、DWDM 用光发射和接收器件、用户接入系统光收发器件与模块、光纤连接器、光纤跳线/尾纤、光衰减器、光纤适配器、光隔离器、光耦合器、光环行器、光复用器/转换器；无线收发芯片和模组、蓝牙芯片和模组。

更多产品请看本公司产品专用销售网站：

商斯达中国传感器科技信息网：<http://www.sensor-ic.com/>

商斯达工控安防网：<http://www.pc-ps.net/>

商斯达电子元器件网：<http://www.sunstare.com/>

商斯达微波光电产品网：[HTTP://www.rfoe.net/](http://www.rfoe.net/)

商斯达消费电子产品网：<http://www.icasic.com/>

商斯达实业科技产品网：<http://www.sunstars.cn/> 微波元器件销售热线：

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室

电话：0755-82884100 83397033 83396822 83398585

传真：0755-83376182 (0) 13823648918 MSN: SUNS8888@hotmail.com

邮编：518033 E-mail:[szss20@163.com](mailto:szss20@163.com) QQ: 195847376

深圳赛格展销部：深圳华强北路赛格电子市场 2583 号 电话：0755-83665529 25059422

技术支持：0755-83394033 13501568376

欢迎索取免费详细资料、设计指南和光盘；产品凡多，未能尽录，欢迎来电查询。

北京分公司：北京海淀区知春路 132 号中发电子大厦 3097 号

TEL: 010-81159046 82615020 13501189838 FAX: 010-62543996

上海分公司：上海市北京东路 668 号上海赛格电子市场 D125 号

TEL: 021-28311762 56703037 13701955389 FAX: 021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)

西安劳动南路 88 号电子商城二楼 D23 号

TEL: 029-81022619 13072977981 FAX:029-88789382