MAINTENANCE MANUAL
FOR
RECEIVER FRONT END MODULE
19D902782G5

DESCRIPTION

The Receiver Front End (RXFE) Module amplifies and
converts the RF signal to the first IF signal of 70.2 MHz.
This is a down conversion process using low side injection.
The RXFE module is powered by a regulated 12 volts and
draws about 260 mA. The RXFE printed wiring board con-
tains the following functional circuits:

- Preselector Filter
- Preamplifier
- Image Rejection Filter
- Injection Amplifier
- Injection Filter
- Double Balanced Mixer
- Fault Detector

All but the Fault Detector circuit in the RXFE module
have 50 ohm impedance terminations.

CIRCUIT ANALYSIS

- Preselector Filter
- Preamplifier
- Image Rejection Filter
- Injection Amplifier
- Injection Filter
- Double Balanced Mixer
- Fault Detector

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IC DATA

U3
19A704125P1
Quad Operational Amplifier

U40
19A704125P1
Quad Comparator

Printed in U.S.A.

Ericsson GE Mobile Communications Inc.
Mountain View Road-Lynchburg, Virginia 24502
CIRCUIT ANALYSIS

PRESELECTOR FILTER

The received RF signal (J2) is routed through the Preselector Filter. This filter provides front end selectivity and attenuates the potential spurious signals of first conversion. Typically, the filter has an insertion loss of 1.5 dB and an operational bandwidth of 19 MHz. The filter is primarily a five-pole dielectric bandpass filter and in the 806-825 MHz range.

PREAMPLIFIER

The output from the Preselector is coupled through an impedance matching network consisting of L10, C11, and DC blocking capacitor C10 to the base of Preamplifier Q1. Q1 is a broadband common emitter amplifier capable of operating in the 806 to 825 MHz range. The Preamplifier stage is supplied by the regulated +12 Vdc line (VCC1) and draws about 60 mA through R13. It has a low noise figure and high Third Order Intercept point. Transistor Q2 provides Q1 with a constant voltage and current source. The bias on Q1 is monitored by the Fault Detector circuit via R40. Capacitors C40 and C41 prevent the RF component from entering the fault circuit. The output signal is coupled to the Image Rejection Filter via an impedance matching network consisting of C12 and L12.

IMAGE REJECTION FILTER

Following the Preamplifier is the Image Rejection Filter. The Image Rejection Filter is a fixed 3-pole dielectric bandpass filter and can meet the desired image rejection of the 806-825 MHz frequency band.

INJECTION AMPLIFIER

The local oscillator input (J3) from the Receiver Synthesizer is coupled through a DC blocking capacitor C20 to U20 which is a MMIC that has about 10dB power gain in the 736-755 MHz range. R20 and R25 provide necessary DC biasing for U20. L20 is a RF blocking inductor.

The second stage of the Injection Amplifier, consisting of Q20, Q21, and associated circuitry, is capable of amplifying the injection signal from 10 dBm to +19 dBm in the 736 to 755 MHz range. R20 and R25 provide necessary DC biasing for U20. L20 is a RF blocking inductor.

The output signal is coupled to the Injection Filter via an impedance matching network consisting of C23 and L23.

INJECTION FILTER

The local oscillator input (J3) from the Receiver Synthesizer is coupled through a DC blocking capacitor C20 to U20 which is a MMIC that has about 10dB power gain in the 736-755 MHz range. R20 and R25 provide necessary DC biasing for U20. L20 is a RF blocking inductor.

The second stage of the Injection Amplifier, consisting of Q20, Q21, and associated circuitry, is capable of amplifying the injection signal from 10 dBm to +19 dBm in the 736 to 755 MHz range. The amplifier is powered by the regulated +12 Vdc line (VCC1) and draws about 70 mA through R24. Transistors Q4 and Q7 provide Q3 and Q8 with a constant voltage and current source. The bias on Q20 and U20 is monitored by the Fault Detector circuit via R20, R25, and R24 respectively.

DOUBLE BALANCE MIXER

The Double Balance Mixer (DBM) is a broadband mixer. It converts an RF signal in the 806-825 MHz range to the 70.2 MHz first conversion IF frequency. The mixer uses low side injection driven by a local oscillator signal of +17 dBm. The mixer conversion loss is typically about 6.0 dB. The IF signal is then coupled to a diplexer, consisting of R30, L30, C30, C31 and L31. Finally, the IF signal is routed to the output connector (J4).

FAULT DETECTOR

The Fault Detector circuit monitors the operation of pre-amplifier and injection amplifier devices. Operational amplifiers U40.1 and U40.2 compare the bias on the Preamplifier Q1 to preset levels, while U40.3 and U40.4 compare the bias levels on Injection Amplifiers Q20 and U20.

When the bias for Q1, Q20, and U20 is within the preset window limits, the output from the comparators is a high level signal which is also sent to the Controller on the FLAG 0 line.

If the biasing for the amplifiers is not within the proper operating range, the fault detector circuit will pull the FLAG 0 line low. This turns off Q41 and the fault indicator, CR40. A high level signal is also sent to the Controller on the FLAG 0 line.

Table 1 - General Specifications

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SPECIFICATION</th>
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<tbody>
<tr>
<td>FREQUENCY RANGE</td>
<td>806 MHz - 825 MHz</td>
</tr>
<tr>
<td>IF FREQUENCY</td>
<td>70.2 MHz</td>
</tr>
<tr>
<td>3 dB BANDWIDTH</td>
<td>&gt;19 MHz</td>
</tr>
<tr>
<td>IMPEDANCE</td>
<td>50 ohms at RF, LO, and IF Ports</td>
</tr>
<tr>
<td>CONVERSION LOSS</td>
<td>-2 dB ±1 dB</td>
</tr>
<tr>
<td>NOISE FIGURE (NF)</td>
<td>&lt;7.5 dB</td>
</tr>
<tr>
<td>THIRD ORDER INTERCEPT POINT</td>
<td>&gt;+16 dBm</td>
</tr>
<tr>
<td>IMAGE REJECTION</td>
<td>&gt;100 dB</td>
</tr>
<tr>
<td>INJECTION POWER</td>
<td>+2 dBm ±2 dB</td>
</tr>
<tr>
<td>TEMPERATURE RANGE</td>
<td>-30°C to +60°C</td>
</tr>
<tr>
<td>SUPPLY VOLTAGE</td>
<td>12.0 Vdc</td>
</tr>
<tr>
<td>SUPPLY CURRENT</td>
<td>260 mA ±20 mA</td>
</tr>
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</table>

Figure 1 - Block Diagram
MAINTENANCE

TEST PROCEDURE

The RXFE module has to be tested for Noise Figure, Gain, Third Order Intercept Point, Isolation etc. With proper current drawing of devices, Bandwidth and Conversion Gain the RXFE module will meet its specifications. The following are test procedures will verify proper Conversion Gain and current drain:

1. Supply 12 Vdc to pin 15A, B, C. (1C is ground.)
2. Inject the desired RF signal into RF IN at a level of -10 dBm.
3. Inject the desired local oscillator signal into LO IN at a level of 0 dBm (LO frequency = RF frequency - 70.2 MHz).
4. Measure the IF OUT power at 70.2 MHz, the ratio of RF IN to IF OUT is -2 dB ± 1 dB.
5. Measure the current drawn by the RXFE module. Typical current drain is 260 mA.

TROUBLESHOOTING GUIDE

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>AREAS TO CHECK</th>
<th>READING (TYP.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW CONVERSION GAIN</td>
<td>Check Vcc Preselector Loss Preamplifier Gain Image Ref. Filter Loss</td>
<td>12 V 1.5 dB 9 dB 4.0 dB</td>
</tr>
<tr>
<td>LED INDICATOR ON</td>
<td>Check Vc of Q1 Check Vc of Q20 and U20</td>
<td>10V 10V</td>
</tr>
<tr>
<td>IF FREQUENCY OFF</td>
<td>Check L.O. FREQUENCY L.O. frequency = RF frequency - 70.2 MHz</td>
<td></td>
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</tbody>
</table>

*NOTE: For troubleshooting the gain or loss, the RXFE needs to be under the normal operating condition:
- 12 Vdc supply.
- Inject L.O. power at a level of 0 dBm into LO IN (13), (LO freq. = RF freq. - 70.2 MHz).
- Inject the desired RF signal at a level of -10 dBm into RF IN (12).
- Terminate the IF OUT (34) with a good 50 ohm impedance.

Use a Spectrum Analyzer and 50 ohm probe (with good RF grounding) to probe at the input and output of each stage to check its gain or loss (see schematic diagram).
RECEIVER FRONT END MODULE

19D902782G5

(NOTICE TO CUSTOMER, ISSUE 4, REV. 3)

NOTES:

1. TORQUE SCREWS, ITEMS 8 AND 7, TO 15.5 +/- 1.3 INCH POUNDS.
2. TORQUE SCREWS, ITEM 11, TO 20 +/- 1.3 INCH POUNDS.
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19D902782G5
(CIR060405. Sh. 1, Rev. 4)