APPLICATION NOTE 1915

Cellular CDMA Mixer Performance with the MAX2538 and KSS IF Filter

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Abstract: The application note presents measured performance of the MAX2538 low-noise amplifier (LNA) mixer IC when matched to a 183.6MHz IF from Kinseki (KSS). Cascade performance is shown, along with the schematic for the IF matching circuit. IIP3 was found to be +9.2dBm.

Additional information:
- Wireless product line page
- Applications technical support

Introduction

This application note summarizes the MAX2538 cellular CDMA (code division multiple access) mixer performance when it is matched to a IF (intermediate frequency) SAW (surface acoustic wave) filter at 183.6MHz (7mm x 5mm package). The particular filter used is KSS part number MSFC30-183-001M0.

The cellular CDMA mixer/IF filter signal path gain, NF (noise figure), and IIP3 (input third order intercept) have been optimized based on gain, IIP3, passband flatness, and adjacent channel selectivity. Cascaded performances have been characterized and are presented here. The MAX2538 clearly demonstrates excellent NF and IIP3 performance for cellular CDMA applications.

Cascaded IIP3 in HGHL (high gain, high linearity) mode achieved is:

\[(62.5\text{dBc}/2) + (-22\text{dBm}) = +9.2\text{dBm}\]

Refer to circuit diagram for component values and plots for test measurement data.

Cellular CDMA Mixer/IF Filter Cascaded Performance

The MAX2538 is configured in cellular HGHL mode. The supply voltage (VCC) is set at +2.80V. The test platform is a multi-layer PCB (printed circuit board) which employs the KSS IF CDMA filter. The block diagram is shown in Figure 1 while measured cascade performance data are shown in Table 1.
The MAX2538 Mixer and SAW Filter Impedance Characteristics

<table>
<thead>
<tr>
<th>SAW Filter</th>
<th>KSS MSFC30-183-001M0</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX2338 IF Port Differential Equivalent Circuit</td>
<td>12.2kΩ</td>
</tr>
<tr>
<td>MAX2338 IF External Load</td>
<td>2.7kΩ</td>
</tr>
<tr>
<td>Equivalent Differential Source Impedance presented to SAW Filter</td>
<td>2.2kΩ</td>
</tr>
<tr>
<td>Single-ended Load Impedance presented to SAW Filter</td>
<td>50Ω</td>
</tr>
<tr>
<td>SAW Filter Input Source Impedance</td>
<td>788Ω</td>
</tr>
<tr>
<td>SAW Filter Output Source Impedance</td>
<td>855Ω</td>
</tr>
</tbody>
</table>

The MAX2538 Cellular Mixer Cascaded Gain and IIP3 Measured Data

RF Frequency = 880.98MHz and 881.04MHz at -22dBm per tone.
LO Frequency = 2129.2MHz.
IF = 183.6MHz Mode = High Gain High Linearity (HGHL), IF0 port selected
V_{DD\_RX} = +2.80V

<table>
<thead>
<tr>
<th></th>
<th>MAX2538</th>
<th>IF SAW and Matching Loss</th>
<th>Cascaded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain (db)</td>
<td>12.0*</td>
<td>-9.0*</td>
<td>+3.0</td>
</tr>
<tr>
<td>IIP3 (dBm)</td>
<td>9.2</td>
<td>100</td>
<td>+9.2</td>
</tr>
<tr>
<td>NF (dB)</td>
<td>8.2</td>
<td>9.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

*Estimated IF filter insertion loss based on measured cascaded gain of +3.0dB and mixer standalone gain of 12dB.
ΔIM$_3$ = -62.5dBc at the IF output

IIP3 = 62.5/2 + (-22dBm) = +9.2dBm

P$_{IN}$ = -22dBm per tone at 881 and 881.2MHz

P$_{OUT}$ = -18.0dBm

Cascaded Gain = +3.0dB

**Cellular CDMA Mixer and IF SAW Filter Frequency Swept Response**

Cascaded MAX2538 cellular mixer and KSS IF filter response:
The MAX2538 Mixer Matching Circuit Components

Matching components are shown in the following figure:

Related Parts

MAX2538 Quadruple-Mode PCS/Cellular/GPS LNA/Mixers

More Information
For Technical Support: http://www.maximintegrated.com/support